Foundations in Dispensing

Semester 1

BTEC Approved Centre

Specsavers

Foundations in Dispensing

Semester 1

Foundations in dispensing

Semester 1

Unit 8 Communication in Optical Customer Service

Chapters 1 - 3

Learning outcomes

The learner will:

1. Understand the skills required for effective communication in optical customer service
2. Understand Communication Methods
3. Understand how to achieve excellent customer service in optical customer service

Chapter 1

Developing Communication Skills

Introduction

Good communication skills underpin the success of any individual involved in frontline patient care. Most assistants will encounter dozens of patients each day, whether making appointments, taking details, assisting the optometrist or dispensing optician by performing certain procedures, or answering telephone enquiries. Successful communication requires you to be able to assess and, if appropriate, modify your own communication style. To do this, you need to understand the elements of communication, including both verbal and non-verbal elements. Applying this knowledge using techniques of questioning, listening and behaviour supports the effectiveness of communication. Likewise, this knowledge can help when attempting to assess patients.

By the end of this chapter, you will:

- Be able to describe your habitual communication style
- Understand how others perceive your communication style
- Understand when and if it is appropriate to modify your usual communication style
- Be able to explain the importance of language, tone and intonation
- Be able to explain the importance of body language, space and position
- Be able to apply good questioning and listening skills
- Be able to define rules for effective communication
- Be able to use behaviour in order to create the right impression
- Be able to use your knowledge of communication skills to assess patients
- Recognise appropriate techniques for controlling a range of patient types and encounters
- Understand the importance of team work
- Be able to explain different methods of communicating in a team

Essential learning for the assessment

You must read and understand all the material in this chapter. For assessment purposes you should learn and be able to demonstrate your understanding of some sections in particular.

1.1 Gaining Practical Experience

One of the strengths of this distance-learning course is that it enables you to gain an immediate understanding of the practical applications of the information you learn, as you actively participate in these activities during the working day. By analysing and controlling how you communicate, you will develop new skills of critical thinking. You will develop self-awareness and a better understanding of communication skills, and your working environment provides you with constant practice. You will receive feedback, either directly from your supervisor or indirectly by the responses you receive from patients and the success with which you perform the various tasks that make up your role. Furthermore, by discussing your experiences with colleagues who are also taking the course, you will also improve your knowledge and performance in these areas. Although you will absorb information by studying the materials contained within the course text, there is no substitute for experience. In this context, this means you should not only read the suggested exercises, but you should also try them out. Having performed each exercise you will be able to reflect on what you have learned and discuss this with your supervisor and colleagues.

1.2 Assessing your Communication Style

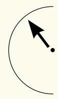
Human behaviour is rich in variety – we all have our own way of doing things. This is shaped by our personality, and significantly influences how we communicate with people. When considering different styles of communication, there is no such thing as one 'best' way. Sometimes it would be easier for us to control the situation in which we find ourselves, such as dealing with an aggressive customer, if we adopted a different style – if we were more assertive, for example. Although we may have our own typical style, we can alter this to suit different circumstances, but only if we understand what our habitual style is, and when and how to change it. In order to create the kind of impression we desire (efficient, knowledgeable, cheerful, positive) we need to know how other people perceive us. We may think that we are conveying an air of serious professionalism when in fact our work colleagues think we are humourless and miserable. To create the desired impression we may need to change our conduct and appearance. This chapter examines the words we use, the way we use them and our body language, all of which affect the impression others have of us. You will learn how to use this knowledge to assess the patients with whom you come into contact, and how to use this assessment to communicate with them more effectively. The chapter also considers how to deal with specific scenarios and how to give and obtain information effectively.

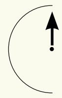
1.2.1 'Know Thyself'

We can all readily think of an occasion when someone's personality or behaviour has influenced our behaviour. For example, think about looking for a suit in a shop where the assistant who is helping has a bright and cheerful personality. Such a personality will probably make us feel more cheerful ourselves, and hence more likely to look positively on suggestions made by the assistant about the clothes on sale. It is easy to see from this example how the impression we make on other people may influence how they behave. In this particular instance the shop assistant wants us to make a purchase and, by being cheerful and positive, is more likely to steer the outcome this way. Contrast this with the shop assistant who is miserable and uninterested – we are more likely either not to bother purchasing the suit or to visit another shop that sells the same suit. In your role as assistant, there are many tasks that you will have to perform. Typical tasks include: collecting information, giving information, teaching, advising and dealing with aggression (complaints). To perform many of these tasks you will require your patients' co-operation. Being aware of and skilfully using certain communication techniques will help you achieve your objective. Before looking at how skills can be used to influence the behaviour of other people, it is important to examine how we are currently perceived by others. It is common for our behaviour to differ depending on our environment. For example, most of us will have a slightly different personality in our social life compared to our work life. Here, we are considering only personalities at work. The purpose of the following exercises is to help you identify your own particular communication style.

Exercise 1.1: Communication style – self-analysis

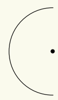
The following exercise is designed to help you assess certain aspects of your work personality. You are asked to grade on a scale how you believe others perceive certain aspects of your public work personality. Be as objective as you can (you don't have to show your results to anyone). There are no right or wrong answers. Draw an arrow on each of the scales below indicating whether, and how strongly, you agree with description A or description B for each of the statements. Try to avoid being in the middle.

eg. If you consider yourself somewhat more flexible than rigid you may mark the first scale 

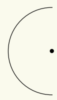
If you consider yourself completely flexible, you may mark it 

When I am at work, I believe that my work colleagues and members of the public will see me as being:

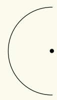
A flexible (open to change and new ideas)
B rigid (set in my ways and not happy to change)



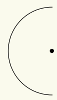
A independent (happy to state my own view)
B a group thinker (usually in agreement with the general view)



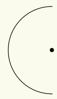
A self-motivated (able to motivate myself)
B in need of encouragement (unable to motivate myself without someone else's direction)



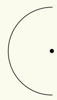
A accountable (enjoying responsibility and making decisions)
B submissive (preferring someone else to make the decisions)



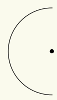
A methodical (deliberate and ordered in my actions)
B spontaneous (rather impulsive)



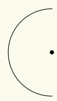
A a logical decision maker (analysing information carefully before making decisions)
B an impulsive decision maker (making decisions on instinct)



A extrovert (outgoing and preferring the company of others)
B introvert (reserved and happy being by myself)



A amiable (easy-going)
B reserved (maintaining a distance)



A a good listener (happy to listen attentively)
B talkative (preferring to do the talking)

A person-focused (performing processes with people)
B task-focused (performing processes on people)

A habitually tense ('on edge' even on a good day)
B relaxed ('laid back' even under pressure)

A someone who takes criticism personally (unhappy with and dwelling on any negative feedback)
B someone who accepts criticism objectively (viewing even negative feedback as helpful)

A pessimistic (often worried about things that haven't happened)
B optimistic (always looking on the bright side)

A easily stressed (unhappy working under pressure)
B not bothered by stress (happy and more productive under moderate pressure)

A lacking in confidence (wary of demonstrating my own abilities)
B self-assured (quite confident about what I can do)

Exercise 1.1 is not an exhaustive look at your personality but it encourages you to consider some aspects of how you behave that can affect how you work. Having completed the exercise you should now look through each of the points and consider how they are likely to affect your face-to-face communication with patients.

Exercise 1.2: Communication style – feedback

As stated earlier, what really matters in communication is how others perceive you. In order to look at this objectively, complete the following exercise, and ask a work colleague to complete the analysis sheet. This colleague should be someone you trust and you should explain to him or her that there are no right or wrong answers. It may be useful to ask more than one of your colleagues to complete this (if you are happy to) as that can help to even out the personal bias of one individual. Please photocopy the sheet if more are required.

eg. If they consider you to be more rigid than flexible, they may mark the scale

If they consider you completely rigid, they may mark the scale

When you are at work, I believe members of the public will see you as being:

A flexible (open to change and new ideas)
B rigid (set in my ways and not happy to change)

A independent (happy to state my own view)
B a group thinker (usually in agreement with the general view)

A self-motivated (able to motivate myself)
B in need of encouragement (unable to motivate myself without someone else's direction)

A accountable (enjoying responsibility and making decisions)
B submissive (preferring someone else to make the decisions)

A methodical (deliberate and ordered in my actions)
B spontaneous (rather impulsive)

A a logical decision maker (analysing information carefully before making decisions)
B an impulsive decision maker (making decisions on instinct)

A extrovert (outgoing and preferring the company of others)
B introvert (reserved and happy being by myself)

A amiable (easy-going)
B reserved (maintaining a distance)

A a good listener (happy to listen attentively)
B talkative (preferring to do the talking)

A person-focused (performing processes with people)
B task-focused (performing processes on people)

A habitually tense ('on edge' even on a good day)
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A someone who takes criticism personally (unhappy with and dwelling on any negative feedback)
B someone who accepts criticism objectively (viewing even negative feedback as helpful)

A pessimistic (often worried about things that haven't happened)
B optimistic (always looking on the bright side)

A easily stressed (unhappy working under pressure)
B not bothered by stress (happy and more productive under moderate pressure)

A lacking in confidence (wary of demonstrating my own abilities)
B self-assured (quite confident about what I can do)

1.3 Elements of Communication

Communication at work is inevitably influenced by the environment in which it takes place. Notice for example, how you communicate differently with a patient you meet by chance when out shopping than with the same patient in the practice. Having looked at the impression we create, we now turn to how that impression is communicated. Communication is a complex process. It consists of what we say, how we say it and our body language.

1.3.1 Language

How carefully should we choose our words? It is often the case that what one person says and what another hears are two different things. This is generally not because of mumbled diction or hearing difficulty, but because people place different meanings on different words. We therefore have to choose our words carefully and tailor them to the understanding of the listener. For example, a child's understanding will be different to that of an adult. We need to be able to assess people accurately and quickly in our meetings with them, so as to be sure that what we are saying is being understood. We must also be aware of cultural implications. Consider dealing with people for whom English is their second language. It is quite likely that when asked a question, they will translate the question back into their first language, consider their response and then translate it into English before responding. One way to ensure that any advice or instruction has been fully understood is to ask patients further questions to test their understanding and then check again as required. One type of language that is taboo is jargon. Patients will not only be unaware of what words such as 'autorefractor' mean, but will resent the use of heavily jargon laden sentences. Jargon creates barriers to successful communication, as patients may think the assistant is deliberately trying to appear superior. When speaking to patients it is important to be as honest and open as possible. For example, telling a patient there will be a 10-minute wait when it is more likely to be 20 minutes will only frustrate the patient and undermine the credibility of the speaker.

Four techniques that can be used to ensure the listener is understanding what is being said are:

1. Be concise, clear and truthful
2. Explain any technical terms used (and never use jargon)
3. Repeat any important messages (for example, when teaching contact lens hygiene)
4. Ask questions to make sure that the patient has understood

1.3.2 Tone and Intonation

When speaking to patients, you are usually attempting to influence them in some way. On different occasions you will be attempting to achieve different outcomes. For instance you may be:

- Issuing instructions (e.g. teaching contact lens hygiene) which will be persuasive or even insistent depending on the importance of the instruction
- Offering information in response to queries, such as the purpose of a particular test or NHS benefits
- Asking questions in order to collect information, for example when collecting baseline data

The tone and intonation of your voice can make a difference. Consider the question: 'Now can you see?' Different intonation and stress can be used to make it mean the following: 'Can you see at this time, rather than 10 seconds ago?' 'No one else can see it, but can you?' 'Now, can you see?' meaning 'Have you any vision?' When asking questions or offering information, the wrong intonation can convey the wrong impression. You must listen to yourself critically and invite feedback from others. Inappropriate intonation can be damaging to the effectiveness of any communication – it might unintentionally convey boredom, tiredness or even lack of interest in the patient. Like the tourist abroad, when having difficulty in making yourself understood, repeating the same message at increasingly louder volumes is unlikely to be successful. It is important instead to reconsider the choice of words and tone.

1.3.3 Body Language

Communication is a complex process and, when taking place on a one-to-one basis between two individuals, will be a mixture of verbal and non-verbal behaviours. The content of what we say and how we say it are important. Equally important are our methods of non-verbal communication – so-called body language. This includes facial expression, posture, gestures, body movement and space or distance. It is important that our body language and our verbal language are complementary (e.g. enthusiastically smiling whilst informing a patient that you have just torn his or her contact lens would most certainly aggravate their reaction!). The following are aspects of body language that will help you communicate effectively and assess patients. For example, a patient might agree that he has understood your explanation of how to clean his contact lenses, but his worried facial expression tells you that he has not.

Posture

An upright posture may suggest self-confidence whereas a slumped or stooped posture might indicate lack of self-confidence. Standing and facing patients directly while addressing them will command more authority than standing at an angle to them. Leaning away from people you are talking to might indicate boredom or a lack of interest in what they are saying. Leaning slightly towards them indicates that you are interested and listening attentively.

Facial expression and eye contact

In a social context we are all experienced at using other people's facial expression as an indication of their true feelings or mood. Facial expression is equally important in the work context. Facial expression can indicate happiness, satisfaction, anger, distrust, disbelief, fear, pain, sadness, concern and so on. Smiling is one facial expression that should be encouraged at work! If you are having a stressful day, wearing an expression of tension will not make it easy to encourage a nervous patient to relax. Maintaining a relaxed facial expression accompanied by a relaxed and confident body posture will help put patients at ease, whilst conveying the impression that you are competent. Eye contact is particularly important when trying to gain a patient's confidence and trust.

Likewise, eye contact is effective in maintaining the patient's attention when giving important information or instructions, e.g. teaching contact lens hygiene. Eye contact also encourages trust, although be careful because if you do not periodically glance away, it can be perceived as threatening.

Space and position

The expression 'personal space' is a familiar one. Essentially each of us prefers to keep a certain physical distance between ourselves and other people and we become uncomfortable if this minimum distance is not maintained. This space will depend on the relationship we have with the other person (e.g. a relative or close friend may come closer without causing us to feel uncomfortable). In the working environment this comfortable distance is likely to be anything between 1 and 4 metres (3–12 feet). There will be occasions when you need to be closer to a patient, for example when performing a measurement such as autorefraction or interpupillary distance. In such circumstances, it is always important to explain what you are about to do. Research has shown that the part of the eye examination that patients enjoy least is direct ophthalmoscopy, particularly if the optometrist does not explain what he or she is about to do. This invasion of personal space may cause the patient to feel threatened. To help understand this observe how the seats in your practice waiting area fill up. If the first patient to arrive sits at one end of a row of chairs, the next patient will probably choose to sit about halfway along – not too close to the first, but so far away that they appear to be unfriendly. You may find that when you are taking personal details from a nervous patient, it is more friendly to sit alongside, rather than stand opposite. Likewise, speaking to a child attending his or her first eye examination may be less formal and more relaxed if you squat down beside him or her and bring yourself to their level. Touch would normally be considered inappropriate in the work context. However, it can be used with care when, for example, with their permission assisting an elderly patient to hold their head still while the optometrist performs applanation tonometry. The act of touch not only enables the reading to be taken more easily, but reassures the patient.

1.4 Asking Questions and Listening

Being aware of intonation is important not only when asking questions and offering information, but also when listening. Certain languages use sounds that could be described as clipped or punctuated. Such a person speaking English may sound aggressive when he or she is not. Although essentially different processes, asking questions and listening are closely connected. They are an important part of interactions with patients. Developing good questioning and, particularly, good listening skills is important for successful communication.

1.4.1 Types of Question

An open question cannot be answered by a simple 'yes', or 'no', or one-word answer. This type of question will encourage a patient to talk (useful for nervous or reserved patients). Open questions usually begin with words like 'how' or 'where' or 'why'. You are likely to use open questions when trying to determine the patient's problem or requirements, or when gathering information. Closed questions can usually be answered with one word (e.g. 'yes' or 'no'). You will normally use these when you are checking facts, e.g. 'Have you been here before?', 'Is your address still 25 North Road?'.

Exercise 1.3: Open and closed questions

Read the following list of questions and place a tick (✓) against any that are open and a cross (✗) against any that are closed.

How many hours did you wear your contact lenses yesterday?

What problems are you having with your glasses?

Do you clean your case every day?

What is your date of birth?

Which styles of spectacle frame do you normally prefer?

Did your mother or father suffer from glaucoma?

What made you decide to visit this practice?

Which is better, morning or afternoon?

How much do you think you would wear contact lenses?

What do you think might be causing your headaches?

1.4.2 Active Listening

Listening attentively and with genuine interest requires practice and concentration. Active listening is supported by appropriate body language such as nodding, smiling or demonstrating concern through appropriate facial expression.

Encourage the flow of the patient's communication by nodding or smiling and using short phrases such as 'of course', or 'uh huh'. It can sometimes help to echo certain significant words or phrases that the patient uses. These phrases should be short, as longer phrases can disrupt the flow and be perceived by the patient as an interruption.

You can demonstrate that you have listened closely to what the patient is saying by summarising what has been said. For example, 'So what you are finding is…', 'So am I correct in understanding that you want…?'. This form of summary is, in itself, a closed question, requiring the answer 'yes'. Repeating what the patient said is a useful way of checking that your interpretation of what the patient meant is correct, and offers the opportunity for the patient to correct any misunderstanding. This is particularly useful when there is a complaint or when collecting information to pass on to the optometrist or dispensing optician. For example, the patient may be requesting an urgent appointment and there aren't any appointments available. You might also use open questions to clarify what has been said.

For example,

'Can you explain what you mean by double – is it blurred or can you see two?'

'You mentioned that you are unhappy with the comfort of your lenses – can you tell me more about this?' Intonation and tone are important, particularly if you are dealing with a grievance or complaint. It is important to use an even tone of voice when questioning in this manner, never an insistent or accusing tone.

1.5 The Assistant's 'Ten Golden Rules for Effective Communication'

The following list effectively summarises what we have covered so far and groups these with behaviours likely to improve effective communication. Keep these in mind when interacting with patients:

1. Match the language and message to the individual (e.g. young, old, uneducated).
2. Match your body language to your words.
3. Be concise, clear and truthful.
4. Use intonation to emphasise your key points.
5. Explain any technical terms used.
6. Avoid jargon.
7. Use aids (e.g. literature, pictures) when practical to reinforce your message.
8. Repeat any important messages.
9. Deal completely with one subject before moving on to the next.
10. Ask questions to make sure you have been understood.

1.6 Using your Knowledge of Communication to Assess Patients

We are used to forming impressions of people we meet and cannot avoid doing the same in our work role as it involves meeting many different members of the public. As you will have no doubt discovered from the self-awareness exercise, these perceptions are not always (or even not often) very accurate. The most common pitfalls include:

1. Paying too much attention to a person's physical appearance, e.g. attractiveness or men with long hair. We should avoid jumping to a conclusion about people's likely behaviour from their physical appearance.
2. Using stereotypes. It is all too easy to treat all elderly patients as we would our granny, or all patients of our own age group as we would our brother or sister. Likewise we might apply stereotypes based on race or class. Be careful to avoid such assumptions.
3. Being too simplistic in our assessments, e.g. defining someone as 'bad' or 'good' or 'lazy' or 'awkward'. Individual people will display many different traits.
4. Ignoring the good points about an individual and focusing on the bad points – easily done!

It is fair to say we all find that some patients are easier to communicate with than others. In your role you are effectively in the 'front line' and therefore have to demonstrate the ability to communicate with many different personalities. Techniques for dealing with different personality types will be discussed later in this module. Before proceeding, you should now complete Exercise 1.4.

Exercise 1.4: Communicating with nervous patients

Write a brief report describing a consultation or interaction you have experienced with an introverted patient who was reluctant to talk. Concentrate on describing the patient's body language and the content of what he or she said. Describe what verbal and non-verbal techniques you used to make your communication more effective.

Review this report with your supervisor and discuss how different verbal and non-verbal techniques can be used to make a patient more communicative.

There are a number of techniques that can be practised in Exercise 1.4 that are applicable to patients with other characteristics.

For example:

- Listening carefully to what the patient is saying and observing body language to be sure that you understand what the patient is saying
- Acknowledging the content (and feelings) of both verbal and non-verbal communication
- Giving full attention and concentrating
- Demonstrating empathy where appropriate
- Using praise when appropriate (e.g. to encourage)
- Filling awkward silences

When attempting to fill an awkward silence, beware of the following:

- Changing the topic
- Making idle promises
- Saying ‘I know what you mean’ when you don’t
- Jumping to conclusions

1.7 The First Meeting

We have already described the assistant as being in the ‘front line’. Successful communication at the first meeting sets the scene for the consultation to follow. Research has shown that some types of behaviour tend to lead to successful consultations. Studies have been conducted of doctors interacting with patients. Elements of the doctors’ behaviour that improved the patients’ happiness and satisfaction were reported to be:

- Displayed warmth and friendliness
- Offered reassurance
- Showed sympathy and understanding
- Discovered and dealt with the patients’ concerns and expectations.

This may seem simple and common sense but is worth bearing in mind, right from the initial point of contact with each patient. Behaviour that helps to create the appropriate impression might include:

- Welcoming patients and attempting to put them at ease
- When collecting information, assessing the patient and selecting the appropriate approach, perhaps: – encouragement whilst working through a list of questions, or – working through the list in a business-like manner
- Inviting the patient to ask questions – ‘Do you have any questions about what we have done so far?’
- Explain what happens next – ‘If you will take a seat again in the waiting area, the optometrist will be with you very shortly.’
  Give patients an indication of how long they are likely to be waiting. In a practice with an open-plan layout you could invite patients to browse through the spectacle frame display or alternatively offer a (current) magazine to read.

1.7.1 Controlling the First Meeting with Different Types of Patient

This is a central part of the role of the assistant. You will gain skills through experience. Although you will find most interactions easy to deal with, certain types of patients may present more of a challenge than others. These are patients who:

- Are very nervous
- Are aggressive
- Are pompous
- Talk too much
- Talk too little
- Are of a different culture to your own

The following are some techniques that may be used to communicate successfully with these patients.

Patients who are very nervous

Exercise 1.4 considered interaction with nervous patients. They may have a family history of eye problems, or may be concerned about the eye exam or what might be diagnosed.

- Use open questions
- Use language and intonation skills
- With a child, use touch if appropriate or play games (see Section 1.8.3)
- Use encouragement techniques
- Sit beside rather than opposite

Patients who are aggressive

More detail about interacting with these patients is given in Table 1.1 below.

- Use appropriate body language
- Use language and intonation
- Use closed questions
- Warn the Optometrist/Dispensing optician/Manager

Patients who are pompous

- Be assertive and remain in control (see Section 1.9.1 below)
- Hand over to an older member of the team if necessary
- Use closed questions
- Body language is very important

Patients who talk too much

- Use closed questions
- Use summarising techniques
- Sit the patient down and remain standing

Patients who talk too little

- Use open questions
- Encourage them by reflecting and using positive body language
- Don't interrupt or show impatience
- Sit beside them

Patients who are of a different culture

- Use clear language and simple terms
- Repeat any instructions and be sure that they have been understood
- Emphasise important points

1.8 Communication with Special Groups

Experience improves the ability to deal with certain groups of patients. We have looked at grouping patients by behaviour type. In this section we will briefly look at techniques for dealing with patients who are young, old or visually/hearing-impaired.

1.8.1 Hearing-Impaired Patients

Patients may (partially) lip read. Use your facial expressions to add meaning to your words. Don't shout, but speak clearly and distinctly. Ensure that you have been understood (perhaps you could use a sign language interpreter). Use written communication (e.g. a note pad). Allow plenty of time. Ask patients to use their hearing aid if they have one.

1.8.2 Sight Impaired and Severely Sight Impaired Patients

Some practices have many such patients, some relatively few, but, at some stage, you will encounter patients who are visually impaired. Introduce yourself and explain what your role is. Always speak from in front of the patient as this demonstrates that you are giving your personal individual attention. Body language is less applicable and therefore language and tone are even more important. Avoid talking louder than usual: just because someone is partially sighted does not mean that hearing is affected. Good lighting is important.

1.8.3 Young Children

Use humour. Use play (e.g. Titmus, Lang tests – see elsewhere in the course). Provide distraction (children have a short attention span). Direct your speech directly to the child in the parent's presence, rather than to the child via the parent (but involve the parent). Use language appropriate to the child's age. Start with questions that the child will definitely be able to answer ('What's your name then?', 'How old are you?'). Be aware of the importance of trust, particularly with young children, and move on to the next procedure if the child is nervous. Avoid saying 'This won't hurt' as this is usually said to a child immediately before a painful procedure is performed and it makes them think about pain! Sit alongside rather than opposite. In most practices the youngest children to be seen are usually those of pre-school age.

1.8.4 Older Patients

It is difficult to offer all-encompassing strategies for communicating with older patients as they are a diverse group and age affects different people in different ways. Probably the main single point here is to avoid stereotyping. Bear in mind the above comments about communicating with visually or hearing impaired patients, and the skills associated with dealing with patients who talk less (open questions, sitting beside them).

1.9 Advanced Communication Skills

1.9.1 Assertive Behaviour

There will be occasions when you have to deal with patients who are aggressive, confrontational or non-compliant in some way. In order to deal successfully with these situations, it is important to be assertive. Table 1.1 highlights the differences between aggressive and assertive behaviour. Developing assertive behaviour takes time and practice. However, the effort is well rewarded as effective assertive behaviour is the answer to controlling situations of conflict or confrontation, even involving aggressive individuals.

Table 1.1. Contrasts between aggressive and assertive behaviour

Aggressive	**Assertive**
judgmental or impulsive	neutral
emotional	direct and firm
demanding	asking
does not respect the rights of others	has respect for self and for others
in a conflict, wants to gain at the expense of other party	wants both parties to gain

The following guidelines encourage the development of an assertive style:

1. Make any statements clearly and firmly.
2. Ensure that your body language is in tune with your spoken language.Keep to the subject under discussion (do not address unrelated issues at the same time).
3. Ensure that you are tactful in your response and respect the other's point of view.
4. Ensure your actions take due account of your interest as well as that of others.

When dealing with conflict, focus on the behaviour rather than the person. For instance, if someone is insulting you, your response should be against the insulting behaviour rather than the individual. A useful technique is always to start your response with 'I' rather than 'you'. The use of 'I' is assertive: 'I would prefer you not to behave in that manner' is assertive, states clearly and firmly what you want (without damaging your self-respect or indicating lack of respect for the other) whereas the use of 'you' is aggressive: 'You should not behave in that manner' is judgmental and accusatory, focuses on the individual more than the behaviour, and is more likely to produce a further negative response. It is inevitable that you will encounter situations where a patient is complaining in a hostile manner or is non-compliant (for example, with their contact lens cleaning regime or appointment attendance). The following three-step process may be useful when managing such situations.

1. Demonstrate that you are aware of the patient's dissatisfaction and empathise with the situation: 'I don't blame you for being annoyed – I would be if it was me', 'I wouldn't be surprised if you thought that using a daily cleaner is excessive.'
2. Define and assess the situation. 'So the problem is that you ordered the new lenses last Friday and we said they would be here today, but they haven't arrived', 'So, you are happy with the cleaning system that you are using, but believe that the daily cleaner is an unnecessary extra'.
3. Define and state the solution. 'We will temporarily glaze a pair of plastic lenses into your frame and will have the anti-reflection coated lenses ready for you, on your return from your trip'. Having revised the solution system with the patient, 'As you can see, the cleaner is an important part of this particular system and this system is the best for the type of lenses you are wearing. If you are still finding it cumbersome, ask the optometrist about an alternative regime at your next appointment.

Exercise 1.5: Dealing with conflict

Write brief notes on how you would deal with the following situations.

Discuss your conclusions with your supervisor. How would you manage:

- Patient touching you in a personal manner?
- Patient refusing to give details of address or date of birth?
- Patient making a complaint and demanding that you interrupt the optometrist?
- Patient who is drunk attending for an appointment?

1.10 The Importance of Teamwork

A team may be considered to be a group of people working together to achieve a common goal.

The team may be formally structured. For example, a specific group of people may be responsible for performing stock takes, whereas another team may be responsible for organising staff training. The objective may be a single event – for example, organising a charity fun run – in which case the team will exist for a limited time. In the day-to-day work of an optical practice, staff working together to achieve customer satisfaction may be considered a single team. In this case the team exists long-term and may be composed of different individuals as people join or leave the practice over a period of time. In a large practice, it may be more appropriate to consider separate teams as having responsibility for delivering products and services to contact lens patients and to spectacles patients. Individuals may be part of more than one team. Teams may have different types of objective, for example decisions or actions. Consider a customer service team which is responsible for liaising with customers, but does not have an input into decisions about the development of customer service standards. The team's purpose is to put plans into action rather than to create the plans. Another team may be responsible for assessing the training needs of staff members, and for deciding what training should have priority.

They make plans about training requirements.

It may be another team or individual's responsibility to put their plan into action, by sourcing appropriate courses or delivering training to meet the priorities set out in the plans.

It is important for effective team work that all team members know exactly what their team objectives are, and the level of responsibility of both the team and team members. For the rest of this chapter we will consider the case of the customer service/dispensing team carrying out its everyday tasks with the objective of maximising customer satisfaction.

1.10.1 The Value of a Team

The most valuable resource of a business is its employees. Every individual employee contributes to the ultimate success of the business. However, successful teams can do more than the individuals could alone. When teams work together well, something known as synergy develops – the outcome of their efforts is greater than the parts. The skills and experience, ideas and learning of a team surpass in depth, range and quality those of the individuals working separately. Another major benefit is that individual members of the team feel more motivated and valued than if they are working in an isolated way. You will know from your own experience that facing challenges in the workplace feels much easier if you have supportive colleagues and if you feel highly motivated.

1.11 Methods of Team Communication

There are numerous ways in which teams in store can communicate effectively with each other. Each of these methods has advantages and disadvantages and different stores will use different methods to suit the needs of their business. It is worth noting that a store using multiple methods of communication at the same time is more likely to be successful.

1.11.1 Huddles

Huddles are a daily meeting where your team are updated on key store activities and targets. They allow the store team to review prior performance and prepare for the day ahead.

These meetings should not exceed 15 minutes or the team may start to lose interest.

Huddles should run immediately before the store opens and then be repeated later in the morning for staff who start later.

Huddles would normally include the following:

- Yesterday's performance in sales, conversion and average dispense value
- Today's sales targets and any available appointments that can be filled during the day
- Key actions for the day ahead
- Any customer feedback
- Recognition for any team members who have done something great
- Give team members the opportunity to contribute on any issues they feel relevant.

1.11.2 Team Meetings

Team meetings can be held on a weekly, monthly or quarterly basis. They can involve the whole team or a department and are a chance to discuss matters in more depth than the 15-minute huddle would allow.

They can also be held on an ad hoc basis when there is news to be communicated or changes being implemented.

1.11.3 Staff Training

Training is a method of communicating new skills and behaviours. It can also involve giving feedback on a person's or team's performance. Training for the whole team would normally be delivered on a weekly basis; however individual training can be an ongoing process in store.

Training also gives us the opportunity to discuss new products and prices and is therefore a very important method of communication.

1.11.4 Performance Review

This is a one-on-one method of communication and can happen as frequently as required. Reviews are used to communicate with an individual about their performance and development. It is a formal discussion between the team member and manager. Performance reviews are important because they communicate the individual's objectives and goals for the next period and allow them to know what is expected of them.

1.11.5 Written Communication

This can take the form of emails, notes or perhaps inserts into a store diary or notebook. This is effective if you are not going to see the person you wish to communicate with or wish to keep a record of the conversation, however these can often remain unread or can be misunderstood. If you have the opportunity to communicate face-to-face this will always be more effective.

Exercise 1.6 Advantages and disadvantages of communication methods

Write a list of the methods of communication used in your store.

For each method think of 2 advantages and 2 disadvantages of communicating using this method.

1.12 Summary

The analysis and control of communication skills enable the individual to direct interactions more effectively. Gaining feedback from others is the most effective way of assessing our own communication style. This feedback can be used to alter our style in order to produce more successful outcomes from patient interactions. The process by which we communicate is complex – the intonation and tone of our voice are as important as the words we choose. Body language, including posture, gestures, facial expression, and use of space and position, are as important as, if not more so than, verbal communication. There are a number of recognised techniques for asking questions and listening that can improve the effectiveness of communication, particularly the skills of active listening. The use of behaviours such as politeness and confidence can further enhance communication. Developing strategies for dealing with different types of patients and different types of encounter equips us to deal more consistently and more effectively with different situations. Assertive behaviour is a skill that can be easily learned and implemented and enables the assistant to deal with all but the most difficult situations.

Working as a team is important and you will accomplish more working as part of an effective team than would be possible individually. Communication between team members is key to the success of the team and this can be done in a variety of methods. The more different ways you can communicate the more effective your team will be.

Chapter 2

Knowing the Customer and Delivery Service Quality

Introduction

Optical practice is a combination of technical knowledge and skills and commercial business operations. Running a successful optical business means attracting and retaining customers and making a profit. Marketing and retailing skills enable optical practices to offer and supply the services customers want in a way which satisfies them as well as making the most efficient use of resources.

By the end of this chapter, you will:

- Be aware that a successful optical business is founded upon understanding the customer
- Understand psychological processes which underpin customer choices
- Understand the marketing mix and how it is used to influence customer choices
- Understand the retail mix and how it is used to deliver the appropriate customer experience
- Understand the principles and purpose of retail operations
- Understand the concept of merchandising and its relation to optical practice

2.1 The Nature of Optical Business

Optical practices exist to deliver eyecare services and products to their customers. The objective of all the systems which together make up an optical business are therefore focused on customers – aiming to make the customers as satisfied as possible with their practice visit. In this chapter we will introduce you to the systems which are used in your practice to deliver an efficient and consistent service to your customers. As different businesses use different systems, we will give a brief overview of the principles of retail operations and then give you some exercises to complete with reference to the systems in your particular practice. The dispensing assistant's primary role is to help the customer make decisions about optical products. Therefore the knowledge and communication skills of the dispensing assistant make a lasting impression on the customer. We have discussed communication skills and eliciting the information required for the dispense elsewhere in this course. In this chapter we look at how we all make decisions about what we buy. To become an effective part of the optical practice team you need to understand something about customer psychology. Once you understand this you can use your communication skills and product knowledge to give every individual customer a satisfying experience and quality service. Consumers place their trust in optical practitioners to advise them on the products that will meet their particular needs. We should take care not to exploit that trusting relationship and encourage them either to buy something which does not meet their visual and aesthetic requirements, or to spend more money – unless the extra cost gives a true benefit to the customer. In the optical professions we are concerned with long-term relationships with loyal and satisfied customers. Our customers must continue to feel happy with the advice and service they have received even after they have left if they are to return to the same practice for their future eyecare and eye wear.

2.2 How Customers Make Decisions

The more you know about your customers the better equipped you will be to provide effective customer service. When we make a purchase the decision process starts much earlier, before we even visit the place where it is available.

The decision-making process involved in making a purchase starts with a 'need' or 'want' experienced by the potential customer and progresses through several stages which involve finding information about fulfilling that desire – for example, paying attention to advertisements, asking friends for a recommendation or 'window shopping'. The decision to purchase is then followed by the purchase itself and putting the product or service to use. The final stage in the process is considered to be the customer's feelings after the purchase.

The pre-purchase activity involved in choosing a product has four stages:

1. Awareness of products and services which may satisfy the desire
2. Interest in these, which intensifies as more information is collected
3. Desire to obtain the product or service
4. Action to obtain the product or service

As the purchaser weighs alternatives as to product, brand and place of purchase the 'interest' stage may be broken down further into:

- Knowledge
- Liking
- Preference

In a competitive market such as optics, marketing may be used to ensure, first, that one's practice is one of the alternatives considered as a place to obtain the desired products, and, second, that information about the practice collected by the individual is favourable and tending to create a preference. It is not simply marketing which influences the customer's preference, however. Repeated positive experiences at the practice (both one's own and that of friends and family) will ensure that whenever the individual desires optical products or services, the patient's customary practice will be at the top of the list. This is known as customer loyalty. Once customers have bought a product which they believe will meet their particular need, they put it into use. Dissatisfaction may arise if it does not perform as well as the customer expected or if friends or family suggest the choice was not a good one, undermining the customer's confidence in the choice and the product. This can of course adversely affect customer loyalty, even if their experience of service in the practice was good.

This is another reason to avoid pressurising customers into a sale with which they are not completely happy. The loss of a customer for the long term can be far more significant to the business than short-term gain of a single sale.

In ophthalmic dispensing, collection of the spectacles from the practice is an important opportunity to overcome any doubts which have emerged since the dispense, through reassurance and reinforcement of the reasons behind the purchase as well as a readjustment of expectations. Communication relating to the collection is discussed in Chapter 3.

2.3 Marketing

Traditional definitions of the marketing mix are the four Ps: product, price, place and promotion. In optical practice, 'product' means the service and optical appliances on offer, 'place' means the location of the practice, its design and layout, and 'promotion' is a message used to attract customers – this includes, but is not limited to, advertising. Advertising is simply a promotional message in the media, which is paid for. Many people confuse advertising with marketing but as you can see there is far more to marketing than simply the design and placement of an advertisement.

Some of the types of marketing communication with which you will be familiar, and which convey impressions about a company's service, are:

- Advertising in the press and on television and radio
- Features in magazines which are paid for (called advertorials or advertisement features)
- Direct mail
- Posters in public areas
- Information leaflets in optical practices
- Posters and cards within optical practices (point of sale material)
- Websites
- Promotional emails

Recently, the definition of the marketing mix has been updated to seven Ps – adding people, process and physical evidence. 'People' refers to the service the customer receives from practice staff, 'process' to the efficiency of operations and 'physical evidence' to the items with which customers leave, and which serve as a reminder of their experience in the practice. The addition of these extra three Ps is considered to complete a picture of the overall customer experience. The Ps are used to reinforce the distinctive image that the company wishes its potential and existing customers to have of its overall service. It may be surprising to learn that it is not just communicating with potential and existing customers which is the preserve of marketing. Determining the customer's needs and wants, selecting the business location and deciding which customer groups the practice should serve are also part of a decision making process which falls under the umbrella of marketing.

In order to appeal to the intended groups or segments of the community (the market), one must know what the market wants and do one's best to fulfil those wants. The techniques which are used to understand more about customers are many, and are often time-consuming, expensive research projects which must be repeated frequently. This means that extensive research-based marketing can only be justified by large organisations. However, customer surveys can be carried out by businesses of all sizes. When one knows the range of product the market wants, where and when they would be prepared or/prefer to get it (place), how much they are prepared to pay for it (price), and what messages will attract their attention, influence their attitudes and convince them to choose a particular product (promotion), then this information is the basis of planning how to capture the market's attention and create a preference for one's particular brand. Through marketing, companies are able to convert general wants, e.g. 'I want to update the way I look', to a specific desire, e.g. 'I want fashion spectacles from this particular optician'.

Exercise 2.1 Marketing

Which of the following are part of the marketing mix?

Price of frames	Design of the patient record
Design of accessories	Choice of consulting room equipment
Recruiting new staff	Organisation of the stock room
A survey of designer brand preferences	TV advertisements about products
Posters in the window	

Marketing research information is also used to make decisions about which product ranges to buy and how to operate one's business, although these two areas are not part of marketing itself. As we discussed earlier in this chapter, it is not just the promise of fulfilling a need which brings the customer to the door, it is the way in which that need will be fulfilled which causes the customer to select a particular practice.

The General Optical Council (GOC) publishes rules on publicity which control the advertising of optical services. In addition there are general regulations on advertising to ensure the public is not misled by over-inflated claims for a product.

In conclusion, the elements of the marketing mix enable optical practices to understand their customers and this provides information about customer expectations, which helps practice owners create a preference for their service among potential customers.

2.4 Retail Operations

In the previous section, we discussed how knowing more about customers helps practice owners create a preference for their service. It also enables them to make decisions about where to set up their business in the first place, and how to organise their customer service, practice systems, products, layout and design and what values they offer the customer (e.g. 'value for money', 'speedy service' or 'exclusivity'). The decisions made will determine the customers' experience when they visit the practice.

These factors – which affect customers' experience in the practice – are known as the retail mix (Figure 2.1).

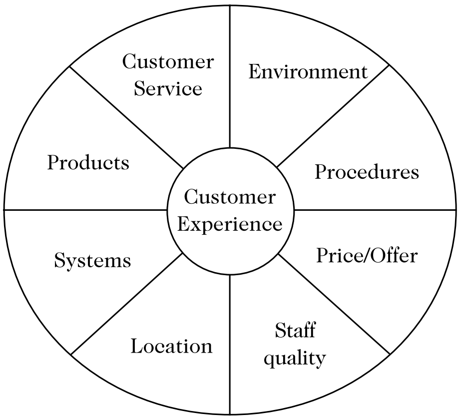

Figure 2.1 The retail mix

'Operations' is the term used to describe the policies and procedures which keep the business going from production through to delivery of products and services. It is not enough to set policies and procedures: you must also ensure they are put into practice consistently. The manager cannot be everywhere at once, so a method has to be found to enable the manager to delegate, but have procedures in place to be able to check that systems are properly carried out. Documentation is the key to monitoring. Every process is written down, and standards and ways of measuring performance are set. This is essential not only to ensure efficiency, but also for compliance with the legal standards which regulate some aspects of optical business. In a multiple practice, the responsibility for documenting and setting standards is often centralised, to ensure consistency for customers and to save time and duplication of effort among practice managers. These procedures may be set out in a comprehensive operations manual.

There are three main priorities for operations:

- to satisfy the customer
- to make efficient use of resources
- financial performance management

Decisions about operations are based on marketing information – knowing what customers want, when they want it and how much they are prepared to pay for it (specification, time and cost). Operations are designed to provide the environment to deliver these elements. Beyond these basic requirements, you also have to consider the quality of service required. It is often possible to boost customers' perceptions of service without changing the specification, time or cost.

The challenge for the manager is to ensure the business systems are efficient enough to deliver these elements while making a profit. No business can survive – let alone keep up with changes in customer requirements and the competition – while running at a loss. In a multiple organisation, customer service must also be consistent in all practices, both because marketing leads to similar expectations among customers who live in different places and also because consistent standards and procedures provide efficiency. For those who use an operations manual, it is important that staff understand, remember and adhere to the systems and procedures. Therefore, the manual must be clearly and carefully written and its contents must be put into practice by regular training. Some procedures require strict compliance, for example, if they are designed to fulfil legal requirements.

The challenge for members of staff is to add as much value for the customer through the way they deliver their service, while conforming to practice standards of time, cost and quality. In a retail business, the customer service team's overriding purpose is to ensure customer satisfaction. Customer satisfaction can therefore be taken as a measure of quality. To provide satisfaction the assistant needs to spend a certain amount of time with each customer. There is of course a variation in the amount of time each customer needs, in order to meet their expectations. With experience, one picks up signals from every customer, for example, whether they are in a hurry, particularly demanding or have concerns, allowing one to adjust service time accordingly.

If the demand for a service is growing, more staff are needed to ensure the level of service continues to meet the expectations of the growing number of customers. However, recruiting more staff increases the costs of running the business. For the survival and success of the business, the amount of money spent by customers on goods and services must exceed the cost of running the business. There is therefore an optimum ratio of staff to customers which enables the staff to spend enough time with customers in order to deliver a quality service, but not to overburden the business with staff costs such that income from sales is insufficient to ensure long-term survival and prosperity. If there is a steady and consistent fall in the number of customers or the amount they are prepared to pay for the service, the business must consider ways to reduce costs, for example reducing the number of staff to restore the optimum ratio. For most service businesses, there are peaks and troughs in demand during the day, over the working week, and at different times of the year. This is called seasonality (a related concept to seasonality in merchandising).

The question then arises of how to maintain optimum staff to customer ratios to provide good service.

Some of the strategies used may be to take on additional part-time staff to cover peak periods, and arrange staff rotas to give the best fit with demand.

Appointment times are the traditional way to stagger demand in optical practices, to iron out the peaks and troughs, so the ratio is relatively stable and predictable and no one has to wait for more than a few minutes. The realities of modern optics are that many practices are in areas of high customer footfall, and many people simply walk in, expecting to be served without an appointment. This makes it much more difficult to plan service levels, and there are inevitably times at which the number of customers exceeds the ideal levels for optimum service. The reality is that few business owners will consider taking on a new member of staff unless demand exceeds capacity regularly, and looks set to do so for the long term.

The actions of individual members of staff at such times can have a tremendous impact on service levels in peak demand periods.

At times when there are customers waiting and every dispensing assistant is busy, each assistant should try to reduce the time spent with a customer, without compromising the customer's satisfaction with the service. Some of the strategies to minimise the impact of time pressures on customer satisfaction are:

- Forewarn the customer if the service is running late, apologise and give an accurate waiting time.
- Conduct tasks which are not essential to customer service (e.g. stock/paperwork) outside peak periods.
- Use vital seconds to reduce dissatisfaction.

If you have a few seconds while your customer browses, why not acknowledge the next customer and apologise for the delay? Being ignored compounds the dissatisfaction caused by the delay.

Listen to feedback from customers on what they think are the factors which make the greatest contribution to service quality. By concentrating on these key success factors when serving customers at busy periods, you reduce the chance of compromising the perception of service quality even though you may spend less time with them. If the practice operations have been designed by a manager for the purposes of cost-efficiency then deviation from those standard processes may add cost. In some circumstances it may be that you can be flexible with these systems to meet the requirements of a customer, i.e. trade off cost and quality for the sake of customer satisfaction. Establish through discussion with your manager where it is and is not acceptable to be flexible in this way. If customers are making frequent requests for an additional service element it may be that the systems need to be revised. Indeed, customer service expectations have increased dramatically in recent years and have provided a source of competitive advantage for some businesses. As the assistant is at the 'coal face' of interactions with the customer, his or her experience provides a valuable insight into customers' evolving expectations and a source of new ideas for service improvement.

2.5 The Patient Record

2.5.1. Record Keeping

It is vital to keep a clear and thorough record of every sight test, contact lens visit or dispensing problem that a patient has with us. Not only does this allow us to track how a patient's prescription may alter over time, but also allows us to record other relevant information that could alter how we treat a specific patient. For example, systemic health conditions such as diabetes could have an impact on the tests we need to perform in the test room or sight test recall. Good record keeping allows us to easily see a patient's optical history and also the results of clinical tests that have been performed.

The 'Test Room' module on Socrates allows the optometrist to record pertinent information in several specific areas. This includes pre-test results, for example tonometry and auto-refractions as well as results from different parts of the eye examination. Data is input into the 'Test Room' module by both touch screen tabs and by typing via the keyboard for more detailed information. This data is stored at each visit, and can be quickly seen again by the optometrist at future visits.

There is a golden rule with record keeping; 'If it's not written down, it didn't happen'. In this modern age of litigation it is very important to remember this. If an optometrist conducts a specific test or gives advice to a patient, but doesn't record it, then it can't be relied upon in the event of a patient alleging negligence.

In reality, the optometrist should be documenting the result of each and every test carried out during the sight test, along with every piece of advice given, and every response from the patient.

2.5.2 Understanding the Patient Record

Title		First Name		Surname		TR 1285424
DOB:		Age:		Contact Number:		
Address:						Customer ID:

Appt Type:		Appt Room:		Appt Date:		Appt Time:	
NHS/Private:		Voucher Y/N:		NHS Reason:			
Last Sight Test:		C/Lens Wearer:		Last C/Lens Check:			

Last Test Results	Sph	Cyl	Axis	Prism		Add	Type	CD	VA
R									
L									

Prescribed Rx	Sph	Cyl	Axis	Prism		Add	Type	CD	VA
R									
L									

C/Lens	Style	Base Curve	Dia	Sph	Cyl	Axis	VA
R							
L							

Pre-Test	Sph	Cyl	Axis	IOP	Fields	Colour	K Read	Photos
R								
L								

Habitual Rx		Sph	Cyl	Axis	Prism		Add	Type	CD	VA
1	R									
	L									
2	R									
	L									
3	R									
	L									

Notes:

THIS FORM MUST BE DISPOSED OF SECURELY

Title		Forename		Surname		
Date		Appoint Type		Appoint Time		Customer No.

Address

Post Code

Contact Number		DOB		Age		TR No.	
Last Test		Last Test N or P		Last Recall Period		Store ID	
NHS / Private		NHS Reason				Driver HGV PRV PSV M/C	
Doctor		Surgery					
C/Lens Wearer?	VDU	Occupation / Hobbies					

Reason For Visit

Pre–Test	Sph	Cyl	Axis	IOP	Time	Fields	Colour	K Read	Photos
R									
L									

		With RX	Without RX	Current Specs		Sph	Cyl	Axis	Prism	Add	Type	CD	VA
C T	D			A	R								
	N				L								
F D	D			B	R								
	N				L								

General Health

Ph or ia			Last RX on System	Sph	Cyl	Axis	Prism	Add	VA
	D								
	N		R						
MOT			L						
NPC Cm			Accommodation						

Medication

Ocular History

Family History

Supplementary Tests

R	Examination	L
	Lids & Lashes	
	Cornea & AC	
	Lens	
	Vitreous	
	Optic Disc	
	CD Ratio	
	Vessels	
	AV Ratio	
	Macula	
	Periphery	
	Pupils	

Unaided	R		L		BIN	

RX	Sph	Cyl	Axis	Prism	DVA	Bin VA	Nr Add	Nr VA	Rd CM	OO Specific Appoint Type
R										
L										NI Number

Pres. RX	Sph	Cyl	Axis	Prism	DVA	DUO	Bin VA	Inter Add	Other Add	Nr Prism	BVD	PD
R												
L												

No Change	No Rx Req	New Rx Req	Rx to Px	Refer GP	Suitable for C/Lens	NHS Voucher	NHS Early Test Reason	Recall Period

Options	SVD	SVI	SVN	BIF	VARI	Ultra Clear	Ultra Tough	Tints	Thin & Light	Polar	Reactions

Advice Given / Action Taken

OO Name		OO Signature	

Figure 2.2a and 2.2b Samples of record card

After the eye examination an optometrist will usually provide a single sheet of A4 showing the most important test results. This is generally adequate. In some cases, for example if a patient is having problems with their spectacles, this information may not be enough and a full clinical record may be required.

To print this off click on the main 'Socrates' tab and then select the 'Reports' tab in the subsequent menu. Scroll through to find the 'Full Clinical Record' tab and then use this menu to print off any previous sight test records.

At first glance the 'Full Clinical Records' may appear daunting, but all the information recorded on there is broken down into smaller sections. There may be a few unfamiliar abbreviations written down in your record. The main abbreviations that you may come across include:

C	with
S	without
Px	patient
Cx	customer
Sx	symptoms
Rx	prescription
H/As	headaches
BVD	vertex distance
IOP	Intraocular pressure, i.e. the tonometry results always recorded with the time at which the test was carried out
CD	cup to disc ratio, used when describing the appearance of the optic nerve head, e.g. 0.3
AV	ratio of the diameters of the retinal arteries to veins, e.g. 2/3
NPC	near point of convergence
PERRLA	pupils equal, round, and respond to light and accommodation

If you find anything on your sight test record that you are unable to decipher, then ask one of your optometrists to explain it!

2.5.3. History and Symptoms

This is a critical section of the record. The information gathered by the optometrist and recorded in this section at the start of the consultation should tell us why the patient has decided to have a sight test. This would include what problems they are having with their vision (if any), and any relevant medical details that could potentially affect the patient's ocular health.

The optometrist also uses this section of the record to note any information relating to the patient's occupation and hobbies. This could be useful when prescribing glasses, e.g. a patient that requires protective safety glasses, or someone who needs a specific prescription for playing the piano.

Immediately below this is the section of the record where the optometrist documents the autorefraction and tonometry results, which are often measured during pre-testing.

2.5.4. Muscle Balance Tests and Accommodation and Pupils

The optometrist carries out certain clinical tests to assess the binocular vision of the patient. This is important to ensure both eyes are aligned, i.e. that both eyes are viewing the same object at the same time. If for some reason the eyes are not aligned then the patient will have poor binocular vision; this is the reason why some patients cannot appreciate the 3D sections of modern films as they require good binocular vision to be viewed properly. Alignment of the eyes is controlled by 6 extra-ocular muscles.

Assessment of binocular vision can include the following tests:

- cover test, where one eye is occluded at a time to observe if there is any imbalance of the ocular muscles.
- motility test, where the patient follows a pen-torch in different directions and the optometrist observes the muscle movement
- near point of convergence test (NPC) which allows the optometrist to monitor the patient's ability to view near objects.

Sometimes imbalances in a patient's binocular vision need to be corrected using prism, which can be measured using the Mallet unit.

Accommodation is a measure of the ability of the eyes to focus on near visual tasks and in practice is commonly measured using the RAF rule. Ask an optometrist to demonstrate this piece of equipment being used.

Pupil assessment is extremely important, as it is one of a few neurological tests optometrists carry out, and can reveal if there is any damage to the optic nerve or 3rd cranial nerve.

2.5.5. Refracted Rx and Prescribed Rx

The 'Refracted Rx' refers to the prescription found by the optometrist in the test room following the sight test. The 'Prescribed Rx' refers to the prescription that the optometrist decides should be used to make up the patient's glasses. 'Habitual Rx' refers to the prescription which the patient is currently wearing.

Most of the time, the refracted prescription and the prescribed prescription will be identical. However, on occasion the optometrist may decide that they want to modify the refracted prescription before prescribing it, usually in order to ensure the patient tolerates the new prescription well.

Any additional information that the optometrist deems useful to the dispensing assistant can also be annotated here, e.g. that the patient requires bifocals, or that they have an allergy to nickel containing frames.

2.5.6. External Eye and Ophthalmoscopy

One of the most important parts of the patient's sight test is the assessment of the external and internal structures of the eye. The optometrist commonly assesses the internal eye by ophthalmoscopy, either using a direct ophthalmoscope or more commonly a slit-lamp in conjunction with a Volk lens. The external eye is assessed using a slit lamp. The images captured using digital retinal photography (DRP) are also useful to the optometrist at this stage, as they can show up any retinal disease. The retinal photographs also allow any findings, normal or abnormal, to be communicated to the patient.

Thankfully, most people have healthy eyes. Even so, the optometrist still has a responsibility to document what was seen and what equipment was used to assess the health of the eyes. On occasion, when the patient shows signs of eye disease, this also needs to be recorded accurately so that any changes or deteriorations can be monitored, but also this information is used as part of any referral to a general practitioner or eye specialist.

Remember the golden rule of record keeping: 'If it's not written down, it didn't happen'? Nowhere is this more important with a patient's sight test record than the findings of the ocular health, as certain eye diseases could potentially affect the patient's vision in the future. If the optometrist has not written down the results of each test carried out then it could be argued that those tests were never actually done.

2.5.7. Additional Tests and Advice given/Action Taken

Finally there is a section on the full clinical report located above the 'External Eye and Ophthalmoscopy' section titled 'Additional Tests'. This is often used to record clinical tests that do not always need to be carried out with every patient, e.g. colour vision testing. The optometrist should record what test was carried out using which specific equipment, and what results were found.

The Advice given/Action taken section is fairly self-explanatory. It is an area for the optometrist to document advice given to the patient regarding the results of their sight test and what action (or actions) they have taken, e.g. 'referred patient for consultation regarding cataract surgery'.

Exercise 2.2 Patient record

Using a printout of your own full clinical records identify where the following measurements are located and what they were for you:

- Right eye cup to disc ratio
- Left eye corrected distance visual acuity
- Distance cover test with or without glasses
- Instrument used to assess your ocular health

2.6 Cleanliness

It is easy to dismiss cleaning and tidying and consider it a menial task. However, it is critical to making a good impression on the customer and therefore deserves a good deal of attention. Every part of the practice needs to be clean and well presented. For example, all glass – windows, mirrors and doors – should be clean and smear-free. All display material should be up to date and correctly positioned. Carpets should be clean and in good repair. The reception should be uncluttered, clean and organised. All display units should be dust-free and clean, with no gaps in the display. The dispensing area should be tidy and convey a professional appearance. Any frames kept on display should be regularly cleaned and inspected for damage. As most frames dispensed will be taken from displayed stock it is essential they are maintained in pristine condition.

Staff appearance is also important to creating the right impression. Shoes and clothing should be appropriate, clean and pressed, and attention should always be given to personal hygiene. Posture is also important: slouching and leaning against the desk imply lack of interest, as does standing with you hands in your pockets and supporting your chin in your hand when sitting with a customer.

Cleanliness is not only a valuable way of adding value to the service, minimising the chance of cross-infection and maintaining high levels of hygiene within clinical areas are important issues in healthcare as a whole. A number of practical steps can be taken and it is possible to design a practice protocol which, when adhered to, should significantly reduce the risk of cross-infection.

2.6.1 Infection Control

There are many procedures that can potentially spread infection. As you have already learned, eye infections can range from conjunctivitis, which can cause considerable discomfort, to sight-threatening keratitis (e.g. caused by Acanthamoeba or Pseudomonas aeruginosa. Every precaution should be taken to ensure that such an infection does not arise as a result of a visit to the optometrist!

In addition, some skin infections and viruses such as Herpes (e.g. cold sores) can be spread by contact and it is equally important that the practice is not the source of such spread of infection.

Infection control is based on ensuring that all instruments that come into contact with patients, and all surfaces on which disinfected/sterilised items, such as contact lenses, are placed, are regularly cleaned and disinfected.

Definition of cleaning, disinfection and sterilisation

Cleaning is the removal of debris from a surface.

This debris might allow the proliferation of microbes and may reduce the effectiveness of any disinfection or sterilisation procedures. Disinfection is the process of reducing the number of microbes present, but not necessarily removing all bacteria and viruses. Sterilisation is the process whereby all microbes, including spores and viruses, are completely killed.

Hand hygiene

How often should you wash your hands when working in practice? The answer to this is really common sense. Washing hands is important before handling contact lenses.

It is also important following procedures such as handling contact lenses that have been removed from a patient's eye (tears can be a source of cross-infection) and before handling items that have been sterilised (such as a tonometer head) or prior to instilling eye-drops.

Liquid soap should be used in preference to bar soap, as the latter, when wet, often harbours many bacteria (e.g. Pseudomonas).

As hand washing is likely to be frequent, you may find that it is preferable to use a gentle soap to avoid drying the skin, although it is important that all traces of soap are removed before handling contact lenses. Hand towels, if used, should be replaced frequently, although many practitioners prefer to use paper towels, as multi-use hand towels are another potential source of bacteria and cross-infection.

Before leaving the topic of hand hygiene, it is worth mentioning that all cuts and abrasions should be covered with waterproof sticking plasters.

Cleaning and disinfection of the practice environment

Instruments

Parts of instruments that come into contact with the patient's face, such as head- and chin-rests, trial frames, phoropter heads, pupilometers and rulers, should be cleaned and disinfected regularly. Maintaining hygiene in this way is good practice, but is particularly important for preventing cross-infection with infectious eczema or Herpes. It is satisfactory to use a moistened tissue such as a Medi-Wipe (which is impregnated with ethanol and chlorhexidine) for general cleaning purposes of the instrument and instrument table. However, a freshly opened alcohol swap (i.e. not from a multi-tissue dispenser) such as a Medi-Swab (which is impregnated with isopropyl alcohol) should be used to disinfect the chin- and head-rest. Chin-rest tissues should be used wherever possible.

Surfaces

Work surfaces in the consulting room and contact lens areas should be cleaned on a regular basis. It is satisfactory to use Medi-Wipes for this purpose. If disinfected tonometer heads or contact lenses are to be placed directly on to the surface, then it should be further disinfected by the use of an alcohol swab. Some practitioners choose to designate a particular area of the practice as a 'clean zone', which is regularly disinfected for such use. It may help if this area is marked as such, to avoid contaminated objects being placed in the clean zone. For example, any surface used during teaching patients to insert, remove and clean lenses should be designated as a clean zone and maintained accordingly. Sinks can be kept clean by use of an antibacterial spray, Medi-Wipes or solutions containing chlorine such as Milton.

Tonometer heads

As these are placed in direct contact with the patient's cornea, it is essential that tonometer heads are adequately disinfected. The easiest method to follow here is to use a freshly opened alcohol swab. The tonometer head must be allowed to dry completely before being used again. If the tonometer head is in frequent use, the practitioner may prefer to use a solution containing a specific concentration of chlorine for disinfection purposes. Chlorine solutions are used in hospital and are effective against bacteria and viruses, although a fresh quantity must be made up each day. With non-contact tonometry, other than the procedure advised above for chin- and head-rests, there are no special precautions to be taken regarding hygiene.

Exercise 2.3 Infection control protocol

Draw up a cleaning and disinfection protocol for your practice. Make sure that everyone in the practice is aware of its content.

2.6.2 Maintaining Practice Supplies

In addition to checking the cleanliness of instruments and surfaces, the assistant may be responsible for maintaining such things as stocks of consumables and instrument spares.

Consumables

These include the following:

- Thermal paper for AR, tonometer, auto-focimeter and motorised phoropter
- Paper and ink cartridges for field equipment printer
- Chin-rest tissues
- Medi-Wipes
- Alcohol wipes (e.g. Medi-Swab)
- Tissues

- Soap, towels and lens-cleaning cloths
- Glass marker pens

Stationery

The assistant may be responsible for checking that adequate supplies are kept of paperwork to be used in the practice. This includes NHS forms, practice letterheads, referral pad and envelopes.

Exercise 2.4 Maintenance of supplies

Discuss the examples given above with your supervisor. Identify maintenance responsibilities that your supervising optometrist is happy to delegate to you. Draw up a list of these responsibilities and agree a frequency at which they should be checked (eg some of them might be daily, some weekly and some monthly).

2.7 Cost Control

It is your responsibility as an employee to make sure you use your time productively and do not waste resources. Sometimes it is not immediately obvious how the assistant who has no managerial responsibilities can contribute to the financial success of the business. Some understanding of the costs of optical practice are useful to illustrate this. The basic principle of retail business is that sales income minus costs leaves an amount which, after tax, leaves some profit for the director. Directors have invested in their business, and they must make enough profit to live on and to invest in their business for the future. (If the profit on their business is no more than they would get from putting their money in the bank, they won't stay in business for long!) There are two types of cost which the practice has. These are called fixed and variable costs. The fixed costs are those which do not vary in the short term.

These are items such as rent and rates of the premises, heating, lighting, salaries and accounts.

Variable costs are those which are directly related to the number of products sold or customers served.

The variable costs of an optical business can be broken down into the following:

- Lens cost of sales (COS) – this is the amount of money the practice spends on purchasing prescription lenses for customer orders and can be affected by remakes (when a customer is unhappy with the product and asks for it to be remade) or wastage (when the product is damaged in the lab and has to be reordered).
- Frame COS – this is the amount of money the practice spends on purchasing frames and can be affected by theft of the frame stock (which can be highlighted early, and subsequently reduced, with regular stock counts) or any remakes which require a new frame to be used and the original frame to be discarded.

  When frame and lens COS are combined this is known as spectacle COS.
- Contact Lens COS – this is the amount of money the practice spends on purchasing contact lenses and contact lens solutions. It in theory may also include the cost of posting of contact lenses to patients; however some practices will choose to record this separately. Contact lens COS can be affected by theft of contact lens stock, providing patients with additional lenses without charging them, accepting old stock from a patient which cannot be returned to a supplier and a clinician's decision to use a less profitable product because it provides additional benefits to the patient.

Both fixed and variable costs have to be covered by sales income, so prices have to be set at a level which covers both. The more transactions there are, the lower the amount of fixed costs allocated to each transaction. So by generating loyal customers, the assistant can benefit both practice profitability and customer value for money because the owner can afford to pass on lower prices to the customer.

Here is an example. If a bookshop has £2,000 in fixed costs per month and sells books which cost £2 to buy from a wholesaler, how much will the shop need to charge to cover its costs if it has (a) 100 customers and (b) 1000 customers per month, assuming every customer buys one book?

(a) Total costs = fixed costs (£2000) plus variable costs (100 customers × £2 per book)
Total costs = £2000 + £200 = £2200
For income to equal costs, the price charged to each of the 100 customers must total £2200.
Therefore price = £2200/100 = £22 per book.
Now let's consider the situation where there are 1000 customers.

(b) Total costs = fixed costs (£2000) plus variable costs (1000 customers × £2 per book)
Total costs = £2000 + £2000 = £4000
This is higher than in (a) because there were more customers, so the owner bought more stock.
For income to equal costs, the price charged to each of the 1000 customers must total £4000.
Therefore price = £4000/1000 = £4 per book.

No business can survive just by covering costs of course, but this simple illustration shows that if fixed costs are high – as in retailing where you have the costs of premises and staff – the number of customers makes a big difference to minimum prices which can be charged.

Assistants contribute to costs, not only in terms of their salary and insurance, but also in the way they perform their activities. For example, careful stock rotation and stock checking ensure frames are available when customers want them so sales are not lost due to being out of stock.

Stationery, photocopying and telephone use may seem inconsequential, but when considered over a long period they constitute a major cost to the business, so again not wasting paper or administration resources, however small, makes a difference to the business over time. Good communications with customers reduces the risk of misunderstandings which can otherwise lead to complaints. These tie up senior staff's time, and have potentially serious consequences for the reputation of the practice.

Now consider a busy period in practice. Every customer who comes through the door is a potential loyal customer to the business. If someone walks out because of having to wait an unacceptable length of time before being served, then that is the collective responsibility of the dispensing and customer service team.

The assistant contributes to revenue by giving customers advice on what products to buy, and giving them a pleasant service experience so they are delighted with what they buy and, ideally, become regular customers. However, if assistants spend too much time with a customer, they may increase delays for others who are waiting. The small additional benefit for the one customer is offset by the substantial impact on others. Waiting time is a major cause of customer dissatisfaction. Worse, a member of staff who is late back from break may cause delays because colleagues cannot cope with demand while they are short-staffed.

Finally, most modern administration systems are designed to be quick and simple and computer systems cost a great deal to install. If assistants do not work to the standard system, for no other reason than that they prefer 'their own way', unwittingly they may increase costs through making administration take longer and reducing the usage of the computer system.

In summary, the decisions you make about how you can spend your time can contribute to costs and benefits to the business. The choices are not always simple, but becoming more aware of how systems work in your practice enables you not only to perform your tasks more efficiently but also perhaps to see how procedures can be changed to increase efficiency still further. If you give your manager new ideas for improving the business you will be making a major contribution and no doubt advancing your career prospects at the same time.

2.8 Merchandising

Merchandising is the term used to describe the process of selection, buying, stock management and display of the range of products and/or services, which a particular business is offering to consumers.

In dispensing practice, the products and services are the optical appliances supplied to customers as well as the specialist advice of the dispensing team. Decisions need to be taken about the type, quantity, price, quality, time and place of these products and services. Who makes these decisions varies. In a small practice, all such decisions may be made by an optometrist or dispensing optician. In a large practice with a team of 20–30 people, different elements of merchandising may be delegated to several members of the team.

In a business such as optical practice, the type of merchandise offered is more specialised than say what is stocked in a supermarket, and there are strict legal standards governing the sale and supply of many optical products. There are many choices available to optical practices. They may choose to concentrate on high-priced fashion frames and contact lenses, or to cater for a more price-conscious clientele. They may offer a good range of sports vision, safety or low-vision products and services. They may link up with local healthcare services to provide shared care of, say, cataract or glaucoma patients, and acquire a range of products of particular relevance to these groups.

The practice in which you work will have a particular approach to the type and variety of products it offers to the customer. A few key terms are used to categorise the merchandise offered by a store or practice:

Range: A collective term for all the types of products offered at a given time by the store.

Stock or inventory: A collective term for the number of products in the store at a given time.

Assortment: The variety of products within the range.

A deep assortment is one which has a large number of products within a small number of categories or lines.

A broad assortment is one which has a large number of categories or lines, within which only a few choices may be available. For example, in a store with the same number of products an optical practice has a narrower assortment than does a retail chemist – the optical practice stocks spectacle frames and lenses, contact lenses and solutions, plus a few additional lines; the chemist stocks pharmaceuticals, baby products, health and beauty products.

Line: A category of product offered within a store. Different businesses will classify their lines according to different criteria. For example, one optical practice may include all their men's frames in a line they call 'men's'. Another may include all frames in a particular price band in a line they call 'mid-price'.

Others may classify their frames according to material or brand, e.g. 'metals' or 'Brand XX'. Being consistent about classifying products is important for accounting and assessing stock levels. Style: A particular product within a line, which may come in a variety of colours and sizes. Styles have a particular reference code which enables the store to order stock from suppliers.

A good dispensing assistant has a knowledge of the ranges and lines which are stocked, and enough knowledge of their features and benefits to select products appropriate to individual needs.

If they are responsible for selecting stock, merchandisers need to keep abreast of suppliers' new products, trends in the market and the ranges of their competitors.

Exercise 2.5 Product knowledge

Talk to your supervisor about the range and lines of frames which you stock. Ensure you understand why particular lines are stocked, which are the most popular with your customers and why.

2.9 Summary

A successful optical business is founded upon understanding its customers. Optical Assistants must have an understanding of the psychological process involved in customer choices and how customer choices are influenced through marketing. The information gained from this chapter should be used to deliver an appropriate customer experience that exceeds expectations.

Chapter 3

Communication and the Customer Journey

Introduction

In Chapter 2 we discussed the customer's psychological pre-purchase behaviour. Here we discuss the elements of customer communication which help achieve satisfaction at every step of the customer's experience in the practice. The main objective in every encounter with customers is at least to satisfy, and if possible to exceed, their expectations.

By the end of this chapter, you will:

- Understand how effective communication influences customers' impressions
- Understand aspects of customer behaviour
- Reflect on your own communication skills during key points in customer contact

3.1 Applied Communication in the Customer Journey

3.1.1 Communication and the Customer Journey

Once customers enter the practice they pass through a standard sequence of procedures, often called the 'customer journey'. Note that although these procedures may occur in different parts of the practice, we are discussing here the interaction between the customer and the service team, rather than the physical movements within the practice. Later in this chapter we discuss in more detail customer behaviour and the sales cycle.

Figure 3.1 Customer journey or sales cycle

For now, we simply note that, from the reception area, many customers will move on to an eye examination before the handover to the dispensing team. The dispensing process may be considered to move from lens and frame selection to dispense. At this point customers leave the practice, but they then return to collect their spectacles. The collection may be considered a continuation of the dispensing process and deserves particular attention, as it is the final point of contact with the practice during a single purchase of goods or services and has a lasting effect on customers' perception of the practice.

As every customer is different, and have their own particular needs, you will need to adapt your communication accordingly. There are basic skills which the expert communicator uses to mix and match to achieve the desired outcome.

At all parts of the sales cycle you are seeking to influence customers in some sense. Choose an appropriate tone of voice for the desired outcome.

For example you may be:

- Issuing instructions (e.g. explaining how to look after the spectacles)
- Offering information in response to a query (e.g. 'Is there anything I can do to stop my glasses steaming up when I play sport?')
- Asking questions (to assess the needs of the customer and NHS entitlements)

As customers move around the sales cycle, they may meet and part company with several members of the practice team. These handover points are times when they can feel uncertain about what is to happen next and when sensitive information may need to be conveyed. If the process requires discretion, be sure you conduct it in a place or manner which ensures patients do not feel their privacy has been compromised.

3.1.2 Reception

The reception area has a very important role to play in the customer journey. It is often the area of the practice where customers will have their first encounter with the team and the business. Regardless of whether the communication is over the phone or in person, this will be the customer's first impression of the practice and you.

We have already discussed the communication required during the first meeting in Chapter 1. However it is worth reminding you that first impressions count! Verbal and non- verbal communication skills are vital here.

3.1.3 Clinical Assessment

When carrying out clinical procedures such as a pre-screening or clinical assessment it is important that you always explain fully each aspect about to be performed. Customers may never have experienced these before or may be apprehensive about what will happen next. It is your job to make them feel at ease and understand the benefits of these procedures. Also ensure you give the patient the opportunity to ask questions.

It is vital that the patients are made to feel like individuals and not a 'cog in the wheel'. This stage of the journey can be very process driven and it is important we have patience with our customers and take the time to build rapport and relax them.

As a clinical assistant, there may be times when you are asked to perform a delegated function by an optometrist which will form part of the patient's clinical record. The type of tasks that may be delegated to you can include taking retinal photographs, autorefraction, performing non-contact tonometry and visual fields assessment. In the case of dispensing you may be required to record measurements such as pupillary distances and heights.

As the clinical assessment information forms an important part of the patient record it is extremely important that the information is communicated effectively and accurately to the optometrist responsible for the care of the patient. It is important that this information is not amended or adjusted by the assistant and must be an accurate representation of the test you have performed.

The way you communicate these results to the optometrist or dispensing optician should ideally be printed or written so there is physical evidence which will form part of the patient record. It is important that the optometrist in question has a chance to intervene to avoid any potential duty of care issues so when you are uncertain of the results in question you must ensure the optometrist is aware of this before the patient leaves the practice.

It is also important that any dispensing measurements are recorded accurately and appropriate dispense notes made to ensure comprehensive records are kept in case any issues with the spectacles dispensed should arise later. As with clinical assessment notes it is important that you recognise your limitations and when appropriate seek further advice if needed. If you are unsure about any measurements you are taking it is important to communicate this to a registered dispensing optician or optometrist who should be given the opportunity to check your measurements to avoid any potential measurement issues and maintain the accuracy of the patient record.

3.1.4 Eye Examination and Handover

The optometrists have taken part in training to enhance the customer experience in the test room. A lot of this training is behavioural and is designed to improve the communication between the optometrist and the customer.

It is vital that the optometrist keeps the customer informed throughout the stages of the eye exam.

Your role is to enhance this experience by way of a three-way handover. As the name suggests, this process requires the input of 3 people: the customer, the optometrist and the optical assistant.

A successful handover should include six pieces of information: the customer's name, any change in prescription, the intended use of the product to be supplied, recommendations from the optometrist, promotions the customer may be interested in and any clinical information that may be relevant to the dispense.

The optometrist should introduce the dispenser to the patient and vice versa, to ensure a personalised service. The recommendations will be best received as a three-way discussion where the dispenser has the opportunity to recommend products based on the lifestyle requirements and their expert knowledge in this area. Therefore ensure you are involved in the discussion at this stage.

3.1.5 Pre-Dispense Discussion

When you greet customers at the handover after an eye examination, take a couple of minutes to guide them to the dispensing area and explain what you will be discussing. Put them at ease before you start questioning them about their eye wear needs. Ensure you are in an area which gives a feeling of privacy.

Start by reviewing the recommendations of the optometrist and read the record card, not just the prescription. It will give you valuable starting points for your assessment of the customer's requirements, for example occupational considerations, including working distance and conditions.

Read any dispensing history to indicate frames and lenses previously supplied. If the patient is currently wearing spectacles, examine them thoroughly. Note the form and type of lens previously worn, the position of the optical centres, the material used and any coatings.

If certain anomalies are identified in the patient's current spectacles, which could cause problems, it may be useful to ask the patient about any problems experienced. Not only will this reinforce the customer's confidence in your optical knowledge, but it may address problems identified during the eye examination and handover. For example, if the optical centres are set away from the pupils then the patient may have experienced double vision or diplopia. If no such problems have occurred, seek advice on whether to place the optical centres of the new spectacle lenses in a similar position.

Exercise 3.1 Using the patient record

Discuss with your supervisor how each section of the record card may influence a dispensing decision, to ensure you are making maximum use of the information at your disposal.

The customer should be encouraged to do the majority of the talking at this stage to allow you to fully understand their requirements.

Be wary of it feeling like an interview, keep your questions open to promote discussion.

Questions like "Could you tell me what your average week is like?" will warrant a lengthy answer from your customer and give you information about their occupation, hobbies and any regularly performed tasks.

By the end of this stage you should know enough about your customer to assist them in selecting an appropriate frame and have decided on the most suitable lens options.

3.1.6 Frame Selection

Following a successful pre-dispense discussion, it should be apparent what frames the customer is looking for. Although there is a vast amount of choice so ensure you stay on hand to assist the customer during this stage.

Confidence and a decisive attitude will be key during frame selection. Be sure to explain price options and detailed characteristics of each frame you suggest. Be honest with the customer and if you feel a particular frame is unsuitable then make sure you inform them why in a constructive manner and be able to suggest an alternative.

Also offer advice in the fit of the frame and any adjustments you feel will be necessary. This must be done in a professional manner and one in which the customer can understand.

Once a suitable frame has been selected, confirm the customer's choice and that they are happy with their selection. Ensure the customer does not feel rushed in their decision and is happy to move on to be dispensed.

3.1.7 Dispense

During the dispense, it may be tempting to resort to jargon when answering queries, but technical terms will create a barrier to further communication and may give the impression you are trying to impress. Repeat any instructions which are important and ask questions to make sure customers understand the information you are giving them.

Ensure you interact with the customer while processing the order. Explain any measurements taken and use the relevant tools to create a professional impression of this process. When the customer is ready to leave the practice, say a few words about what to expect at the collection, in particular that their spectacles will have any final adjustments made and visual performance checked.

Leave them with a positive impression, and remember to smile and thank them for their custom when you part company.

3.2 Selling/Recommendation Skills

It is a mistake to consider that trust and confidence arise naturally in response to a practitioner's technical skill and knowledge. The following will help motivate the customer to act on your advice, whether this relates to buying a product or following that advice:

- Be confident, determined and enthusiastic
- Believe in the products and services you offer
- Be polite but never too familiar, avoiding insincere flattery
- Demonstrate expertise, without using jargon

Your aim in customer service is to satisfy customers' requirements. Once your perceptual, questioning and listening skills have enabled a clear assessment of their requirements, you can help find a solution.

The ethical framework of the optical professions ensures they act in the best interests of their clients. The selling part of delivering customer service – both one's advice and merchandise – does not conflict with this framework. It is a vital part of matching the product and advice to the needs of the individual customer.

Selling is essentially providing assistance to customers in making a decision about purchasing a product. The merchandise in an optical practice is personally tailored, complex and may be expensive. Customers therefore need and expect assistance with their purchasing decision. Some may require more help than others in reaching that decision. For some, the only advice and recommendation required is ensuring their understanding of the features, benefits and drawbacks of each alternative. This means helping them visualise the experience of the benefits in a real-life situation, directly relevant to them. Always take the time necessary to ensure understanding of the information you give before you prompt a decision from customers. Nevertheless there are times when customers are having difficulty making a choice and want you to influence their decision. How you do this will depend on your assessment of customers' expectations and aspects of their behaviour.

Whatever the level of assistance you give, never be so assertive that you push customers into buying something they are not comfortable with. You may be absolutely convinced that product A will be better for a customer than product B. Nevertheless, when you have made sure the customer knows the facts and their implications – which you believe should overcome any concerns about product A – the customer may still decide to take product B. You have to accept that it is the customer's choice. Customers are unlikely to return to your practice if they feel intimidated – even if you are proved right in the end! Likewise, be careful not to offer a short-term fix, with which the customer is not completely satisfied. General points on prompting a decision from customers (the retail term is closing the sale) are:

- Timing is critical. Offer information about a product while the customer's interest is captured by it. Interest can wane in a matter of seconds.
- Customers must feel the buying decision is their own. Avoid presenting your own views too forcefully and give them the time they need to come to a decision.
- Ensure you know NHS entitlements, your practice's current promotions, pricing information and credit systems to ensure you can answer customers' price questions confidently during decision-making. Never make NHS customers feel they are getting inferior service or less attention from you than private customers.
- Know how long it will take for the spectacles to be made up, as delays to the collection can make customers dissatisfied, even if they leave the dispense with a very positive impression.

3.3 The Collection and Fitting

We discuss this part of the sales cycle in detail because the collection of the customer's spectacles is perhaps the most important part of the dispensing process from the perspective of customer satisfaction. It is the last impression of the practice, which will stay with customers for longest. It can undo all the good work of establishing trust during their previous visit to the practice. If they leave with a poor impression, they may not return. The technical fitting of the spectacles is of paramount importance both during the collection and whenever a patient presents for a routine frame adjustment.

If at all possible, try to fit spectacles that you have dispensed. You may have developed a relationship with patients so they feel at ease and confident in your abilities. Try to use the patient's name frequently, to make the collection more personal.

You should take control of the collection.

Rather than allowing patients to pick up and try on the spectacles, offer them a seat and stand in front of them as you place the spectacles on their face. Using this procedure, if the frame is in need of some adjustment, this should be immediately obvious to you. This enables you to remove the frame before patients are aware of any problem, and become concerned that their spectacles may not be 'correct'.

Patients assume that the adjustment is complete only when they are handed the frame by the fitter, and invited to put it on. So if this is your first move, patients tend to assume that the spectacles are ready, and that any subsequent adjustments are an attempt to rectify an error, which may lessen their confidence in the fit. As you do for the dispense, always read the record card before fitting spectacles, since it may contain information pertinent to the collection. You must be aware of the prescription in the spectacles before putting them on the patient. There is nothing worse than asking a patient to see distance objects through a pair of reading spectacles! The sort of information which you should note from the record card is:

- Has the patient worn spectacles before?
- Has the patient worn bifocals/progressives before?
- What standard of vision can the patient expect to obtain from the spectacles?
- Has there been a change in prescription?
- What are the spectacles for?
    - Near vision
    - Distance vision
    - Intermediate vision
    - Bifocals
    - Progressives
    - Trifocals
    - The correction of a muscle defect

From the information on the record card you can identify potential problems, and forewarn patients. If you can forewarn patients what to expect from their spectacles before putting them on, you will minimise the chances of customer dissatisfaction.

- If patients are myopic and have not worn spectacles before, they should expect objects to appear sharper and clearer but slightly smaller with their new spectacles. Objects may also appear further away.
- If patients are hypermetropic and have not worn spectacles before, they should expect objects to appear sharper and larger with their new spectacles. Objects may also appear closer.
- If there has been a significant change in prescription, patients may need time to adjust to the new spectacles.
- If there has been a change in the cylinder value or a change in axis direction, patients may feel slight nausea, and straight lines may appear to run at an angle. Another common problem with cylinder changes is that round objects appear to take on an oval shape. These phenomena will subside with time.
- If there has been a change in the type of lens material, patients may experience phenomena such as colour fringing or blurring, depending on the type of material.
- Remind patients of the period of adjustment to progressive lenses, reassure them of success if they persevere, but invite them to contact the practice if they have any concerns.

In section 3.2 above we discussed assistance during the decision-making process. For customers who have made a decision for either aesthetic or visual reasons which for them are new, provide reassurance at the collection, to ensure they remember the features and benefits which attracted them and fully understand the changes in vision that they can expect from the new product. Reassurance is needed by people adjusting to change, however minor the change may seem to you.

Ensure they understand the care of the products you dispense and pay particular attention to customers receiving their first pair of varifocals. You need to remind them of the adaptation process and give them the opportunity to ask questions. Explain the after-sales service and give them your name as a personal contact point if they have any problems. Finally check their understanding before they leave the practice. Leave them with a positive impression, and remember to smile and thank them for their custom when you part company.

Exercise 3.2 The collection – communication

Write down a short account of a collection, noting which elements you chose to concentrate upon in your interaction with customers and which questioning and listening skills you used to advise and reassure them.

3.4 Complaints

All practices – however committed they are to customer service and quality operations – have dissatisfied customers from time to time. The trust and loyalty of the customer are at risk in these situations and an effective system for handling complaints can resolve problems without sacrificing the customer's future loyalty.

Practices have formal systems to manage written complaints.

The vast majority of the complaints referred to the Optical Consumer Complaints Service arise in large part from communication problems (see OCCS Annual Report). The OCCS recommends 'explanation and discussion in order that the patient fully understands the action and outcome of the visit to the practice… Use of appropriate leaflets and written material to reinforce the advice given is recommended.'

It is essential that all practice staff are well acquainted with the system and are trained to deal with customers who are angry or upset. Some areas of difficulty highlighted in the past by the OCCS are NHS voucher values, cataracts and rimless spectacles. The OCCS recommended that practitioners should: 'stress that where a patient is entitled to a voucher, it is only towards the cost of the appliance and may not, indeed cover the cost.' For cataract patients who are referred, 'it is important that the patient understands the temporary nature of any new spectacles and the cost implications.'

For patients dispensed rimless spectacles, 'These delicate, lightweight spectacles need particular care when handling. This should be explained carefully to patients before purchase'.

You can see how all these causes of complaint could have been avoided if good communication principles had been followed. As we have stressed previously, it is not enough to mention something to patients, you must use your questioning and listening skills to ensure their understanding, and take the opportunity to reinforce it during the collection.

The serious implications of some complaints, including legal and professional liability, mean you must never be drawn into commenting upon a complaint, agreeing with the customer's grievance or taking sides.

When facing an angry customer, follow the procedure outlined in Chapter 1 on assertive behaviour.

Exercise 3.3 Handling a complaint

Note down details of a recent situation in which you have had to deal with an angry or disappointed customer. Think about how the encounter made you feel and the outcome of your contact with the customer. Discuss with your supervisor any areas where you did not feel confident – or if you handled the situation particularly well, discuss the communication skills you put into practice.

Through good communication with every customer, complaints are kept to a minimum. Equally, good communication when the complaint arises can often resolve a problem without losing the customer's loyalty. It is possible to deal sympathetically with a problem without admitting liability. Chapter 1 discussed communication techniques which are used for managing difficult situations.

3.5 Summary

Communication is key to delivering excellent customer service. Good communication skills will form the basis of the customer's impression of the staff and the business. The customer must be made to feel important and individual.

"A customer is the most important visitor on our premises. He is not dependent on us. We are dependent on him. He is not an interruption in our work. He is the purpose of it. He is not an outsider in our business. He is part of it. We are not doing him a favour by serving him. He is doing us a favour by giving us an opportunity to do so." – Gandhi

This chapter has allowed you to reflect on your own communication skills and hopefully helped to improve them, thus improving your customer service and key points throughout the journey.

Unit 2 Use of Spectacles

Chapters 4 – 7

Learning outcomes

The learner will:

1. Understand how the eye focuses light from an object and common refractive problems
   - You must understand how light is affected by the refracting structures of the eye in the normal eye
   - You must know the terminology for different types of basic optical problems that can affect the eye, the principles of each and how they may be corrected by spectacle lenses
2. Understand the practical application of spectacle lenses
   - You must understand concepts, units of measurement, terminology and apply some basic optical theory relating to spectacle lenses, especially:
     – focal power, focal length and radius of curvature
   - You must understand how the power of the lens relates to its correction of visual problems
3. Know the properties of spectacle lens materials. You must understand what the following terms mean and the effects of changing them:
   - refractive index, density and V-value

Chapter 4

Functions of the Human Eye

Introduction

An understanding of the basic functions in the human eye is important for any role within the optical industry. An Optical Assistant may be required to explain these functions to patients in relation to their correction or defect. This chapter will give you an introduction to the eye and it will then be explored in more detail in Semester 2 the next module.

By the end of this chapter you should possess knowledge and understanding:

- Of the basic optical principles of the eye
- About the structures of the eye responsible for refraction of light
- About how the anatomy of the eye is related to ametropia
- Of emmetropia
- Of spherical ametropia
- Of astigmatic ametropia
- About the anatomical causes of presbyopia
- Of the refractive correction of presbyopia

4.1 Basic Structures in the Eye

The anatomy of the eye will be covered later in this course. For now you need to know about three structures, the cornea, the lens and the retina (Figure 4.1). The eyeball is roughly globular. The cornea forms the front of the eyeball and is a transparent window allowing about 90% of visible light to pass through to the back of the eye. The lens is positioned inside the eye between the cornea and the retina, so that light entering the eye through the cornea passes through the lens before reaching the retina. In a normal, healthy eye the lens is transparent and both its front and back surfaces are convex (bulging outward). The innermost layer lining the back of the eye is the retina. It is a very complex structure and is made up of eight layers. When light passes through the lens, it travels on to reach the retina, where it triggers electrical impulses which travel to the brain.

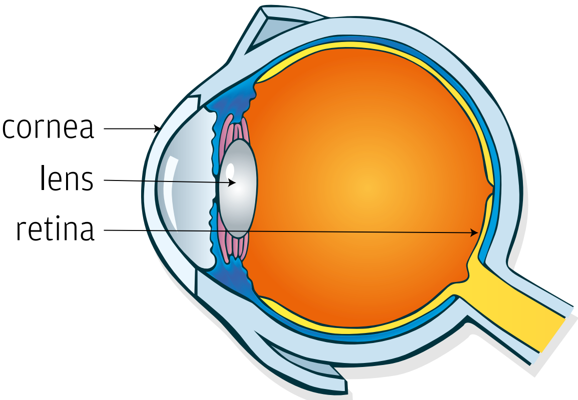

Figure 4.1 – Basic eye with cornea, lens and retina labelled

As we will discuss further in the following chapters, rays of light can pass from one transparent substance into another, for example from air into water. If the substance the light leaves and the one it enters are different then the light will often bend as it enters the second substance. The bending of light in this way is called 'refraction' and the ray of light is said to be refracted. Different materials have different power to refract light, some bending the rays more (higher power) and some bending them less (lower power). The properties of the substances which affect their ability to refract light will be discussed in more detail in the next chapter, but for now all you need to know is that - although they are not the only transparent parts of the eye through which light passes - the cornea and the lens are the main parts of the eye which cause light to be refracted (Figure 4.2).

Rays of light from a distant object leave the object in all directions, and a few of these are travelling in the right direction to reach the eye of a person looking at that object. When those rays of light enter the cornea they are refracted a little. They then travel on through the lens where they are refracted again. Because of the convex shape of the lens the rays are refracted towards the centre of the lens. The rays are now travelling on a path that brings them towards each other, and at a particular point the rays come together

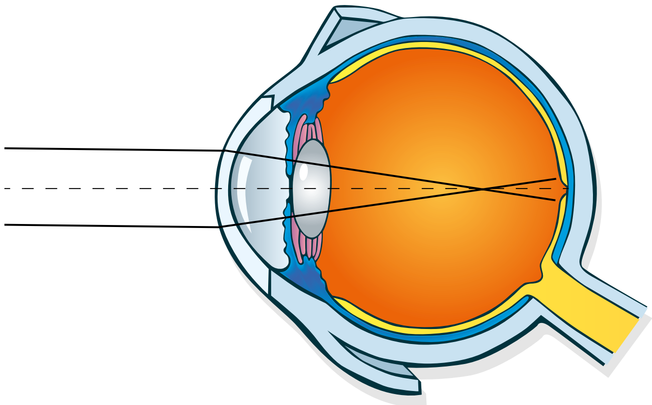

Figure 4.2 Two peripheral rays reaching a focus

4.2 Emmetropia

Ideally the observer's cornea and lens together should bend rays of light coming from the distant object so that they come together to form a sharp image of the object on the retina (Figure 4.3). When this condition is met, it is known as emmetropia, and the person's eye is said to be emmetropic. If both eyes are emmetropic, the person will be able to see distant objects clearly without the use of spectacles.

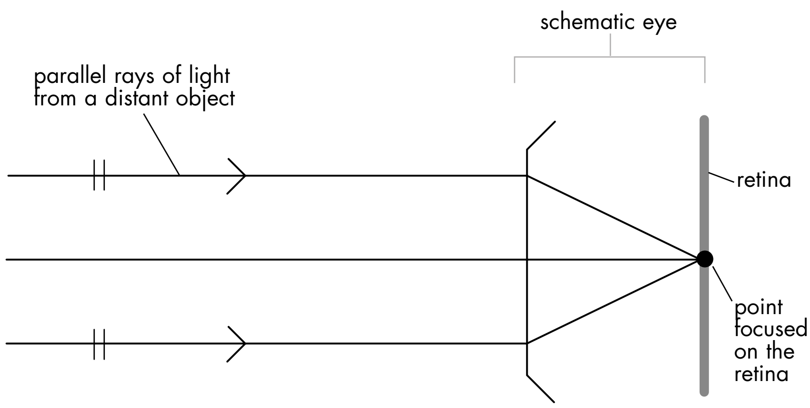

Figure 4.3 An uncorrected, unaccommodating emmetropic eye

4.3 Ametropia

When an eye fails to focus light from a distant object to a sharp image on the retina, then the condition is known as ametropia, and a person is said to be ametropic and may require spectacles to see distant objects clearly. There are two mains types of ametropia:

1. Spherical ametropia
   (a) Myopia
   (b) Hypermetropia
2. Astigmatic ametropia

4.3.1 What is a Prescription?

You will come across a couple of different meanings of the word 'prescription'. One is the official document the patient is given after the eye examination – which is similar to the use of the word when a doctor issues a prescription for drugs etc.

The other use of the term 'prescription' is the one we are referring to here – a standard way of expressing the power and type of lens required to correct the patient's ametropia.

A spherical ametrope's prescription is recorded as follows:

the sign of the lens (– for a negative lens for a myope and + for a positive lens for a hypermetrope), followed by the power of the lens, which is a number, and finally 'DS' (which means dioptres sphere). For example:

– 8.00DS
– 6.50DS
+ 3.00DS
+ 4.25DS
+10.50DS

0.25DS is the smallest step you will come across between prescriptions, so you will not see numbers like +4.40DS or -8.33DS.

4.3.2 Myopia (short-sightedness)

In a myopic eye, rays of light from a distant object are focused by the eye's refractive system such that a sharp image of the object occurs in front of the retina, and the patient is said to have myopia (Figure 4.4). The lay term for myopia is short-sightedness.

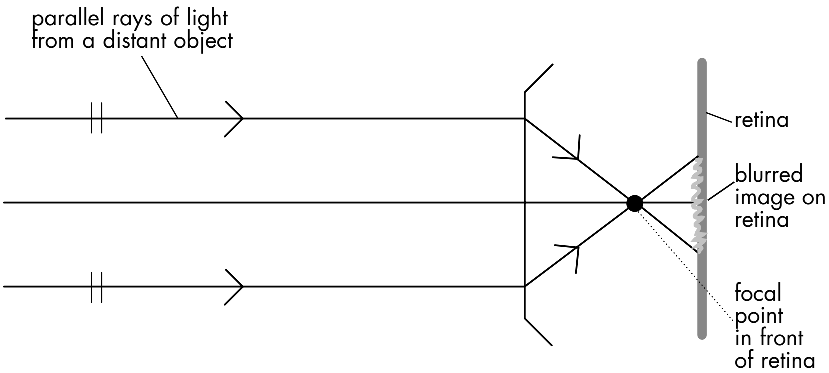

Figure 4.4 The uncorrected, unaccommodating myopic eye

Myopia may be corrected by a spherical concave negative-power lens. This shape of lens will bend light rays outward slightly. Recall that the myopic eye bends light rays from a distant object too much so they focus in front of the retina, making these rays diverge a little before entering the eye compensates for this, moving the point of sharp focus back to the retina (Figure 4.5).

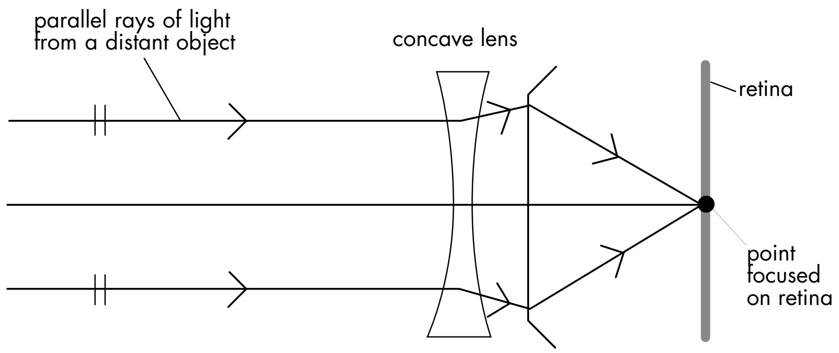

Figure 4.5 The correction of myopia

4.3.3 Hypermetropia (long-sightedness)

The hypermetropic eye is not strong enough in its relaxed state to bend the light from a distant object to a sharp image within the eye. The sharp image would (theoretically) occur behind the retina, and the image on the retina would be blurred. The patient is said to have hypermetropia (Figure 4.6). The lay term for hypermetropia is long-sightedness.

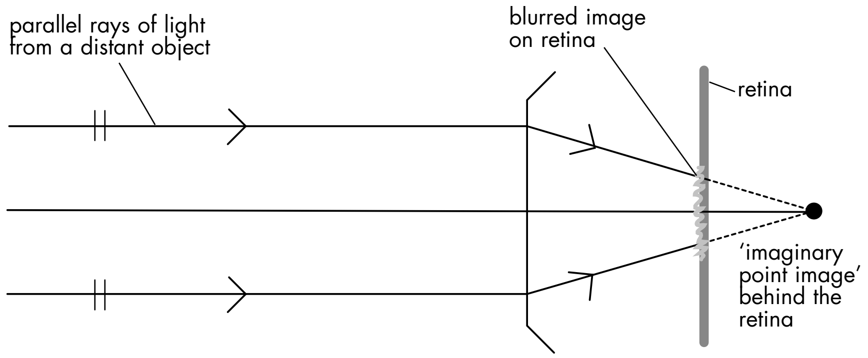

Figure 4.6 Uncorrected, unaccommodating hypermetropic eye

As you know the eye can focus on near objects as well as distant. This happens when we, say, look away from a film we are watching, to glance at our watch. This increase in power results from changes in the shape of the lens, the lens effectively becoming more convex in shape (this is called accommodation).

So the hypermetrope can increase the power of the lens through accommodation - bringing the sharp image of a distant object forward from behind the retina onto the retina. This means that sometimes they can see clearly at a distance without the need for spectacles. A 20-year-old with a prescription of +2.00DS may comfortably be able to focus on distant objects without spectacle or contact lens correction. (The person then accommodates even further to look at nearby objects.) The amount by which the lens can change its power – and therefore the range of distances at which the eyes can comfortably focus -changes with age. A child has a much greater range than a person over 60 for example.

This does not mean that young hypermetropes can always compensate for their problem and see distant objects well without spectacles. Long periods without relaxing the focusing power of the eye can lead to problems, such as headaches. A large amount of uncorrected hypermetropia can lead to the development of a squint.

Hypermetropia may be corrected by a spherical convex, positive-power lens, so that light reaching the eye is converging. The power of the lens is chosen such that the image will be brought to focus on the retina (Figure 4.7).

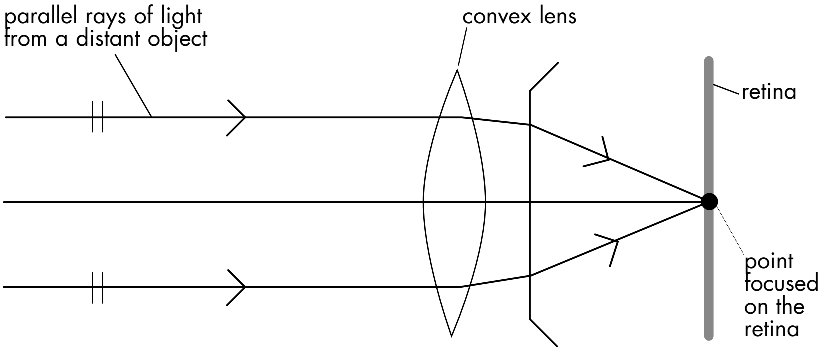

Figure 4.7 The correction of hypermetropia

4.3.4 Astigmatism

Think of the lines of longitude and latitude on the Earth. If the Earth is completely spherical the curve from pole to pole will be the same as the curve from one point on the Equator to the opposite side of the globe. In fact the Earth is not a perfect sphere and is slightly squashed at the poles so the curve of the Equator is more bulbous than the curve of the lines connecting the poles. If you made a giant lens using half of the Earth as your mould the lens would have an astigmatic surface.

Astigmatism is present when the curvature of the surface of the cornea or the lens of the eye varies in different directions. In optics these 'directions' are called 'meridians' which are imaginary lines that join a point on one side of the curved surface to the point on the edge directly opposite. The circular structure could be the lens, the cornea or a lens in front of the eye. In the case of the Earth above the Equator would be one meridian and the pole-to-pole longitude line would be another. The Equator of the Earth and lines of longitude are perpendicular to each other (at 90° to each other).

In the eye, astigmatism may be caused by the curvature of the cornea being steeper in one meridian than the other (corneal astigmatism). Corneal astigmatism is often described to patients as the front of the eye being 'rugby ball-shaped' instead of 'football-shaped'. Alternatively, the astigmatism may be caused by the shape of the lens (lenticular astigmatism). The patient's total astigmatism may be a combination of corneal and lenticular astigmatism.

We will find out in the next chapter that curvature is related to lens power, so differences in curvature in the cornea/lens of the eye means that they have different powers to refract light at different places. So light rays entering one place will be refracted more than light rays from the same object entering at another place, and there will be more than one point at which the rays are focused.

4.3.4.1 Regular astigmatism

In regular astigmatism, the two principal powers are at 90° to each other. There are five types of regular astigmatism:

1. Simple myopic astigmatism, in which one focal point is on the retina and the other in front of the retina (Figure 4.8)

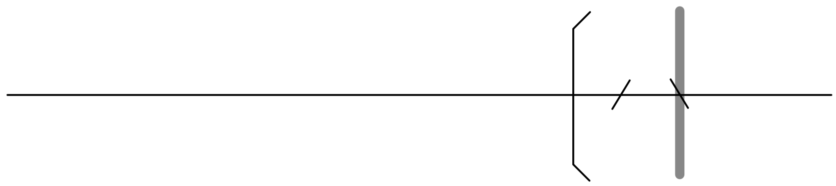

Figure 4.8 Simple myopic astigmatism

2. Compound myopic astigmatism, in which both focal points are in front of the retina (Figure 4.9).

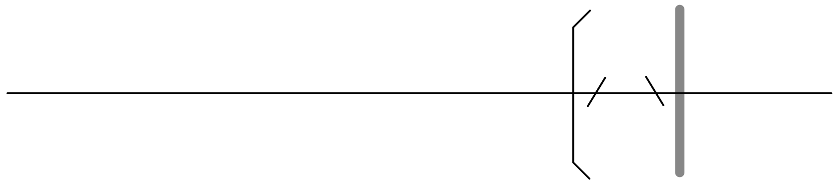

Figure 4.9 Compound myopic astigmatism

3. Simple hyperopic astigmatism, in which one focal point is on the retina and the other behind the retina (Figure 4.10).

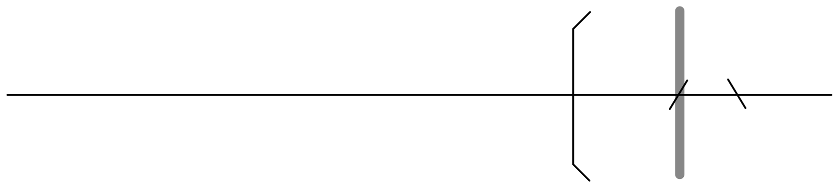

Figure 4.10 Simple hyperopic astigmatism

4. Compound hyperopic astigmatism, in which both focal points are behind the retina (Figure 4.11).

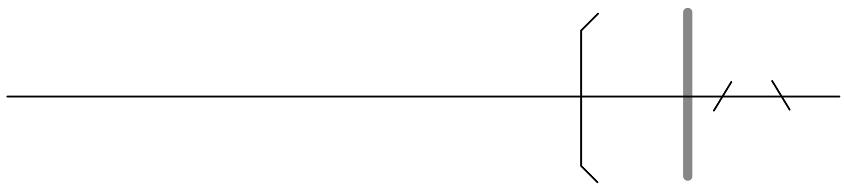

Figure 4.11 Compound hyperopic astigmatism

5. Mixed astigmatism, in which one focal point is in front of the retina and the other behind the retina (Figure 4.12).

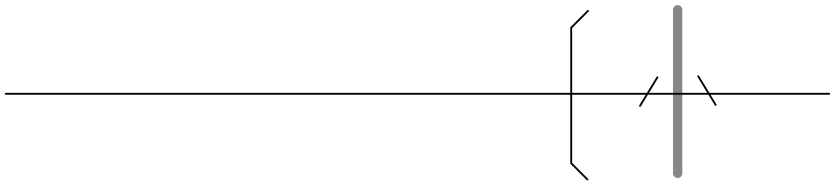

Figure 4.12 Mixed astigmatism

Astigmatism needs to be corrected with a cylindrical lens called a toric lens, that has two different powers at 90° to each other, to bring the two focal points together on the retina. The person with astigmatism may also be myopic or hypermetropic so the lens correction may include a spherical correction as well (Figure 4.13).

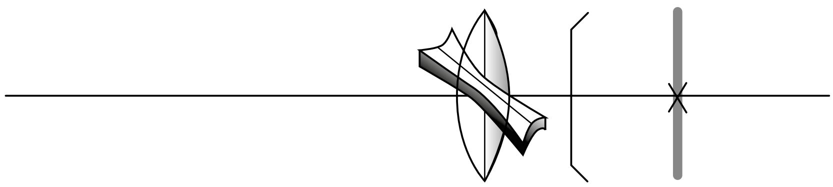

Figure 4.13 Correction of mixed astigmatism with toric lens

4.3.4.2 Irregular astigmatism

Most cases of astigmatism that you will encounter will be regular astigmatism. However, irregular astigmatism does occur, in which the two principal meridians are not at 90° to each other.

4.4 Presbyopia

As we get older, the lens grows and becomes stiffer, the lens capsule that holds the lens has less flexibility and the ciliary muscle becomes less efficient. The combination of these factors results in a decrease in the ability of the lens to change shape and hence power to accommodate.

When these age-related changes reach a point that makes an individual's eyes unable to accommodate sufficiently to be able to read or focus on close work, they are said to have presbyopia.

Invariably this occurs in the early to mid-40s, and everybody becomes presbyopic at some point. Exactly when we become presbyopic depends not only on our age, but also on our chosen working distance for near vision. If you habitually hold a book 30cm from your eyes when you read, you will notice the effects of presbyopia sooner than if you adopt a longer working distance, i.e. read a book on your lap about 50cm from your eyes.

To correct presbyopia, the patient requires a reading addition (often shortened to 'add'). This comprises a positive lens in addition to any distance prescription. The older a person becomes after presbyopia occurs, the greater the reading addition will become, until it finally reaches a plateau at around 65 years of age. The reading addition plus any distance correction can be provided by single-vision reading glasses, bifocals or varifocals. These will be covered in detail in later chapters. Interestingly, myopes with an appropriate prescription may be able to remove their distance spectacles to read close up (as they naturally focus close to objects). This often confuses a lay person, who may not understand how you can remove your spectacles and yet see more clearly.

4.5 Prescription Analysis

The defects which require a correction have been highlighted during this chapter. As a dispenser you need to be able to interpret a prescription to understand what defects the patient is suffering from.

For example if the sphere of the prescription is minus, the patient is myopic (short sighted)and if the sphere is positive they are hypermetropic (long sighted).

If the prescription includes a cylinder and axis then the patient has astigmatism. If an add is included then the patient is presbyopic.

This summary table of different eye conditions and prescriptions summarises much of what has just been discussed.

Table 4.1 Visual defects summary

DEFECT	OPTICAL TERM	WHATS HAPPENING IN THE EYE	WHAT CAN PATIENT SEE	WHAT CORRECTION REQUIRED
PERFECT (no defect)	Emmetropia	Light is focused on the retina	Eveything is clear	None
SHORT SIGHTED	Myopia	The light is focused in front of the retina	No issue close up but blurred in the distance	Minus sphere
LONG SIGHTED	Hypermetropia	Light focused behind the retina	Distant objects clear but close objects blurred	Plus sphere
UNEVEN CURVES ON CORNEA	Astigmatism	Rugby ball shaped cornea	Objects may be blurred or sloping	Cyl and axis (Axis will show the direction of the correction)
CAN NO LONGER SEE CLOSE UP	Presbyopia	The crystalline lens is losing elasticity	Patient struggles to read or work close up	Add
MUSCLE IMBALANCE	Phoria/Tropia	The muscles are not working properly causing the eye to turn	Patient may experience double vision if not corrected	Prism

Exercise 4.1 - Analyse the following prescriptions with your supervisor and discuss lens options

	Sphere	Cyl	Axis	Add	Prism
Right	-2.00	+1.00	180		
Left	-1.75	+0.75	170		

	Sphere	Cyl	Axis	Add	Prism
Right	-6.00			+1.00	
Left	-6.75	+0.75	170	+1.00	

	Sphere	Cyl	Axis	Add	Prism
Right	+4.00			+2.00	
Left	+4.25			+2.00	

	Sphere	Cyl	Axis	Add	Prism
Right	-0.25			+2.50	
Left	0.00			+2.50	

4.6 Summary

This chapter introduces some of the most important aspects of ocular function – the refraction of light entering the eye, causing it to be focused onto the retina at the back of the eye. Normal refraction is discussed as well as the different types of refractive error. From an understanding of the causes of these refractive errors, the principles of their correction with ophthalmic lenses can be understood.

Chapter 5

Ophthalmic Lens Materials

Introduction

Knowledge of ophthalmic lens materials and their properties is imperative when dispensing spectacles. As a dispenser you must be able to recommend and advise patients on the availability of materials to suit their needs.

By the end of this chapter you will:

- Have an understanding of the properties of ophthalmic lens materials
- Be able to identify the essential difference between glass and plastic lens materials
- Be able to answer patients' questions about the properties of ophthalmic lens materials
- Possess a basic understanding of refractive index
- Possess a basic understanding of density
- Possess a basic understanding of V-value
- Be aware of the relationship between lens power and lens curvature
- Be aware of a number of types of lens with different indices

5.1 Ophthalmic Lens Materials

There are several properties of ophthalmic lens materials which should be given consideration each time a dispense is undertaken. These properties affect lens thickness, weight and the amount of aberrations caused by the lens. The properties are not considered in isolation, but in combination with other factors such as scratch resistance, impact resistance, the amount of reflection, tinting properties and design. This chapter will address the primary properties, of which the dispensing assistant should have a working knowledge.

In order to advise patients of the advantages and disadvantages of the ever-increasing range of products available to us, we must have a clear understanding of the properties of ophthalmic lens materials and be able to convey this knowledge to patients.

The essential difference between glass and plastic lens materials is their density. Plastics have a lower density than glass, so if two lenses of the same volume are manufactured from the two materials, the plastic lens will be lighter. However, when comparing the various merits of lens materials, it is not simply weight that must be considered. Lens materials need to be physically durable and resistant to atmospheric attack.

The choice of material will primarily depend on a combination of thickness, weight and comfort of vision away from the lens centre. It is important to understand how these three properties affect the dispensed lens so that you are able to help customers make informed decisions about lens choice.

5.2 Optical Properties of Lens Materials

Why are refractive index, specific gravity (or density) and V-value of such importance when dispensing lenses?

- Refractive index affects the lens thickness.
- Specific gravity affects the weight of the lens.
- V-value affects visual comfort when looking away from the optical centre of the lens.

In order to understand why these characteristics affect lenses in this way we need to introduce some optical theory.

5.2.1 Refractive Index

In optics, the symbol n is used to denote refractive index. As a general rule, the higher the refractive index of a material, the thinner the spectacle lens made.

Rays of light can pass from one substance, or medium, into another, for example from air into water. If the medium they enter has a different refractive index to that of the medium they are leaving, then the light will be bent or refracted (Fig. 5.1).

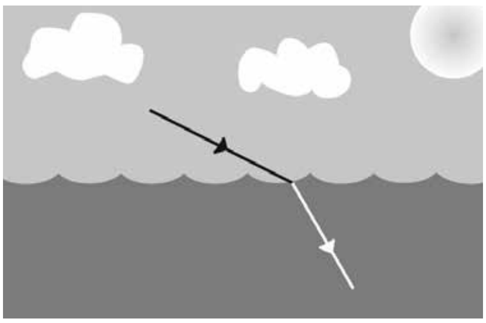

Figure 5.1 Bending of light as it moves from air into water (refraction)

The reason for this bending (refraction) is that light can travel faster in the lower-index medium (air) than the higher-index medium (water). Therefore incoming rays of light are slowed down by the water and take longer to emerge. They are, as a result, refracted. In optics, generally we are considering cases in which light rays pass from air – the surrounding medium – into a material of a higher index (a lens). The higher the refractive index of the material the light enters, the greater the refraction will be.

Figure 5.2 shows the path taken by a ray of light in air as it passes through two lenses which are identical apart from the material from which they are made. The first is manufactured from standard plastic (commonly known as CR39) and the second from standard Crown glass, a material of higher refractive index.

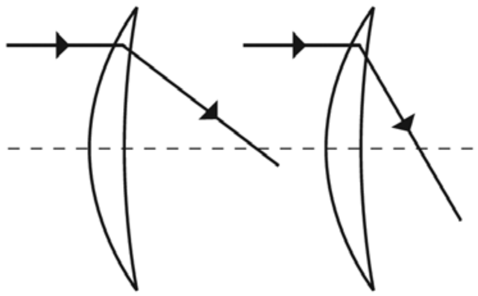

Figure 5.2 Refraction of light as it enters lenses made of materials of different refractive index

It can be seen that, over exactly the same distance, the ray of light is refracted more by the Crown glass lens than it is by the plastic lens. In other words, the higher-index material causes a greater reduction of the light's velocity. The ray of light is therefore in the higher-index material for longer, and is therefore refracted to a greater extent.

One way of remembering the properties of high-index materials is to imagine that the molecules making up the high-index material are more tightly packed together, so less lens volume is required to obtain the same lens power.

- **Classific tion of materials of different refractive indices**

Because of the wide range of materials available today, it is important to use a consistent system when describing a lens material as mid or high-index.

Table 5.1 Classification of refractive indices

Classification	**Range**
Normal-index	1.498 and above but less than 1.54
Mid-index	1.54 and above but less than 1.64
High-index	1.64 and above but less than 1.74
Very-high-index	1.74 and above

Broadly speaking, materials of higher refractive index are used to produce thinner lenses, and this is particularly useful for patients with myopic prescriptions.

If we consider two lenses of equal power, diameter and similar form, then we can assume that, if one lens is made of a material of higher refractive index than the other, it will appear thinner. This thickness reduction (Table 5.2) could be said to be due purely to the increase in refractive index of the material. From Table 5.2 it can be seen that a lens material with refractive index in the region of 1.70 will be 25% thinner than the Crown glass lens.

The data in Table 5.1 are taken from the British Standards publication Specification for Complete Spectacles (BS7394: Part 2). Extracts from BS7394: Part 2: 1994 are reproduced with the permission of BSI under licence no. PD\1998 1802. Complete editions of the standards can be obtained by post from BSI Customer Services, 389 Chiswick High Road, London W4 4AL.

Table 5.2 Thickness reduction

Refractive index	Relative curvature	Thickness reduction (%)
1.60	0.87	13%
1.67	0.75	25%
1.74	0.65	35%
1.90 glass	0.58	42%

Note: values are relative to Crown glass of refractive index 1.523.

We will look at Relative Curvature in more detail in Chapter 6.

5.2.2 Specific Gravity

The specific gravity or density of any lens material determines its weight. Therefore, for convenience, we can take the weight of one cubic centimetre of the material (g/cm3) as the density of the material. (Manufacturers follow this convention.)

Table 2.3 gives density values for the Carl Zeiss range of glass lenses. Taking the lens type Lantal 1.8 as an example, every cm3 weighs 3.62g.

Table 5.3 The density values for the five glass lens types available from Carl Zeiss

Lens type	Density (g/cm^3)
Punktal	2.55
Punktal SL	2.67
Tital	3.19
Lantal 1.8	3.62
Lantal 1.9	4.02

It should also be noted that as the refractive index of the material increases, so does its weight. It is therefore true to say that if you weigh an object made of a high-index glass material and the same size object made out of standard glass, the high index version will be heavier.

However this does not mean that a lens of a given power is always heavier when made out of higher index material. For example, consider two glass lenses of equal power, say –10.00D; one made of glass n =1.523 and the other n = 1.80. The n=1.80 lens will be thinner so, although it is a heavier material per cubic centimetre, the lens has less volume. In this case, the lens made from n = 1.80 material is lighter than one made from n = 1.523 material.

In other words, even though a lens is made from a denser, high-index material, its finished weight may be less than that of a lens made using a lighter, normal-index material, because there is less of it!

As a general rule, at lower powers, high-index glass lenses are generally heavier than standard index, since the high-index material does not produce such a large reduction in lens thickness at low powers.

So what does this mean in practice? Clearly, if the weight of the finished lens is the main priority for the patient, a plastic material of low specific gravity should be considered. Very low specific gravity is probably the main advantage of plastics. Table 5.4 gives the values for a selection of plastic lens materials.

Table 5.4 Specific gravity values for various plastics

Material	**Refractive index**	**Specific gravity (g/cm³)**
Ultratough (CR39)	1.498	1.32
Polycarbonate	1.59	1.22
Extra Thin & Light	1.6	1.32
Super Thin & Light	1.67	1.36
Ultimate Thin & Light	1.74	1.46

5.2.3 V-value

As we have already seen, if a ray of light is travelling through air and suddenly enters a substance of higher refractive index, such as glass, it will immediately be bent or refracted. Light travels in waves. Sunlight is not just visible light, but an array of waves called the electromagnetic spectrum. The part of the spectrum which the human eye can see falls into a narrow part of this range and is usually called white light (Figure. 5.3).

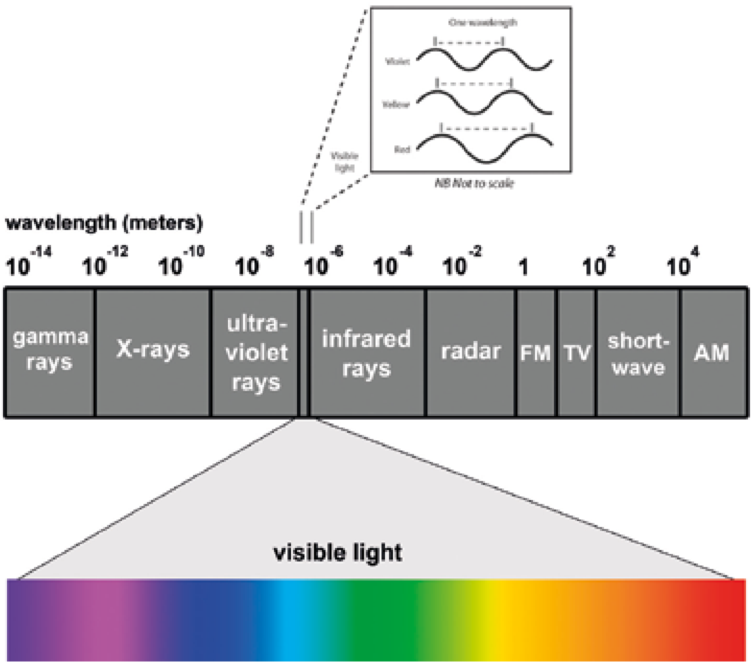

Figure 5.3a The electromagnetic spectrum. Each type of radiation includes a range of wavelengths. The approximate range for visible light is shown.

White light is made up of a mixture of different wavelengths of light. We see colour because each wavelength of light has its own colour. Red has the longest and violet the shortest wavelength (Figure. 5.3b). Light of different wavelengths or 'colour' travels at a different velocity in glass and other media, and so is refracted to a different degree when entering them (Figure. 5.4). For example, red light has a relatively long wavelength, and travels faster through glass than shorter-wavelength blue light. Thus red light is refracted less than blue light. The wavelength of yellow light is about mid-way between those of red and blue light.

Figure 5.4 shows that a material refracts each component colour of white light by a different amount. On emerging from the material, the white light has been split into its component colours (Figure. 5.3). This splitting of white light is known as dispersion, and is potentially problematic for spectacle wearers; patients will be aware of coloured fringes around objects viewed through lenses with a high degree of dispersion.

Figure 5.4 The refraction of the various coloured components of white light by a prism

V-value is a term used to describe the amount of dispersion produced by a particular lens material. The lower the V-value of a material, the more dispersion it produces.

Table 5.5 V-values for some high-index materials

Supplier Material	**Refractive Index**	**V-value**
Various Crown	1.523	58.8
Pilkington Slimline 640	1.600	41
Hoya LHI II	1.600	42.5
Zeiss Tital	1.706	39.3
Hoya LHI I	1.702	40.2
Zeiss Lantal	1.800	35.4
Hoya THI II	1.800	33.3
Zeiss Lantal	1.900	30.3
Various CR 39	1.498	57.8
Pilkington Spectralite	1.54	47

Hoya HL II	1.560	40.0
Nikon Lite DX II	1.560	41.0
Nikon Lite DX III	1.60	36.0
Various Polycarbonate	1.586	30
Seiko Superthin 16	1.60	36
Nikon Lite IV	1.67	32.0
Hoya -	1.71	36
Nikon -	1.74	33

V-value is of particular significance when dispensing high-index materials since, generally, the higher the refractive index, the lower the V-value and so the greater the dispersion produced. Some V-values for commonly used materials are given in Table 5.5.

Fortunately, the adverse affects of a low V-value can be minimised by correct centration of the spectacle lenses. Since V-value only becomes an issue when the eye looks through points away from the optical centre of a lens, positioning the centres directly in front of the pupils will help to limit any problems. So you can understand why dispensing of high index lenses requires accurate measurements and frame fitting so that good centration is achieved.

In addition, it is customary when dispensing progressives, for example, to instruct patients to turn their head in the direction they wish to look, to ensure they are looking through the centres of the lenses as much as possible. This will help them adapt to lenses with low V-values.

Exercise 5.1 Complete the table below of V-values for the lenses you use regularly in practice.

Lens	**Refractive Index**	**V-value**

5.3 Spectacle Lens Materials

So far we have looked at the range of Refractive Indices available in Spectacle lens materials, however we have not considered the properties of the different materials we use in optics.

5.3.1 CR39

CR39 is an abbreviation for Columbian Resin, which is the type of plastic we use in our standard lenses. In Specsavers, we also provide a scratch resistant coating on our CR39 lenses.

5.3.2 Polycarbonate

These lenses have good impact resistance. They are also becoming more popular in rimless and general-purpose spectacles for their durability. Polycarbonate has some additional advantages in that it has good UV protection, a higher refractive index than CR39 and is very light. However, abrasion resistance is poor, although this is largely resolved by coating the lens with a protective layer.

The other consideration is the visual quality. Polycarbonate has a V- value of 30 (table 5.5) which is the lowest of all lens materials. This means the dispersion is high and visual quality reduced. This will cause a problem for patients with high prescriptions or who are required to regularly look away from the lens centre.

5.3.3 Trivex

These lenses, like polycarbonate, have good impact resistance. They have a refractive index of 1.53 and so are thinner and lighter than CR39. Unlike polycarbonate, Trivex has a good visual quality and a V-value of 45. This means the visual quality is almost identical to CR39.

5.3.4 Toughened Glass

Glass lenses can be toughened using a carefully controlled heating and cooling process. The glass is heated to its softening point and then rapidly cooled. This treatment causes the outer portions of the glass to cool more rapidly than the interior, which remains comparably fluid for some time. As the interior finally cools to the same temperature as the outer surfaces, it contracts and exerts tension on the rigid outer surface, producing an outer compressive envelope enclosing an interior under greater tensile stress.

Toughened lenses are far more durable than ordinary glass lenses, for not only are they more difficult to break, but they are also more resistant to scratches, owing to their increased surface hardness. When a toughened lens does break, it tends to crumble into relatively harmless cubes of glass, thus greatly reducing the danger from sharp edges and splinters. In order to ensure that the toughened lens has an adequate layer of surface compression, the thickness of the lens, before toughening, must not be less than certain minimum values. Lenses which are intended for heavy-duty use should have a minimum centre thickness of 3.3mm, and the thinnest edge of a positive lens should not be less than 2.5mm. With lenses intended for light duty, the respective thicknesses are 2.4mm in the centre and 1.8mm at the edge.

Certain types of lenses are not normally accepted for toughening. These restrictions include minus lenses over the power of –10.00D, lenses whose diameters exceed 52mm and lens shapes with sharp corners. Drilled or slotted lenses (for rimless mountings) are also excluded.

5.4 Summary

Having considered the most important properties of ophthalmic lens materials, an ideal lens would have:

- High refractive index
- High V-value
- Low specific gravity

Unfortunately, the ideal lens does not exist, so lens selection is invariably a compromise between thickness, weight and V-value. The secret to successful dispensing is to find the best compromise to meet each customer's needs by paying particular attention to their individual needs and expectations.

Chapter 6

The Optics of Ophthalmic Lenses

Introduction

Ophthalmic lenses are described not only in terms of their material properties, but also in terms of their optics. This chapter will expand your knowledge of the optics of ophthalmic lens materials and how these properties may affect patients' physical and visual comfort.

By the end of this chapter you will:

- Have an understanding of the optical properties of convex (plus) and concave (minus) lenses
- Be able to explain the relationship between lens power and focal length
- Have an understanding of the role of lens curvature and refractive index on the power of a lens surface
- Have an understanding of the function of ophthalmic prisms
- Demonstrate an understanding of astigmatism and cylinder lenses
- Demonstrate an understanding of sphero-cylinder lenses
- Be familiar with the principles of lens transposition
- Be able to demonstrate accurate transposition skills

6.1 Spherical Lenses

In your training you will have considered the different defects of the eye and how these may be corrected with spectacle lenses. Simple errors of refraction which are not accompanied by astigmatism are corrected with spherical lenses. The term 'spherical' refers not to the shape of the lens but to the form of its surfaces. In a spherical lens, each surface forms part of an (imaginary) sphere.

Spherical surfaces are either convex or concave (Fig. 6.1). A convex surface is one that bulges outwards at its centre so that a straight edge placed across it will touch at only one point (in the centre) and will therefore 'rock'. A concave surface appears hollow (like a cave) so that a straight edge placed across it will touch at each extremity.

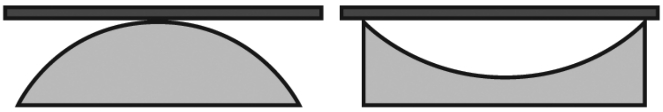

Figure 6.1 Cross-section through (left) a convex surface and (right) a concave surface

6.1.1 Plus and Minus Lenses

Spherical lenses may be divided into plus (or converging) and minus (diverging) lenses.

This classification is a fundamental one because it is based upon important optical properties of ophthalmic lenses.

As discussed earlier, we see things because they emit or reflect light into our eyes. Rays of light are imagined to spread out from every point of a visible object in straight lines. A narrow cone of rays is termed a pencil of light, referred to just as a pencil (Figure 6.2) and where the rays come to a point is called the focus.

If the object is sufficiently distant, the rays which form the pencil of light originating from the object can be considered to be parallel on reaching the eye (Figure 6.2).

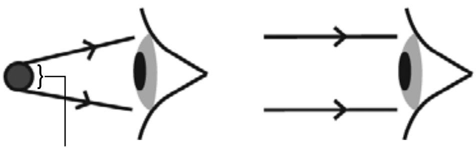

Figure 6.2 Light entering the eye from near and distant objects

When you place a lens between the eye and the object it will change the path of any rays which pass through. The shape of the lens as well as the material it is made from will affect the way the light passes through it. As we will see, plus and minus lenses affect light very differently.

If a parallel pencil of rays is directed from left to right along the optical axis of a plus lens, the lens will cause the rays to bend or converge towards a single point on the right of the lens known as the second principal focus (given the symbol F′) (Figure 6.3).

If a parallel pencil of rays is directed along the optical axis of a minus lens, however, the lens causes the rays of light to spread out or diverge as if they appear to originate from a single point to the left of the lens. This point is, again, the second principal focus.

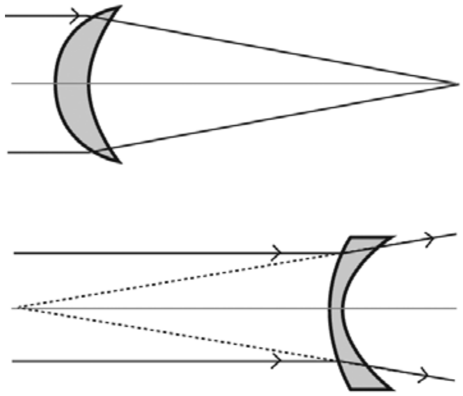

Figure 6.3 The second principal focus (F′) and focal length (f′) of (top) a plus lens and (bottom) a minus lens)

6.1.2 Lens Power

The distance measured from the back [vertex] of a lens to its second principal focus is known as the focal length (symbol f′) of the lens (Figure 6.3). Lenses are not only classified according to whether they are plus or minus but also by their power. Lens power is calculated by dividing 1 by the focal length. We can convert a power to a distance or vice versa by taking the reciprocal (1/value) of the value in question. This is used regularly in optics.

Expressed mathematically,

$F = 1/f$

where F is the lens power (measured in dioptres, D) and f is the focal length (measured in metres, m). A 1.00D lens has a focal length of exactly 1m.

The unit of power is the dioptre, and ophthalmic lenses are normally prescribed and made in steps of 0.25D. Power is written in decimal notation, with two figures after the decimal point, even if they are '00'. If this is not done every time, mistakes may occur. For example, +1.0 may be misread as +10 if the decimal point is not clear, –.5 misread as –5, and so on.

So you can now specify a spherical lens by stating its power with a plus or minus sign in front to denote whether the lens has a converging or diverging effect.

Examples

If a plus lens has a focal length of +12.5cm, its power will be 1/+0.125m

If a minus lens has a focal length of –40cm, its power will be 1/–0.40m

6.1.3 Surface Power

Each of the surfaces of a lens (front and back) has its own surface power which contributes to the power of the lens as a whole.

The power of a surface is determined by two factors:

1. The extent of the curvature of the surface
2. The refractive index (n) of the lens material

Adjusting either of these will increase or reduce the power of the lens. For instance, if one surface of a lens is made more curved, then the power of the surface will increase. A good example of this can be seen in practice with high plus lenses.

If we compare the appearance of the same lens form, made from the same material with a power of +2.00D or +10.00D, the +10.00D lens is obviously more bulbous. This is because it has a steeper front surface (Figure 6.4). Similarly, if one surface of a lens is made less curved or flattened, the power of the surface will be reduced. The term used to describe the amount of curvature of the surface is the 'radius of curvature'. If you imagine that the surface of the lens is a small section of a sphere, then a small sphere – like a tennis ball - has a small radius (distance from the centre of the sphere to its surface). A large sphere – like a planet - has a large radius of curvature (distance from the planet's core to its surface). The tennis ball surface is much more curved than the planet's surface. (Some planetary inhabitants might even think their world is flat!) So if they were lenses the tennis ball has a smaller radius of curvature than the planet. It might seem surprising but this example shows that a smaller radius of curvature means that the lens is more curved and a larger radius of curvature means that the lens is flatter.

The power of a convex surface is always positive and that of a concave surface, always negative. When the two surface powers of a lens are added together, the result is usually a close approximation to the overall power of the lens. So in the above examples, increasing or decreasing the curvature of one surface will result in a change in the overall power of the lens.

The thickness of the lens introduces a complicating factor, and you should note, therefore, that simple addition of the surface powers is only an approximation.

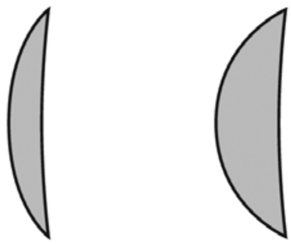

Figure 6.4 General appearance of (left) a standard +2.00D lens and (right) a standard +10.00D lens (not to scale)

Adjusting the second variable, the refractive index, will have a similar effect on the power of the lens. Choosing a material with higher or lower refractive index will result in an increase or decrease in the power of the lens, respectively. This enables us to produce thinner lenses simply by manufacturing them from materials with higher refractive indices. For example, a lens with surface powers of +6.00 D and –8.00 D (Figure 6.5) will have an approximate power of –2.00 D.

Front curve

= +6.00 D

Back curve

= –8.00 D

Total power = +6.00 D + (–8.00 D) = –2.00 D

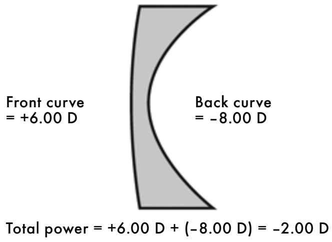

Figure 6.5 Diagram of a -2.00 D lens of front surface power +6.00 D and back surface power -8.00 D

We have already stated that spherical lenses are used to correct refractive errors where no astigmatism is present. For instance, if we consider a patient with a +3.00 D prescription, we could say that his eyes are effectively 3.00 D too 'weak' to focus on distant objects clearly. Furthermore, since we know that the flatter the surface, the weaker its power, we could suggest that the 'weakness' is the result of the corneal surface being too flat. Therefore, 3.00 D of power must be added all over the eye to correct the vision. A +3.00 D spherical spectacle lens will provide this additional power all over the surface of the eye. The opposite is true for a minus. We could say someone with a -3.00D prescription has eyes that are 3.00D too "strong" to focus on distant objects or the corneal surface has curves that are too steep.

6.1.4 Ophthalmic Prisms

There are occasions when the optometrist will prescribe prisms to reduce symptoms of eye strain or double vision. Customers with a muscle imbalance need prisms to help them fuse the images from each eye into a single image. Prisms change the direction of light passing through them in a particular way (Figure 6.6). A prism will always deviate light towards its base and the image will appear to move towards the apex.

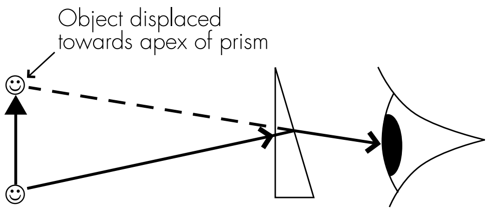

Figure 6.6 The deviation of light by a prism

When prescribing prism, the optometrist will specify the amount and the position of the prism base The symbol used for prism power is a capital Greek delta symbol which looks like a triangle Δ. The direction of prism can be prescribed as 'in' 'out' 'up' or 'down'.

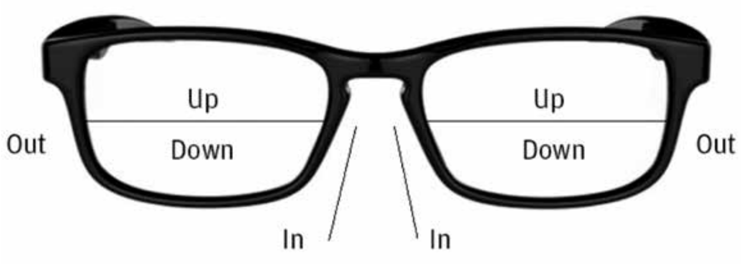

Figure 6.7 Positions for the prism base in a spectacle lens

Exercise 6.1 Prism lenses

Ask your supervisor to let you compare the different prism lenses in the trial case and observe how distant objects appear to move when looking through the prism compared with your normal vision.

6.2 Astigmatic Lenses

So far, we have only considered spectacle lenses incorporating two spherical surfaces, each of which has a constant power in all directions outward from the centre. In other words, if you place the lens onto a focimeter and turn the lens around, you will observe no change in the power reading. When prescribing spherical spectacle corrections, we are assuming that the power required by the eye in order to render it (temporarily) emmetropic (ie no refractive error) is constant over the entire surface of the eye. If the ametropia present is purely due to the curve of the cornea being too steep or too flat to focus incoming rays onto the retina, then the cornea is equally curved over its entire surface, and a spherical lens is prescribed to remedy this. Many customers do not have an equally curved cornea in all directions, as described in Chapter 4. The astigmatic eye is said to require different corrective powers in different directions (known as 'meridians'). In the astigmatic eye, the corneal surface is not equally curved over its entire surface; the cornea may be too flat in one direction, and too steep in another, giving rise to the 'rugby ball' shape commonly referred to in practice (Figure 3.8). This analogy refers to the shape of the cornea, not the entire eyeball! In this case, the direction in which the cornea is too flat needs additional lens power, and the direction in which the cornea is too steep needs a reduced lens power.

Note that astigmatism may also arise if the surfaces of the other major refracting component of the eye, the lens, are not spherical. If this is the case, the condition is termed lenticular astigmatism. The end result is the same, and for this discussion, we will assume that only corneal astigmatism is present.

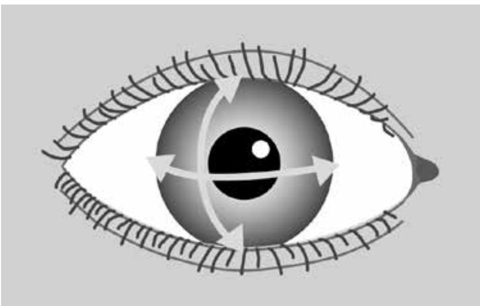

Figure 6.8 Front view of an astigmatic eye

For a spectacle lens to correct astigmatism, the power variation required is a minimum power along one meridian (along the vertical in Figure 6.8) which gradually increases to a maximum power along a second meridian at right angles (90°; see Figure 6.9) to the first (the horizontal meridian in Figure 6.8). These minimum and maximum power meridians are known as the principal meridians of the lens.

If the eye needs no correction along one of its principal meridians a cylindrical lens may be used (Figure 6.10). A cylindrical lens is obtained by cutting a section from a cylinder of lens material.

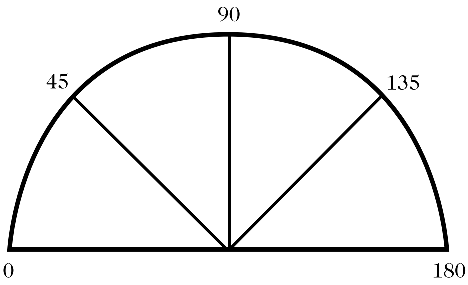

Figure 6.9 Angles in degrees, as marked on a protractor. Lines at a 90◦ angle to each other are also said to be at 'right angles'

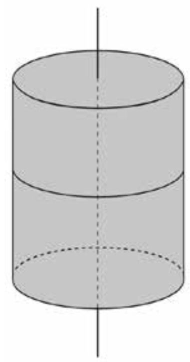

Figure 6.10 A cylinder, which is produced by rotating a straight line, PQ, around a second line, AA'. The two lines remain parallel and equidistant from one another. The stationary line AA' is known as the axis of revolution of the cylinder and the distance between the two lines represents the radius of curvature of the cylindrical surface

A cylinder is flat along its axis with maximum curvature at right angles to the axis. Therefore we say the power lies 90 degrees to the axis and so the thickest part, when incorporated into a lens is actually 90 degrees to the axis provided in the prescription. Imagine placing a ruler on the surface of the cylinder shown in Figure 6.10, parallel to the line AA'. The ruler would fit flush against the cylinder, showing that along its axis, the cylinder has no curvature (and therefore no power). If, however, we place the ruler against the cylinder at right angles to the line AA', it will touch the surface at only one point, the surface having a very definite curvature, and therefore power (Figure 6.11).

It follows from this that if an eye needs a correction along just one meridian, say the vertical meridian, then we should position a cylinder of the correct power with its axis along the horizontal (ie at 90◦to the meridian that requires a correction). This will provide the required power along the vertical meridian, where it is needed, but leave the horizontal meridian unchanged.

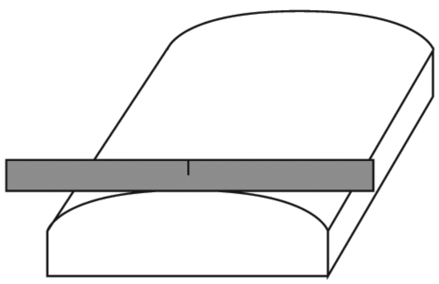

Figure 6.11 Curvature of a cylinder at 90◦ to its axis

In real practice, the customer often needs a correction along both of the eye's principal meridians, rather than just one, and for such eyes, toric lenses are required. These are lenses with two different powers along the two principal meridians.

6.2.1 Cylindrical Lens Prescriptions

From the above, it should be clear that a cylindrical lens must be positioned over the eye so that the cylinder axis coincides exactly with the meridian of the eye which requires no correction. Therefore, a prescription for a cylindrical lens must state the direction of the axis. The axis direction is always written after the cylindrical power, eg +3.00DC axis vertical, or as it is generally written, +3.00DC × 90 (where DC is the unit of cylindrical lens power, note no degree sign is used for the axis direction).

If the power is needed only in the vertical meridian the cylinder must be placed with its axis horizontal, i.e. +3.00DC × 180.

The axis direction may be given as any value between 1 and 180, depending on where the cylindrical correction is required.

It may help to denote such corrections by drawing a cross with its limbs in the vertical and horizontal meridians, marking each limb with its particular power. A correction shown in this way is known as a power diagram (Figure 6.12).

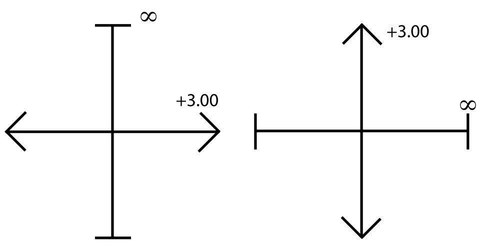

Figure 6.12 Power diagrams for cylindrical corrections stated above. Left, +3.00DC x 90 Power lies along the horizontal, since the cylinder axis is vertical. Right, +3.00DC x 180. Power lies along the vertical since the cylinder axis is horizontal. ∞ means plano (zero power)

We can add and subtract powers which are in the same meridians.

So two cylinders placed with their axes parallel to one another can be replaced by a single cylinder whose power is equal to the sum of the two powers:

+1.00DC × 90 combined with +2.00DC × 90 is equivalent to +3.00DC × 90

Likewise, two cylinders of equal power but opposite signs placed together with their axes parallel will neutralise each other:

+2.00DC × 90 combined with –2.00DC × 90 will produce zero power.

We can also combine cylinders with axes in different directions, but we need to remember the rules:

Two identical cylinders placed together with their axes at right angles are equivalent to a sphere whose power is equal to either of the cylinders:

+1.00DC × 90 combined with +1.00DC × 180 will produce +1.00DS sphere.

- ***Sphero-cylindrical lenses***

We know that a patient with astigmatism will need two specific corrections along the two principal meridians. We could achieve this by positioning two cylinders with their axes crossed in front of the eye (crossed cylinders).

Example 6.1

A patient requires +3.00D in the vertical meridian and +2.00D in the horizontal meridian. The following cylinders could be placed in the trial frame to give the required correction:

+3.00DC × 180 / +2.00DC × 90

That is, a +3.00 cylinder (or cyl) with its axis horizontal is used to correct the vision in the vertical meridian, and a +2.00 cyl with its axis vertical is used to correct the vision in the horizontal meridian, because we know that power in a cylinder lies at right angles to its axis. Indeed, we can write all prescriptions in this way: this is called crossed-cyl notation.

However, instead of writing the prescription in terms of a combination of two cylinders, it is generally expressed as a combination of a spherical component and a cylindrical component.

Example 6.2

Consider the correction +3.00DC × 180 /+2.00DC × 90. If we were to place a spherical lens of power +3.00 DS in front of the eye, then it would be corrected fully in the vertical meridian, because +3.00D of power is required in this meridian. However, in the horizontal meridian, the eye only needs +2.00D correction, and the spherical lens will provide an excess of +1.00D power. Therefore, in order to provide the correct prescription along the horizontal meridian, +1.00D of power must be removed in that direction only.

This can be achieved by placing a cylinder of power –1.00 DC with its axis vertical, behind the sphere.

Both crossed-cylinder and sphero-cylinder combinations are shown in Figure 6.13. Note that the end results are identical.

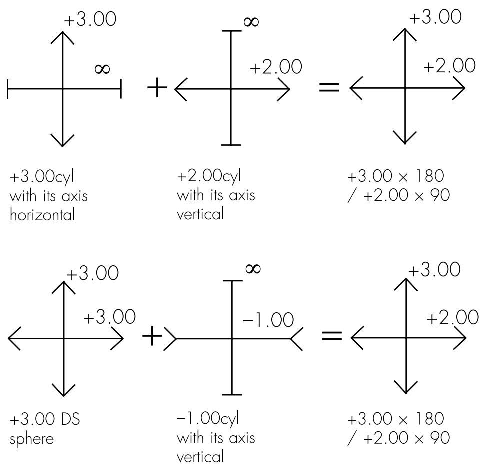

Figure 6.13 Top, crossed-cyl notation of +3.00DC x 180 /+2.00DC x 90. Bottom, sphero-cylinder notation of +3.00DS / -1.00DC x 90. Both notations give the same end result. Notice the different direction of the arrows for the negative cylinder.

Example 6.2 shows that the prescription can be written as:

A combination of two positive cylinders of different powers with their axes at 90° to each other (crossed-cyl notation).

Or:

A combination of a plus sphere and a minus cylinder with its axis along a stated direction (sphero-cyl. notation). Since the cyl is negative in this case, this form is known as minus-cyl form).

The combination could also be written in another form as:

A combination of a plus sphere and a plus cylinder with its axis along a stated direction (plus-cyl form). The prescription, in this case, would be written as: +2.00DS / +1.00DC × 180

Here, a +2.00D sphere is placed in front of the eye, its power working in all meridians.

However the vertical meridian of the eye requires a correction of +3.00D. This is provided by placing a +1.00D cyl with its axis horizontal behind the spherical component.

This combination of sphere and plus cyl will also give the required correction.

- ***Transposition of sphero-cylindrical prescriptions***

It is important to be able to understand a sphero-cylindrical lens in either of its forms, or in its cross-cyl form. This is because, for example, the optometrist may write the patient's prescription in minus-cyl form, while the laboratory may use plus-cyl form for ordering lenses. The process of changing from one form of notation to another is known as transposition. Although we could use the processes outlined above to transpose given prescriptions, it is more convenient to apply a set of established rules.

These rules are given below and should be memorised until transpositions can be undertaken automatically.

Alternate sph-cyl forms:

- Combine the sphere power with the cyl power and record this as the new sphere
- Change the sign of the old cyl but keep the value the same and record this as the new cyl value
- Change the old cyl axis by 90° ensuring we remain between 1 and 180 and record this as the new cyl axis.

Example 6.3

For the prescription

R +3.00 / -1.00 x 90

New Sphere +2.00

New Cyl +1.00

New Axis 180

Alt sph-cyl form: R +2.00 / +1.00 x 180

Cross-cyl form to sph-cyl form:

- Write either cross-cyl as the sphere
- Subtract the cross-cyl chosen as the sphere from the other cross-cyl to find the cylinder (i.e. the cylinder is the power which must be added to the cross-cyl chosen as the sphere to produce the second cross-cyl)
- The axis of the sph-cyl form is the same as the axis of the cross-cyl that is not chosen as the sphere

Example 6.4

+2.00 x 90 / +3.00 x 180

New sph +2.00 DS

New cyl +1.00 DC

Axis 180

Sph-Cyl form: +2.00 / + 1.00 x 180

Either sph-cyl form to cross-cyl form:

- The first cross-cyl is equal to the sphere of the sph-cyl form (written as a cylinder), with its axis at right angles to the axis of the cyl in sph-cyl form
  The second cross-cyl is equal to the algebraic sum of the sphere and cyl from the sph-cyl prescription (written as a cylinder), with its axis the same as the axis of the cyl in the sph-cyl form.

Example 6.5

+2.00/+1.00 x 90

Show on power diagram +2.00 in both meridians, +1.00 in horizontal meridian making the total power +3.00 along 180.

Power lies +2.00 along 90 and +3.00 along 180 which means the axis is +2.00 x 180/ +3.00 x 90. This gives the resultant cross-cyl prescription.

We would use cross cyl form in stores to help visualise where the thickness would lie in the lens. If we know where the higher power lies we can use this information to aid frame selection.

Chapter 7

Lens Form

Introduction

Lenses are available in a variety of different forms and as a dispenser you must have an understanding of when a certain form is appropriate. The cosmetic appearance and vision may be improved by selecting the correct form of lens.

By the end of this chapter you will be able to:

- understand the differences between aspheric and spherical lenses
- understand the advantages and disadvantages of aspheric lenses
- be able to take appropriate measurements which are important in relation to aspheric lenses

7.1 Lens Form

Before starting a dispense you will already have looked at the prescription and will have some idea of the lens type and material to discuss with the patient. One factor that is often omitted from the discussion is the lens form, which is the shape (whether curved or flat) of the front and back surfaces. Yet lens form plays an important role in the visual performance of the lens. The amount of aberrations and distortions the spectacle wearer will experience can change substantially if the lens form is changed. If this is not discussed with the patient it may lead to dissatisfaction and complaints.

Modern manufacturing techniques have already computed vast numbers of designs for all prescriptions to minimise or eliminate distortion and aberrations (so-called 'best-form' lenses). However there is always the possibility you may encounter someone who has not worn the best form or prefers a different one.

To help explain how the same-power lens can have different forms, consider the example of a +5.00D lens. This can be made in either a flat form or a curved form using the same material – by using different powers on the front and back surfaces. (Recall from the previous chapter that if we ignore the thickness of the lens, the total power is the sum of the powers of the two lens surfaces.)

Figure 7.1 illustrates five different forms that all give a total lens power of +5.00D.

a. Planoconvex (i.e. flat one side, convex the other): F1 = 0.00D, F2 = +5.00D. Total power = +5.00D

b. Equiconvex (i.e. equal curvature on both surfaces): F1 = +2.50D, F2 = +2.50D. Total power = +5.00D

c. Biconvex (i.e. both surfaces are convex but to a different degree): F1 = +3.50D, F2 = +1.50D. Total power = +5.00D

d. –2.00 Base meniscus (a meniscus lens has a convex front and a concave back surface): F1 = +7.00D, F2 = –2.00D. Total power = +5.00D

e. –4.50 Base meniscus: F1 = +9.50D, F2 = –4.50D. Total power = +5.00D

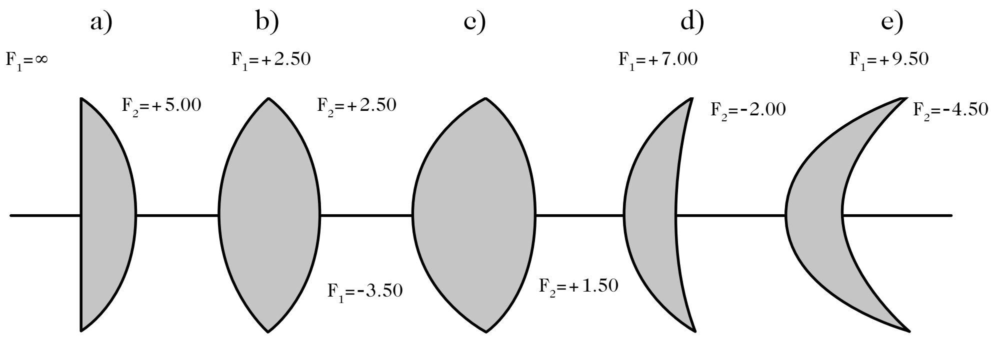

Figure 7.1 Five forms giving the same total lens power: +5.00D (see text above)

If the eye views an object through the optical centre of any of these five forms then there will be no aberrations or distortions and the power will be the same. However, as the direction of gaze moves away from the optical centre, aberrations caused by the shape of the lens surfaces and the characteristics of the materials used become apparent.

We will look at the types of distortions and aberrations in later chapters.

7.2 Aspheric Lenses

So far we have considered best-form lenses to minimise problems with off-axis performance using spherical surfaces. Best-form lenses are not the only option available to us. With the introduction of high-tech computers and computer numerically controlled (CNC) machines it is possible to produce lenses with complex aspheric surfaces.

Any surface that is not totally spherical can be called aspheric, therefore a cylindrical or progressive lens can be classed as aspheric. CNC machines produce a range of simple to complex aspheric surfaces which can even incorporate curves designed to cancel out oblique astigmatism and spherical aberration.

7.2.1 How do Aspheric Lenses Work?

The principal use of aspheric lens designs is the reduction or elimination of optical aberrations produced by looking through an ophthalmic lens obliquely. Aspheric lenses comprise astigmatic surfaces, designed to neutralise the amount of oblique astigmatism aberration produced by the lens. This is done by increasing the amount of negative surface astigmatism towards the periphery of the lens. The amount of asphericity is called the p-value, and this can be altered to reduce different amounts of aberration. Lens aberrations occur as the wearer gazes away from the optical axis of the lens, which is an imaginary line perpendicular to the optical centre, to use his or her peripheral vision. Consequently, we often refer to the peripheral performance of a spectacle lens as its off-axis performance. The peripheral vision through a lens that suffers from oblique astigmatism is blurred, and the wearer experiences a limited field of clear vision. However it does not completely eliminate visual problems. There is usually a compromise between the reduction of aberration due to the prescription and distortion caused by the aspheric lens form.

7.2.2 Advantages of Aspheric Lenses

1. Dioptric appearance improved by 2–3D.
2. Less spectacle magnification (this reduces the ‘bug-eyed’ effect for high-plus prescriptions and improves cosmetic appearance, as it reduces the emphasis of wrinkles around the eyes that would otherwise be highlighted by high-plus spherical lenses).
3’ Good mean oblique power, i.e. the power of the lens is more constant across the lens surface, unlike spherical lenses, where the only point on the lens with full power is the optical centre.

7.2.3 Disadvantages of Aspheric Lenses

1. Reflections may be greater due to the flatter surface.
2. Spectacle checking is more difficult.
3. There may be increased distorion.

7.2.4 Aspheric Plus Lenses

Aspheric plus lenses have particularly important applications in the condition known as aphakia. Aphakes are patients who have eyes with no lenses, e.g. cataract patients who have had their lens removed but not replaced with an implant. They have a very high plus prescription. In high-plus lenses, which are convex in the centre, the weight of the lens is problematic, so aphakes are often prescribed lenticular lenses. These are lenses which have a central zone finished to prescription surrounded by a supporting margin which is made thinner to reduce the weight of the lenses. Two types of lenticular lens are shown in Figure 7.2.

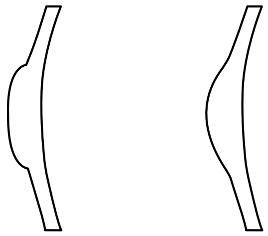

Figure 7.2 Two types of lenticular lenses

There are cosmetic and visual problems with these lenses. Their shape is both very obvious ('fried-egg' appearance) and unattractive. Using high-index materials to help reduce the weight of the lens produces transverse chromatic abberation or TCA (where coloured fringes can appear around objects when looking through the edges of the lens) and there is a distinctive effect on their visual field, called a 'jack-in-the-box' ring scotoma. As the lens has a prismatic effect, there is a ring between the part of the visual field seen through the lens and the outer edges of the visual field, which are beyond the edge of the lens. As objects move between the outer part of the field (uncorrected vision) to the area seen through the lens, they pass through this ring scotoma where they suddenly disappear and reappear again (hence the 'jack-in-the-box').

Computer technology has enabled the design of high-plus aspheric lenses with flatter edges. This results in a much subtler 'fried-egg' appearance than with the lenticular lens (Figure 7.2). The advantages of an aspheric plus lens are not only cosmetic but also better visual performance. There is less TCA and magnification, good mean oblique power (i.e. the power is relatively constant across the lens surface) and reduced distortion. The lens is also available in bifocal and progressive designs.

7.2.5 Aspheric Minus Lenses

In lower negative powers (i.e. –0.25D to –5.00D) the front surface curve is usually positive and therefore bulbous. An aspheric design makes the lens flatter and therefore marginally thinner, at the same time as increasing the optical performance. However it should be pointed out that the more negative the lens becomes, the flatter the front curve will be. When the front curve is nearly flat there will be a less satisfactory cosmetic result (due to increased reflections and the difficulties of glazing a flat lens into a curved spectacle frame), so the only advantage in this case will be the optical performance of the lens. Take care to explain to the patient that the lens will be flatter and what this means cosmetically.

7.2.6 Measurements for Aspherics

Due to the flatter peripheral curves it is recommended that the optical centres should be:

- centred horizontally according to the mono interpupillary distances and
- centred vertically according to the pantoscopic tilt

The rule for centering vertically is that for every degree of pantoscopic tilt you lower the heights by 0.5mm. So for example if you measured the vertical heights to be 20mm but then added a 10 degree tilt you would lower your heights by 5mm if dispensing aspheric lenses. Any prescribed prism should be worked on to the lens at the time of manufacturing rather than using decentration to create the prism, as decentring the lens could cause distortion to become more apparent.

Exercise 7.1 Aspheric lenses

Discuss with your supervisor reasons why an aspheric lens may be the best lens option for your customer. Discuss the benefits using the virtual toolbox to assist you.

7.3 Summary

Lenses can be produced in many forms. Aspheric lenses can often be the most beneficial form available to the patient. It has many advantages such as, better off centre vision, less magnification and cosmetically flatter in shape. When dispensing an aspheric lens care must be taken to ensure measurements are accurate.

Unit 7 Supporting the Provision of Spectacle Frames

Chapters 8 - 10

Learning outcomes

The learner will:

1. Understand the materials used in spectacle frames.
2. Understand how spectacle frames are selected and adjusted.
3. Understand the British Standard of measurement of spectacle frames.

Chapter 8

Frame Materials and Construction

Introduction

Dispensers are often required to be frame specialists in store. This chapter will introduce you to a variety of frame materials and construction methods. It will be delivered via an E-learning module and a series of exercises to aid your understanding of the subject.

By the end of this chapter you will:

- Be able to identify the materials used in the manufacture of spectacle frames.
- Be able to describe the properties of spectacle materials.
- Be able to explain the advantages and disadvantages of different materials.
- Be able to describe the components of spectacle frames.
- Be able to describe the types of spectacle frame construction.

The topic of frame materials and their adjustment and manipulation is largely practical. However, the basic properties of the materials used in spectacle frames should be fully understood. The following list includes most of the frame materials currently in use or circulation in the UK, and you are advised to seek out examples of as many of them as possible, until you are familiar with their properties.

8.1 Materials

8.1.1 Plastic Materials

- ***Cellulose acetate***

This is the plastic material most widely used in frame manufacture. Made from cotton linters and acetic acid, the material is made in a block form and then sliced into sheets from which the frame components, such as the front and sides, are manufactured by cutting, routing and polishing. The sides of these frames are invariably reinforced, and most modern frames are fitted with pinless pillar-type joints.

The colour is produced using water-based dyes, which is one of this material's main advantages, as virtually any colour shade in transparent or opaque form can be used.

One drawback of the material is that a number of individuals have some allergic reaction to cellulose and the surface of the material is subject to attack from skin acids in perspiration. This may cause the material to discolour, especially at the bridge.

Adjustment and glazing of these frames involve heating the frame to its reshape temperature of about 60°C. Care should be taken not to leave the frame immobile in the frame heater, as this may lead to bubbling and blistering of the material.

The low adjustment temperature and lack of elastic 'memory' (the ability of a material to return to its original shape on cooling) mean that these frames tend to be unstable. As a result, they may relax and warp in storage, particularly when unglazed. This material also tends to discolour with age.

Most modern acetate frames are finished with a hard, high-gloss polyurethane or acrylic lacquer to improve scratch resistance and appearance.

- ***Cellulose propionate***

This material is made from cellulose flake treated with propionic acid. The material is injected, in liquid form, into a mould. After moulding, it is dyed and lacquered.

Cellulose propionate is stronger, more resistant to temperature, more elastic and resistant to ageing (and discolouring) than acetate. It is also hypoallergenic.

Propionate frames are lighter in weight than acetate frames and, because of the increased strength of the material, further reduction in weight can be achieved by using thinner frames.

The reshape temperature of propionate is 70°C, but excessive heat will cause shrinkage.

Propionate frames, like acetate frames, have reinforced sides.

- ***Carbon fibre***

The carbon fibre material used for frame manufacture is a blend of carbon fibres and other ingredients, such as nylon or copolyamide. Carbon fibre graphite is extremely durable and is essentially the same material that is employed in the manufacture of golf clubs, tennis racquets and skis. It is stronger than steel and lighter than aluminium, which makes it an ideal substitute for metal components.

When applied to eyewear, carbon is used to mould an extremely thin frame that will not, as metal sometimes will, bend or stretch out of alignment. Since carbon fibre has a high melting point, carbon frames are heat-resistant and, in contrast to some plastic frames, do not lose their shape at high temperatures.

At the same time, carbon produces a lightweight frame, and since it can be fashioned into such a thin design, carbon frames tend to be lighter than plastic frames. This is a principal reason for its extensive use in sports eyewear. One disadvantage is the limited range of – mainly opaque – frame colours.

It is also advisable to glaze frames cold. Heat is never applied prior to the insertion of the lens. For this reason, the frames usually have metal sides with acetate end tips, to enable heat adjustment of the sides.

- ***Polycarbonate***

This type of frame material is mainly used for safety eyewear in the form of one-piece eye protectors and side-shields on frames. The material is soft, and hence prone to scratching, but has a very high impact resistance.

8.1.2 Metal Frames

- ***Titanium***

There are three different types of titanium frames currently available:

- Pure titanium frames: these can be up to 48% lighter than conventional metal frames.
- Clad titanium frames: here, the pure titanium base metal of the frame is overlaid with another metal. At present, nickel chromium is the metal most commonly used. The overlaying process itself is almost identical to that used in the manufacture of rolled gold. Clad titanium is 25–37% lighter than ordinary metal frames.
- Partial titanium frames: some parts of the frame are made from pure or clad titanium, and the remaining parts are made from other metals.

Titanium frames are resistant to corrosion and perspiration, the material is both hypoallergenic and extremely durable. It is very flexible and also highly resistant to abrasion.

Production costs, however, are high due to the specialised methods for welding, buffing and machining, which must be carried out in an atmosphere containing no oxygen or nitrogen.

- ***Nickel silver***

Formerly known as German silver, this material is cheaper than rolled gold but just as serviceable. It is white in appearance due to the bleaching effects of the nickel and zinc components of the metal. It contains no silver, despite its name, comprising instead about 60% copper, 20% nickel plus some zinc and various other metals. It is usually electroplated with pure nickel after manufacture.

The material is fairly resistant to corrosion and is tough and springy, making it ideal for temples and bridges. However, it should be noted that a high proportion of the population may suffer from allergic reactions to this material.

- ***Aluminium***

This is a lightweight metal which is resistant to both staining and tarnishing. It can be ionised to produce a range of colours, but cannot be brazed or soldered, joints are always riveted.

The rigidity of the material makes glazing and adjustment difficult, and, since it is cold to the touch, the sides must have plastic end tips.

- ***Stainless steel***

This material is lighter than conventional steel and, although very rigid, it is also slightly more flexible. The material does not rust, and is often used as brow bars on rimless mounts.

- ***Plated metals***

The majority of metal frames on sale in practice today are made from plated base metals.

The base metal is plated by electrolytic methods, which is perhaps the most popular type of surface treatment. The frames can also be sprayed or enamelled to give a colourful appearance or, alternatively, plastic coatings of different colours may be applied.

Exercise 8.1 Plastic frame materials

Fill in the material in the table below based on your learnings from the e-learning module.

Material	Properties	Manufacture	Advantages	Disadvantages	Image
	Adjusted at 60°C. May blister if overheated. Tend to be unstable in storage and easily warped.	Routed, cut from sheets of acetate. Sides fully reinforced. Joints heat sunk so no visible attachment. Colour can be dyed, solid or laminated.	Any colour shade can be used. Most widely used in frame manufacture.	Customers may have allergic reaction to cellulose. Material may discolour with age and wear. The type of manufacture is expensive with high wastage.	
	Adjusted at 70°C. Excessive heat will cause shrinkage.	Injected in liquid form, into a mould then dyed and lacquered. Sides are fully reinforced. Joints are also injected with no visible sign of attachment.	Stronger, more resistant to temperature, more elastic and resistant to ageing than acetate. Hypoallergenic. Lighter in weight. Can be manufactured in mass with little wastage.	Sensitive to extreme heat	

Material	Properties	Manufacture	Advantages	Disadvantages	Image
	Adjustment temperature 80-120°C. Once cooled new shape will be retained in memory and when heated will return to original shape.	Injection moulding then dyed and lacquered. Sides have no reinforcement only a short joint insertion.	Extremely lightweight and hypoallergenic. Scratch resistant and maintains its shape well.	Relatively brittle when cold.	
	High melting point and so will not lose shape at high temperatures. Often used in sports eyewear. Cold glazing and usually have metal sides for adjusting.	A blend of carbon, nylon and copolyamide.	Extremely durable. Stronger than steel and lighter than aluminium.	Limited range of colours.	
	Cold glaze only and no use of alcohol based cleaners. Low shrinkage and easy to colour.	Injection moulded.	Lightweight, flexible, strong, durable, anti-corrosive, perspiration-resistant.	Sensitive to heat and alcohol based cleaners.	
	Often used in sports wear. New technologically advanced plastic.	Injection moulded	Lightweight and durable.	Colours limited- usually black.	
	Mainly used for safety eyewear. Highly transparent and heat resistant. Flexible.	Injection moulded. Velocity tested for impact resistance.	Extremely high impact resistance. Lightweight.	Soft material prone to scratching.	

Exercise 8.2 Metal frame materials

Fill in the material in the table below based on your learnings from the e-learning module.

Material	Properties	Manufacture	Advantages	Disadvantages	Image
	Does not discolour or rust.	Laser soldered assembly. Colour applied by high frequency electric current known as galvanisation. Welded and buffed in an atmosphere containing no oxygen or nitrogen.	Hypoallergenic. Light weight, flexible and non-corrosive. Extremely durable.	Production costs are high due to specialised methods used.	
	White in appearance due to bleaching. Contains 60% copper and 20% nickel.	Electroplated colour and soldered assembly.	Cheap. Resistant to corrosion. Tough and springy.	Dull silver finish. A high proportion of customers may be allergic to this material due to nickel allergies.	
	Cold to the touch. Glazing can be difficult due to rigidity of material.	Riveted, drilled and pinned joints. Coloured using electroplating.	Lightweight. Stain resistant.	Very rigid making it difficult to adjust.	
	Does not rust. Often used in rimless mounts.	Welded assembly. Electroplated colour.	Lighter than steel and slightly more flexible.	Welding blobs often seen on joints. Very rigid.	
	Base metal contains Nickel. Most common metal used in frames.	Soldered assembly. Electroplated colour.	Wide range of colours available.	Colour can easily wear off.	
	Rims are made from titanium and so are hypoallergenic however the sides and bridge are not.	Laser soldered. Electroplated colour.	Ideal for heavy handed patients or those with children as very flexible at bridge and sides.	Can lose shape over time.	

8.2 Frame Descriptions

Frames can be classified using a variety of methods. In practice these are normally by frame ranges e.g ladies, gents, designer, children's. Within these ranges they can be further divided by material, style and colour.

8.2.1 Frame Material

Frames are often split into metal and plastic. We have looked at the range of frame materials available. See section 8.1.

8.2.2 Style

Styles would be referred to as either full rim, meaning there is a plastic or metal rim all the way around the lens, or supra, meaning there is only a rim part way around the lens, usually on the top. Frames can be classed as rimless if there is no rim around the lens, here the lenses would be attached by drilling through the sides of the lens and attaching the sides using rivets and bolts.

- ***Lens shape***

The shape of the lenses is often described when referring to the style of the frame. These may be as simple as square or round to many customers however as optical advisors you should be more accurate and descriptive than this. The most common lens shapes are contour, upswept/cat eye, quadra, aviator, oval and half eye (although half eye are seen less and less these days).

Lens Shapes

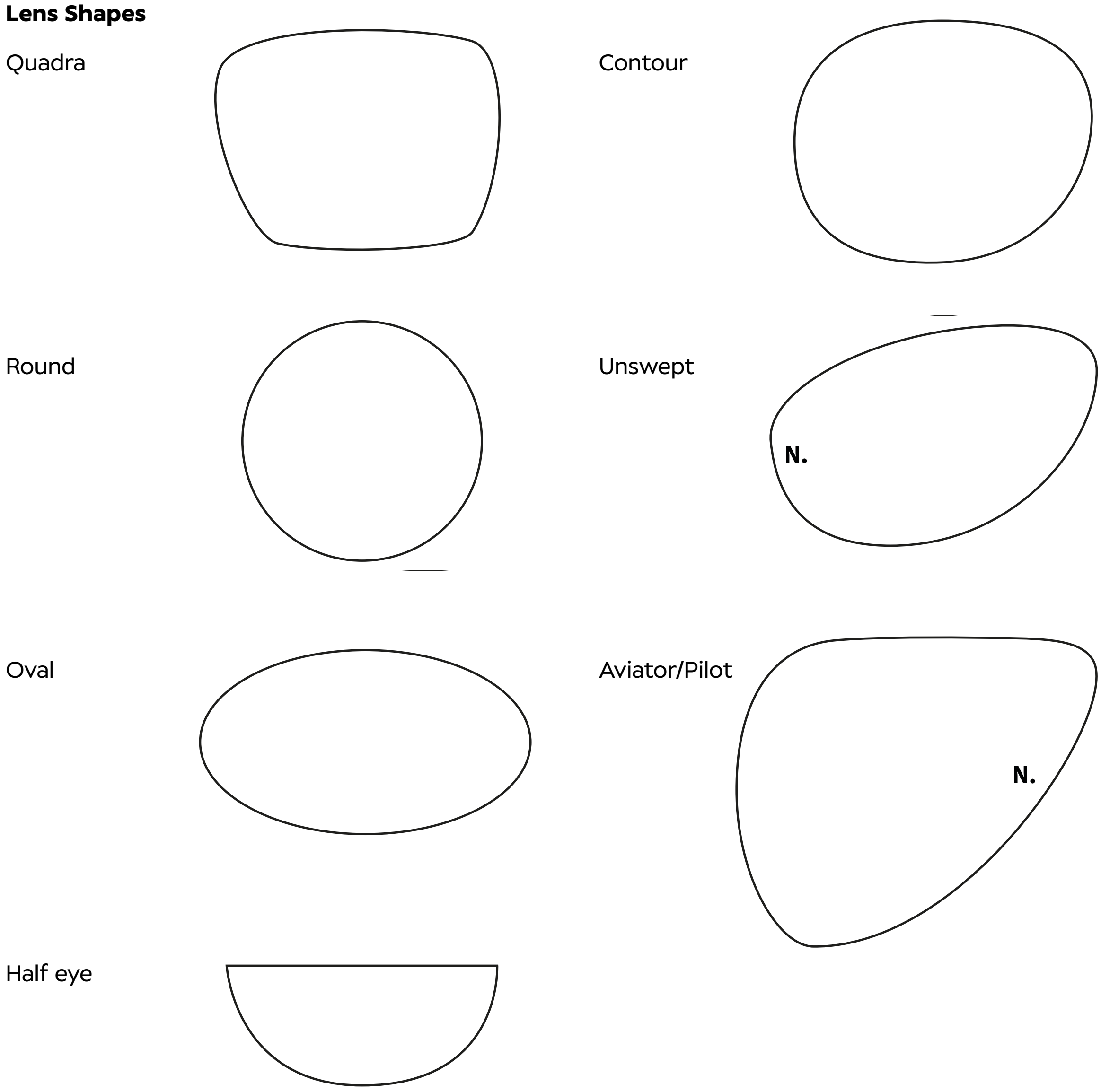

Fig 8.1 Lens shapes

8.2.3 Frame Construction

Throughout a dispense you may also be required to provide information on the construction of the frame including the type of bridge, joint or side of the frame.

- ***Bridge***

The bridge of the frame depends wholly on whether the frame is metal or plastic. Metal frames have adjustable pads made from either cellulose acetate which is very rigid or silicon which is soft and flexible. Occasionally you will also see pads made from vinyl and silicon pads containing fluid which are called Bio-form pads. These mould to the shape of the patient's bridge making them more comfortable and great for older patients who have very thin skin across the bridge of their nose. Metal frames may also be fitted with a comfort bridge which is a plastic insert which has contact round the bridge of the nose rather than just at two points.

Plastic frames have fixed pad bridges which are raised, moulded pads at either side of the bridge that are made from the same material as the frame. These cannot be adjusted and so it is vital that the pads fit the customer well at the time of frame selection. You may also see frames with regular bridges, where there is no pads at all, or keyhole bridges, where the bridge is mounded in the shape of a keyhole.

- ***Joints***

The type of joint also relies on whether the frame is plastic or metal. Plastic frames have either "Butt" or "Mitre" joints. See figure 8.2 below. If the joint is set back from the frame front and is along the line of the side, it is known as 180 degree joint.

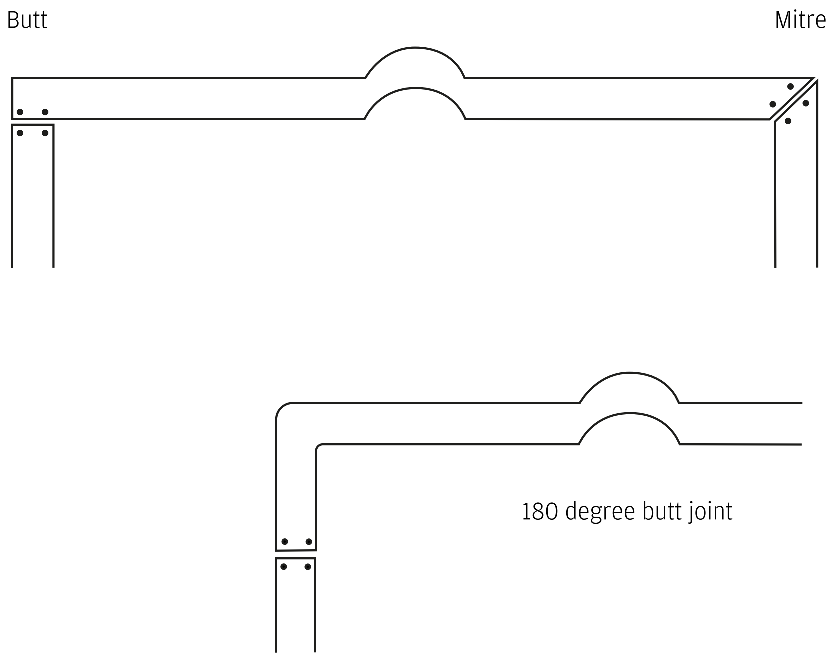

Fig 8.2 Types of joint

Metal frames have "Tenon" joints. The rings within the joint, which hold the screw, are called charniers. We would describe the joint by the number of charniers it has. Standard joints have 3 charniers – 2 facing the front and 1 to the side. A joint with 5 charniers is called a semi library joint and a frame that has 7 charnier joints is called a library frame. These are not seen often.

How the joints are attached is also important. Plastic frame joints can be either heat inserted with no visible signs of attachment, pinned, screwed or injected. If the joint is pinned, pins will usually be visible on the inside of the frame but concealed at the front. With screwed joints the screw fixing will be visible inside the frame. Injected joints will only be seen in frames that have been manufactured by injection moulding. Here the joint will be injected into the frame front. e.g. cellulose propionate. See exercise 8.1.

Metal frames can be either soldered, pinned or laser soldered. With soldering there are no visible signs of attachment. Pinned joints will be visible on the inside of the frame.

- ***Sides***

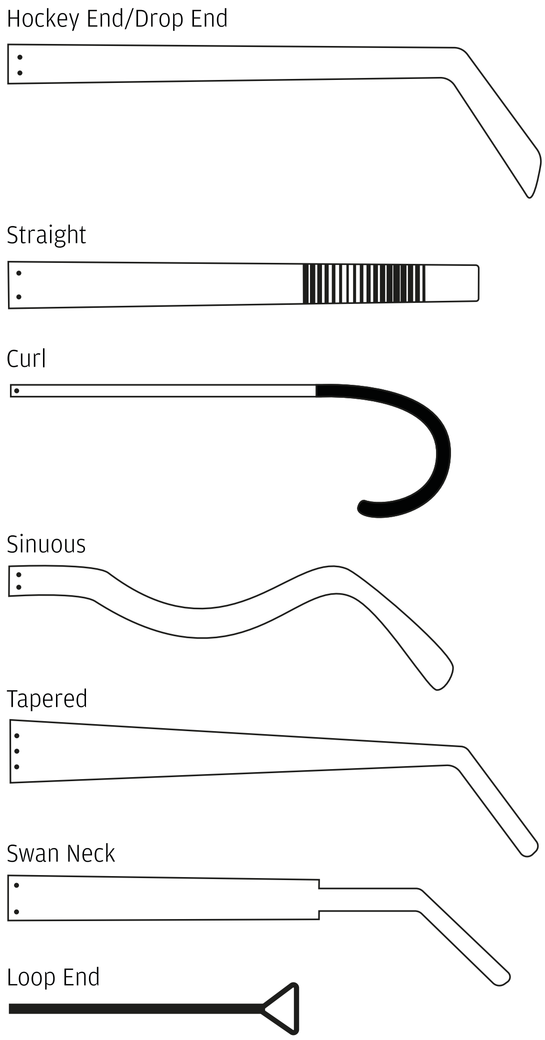

Figure 8.3 Frame sides

Chapter 9

Frame and Facial Measurements

Introduction

This chapter introduces the main facial and frame measurements you will encounter in practice. Although a full understanding of the theoretical relevance of each of these measurements is important, the only way in which you will become completely confident when taking each of them is to practise continually. Practical experience, supported by the knowledge you will gain from studying this chapter, will enable you to fulfil a valuable supporting role to the optometrist or dispensing optician.

By the end of this chapter you will:

- Be able to measure and record interpupillary distance (PD)
- Be able to measure and record monocular interpupillary distance (mono PD)
- Be able to determine the near centration distance
- Be familiar with common frame measurements

9.1 Facial Measurements

9.1.1 Distance Interpupillary Distance – Binocular

One of the first considerations of both the optometrist and the dispenser, before the examination and dispense, is the distance between the patient's pupils. This measurement is of paramount importance and is known as the interpupillary distance (PD).

The anatomical interpupillary distance is shown in Figure 9.1 and represents the distance measured in millimetres from one pupil centre to the other pupil centre.

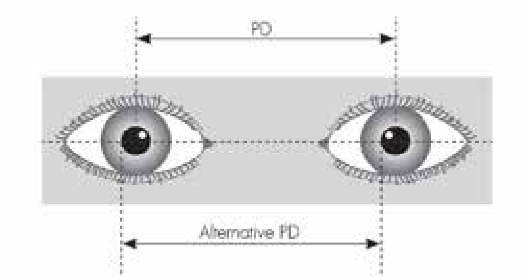

Figure 9.1 Diagram to show the anatomic interpupillary distance (PD)

This measurement is required so that all corrective lenses placed in front of the eye are accurately positioned with the centres of the lenses lined up with the centre of the pupils. Accurate PD measurement and lens centration avoid the introduction of unwanted prismatic effects. Failure to do this may result in visual discomfort and difficulties with binocular vision.

Although the pupillometer is unquestionably one of the most accurate instruments available for measuring the PD, there is no reason why the more widely used PD rule cannot achieve equally precise results, and this is the method upon which we will concentrate as you will need to be able to understand the principles and to perform both methods accurately.

When taking the PD, position yourself directly in front of and at the same level as the patient, at a distance of about 50cm. If you are any closer than this, it is likely that errors will be introduced.

Place the PD rule across the subject's nose and resting against the forehead. It may be useful to adopt the practice of holding the rule between forefinger and thumb, while placing the remaining three fingers against the patient's head to steady the hand. It should be noted here that the dispenser's left eye will be directly opposite the subject's right eye, and the right eye opposite the subject's left eye.

Close your right eye and ask the patient to look into your open eye or at a pencil held centrally in front of it. Then position the PD rule so that the zero mark of the rule is aligned with the centre of the patient's right pupil. Now close your left eye and open your right eye, again asking the patient to look into your open eye or at the realigned pencil. Now read the mark on the rule corresponding to the centre of the patient's left pupil. This represents the binocular PD.

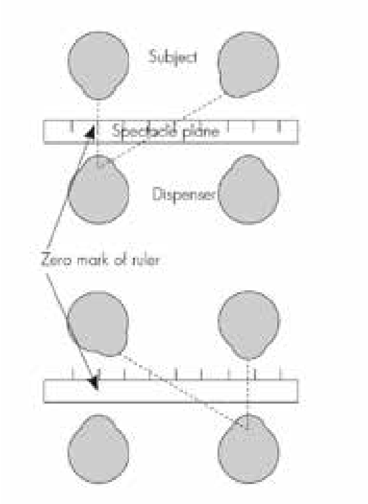

Figure 9.2 Measurement of binocular PD

Occasionally, it may be difficult to locate the exact position of the pupil centre. This may be overcome by using a small pen torch (supplied by many lens manufacturers) instead of the pencil, since the reflection of the point source can be clearly located in the patient's pupil. Alternatively, the edge of the pupil may be used as a measuring point – as long as both pupils are the same size. Similarly, if a patient has very dark irides, making pupil location itself very difficult, then the edge of the limbus may be used (the sharply defined line between the dark iris and white sclera).

It is important to ensure that the measurement is taken from the left side of one pupil or limbus edge to the left side of the other.

9.1.2 Distance Interpupillary Distance – Monocular

It is often necessary in practice to specify the monocular PDs of a patient, and it cannot be stressed enough that this measurement is not the binocular PD halved! The monocular PD is the PD specified for each eye independently, and takes into account the fact that very few people have completely symmetrical faces. Monocular PDs are of particular relevance when dispensing:

- High prescriptions
- Prescriptions which differ significantly between both eyes
- Progressive lenses
- Low V-value materials

This is because, if either of the optical centres is incorrectly positioned, the visual consequences will be greater and significantly more noticeable to the patient.

The monocular PD is always measured from the centre of the bridge to the centre of each pupil, and the procedure comprises four steps:

Step 1: Record the binocular PD as described above.

Step 2: Before removing the rule, note the scale reading at the centre of the patient's bridge. This is the distance from the centre of the right pupil to the centre of the patient's bridge, and is known as the right monocular PD.

Step 3: Calculate the left monocular PD.

Step 4: Take the right monocular PD away from the binocular reading to obtain the left monocular PD.

Step 5: Check measurement.

Step 6: Check this measurement by positioning the rule so that the zero mark lies in front of the bridge centre, and read off the result at the mark corresponding to the centre of the patient's left eye.

9.1.3 Near Interpupillary Distance

This is the distance between the pupils when the patient is fixating on a near object. This will differ from the distance PD since, when undertaking close work such as reading, the eyes automatically move inwards or converge. The near PD will therefore be smaller than the distance PD.

It is important to stress here that subtracting a nominal figure, such as 3–4mm, from the distance PD is not an acceptable way to calculate the near PD. The amount by which the eyes converge can differ significantly from one patient to the next. The method for measuring the near PD is outlined below.

Position yourself at the patient's working or reading distance, which you estimate from questioning the patient. For example, if the spectacles are to be used only for reading, and you establish from your questions that the patient holds reading material at 50cm, then this is how far from the patient you should be positioned, in order to obtain an accurate result.

Then move sideways so that your dominant eye is positioned as centrally as possible in front of the patient's nose. Close your non- dominant eye and ask the patient to look into the eye that is open. Align the zero mark on the PD rule with the centre of the patient's right pupil, and note the position of the centre of the patient's left pupil on the rule. This is the distance between the patient's pupils when focusing on a near, centralised object (the dispenser's open eye) at a specific working or reading distance, the near PD. Note that neither dispenser nor subject is required to shift their gaze during the measurement process.

9.1.4 Near Centration Distance

Our principal concern when taking these measurements is where to place the optical centres of the patient's lenses. Therefore, it is important that we measure the distance between the pupil centres in the plane of the spectacle lenses whilst the patient is fixating upon the object. This measurement is known as the near centration distance.

Unlike the relationship between the distance PD and the distance centration distance (where both values will be approximately the same), the near PD will differ slightly from the near centration distance (Figure 13.3).

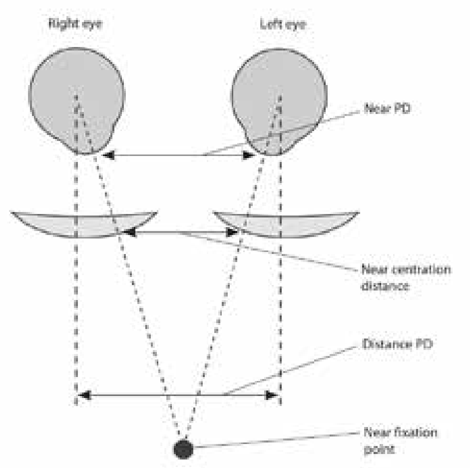

Figure 9.3 Key facial measurements. PD = Interpupillary distance

When taking measurements to determine the near centration distance, we follow the rules for taking the near PD, except the patient wears the frame into which the lenses will be glazed, and the measurements are taken with the rule held against this, rather than the patient's forehead. In this way, the measurement is taken in the plane of the spectacles.

When ordering spectacles for near or intermediate work, the near centration distance rather than the near PD should be quoted. For most patients, the near centration distance will be 3–4mm less than the distance PD, but there are many exceptions to this rule. Therefore, these measurements must be carried out every time spectacles which incorporate a near-vision correction are dispensed.

9.1.5 Additional Measurements for Bifocal Lenses

With bifocal lenses, in addition to specifying both the distance and near centration distances, the position of the top of the lens segment in relation to the patient's pupil also needs to be specified. Typically (but not always) this would be positioned so that the top of the segment is in line with the lower limbus. As this measurement is being made in relation to the spectacle frame (unlike PD and near centration) the frame will need to be in position for measurement. The position of the lower eyelid can be measured either in relation to the horizontal centre line (see next section), or in relation to the lowest part of the bottom rim of the frame.

9.2 Frame Measurements

Frame measurements are a vital part of the dispensing process, whether we are finding the position of the horizontal centre line in order to state the desired position for a bifocal segment, or whether we are ascertaining the head width to let back the sides of a pair of spectacles accurately.

These notes explain what most of the frame measurements encountered in practice actually mean. However, because all of these measurements can only be perfected by hands-on practice, it is beyond the scope of this text to demonstrate how each is taken. You are strongly advised to ask your supervisor to demonstrate exactly how each measurement is taken. All of the measurements given can be taken with a standard frame rule and facial gauge and, with practice, even the more obscure measurements can be easily and accurately performed.

In the UK, the measuring system adopted for spectacle frames is based on the boxed system. This uses the idea of a rectangle or box enclosing the spectacle lenses that are to be glazed into the frame. The dimensions of the smallest box which could enclose the lenses are taken to be the frame's dimensions.

This box consists of a number of horizontal and vertical dimensions and reference points (Exercise 9.1). You need to understand these for ordering and adjusting spectacle frames. They are also, of course, important measurements for manufacturing purposes.

9.2.1 Definition of Common Frame Measurements

The following are some frame measurements with which you should make yourself familiar.

Horizontal centre line (HCL)

An imaginary line equidistant from and parallel to the top and bottom edges of the boxes that could just contain the two lenses.

Crest height

The vertical distance measured from the HCL to the mid-point of the lower edge of the bridge.

Bridge with line

A horizontal line 5mm below the HCL.

Relevant to frame sides:

Angle of side

The vertical angle between a normal to the back plane of the front and the line of the side when opened.

Joint height

The distance from the centre line to the horizontal plane through the centre of the joint.

Downward angle of drop

The downward inclination of the drop from the line of the side, measured near the ear point and in the vertical plane containing the line of the side.

Line of the side

A straight line through the dowel point and the ear point.

Back plane of the front

A plane which touches the back edge of the top and bottom rim of the spectacle frame.

Frame temple width

The distance between the sides 25mm behind the back plane of the front.

Frame head width

The distance between the sides at the ear points.

Angle of let-back

The horizontal angle between the inner surface of the fully opened side, adjacent to the joint, and a normal to the back plane of the front.

Exercise 9.1 Facial measurements

Have your supervisor check your facial measurements for 3 dispenses and sign them off below.

Dispense	Comments	Supervisor signature
1		
2		
3		

Exercise 9.2 Frame measurements

Using a frame rule practice the measurements listed below with your supervisor.

Angle of side

Length to bend

Bridge width or distance between pads

Length of drop

Head width

Temple width

Angle of letback

Chapter 10

Spectacle Checking

Introduction

One of the most important tasks which you may be asked to assist with is the verification of spectacle prescriptions and frame materials. In order to ensure that this is performed accurately, it may be useful to adopt a set routine when determining the properties of spectacle lenses of known or unknown power, and when identifying different frame materials for duplication and/or adjustment purposes.

This chapter explains various ways of developing such a routine. You will learn how to verify and duplicate the specification for all frame and lens types.

By the end of this chapter you will:

- Be able to focus the focimeter eye piece
- Be able to measure lens power accurately
- Be able to describe and demonstrate accurate focimetry of single-vision lenses
- Be able to describe and demonstrate accurate focimetry of bifocal lenses
- Carry out a full product quality inspection of completed spectacles.

10.1 Product Quality

Care should be taken to ensure the finished product issued to the customer is of a high standard and has passed rigorous product quality inspections.

These inspections consist of a number of checks which can be carried out by Lab technicians or optical assistants unless the dispense belongs to someone in a restricted category. In this case the inspection must be performed by a dispensing optician or optometrist.

10.1.1 Surface Quality

Before handing the glasses to the customer, check the lenses for surface quality.

- When held up to a light, check the lens for surface defects
- The material should be of the same material index in both lenses unless specified by a registered Optician. It should be free from abrasions that may impede vision or look cosmetically unappealing due to scratches or treatment faults.

If you notice any surface defects, the lenses must be re-made.

10.1.2 Symmetry and Shape of Lenses

The correct symmetry and shape of both lenses are vital to ensure accurate fitting of optical centration position, cosmetic appearance and frame dimensions.

Both lenses must be of equal inverted shape and size when viewed from front and back.

Figure 10.1 If the shape and symmetry of the lenses is not correct, the glasses should be re-made.

10.1.3 Tension

On a metal frame, closing blocks must close in parallel, without excessive pressure on the mounting screw. If the joint will not close completely, the lens must be removed and reduced in size.

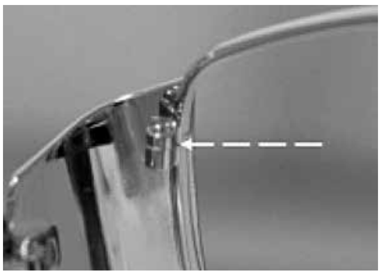

Figure 10.2 An example of a frame with the correct tension. Blocks are correct and flush showing no strain (arrow).

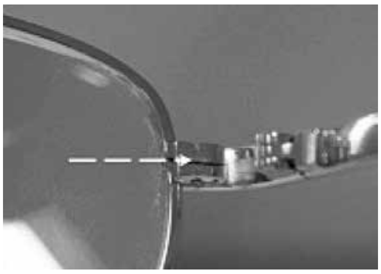

Figure 10.3 An example of a frame with too much tension. Blocks are correct and flush showing no strain (arrow).

In this case, the glasses should be returned to the lab to be either hand edged by the lab technician or re-made.

10.1.4 Safety Bevel

Safety bevelling ensures that the lenses are free from a sharp edge and its application depends on the type of lens and frame:

- The width of the safety bevel should not exceed 0.5 mm and not be visible when viewed from the front of the frame with enough depth to remove sharp edges.
- Plastic lenses fitted to metal or plastic frames only need a back surface bevel.
- All glass lenses, regardless of frame type, need front and back surface bevels and must be free from stars or chips.
- All lenses fitted to rimless/supra frames must have front/back surface bevels to ensure safety, reduce the chance of chipping and ensure an excellent cosmetic finish.
- The purpose of a safety bevel is to remove dangerous edges, not to reduce lens thickness or to hide lens damage.

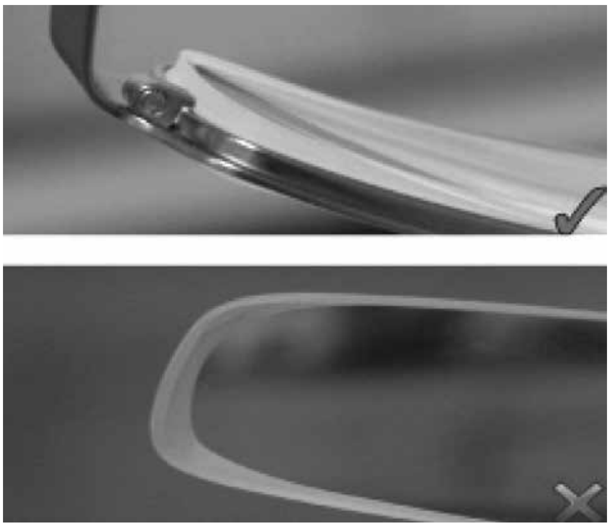

Figure 10.4

If the safety bevel is excessive, the glasses should be returned to the lab where they will either be re-touched or re-made.

10.1.5 Lens Fit

- Lenses should not rotate or move within the frame; the frame rim must fit tightly around the circumference of the lens.

Figure 10.5

- Light must not be visible between any part of the lens and frame rim or closing blocks when held up to an appropriate light source.

Figure 10.6

- Lenses must not be secured with lens liner, packing or any other medium – this does not constitute “fit for purpose”.
- Supra cord must fit within the groove of the lens and the lens liner (figure of eight) should not protrude from the frame at any point.

Figure 10.7

If there are any gaps, the glasses should be returned to the lab where they should be re-made.

If there is supra cord protruding, the glasses should be returned to the lab where they can be repaired.

10.1.6 Cosmetic Appearance

- The bevel position or supra groove should be complete around the circumference of the lens and follow the base curve of the lens to ensure correct and secure fit to the frame
- Rimless frames should have matching dome caps and the fitting screws reduced to a safe and cosmetically appealing length
- In all cases, excessive visible lens protrusion at the front of the frame should be minimal, unless set to customer specification
- No lens dust should be present between the frame and lenses
- Lenses should be clean and free from chinagraph marks or marker pen
- Is the lens thickness or base curve excessive?
- Do the sides open easily with only slight pressure applied?

Figure 10.8

Some issues with the cosmetic appearance of the lenses can be dealt with immediately by cleaning or making adjustments to the glasses.

If the issue is with the lenses themselves, they should be returned to the lab to be re-made.

10.1.7 Lens Treatments and Tints

You should check the lenses to ensure that any treatments or tints that have been ordered by the customer are actually present and correct.

If there is an anti-reflection coating, it must be of the same bloom and colour when both lenses are held approximately 30 cm from the eye using a suitable light source.

If you are unsure, you should return the glasses to the lab for them to be checked.

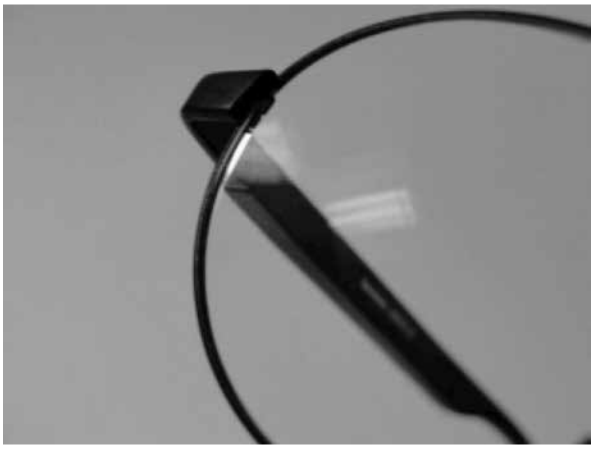

Figure 10.9. Notice how the UltraClear treatment does not go all the way to the edge of the lens

10.1.8 Segment Height and Position

Segment alignment for straight-top and curved-top segments

- The orientation of the dividing line should not be tilted more than 2 (degrees) from the horizontal.
- At all times the symmetry of the frame must not be compromised to accommodate incorrect segment alignment.

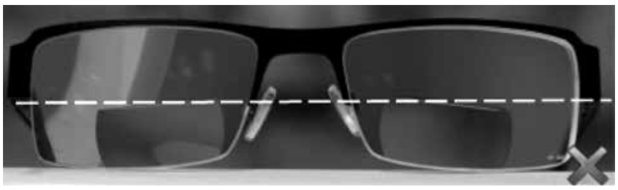

Figure 10.10

10.1.9 Segment Alignment for Progressive Lenses

- The orientation of the dividing line should not be tilted more than 2 (degrees) from the horizontal
- At all times the symmetry of the frame must not be compromised to accommodate incorrect segment alignment

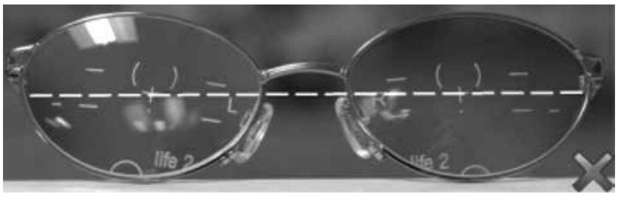

Figure 10.11

In both cases shown (Figures 10.10. 10.11), the lenses should be returned to the lab to be re-made.

Exercise 10.1 Product quality

Arrange with your supervisor to spend time in the lab carrying out the product quality checklist.

Check at least 10 pairs of spectacles and list below the details of each pair and whether they passed or failed. If you have not passed a pair of spectacles please list the reasons why.

Spectacle details	Surface quality	Tension	Safety Bevel	Cosmetic appearance	Symmetry	Treatments	Segment	Lens Fit	Pass/Fail	Reason

10.2 Lens Verification

The most common means by which spectacle lenses are checked or verified is using a focimeter. The focimeter measures the power of any given lens, as well as the axis direction if the lens is prescribed to correct astigmatism. This process is generally referred to as neutralisation. The focimeter is one of the most important pieces of equipment within the practice and, as such, requires a high degree of competency when being used. There are two main types of focimeter in common use: the projection focimeter and the target focimeter. Ask your supervisor to demonstrate the type you use in practice. The projection focimeter produces an image on to a screen which the user views. The target focimeter is the more common instrument; the user views the image down a single eyepiece. Both instruments work on the same principle. They produce an image (the image is different on different machines) – a cross, a series of dots or two single lines. Most machines have a single dial, which is turned to give power readings, and an axis ring to indicate the orientation of the axis. When using any instrument, it is important to understand the image seen and what it shows.

Figure 10.12a Electronic focimeter also known as projection focimeter

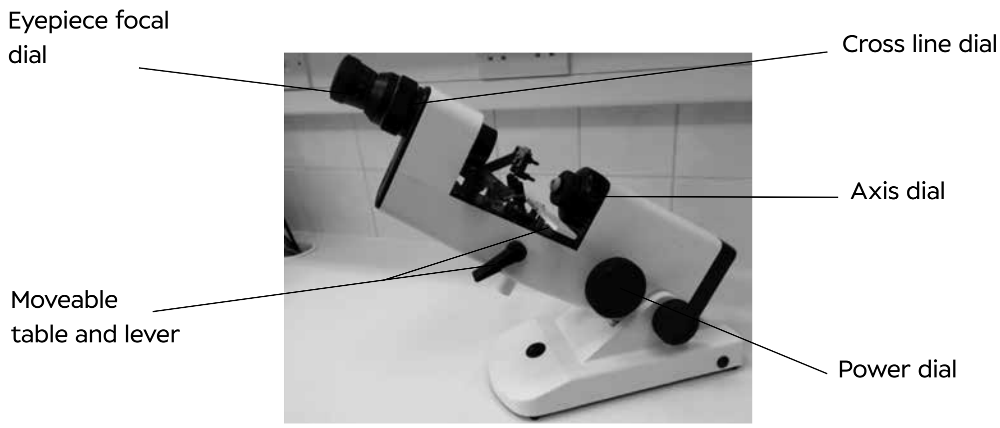

Figure 10.12b Labelled diagram of manual focimeter also known as target focimeter

10.2.1 Single Vision Verification

Exercise 10.2 Focimetry

With your supervisor work through the following steps to manually focimeter a pair of single vision spectacles.

Step 1 – Focus the instrument using the power dial and eyepiece and ensure the image is central.

Step 2 – Place the spectacles in the focimeter and centre them so the centre of the illuminated image coincides with centre of focimeter target. This can be marked as your optical centre.

Step 3 – Turn the power wheel round until the image becomes clear at least in one direction – This will be your sphere.

Step 4 – If the image was only clear in one direction the lens is astigmatic and so we must now turn the power wheel to focus the other half of the image (90° to the first image). This is the combined power of sphere and cyl.

Step 5 – The cylinder value is equal to the 2nd reading – 1st reading. It may be positive or negative.

Step 6 – With the second power still in focus, line up the black cross line so it runs parallel to the lines of the image. This is the axis direction.

10.2.2 Bifocal Verification

Take the same approach when neutralising bifocal lenses as for single-vision lenses. However, with bifocals, we are concerned with the powers in two areas of the lens, namely the distance portion and the near portion. It may help to imagine that the lens is a distance lens on to which a second plus lens (the segment) has been cemented. This plus lens provides the near addition required.

To verify bifocals the steps are as follows:

Step 1 – Note the segment type and ensure it matches the order.

Step 2 – Measure the height of the segment and again ensure it matches the height ordered.

Step 3 – Focus the focimeter.

Step 4 – Record the distance prescription. Ensure the spectacles are positioned in focimeter so the focimeter cone lies behind the distance portion of the lens and the reading segment will not interfere with the measurement. The distance prescription will be verified as you would for single vision.

Step 5 – Find the near addition. Turn the spectacles around so the front of the segment faces the focimeter cone (Fig 10.13) and slide the spectacles up until the focimeter cone lies behind the segment. Find the power of the reading segment, bearing in mind the power recorded will be a combination of distance prescription and near addition. The near addition is the difference between the two powers recorded.

E.g. You find the prescription in Step 4 to be +2.00 DS (distance prescription). You then find the prescription in step 5 to be +4.50 DS (combined distance and near). The near addition = +4.50 - +2.00= +2.50 DS (near add).

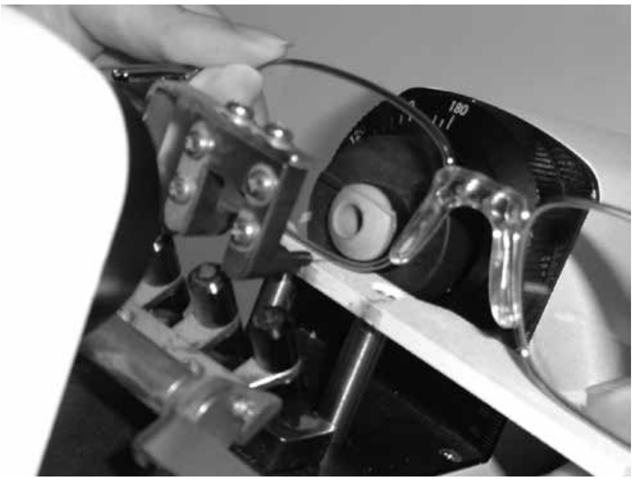

Figure 10.13 Focimetry of bifocals

10.2.3 Progressive Lenses

If you perform the above techniques with a progressive lens you will get a misleading measurement. Therefore when dealing with customers in practice you need to know how to spot whether your customer's current spectacles are glazed with progressive lenses. First, ask the customer what sort of lenses they are. This will not always give you a reliable answer as the customer may simply volunteer that they use their spectacles for reading.

Second, look for engravings in the lens. Progressives have a number of engravings, but the main ones to look for are at the temporal side and at the same height on the nasal side of the lens. The same two signs will be present – usually circles or crosses, which are used to locate the optical centres of the lens. (Note: other symbols will also be present.) As the engravings are often difficult to spot, another tip is to look through the lens at a straight edge and move the lens up and down. You will notice distortion towards the bottom of the lens. With practice, you will soon be able to spot a progressive lens from a single-vision or bifocal before you conduct lens verification.

10.3 Summary

One of the most important jobs in practice is carrying out the final product inspection before releasing the product to the customer. The great service the customer has experienced can be forgotten if the product they receive is not fit for purpose. Part of this process involves the use of a focimeter and so this chapter has introduced this to you. To be able to focimeter confidently can take a lot of practice and so it is suggested that you continue this work with your supervisor.

Unit 9 Procedures in Optical Dispensing

Chapters 11 – 16

Learning outcomes

The learner will:

1. Understand ophthalmic lens properties and their effects on visual performance
2. Understand the dispensing of aspheric and progressive lenses
3. Understand ophthalmic lenses and their uses

Chapter 11

Optical Properties of Ophthalmic Lenses

Introduction

“Dispensing spectacles is somewhat of an art, which requires a myriad of skills to ensure that every patient and spectacle-wearer walks away from your practice with confidence that they have the best possible spectacles for them, not only in terms of the optical performance but also the cosmetic appearance.” Dr Eirian Hughes, BSc (Hons), PhD, FBDO

For assessment purposes you should learn and be able to demonstrate your understanding of some sections in particular:

- know why lens thickness can be altered using different lens materials
- understand the factors that need to be considered when dispensing high-index materials
- understand the relationship between different lens properties
- understand the effect of lens properties on visual performance
- be able to estimate the finished thickness of a lens of different materials
- understand visual distortions caused by lenses and why they occur

11.1 Optical Properties of Ophthalmic Lenses

In a previous module, you were introduced to the idea that lens materials have different properties which affect the patient's physical and visual comfort. In this chapter we introduce the technical terms used to describe the different properties and discuss their effects and the implications for choice of lens. Ophthalmic lens choice is based on four main properties:

1. refractive index
2. specific gravity
3. V-value
4. relative curvature

In this chapter we will look at each of these properties and their application in dispensing practice.

11.1.1 Refractive Index

The refractive index (RI) of a material determines the thickness of a lens. It is given the symbol n and is the ability of a material to bend light rays passing through it. Light bends when it enters a substance which has a different refractive index. This is known as refraction. Light travels more slowly in a substance with a higher RI than in one with a lower RI, so it takes longer to emerge from the other side, resulting in bending or refraction. The higher the RI, the greater the refraction will be. n is the ratio of the velocity (speed) of light in air to the velocity of light in the lens. As it is a ratio, n has no units of measurement.

When the RI of a material is higher, a lens can be thinner. This means that a patient who needs a thick lens made from a standard material can be dispensed a thinner and lighter (and hence more comfortable) lens made from a material with a higher RI.

It is important to know that n varies with the wavelength of light. So, if you are making comparisons between the RI of different materials, you must measure n using the same wavelength of light.

Figure 11.1 shows a ray of light entering two identical lenses – lens 1 is made from standard CR39 plastic while lens 2 is made from 1.6 plastic. Over the same distance (i.e. the thickness of the lens), the material of lens 2 slows the light more – and hence refracts the light more – than the CR39. In practice this means we can make a thinner lens with the same overall power, as the light needs to travel less distance through the higher-index lens to be refracted to the same degree.

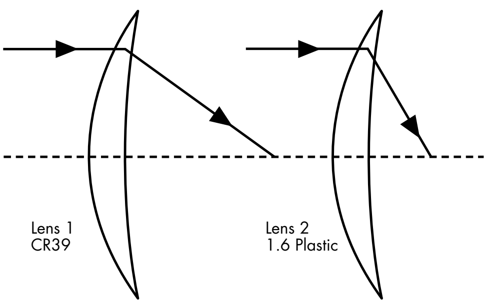

Figure 11.1 Path of a ray of light passing through two lenses of the same thickness made from materials of different refractive index. Lens 1 is made from CR39; lens 2 is made from n = 1.6 plastic

To assist in the choice of lens in dispensing practice, materials are often classified into groups according to their n value (Table 11.1).

Table 11.1 Groups of materials classified by refractive index according to British Standards

Classification	Range
Normal-index	1.498 and above but less than 1.54
Mid-index	1.54 and above but less than 1.64
High-index	1.64 and above but less than 1.74
Very-high-index	1.74 and above

- ***Advantages of high-refractive index materials***

1. They enable high prescriptions to look cosmetically attractive.
2. They can help to reduce the overall mass of the spectacles.
3. In high-plus prescriptions they can reduce magnification, and lessen the 'bug-eyed' effect.

- ***Disadvantages of high-refractive index materials***

(Some of the terms used here are explained later in this chapter)

1. They give rise to more reflections due to the flatter lens curves.
2. They give rise to chromatic aberrations.
3. They can make the mass of the spectacles heavier if dispensed incorrectly.
4. The higher the value of *n*, the softer and more prone to scratching the lens becomes.
5. The higher the *n*, the more difficult it is to tint the lens by dip-dyeing methods.
6. They can discolour with age.

There are many practical implications of these disadvantages. As the finished lens in a high-refractive-index material is softer and hence less durable, it is important to consider whether durability is important to the individual patient. Even with a hard coat, if the patient works in a dusty environment, the lens may soon need replacing.

The amount of light reflected by an uncoated CR39 lens is approximately 8% – only 92% reaches the eye.

In an uncoated 1.9 lens approximately 20% of light is lost, thus only 80% reaches the eye. For this reason most manufacturers will supply lenses with a refractive index of 1.60 or over with an antireflection coat as standard. When dispensing high-index lenses it is often a good idea to combine the hard coat and antireflection coat in one. This means in your explanation to the patient you can highlight the fact that the lens will be thinner, more durable and allow more light to the back of the eye, thus improving image quality.

11.1.2 Specific Gravity

The specific gravity (SG) relates to the density of a spectacle lens. All manufacturers will specify the SG for each lens material they make. SG is measured in grams per cubic centimetre (g/cm3).

As a rule of thumb, the higher the RI of the material, the higher the SG. These figures mean that a 1 cm cube of Thin and Light will weigh 1.24g and a 1 cm cube of Ultra Thin and Light will weigh 1.35g. However, in a finished spectacle lens this does not always mean that using a higher-n material will produce a heavier lens. This is because, as discussed in the previous section, by using a higher *n*, the lens will be thinner and therefore have less volume. It is therefore true to say that a finished lens made from a higher-SG material may well weigh less than that of a lens made from a lower-SG material. This is not always the case in the lower powers because less rigid lens materials cannot be manufactured as thinly as more rigid materials (for example, a low-minus-power glass lens may have a centre thickness of 1.0 mm compared with 2.0 mm for a CR39 lens).

If the V-values (see below) and RI are the same for two materials, it makes sense to choose the material with the lower SG as the finished lens will be less dense and hence lighter. Some manufacturer examples are given in Table 11.3 but consult Specsavers' product guides for further information about the lenses you use in store.

Table 11.2 Specific gravity values for several popular plastic materials

Material	**Refractive index**	**Specific gravity (g/cm^3)**
CR39-Standard Pentax	1.498	1.32
Pentax Extra Thin & Light	1.600	1.34
Pentax Thin & Light Polycarbonate	1.591	1.20
Pentax Super Thin & Light	1.67	1.37
Pentax Ultimate Thin & Light	1.74	1.47

11.1.3 V-Value

The V-value of a lens is a measure of its optical performance and gives the dispenser information about the splitting of white light which passes through the material. When white light enters a substance it may be split into its component colours. This process is called dispersion and it depends on the property of the material, called its V-value. This, in turn, is dependent on the value of n as is discussed below.

Table 11.3 Refractive index and V-values of some commonly used plastic lens materials

Material	**Refractive index**	**V-value**
CR39-Standard Pentax	1.498	58.0
Pentax Thin & Light Polycarbonate	1.591	30.0
Pentax Extra Thin & Light	1.600	41.0
Pentax Super Thin & Light	1.67	36.0
Pentax Ultimate Thin & Light	1.74	32.0

The result of dispersion is called transverse chromatic aberration (TCA) and it may cause problems with visual comfort (see below).

The amount of TCA depends on three things:

1. the power of the lens in dioptres (symbol F)
2. the distance from the optical centre to the visual point (the point on the lens through which the eye is looking) in centimetres (symbol c)
3. the V-value of the lens material (symbol V)

These three factors determine the amount of TCA according to the following equation:

TCA = cF/V

TCA is measured in prism dioptres.

Materials can be classified into groups according to their V-values as follows:

- high dispersion $V < 39$
- medium dispersion $V > 39$ but < 45
- low dispersion $V = 45$ or above

Advice to Patients about TCA

As a rule of thumb, the higher the dispersion or lower the V-value, the more TCA is experienced by the patient. There may be two distinct problems.

When a patient views an object through the periphery of the lens, away from the optical centre, coloured fringes appear around the edge of the object. A common example of this is when a patient looks at a white piece of paper and sees yellow or blue fringes at the edge. This is particularly noticeable for patients who have high-index progressive lenses as they have to look a considerable way away from the optical centre in order to read clearly.

This problem does not often affect clarity of vision, but it is a common source of complaints. It is helpful to forewarn patients and advise them that, although it may be noticeable at first, they will gradually learn to dismiss it.

In low-contrast conditions a further effect on vision may be observed as TCA can cause a reduction in visual acuity. Common complaints are of poor vision at the periphery of the lens. It is important to establish whether this will have any consequences for patients and advise them accordingly.

The minimum amount of TCA that will be noticed by a patient is generally accepted to be 0.1 prism dioptres. The amount of TCA will increase with lens power for a given n, so patients with higher prescriptions are more likely to observe the effects of TCA.

We can also estimate how far from the optical centre the effects of TCA are likely to be observed and advise the patient accordingly. This can be done by rearranging the above formula for TCA as follows:

$c = (V \times \text{TCA})/F$

Example 1

$F = -8.00$ DS

$V = 40$

TCA = 0.1 (i.e. the noticeable minimum)

$c = (V \times \text{TCA})/F$

$c = (40 \times 0.1)/-8.00$

$= (4)/-8.00$

$= 0.5$ cm

i.e. the effect may be noticeable 0.5 cm or 5 mm or more from the optical centre, in all directions.

It may be helpful to advise patients to move their head in the direction they want to look, keeping their eyes looking through the optical centres.

It is generally accepted that you should advise your patient of colour fringing in off-centre gaze if the prescription is greater than 5.00D and the V-value is less than 58.

There are ways to reduce TCA:

1. Dispense materials with a high V-value.
2. Be very accurate with your horizontal and vertical centration, not forgetting the pantoscopic tilt.
3. Ensure correct frame choice.

Exercise 11.1 Frame choice and TCA

Discuss with your supervisor why frame choice may have an effect on TCA. Discuss recent intolerance cases and the reasons why the patient was experiencing TCA.

Attendance of Specsavers' Advanced Dispensing course is recommended.

11.1.4 Relative Curvature

Relative curvature (RC) is a property related to the refractive index (n) of the material. This property is useful in practice to predict the appearance of a finished lens and to determine the n of a material. This is important for example when assessing the edge thickness of a minus lens, e.g. whether it can be fitted to a particular frame, or whether it will be uncomfortably heavy for the patient.

- ***Curvature Compared with Standard Materials***

You will sometimes need to ask how much flatter a lens of a particular material will be compared with Crown glass or CR39 plastic. This question can be answered if you know the RI of the material (n_{mat}), using the following equations:

For comparison with Crown glass:

$RC = (1.523 - 1)/(n_{mat} - 1)$

For comparison with CR39:

$RC = (1.498 - 1)/(n_{mat} - 1)$

The amount of flattening is given as a percentage by $(1 - RC) \times 100$.

Results for common materials are shown in Table 11.4. If you want to use a different standard for comparison, other than Crown glass or CR39, simply substitute the n of the standard lens material for 1.523 or 1.498 in the above equations. Note that if the material you are considering for use has a lower n than your standard for comparison, RC will be greater than 1, and the lens made from the material will be more rather than less curved.

Table 11.4 Relative curvature for common refractive indices compared with Crown Glass

Refractive index	Relative curvature	Thickness reduction (%)
1.6	0.87	13%
1.7	0.75	25%
1.8	0.65	35%
1.9	0.58	42%

Example 2

To find the RC of a 1.74 plastic lens compared with a standard CR39:

RC = (1.498 – 1)/(1.74 – 1) = 0.67

This equates to the finished spectacle lens being (1 – 0.67) × 100 = 33% flatter than a standard CR39 lens.

Exercise 11.2 Relative curvature

Using the correct equation, complete the following table to show the RC values for different *n* values compared with standard plastic CR39.

Refractive index	Relative curvature	Thickness reduction (%)
1.6		
1.67		
1.74		
1.9 Glass		

- ***Estimating Refractive Index***

(You will not be examined on this, but it may prove useful for potential trainee dispensing opticians.)

If you have a lens made from a material for which the n is unknown, you can calculate it from the RC.

Thin-lens theory was introduced to estimate the power of a lens. If we presume the lens is thin, then the sum of the two surface powers (F1 + F2) will give the overall lens power.

Example 3

F1 = +3.00 DS

F2 = –5.00 DS

Hence overall power = +3.00 + (–5.00)

= –2.00 DS

If a patient brings to your practice a pair of spectacles with lenses of an unknown material you can estimate its n using the following procedure:

1. Using a lens clock, record the values of the front and back surfaces of the lens. (Note: These are the patient's lenses, take care not to scratch them!)
2. Using the thin-lens theory given in Example 4 above, calculate the overall power of the lens.
3. Using a calibrated focimeter, record the power of the lens.
4. Using the following equation, calculate the RC:

RC = power determined from the lens measurement divided by power determined with the focimeter.

5. Now that we know the RC, using Table 11.4 we can match the RC to the value of n.

11.2 Dispensing High Prescriptions

Armed with information on ophthalmic lens properties, we can now look at other factors that influence a successful dispense. It is all very well knowing you are going to use the highest index material with the lowest SG and the highest V-value available, but there is no point in selecting an inappropriate frame for the patient's facial features. This section will demonstrate how to maximise the cosmetic appearance and further reduce the weight of the finished spectacles.

Going back to basics, minus lenses are thinner in the centre and thicker at the edges. With this in mind it makes sense always to try to use the smallest suitable frame. This results in the thick edges being cut away in the edging process (Figure 11.2). It does not matter which diameter uncut is ordered, provided it gives the correct decentration (see next section). Most manufacturers will supply lenses up to –10.00 D in either 70 or 75 mmØ; above this power, they may be supplied as 65 mmØ, in order to keep the weight and thickness down, as the frame eye size selected is usually small for prescriptions in this range.

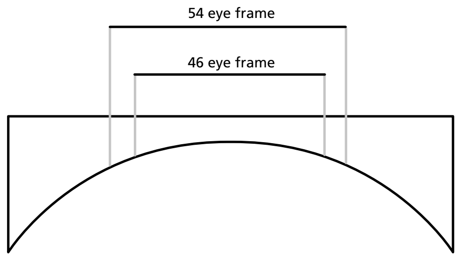

Figure 11.2 Edging removes the thick, heavy edges of a minus lens

The opposite applies to plus lenses – the centre of the lens is thicker and the edges are thinner. If you use a standard-diameter lens to edge into a small frame, the result is to cut into the thick centre, leaving an edge that may be unsuitable (Figure 11.3). In this case it is possible to have the lens surfaced specifically for the frame in order to keep the weight and thickness to a minimum. This process costs more to both the practice and the patient and it is therefore important to know when to ask the laboratory to surface smaller-diameter lenses.

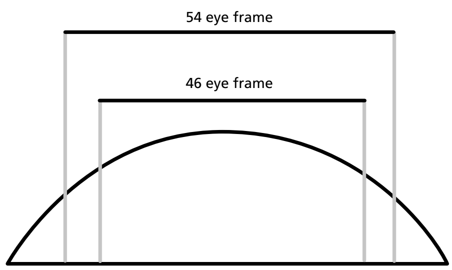

Figure 11.3 A standard-diameter uncut plus lens may be unsuitable for a small frame because edging results in too thick an edge

Most lens manufacturers' stock plus range is plano to +5.00 D combined on a 65 mmØ. (Combined means the sphere and cyl power is added together, e.g. +3.00 DS/+2.00 DC = +5.00 D combined.) As a rule, lenses with an overall power of more than +3.00 D will be fairly thick if a 65 mmØ is used, and edging this into a small, modern frame or a child's frame will result in a thick, heavy lens. Therefore it may be advisable to consider having the lens surfaced. For adult frames, the decision will depend on whether it is a large men's metal or a small ladies' plastic frame, as some men's and larger frames for ladies will require a 65 mmØ. For good results with very high plus lenses, have the lenses surfaced as small as possible and use high-index materials.

11.3 Decentration

Assuming a zero pantoscopic tilt, the optical centres should be positioned directly in front of the pupil in primary gaze. If this is achieved, all of the aberrations and distortions mentioned will be either eliminated or minimised.

In the standard boxed system, the centration point of the lens coincides with the optical centre. However the shape of some frames requires that the optical centres are closer to the outer or the inner edge of the lens. The displacement of the optical centre of the finished lens from the boxed centre is called decentration. In order to achieve this decentration, more is cut away from one side of the uncut lens than from the other. This results in either the nasal or temporal edges being thicker than the other. The more the lens is decentred, the larger the difference in thickness between the two sides of the lens and the larger the overall diameter of the uncut lens has to be in order to produce the required decentration.

With modern frames, if decentration is required then it is normally towards the middle of the frame. If this is the case, then minus prescriptions exhibit more thickness at the temporal edges. This is more obvious when viewed side-on, often making the patient self-conscious. In plus prescriptions the nasal edge is thicker, which concentrates the weight of the spectacles over the weight-bearing nose pads, and often results in discomfort or unsightly red marks.

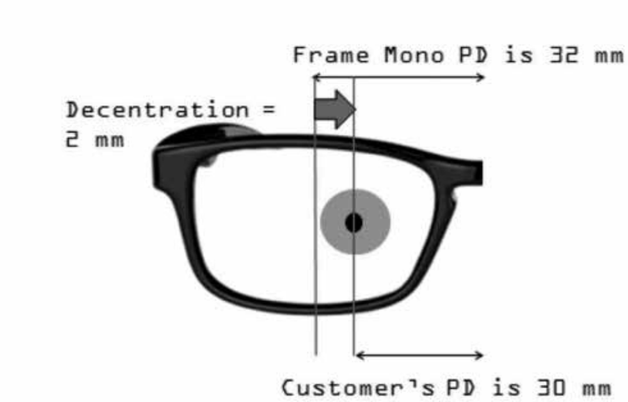

Figure 11.4 Calculating the amount of decentration required is simple. It is the difference between the frame interpupillary distance (PD or distance between boxed centres) and the patient's PD divided by two: e.g. distance between boxed centres = 64 mm patient's PD = 60 mm thus decentration in each eye = (64-60)/2 = 2mm

11.4 Blank Size

Dispensers must have the knowledge, not only to choose a suitable frame for the patient, but to use their expertise to maximise lens appearance in the finished spectacles. As discussed there are many aspects of the lens that must be considered. Perhaps the most important of these is the size of the uncut lens that will be glazed.

A blank size represents the diameter of an uncut lens before it has been fitted to a frame. The larger the blank size, the thicker the lenses will be. This is especially important in plus prescriptions as the thickness will be contained in the centre and therefore more visible once glazed.

It is important to be aware of frame choice as the combination of the customer's PD and frame size will dictate the blank size and therefore have an effect on the final result.

Measuring the blank size during the dispense journey is crucial to ensure the frame is suitable. This allows the creation of a great finished product for the patient and ensures patients are accurately informed as to when their glasses will be ready for collection, dependent on stock ordering processes.

To measure the blank size we follow a few simple steps.

- Look at the numbers inside the frame that will tell you the frame size, e.g. 49-20
- The large number is the lens size and the smaller number is the distance between the lenses – these 2 numbers added together give us the distance between boxed centres , e.g. 49 + 20 = 69 mm

Figure 11.5

- You should then measure your customer's PD using a pupilometer. e.g. 64 mm.
- Then deduct your customer's PD from your distance between boxed centres 69 mm – 64 mm = 5 mm or 2.5 mm in each eye. This is the total amount you would have to physically move the optical centre of the lens to make sure it sits in front of the patient's pupil. This is called decentration.
- Measure the widest part of the eye shape from the inside of the rim, using a frame rule.

Figure 11.6

- Add this measurement to the difference between the customer's PD and the distance between boxed centres. e.g. 65 mm + 5 mm (from above) = 70 mm
- Add on 2 mm for glazing purposes. e.g. 70 mm + 2 mm = 72 mm

This is the minimum diameter of lens required to fit the frame.

By using this method in practice dispensers can ensure they maximise the lens appearance and, if combined with a suitable frame choice and lens treatments such as antireflective coatings, will provide the patient with a cosmetically attractive finished pair of spectacles.

11.5 Aberrations and Distortion

There are various adverse effects on the quality of image.

The most common are:

- oblique astigmatism
- distortion

11.5.1 Oblique Astigmatism

Oblique astigmatism is a blurring of the image when looking through the edge of a spectacle lens (Figure 11.7). The effect arises because unwanted astigmatism is introduced when the light passes through the lens at this angle, as if a spherocylinder lens had been prescribed. It can be seen by using a spherical +3.00 DS lens on a focimeter. When the lens is in the correct position on the focimeter it will read +3.00 DS. By slowly tilting the lens you create an astigmatic image/power.

Thinking back to earlier modules, in optics we consider two parallel rays of light coming from the same point on an object in the distance. These hit the lens at an angle of 90° (perpendicular) to the lens surface and the lens brings them to a point of sharp focus on the retina. When light passes through the lens surfaces at their edges, the surfaces are no longer at 90° to the light, and the result is two points of focus rather than one and a blurred image.

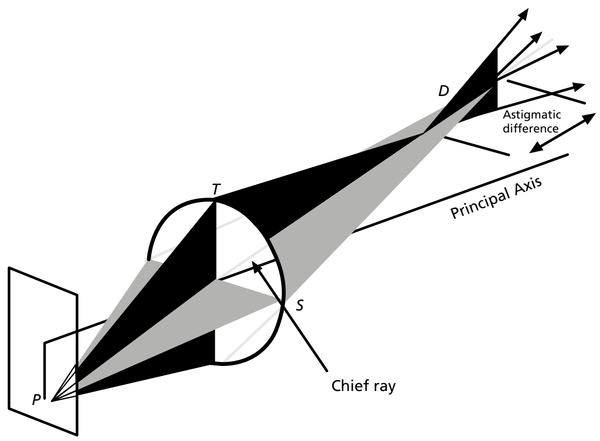

Figure 11.7 Oblique astigmatism

11.5.2 Spherical Aberration

Due to narrowness of the pupil aperture, spherical aberration may be largely ignored for spectacle lenses. However, the aberration may prove troublesome in some optical appliances such as telescopes, where large apertures of the lenses are used.

In spherical lenses, incoming parallel rays of light entering the lens at the periphery are refracted more than those close to the visual axis because the lens has greater curvature towards the periphery. Consequently, the peripheral rays do not form a single focus on the retina and the image is blurred (Figure 11.8).

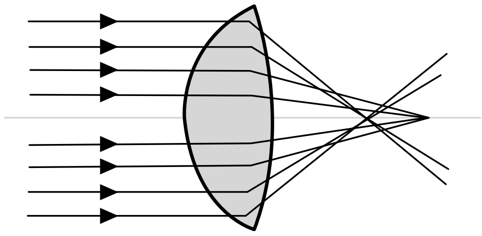

Figure 11.8 Spherical aberration

11.5.3 Distortion

Distortion is the term used to describe an effect on the shape of an image rather than its quality or sharpness. Distortion occurs because of the increase in the spherical surface towards the edges of the lens. As a result, straight objects can appear bowed in two ways, depending on the nature of the prescription.

Plus prescriptions create a classic 'pincushion' distortion (Figure 11.9). Here the centre of the image appears further away from the eye than the four corners.

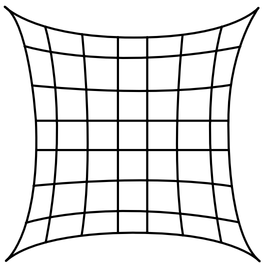

Figure 11.9 Pincushion effect. The object (a regular grid) has a distorted image viewed through a plus lens

Exercise 11.3 Pincushion distortion

Using the Virtual Dispensing Toolbox, enter a high plus prescription into the aspheric module and observe the pincushion distortion as you increase the plus power.

Minus prescriptions create the opposite effect to plus lenses – straight lines appear to bulge outwards, forming what is known as barrel distortion (Figure 11.10). The centre of the image appears to be closer to the patient than its edges.

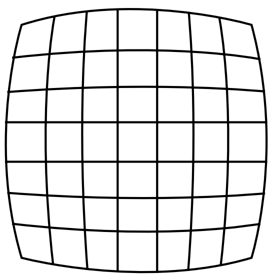

Figure 11.10 Barrel distortion. The object (a regular grid) has a distorted image viewed through a minus lens

Exercise 11.4 Barrel distortion

Using the Virtual Dispensing Toolbox, enter a high minus prescription into the aspheric module and observe the barrel distortion as you increase the minus power. This is harder to see than the pincushion effect.

11.5.4 Advice to the Patient Concerning Aberrations and Distortion

What relevance does the above discussion have to everyday dispensing? For most patients, the answer is 'not a great deal', as the brain can tolerate and adapt to most of these distortions fairly easily after a few days. However, they may be of concern if there has been a large change in the lens design or the prescription. If you think there may be a problem initially, take care to advise patients of the possible problems they may encounter. It will be less of a shock to them if they are forewarned and if they know the problem will go away after a few days. You will avoid risking patient dissatisfaction and complaints.

It is always preferable to use lenses made in so-called 'best form', which the manufacturer will have already calculated. You can then be confident that you are minimising discomfort to the patient.

11.6 Summary

To summarise, in order to produce the most cosmetically pleasing and functional pair of spectacles, the frame should be related to the patient's facial measurements to produce the correct fit, and combined with the least decentration required. With the addition of the correct lens choice based on the optical properties of the lens, the finished spectacles should provide the optimum vision possible in a light-weight, aesthetically appealing pair of spectacles.

Chapter 12

The Availability and Use of Spectacle Lens Types

Introduction

The majority of spectacle dispenses carried out in practice can be grouped under the following headings:

- Single-vision lenses
- Bifocal lenses
- Progressive lenses

This chapter will consider the properties and features of bifocal and progressive lenses. The topic of industrial safety spectacles and lens surface coatings will also be addressed, as will the availability and use of these different types of spectacle lenses and surface coatings.

By the end of this chapter you will:

- Have an understanding of the relationship between reading addition and working distance
- Be able to identify different types of bifocal lens
- Be able to describe the features and benefits of different types of bifocal lens
- Be able to describe the features and benefits of different types of progressive lenses
- Demonstrate an understanding of the features of hard, soft and ultra-soft lens designs
- Be familiar with the effects of ultraviolet and infrared radiation on the eye
- Understand the importance of safety eyewear and protective tints

12.1 Why do People need Multifocal Lenses?

As we get older it is normal to experience difficulty focussing on close objects, this is called presbyopia. As a result they require the addition of plus spherical power to any distance correction already worn. The first signs of presbyopia are usually a tendency to hold reading material further away than normal or, in myopes, the removal of any distance spectacles when reading.

A typical first-time reading addition may be +0.75 D, or +1.00 D, increasing with age. The appropriate addition depends not only on the age of the patient, but also on the purpose of the spectacles. Generally, the higher the addition, the more limited the patient's ability to focus on distant objects will be. The exact distance at which objects will begin to go out of focus or blur can be found by simply reciprocating the reading addition (1 divided by the reading addition, x i.e. 1/x). The result is the furthest distance, in metres, at which the patient will be able to focus when wearing the spectacles.

Example

A patient wearing a +3.00 D addition will only be able to focus on objects positioned 1/3.00 = 0.33 m away or closer. Thus a reading addition severely limits the depth of field over which the patient can see.

Similarly, a patient dispensed a +0.50 D reading add will only be able to focus on objects up to a distance of 1/0.50 = 2.00 m. Anything beyond this appears blurred. In order for this patient to see objects beyond 2 m, she will need to remove her reading spectacles. In addition, if she requires a distance prescription, she must wear distance spectacles.

The near addition is related to (is the reciprocal of) the maximum distance at which clear vision will be possible, which enables us to assess the patient's required distance, by asking the appropriate questions. For example, let's consider a patient who has no remaining accommodation and needs intermediate spectacles for VDU work. If the VDU is positioned 1 m away from the patient's eyes, the intermediate addition required will be 1/1 = +1.00 D.

From this, it is clear that the type of work undertaken by the patient will greatly influence the required addition, and this is why thorough questioning of the patient is so important to establish the purpose of the reading spectacles.

The type of correction depends on a number of factors, such as the prescription itself, the type of work performed by the patient and other specific functional requirements. Single-vision reading spectacles may be prescribed to correct the problem, but, as mentioned in the examples above, patients may need to change between near and distance corrections constantly. This can be highly inconvenient, particularly if the patient's working environment involves several different working distances. Multifocal lenses have the advantage over single vision of offering more than one correction. The inconvenience of changing single-vision spectacles can, in part, be overcome by dispensing bifocals or trifocals, and even more by dispensing progressives.

12.2 Bifocal Lenses

Bifocals contain two portions of different powers. Normally these portions will contain the distance and near corrections, but in fact any combination of distance, intermediate and near may be used depending on the patient's requirements. There are four different types of bifocal: split, cemented, fused and solid. Different types of bifocals have different advantages and disadvantages, and it is these which must be considered when deciding upon the final lens to be dispensed to the patient. No single lens will offer a solution to all of the patient's needs, so once again the end result must be achieved through combining product knowledge with a willingness to compromise.

12.2.1 Split Bifocals

As the name suggests, split bifocals are produced by taking two separate lenses, cutting them in half, and placing the distance portion in the upper part of the frame, and the near portion in the lower part. This was the first type of bifocal and was popularised by Benjamin Franklin, hence the widely known name for this lens type – the 'Franklin split' (Figure 12.1). Its main advantage is that the distance and near optical centres can be positioned independently, allowing any prismatic corrections for distance and near to be incorporated separately. Its main disadvantage is its cosmetic appearance: it has a very pronounced ridge where the two component lenses meet, which can also become dirty with wear.

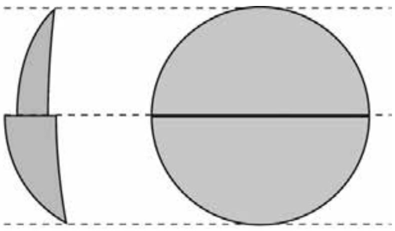

Figure 12.1 Franklin split bifocal lens

12.2.2 Cemented Bifocals

The cemented bifocal (Figure 12.2) was developed after split bifocals. A thin plus lens is cemented on to the distance portion. The advantages and disadvantages of cemented bifocals are similar to those of split bifocals – the two portions can be centred independently and prisms can be incorporated easily, but the cosmetic appearance and durability are poor. Cemented lenses are now very rarely dispensed.

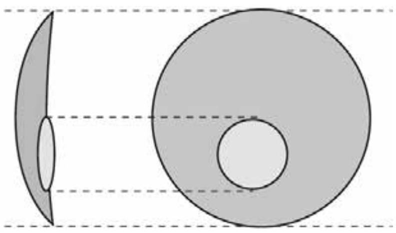

Figure 12.2 Cemented split bifocal lens

12.2.3 Fused Bifocals

Fused bifocals use two pieces of glass of different refractive indices; the index of the near segment is greater than that of the distance portion. The lens is manufactured by grinding out a depression in the lower part of the distance lens and then fusing a 'button' of equal but opposite curvature into the depression. The button is then ground and polished to the same curvature as the distance or main lens. Although the curvature of the near portion is the same as that of the distance portion, its higher refractive index produces the extra plus power required. Modern fused bifocals generally have the segment fused on to the front surface of the lens; any correction for astigmatism is worked on to the back surface of the distance lens.

The main advantage of fused bifocals is cosmetic. The segment is inconspicuous and available in a wide selection of shapes and sizes.

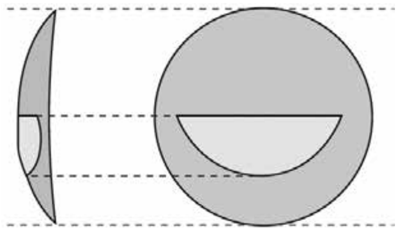

Figure 12.3 Flat-top fused bifocal

Their overriding disadvantage used to be that the relatively low V-value of the near segment tended to produce colour fringing. However, better-quality high-index materials are now available which largely overcome this problem. Nevertheless, some disadvantages remain: the high-index material used for the segment is softer and therefore more prone to scratching, and prismatic correction cannot be worked on to the segment.

12.2.4 Solid Bifocals

Solid bifocals are manufactured from a single piece of glass or plastic and are probably the most common type of bifocal in use today. Originally, the reading portion was cut into the distance portion, but the segment is now produced by a change in curvature of the surface of the distance portion, so the dividing line is smooth.

The advantages of solid bifocals are the larger sizes and shapes of segment available, the absence of any significant colour fringing, and the ability to control the centring of the segment by worked prisms. Segments can be on the front or back surface of the lens. The main disadvantage of solid bifocals is the pronounced ridge on flat-topped plastic segments, which gives them a less acceptable cosmetic appearance. The range of segment shapes and sizes, particularly in plastics, is fairly large, and the flat-top design is shown in Figure 12.3.

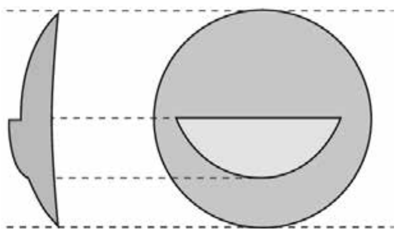

Figure 12.4 Flat-top solid bifocal

Table 12.1 Available segment sizes and shapes

Fused	*Solid*
Crown glass	*Crown glass*
Segment on front surface	**Segment on back surface**
24mm Round	24mm Round
C25/C28/C32	C25
D25/D28/D35	30mm/38mm/45mm Round
Segment on back surface	E-type
C25/C28	**Segment on front surface**
1.6 index main lens	40mm Round
C25/C28	E-type
1.7 index main lens	**1.7 index (segment on back surface)**
D25/C28	**22mm Round**
1.8 index main lens	**Upcurves**
D25	22mm/38mm/50mm
Photochromic	**Photochromic**
Segment on front surface	**Segment on back surface**
C25/C28	30mm/38mm Round
D25/D28	Segment on front surface
Segment on back surface	E-type
C25/C28	CR39
Photochromic shell on high-index glass	**Segment on front surface**
1.7 and 1.8	22/24/25/28/38/45mm Round
D25/D28	D25/D28/D35/D40
C25/C26/C28/C40	E-type

Exercise 12.1 Bifocals

Using the Virtual Dispensing Toolbox, use the Lens Type module and Varifocal Comparison module to discuss with your supervisor the advantages and disadvantages to dispensing a patient with bifocals.

12.3 Progressive Power Lenses (PPL)

Progressive lenses (varifocals) were introduced in the 1960s to tackle the optical limitations of bifocals. As their name suggests, the power varies down these lenses. The distance correction is at the top and the near correction at the bottom of a progressive lens. This benefits the wearer since the lens offers a visual correction for most distances and, unlike bifocals, the transition from the distance to near correction is smooth. Moreover, progressives offer the convenience of being able to wear just one pair of spectacles for all viewing distances.

In fact, progressives can be said to have four distinct zones, each performing different functions:

1. The upper portion, designed to correct any distance prescription
2. The lower portion, designed to correct any near prescription
3. A corridor, with a progressive power providing a continuous change of power from distance to near
4. Temporal and nasal peripheral portions, which occupy the remaining areas of the lens

The precise size and shape of each of these zones differ from one design to another, leading to a vast range of progressive lenses. The range of progressive lenses can be broadly divided into three basic design groups: hard, soft and ultra-soft.

12.3.1 Hard Designs

Hard designs are characterised by:

- wide distance and near zones
- narrow intermediate zone
- high levels of distortion are found at the nasal and temporal edges concentrated into smaller areas

All early PPLs were hard designs and patients regularly experienced problems adapting unless they had already been wearing bifocals. This was because of the limited areas within the lens which were useful for vision. With these early designs the areas of blending were not as smooth as modern lenses, and many patients commented that when they moved their head they were aware of distorted peripheral vision, like looking through old distorted window glass.

Examples of hard designs are the Pentax Alpha and Pentax Tria.

Hard designs are rarely dispensed these days but may be recommended when prolonged close work is undertaken with only occasional intermediate use.

12.3.2 Soft Designs

Soft designs are characterised by:

- wide intermediate and near zones
- lower levels of distortion than hard designs, spread over a larger surface area
- longer progression corridor

Soft designs can be uncomfortable for myopes for whom distance vision is important, as the more even distribution of distortion across the lens means that peripheral distortion is introduced into the distance portion of the lens and this can reduce the useful visual field. This design is not commonly dispensed these days but is most suited to first-time wearers and patients who are sensitive to changes in their prescription. An example of soft design is the Pentax Novus. Soft designs are appropriate for patients who require good vision at an intermediate distance.

12.3.3 Ultra-Soft Designs

Ultra-soft designs are characterised by:

- wide distance zones
- low levels of distortion all over the surface area
- design stabilisation (this will be explained later in this chapter)

This is a more advanced PPL lens design and aims to give the most natural vision at all possible distances. Ultra-soft lenses are made in different computer-generated designs, each of which best suits a particular prescription. The designs are often represented using isocylinder plots, which look like contour lines on a map (see Figure 12.5). They show the approximate size and shape of the different areas of the lens. The closer the contour lines are, the more distortion will be experienced in that area.

As with soft designs, these lenses are most suitable for new PPL wearers. Examples of ultra-soft designs are the Pentax Gamma and Pentax Origo.

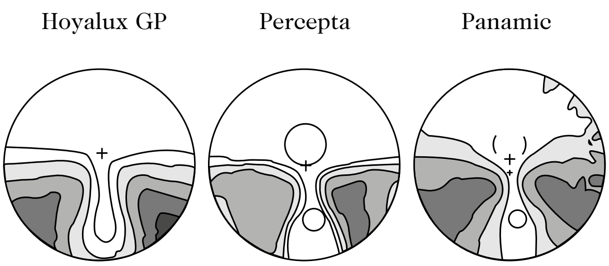

Figure 12.5 Ultra-soft PPL designs

12.3.4 Lenses for the Individual

'Tailor-made' lenses take account of an individual patient's prescription and centration in order to produce a progressive lens design that minimises distortion for the patient.

Tailor-made lenses use the most innovative technology to ensure the patient receives a product individual to them and their needs. They can also be referred to as "Free Form lenses" as this is the name given to the manufacturing process.

12.3.5 The Advantages and Disadvantages of Progressive Lenses

The advantages of progressive lenses are:

- The transition from distance to near is invisible.
- The lens is cosmetically identical to a single-vision lens.
- There is no jump in the image when patients shift their gaze from distance to near.
- A correction is provided for virtually all distances.

Some of their disadvantages are:

- There are areas of surface aberrational astigmatism, which result in blur.
- Adaptation to progressives may be fairly difficult in comparison with other lens designs.
- A greater degree of head movement is required during adaptation in order to locate the various zones.
- The length of the progression corridor demands that the eyes must be lowered further than with traditional bifocal designs when moving one's point of focus from distance to near.
- The amount of surface aberrational astigmatism will increase as the add increases and so even customers who have not changed lens design may need to adapt as their add increases with age.

We will study Progressive lenses in more detail in Chapter 13.

Exercise 12.2 PPLs

Using the Virtual Dispensing Toolbox- Varifocal Categories, compare each type of progressive lens discussed and the visual restrictions of each. Discuss with your supervisor how you would talk to the patient about each design available and select the best design for their needs.

12.4 Industrial Safety Spectacles and Tints

In practice, we are often called upon to provide spectacle lenses that are not intended to correct refractive errors, but rather to protect the eyes against either undesirable radiation or mechanical hazards. The radiation may be, for example, heat, light (such as glare) or ultraviolet (UV) radiation. The mechanical hazards may be wind, dust and other flying particles, or simply the risk of the lens shattering while in use. This section will deal briefly with these hazards and examine the applications we can prescribe to protect against them.

12.4.1 Radiation

Light of different colours has different wavelengths. The electromagnetic spectrum is a form of radiant energy, and if the eye is exposed to electromagnetic radiation, including light, which is too intense or concentrated, the very delicate retina (and in particular the macula) may be damaged. Of course, the cornea, lens, aqueous humour and vitreous humour lie between the retina and the outside world. Damage may also occur to the cellular structure of one or more of these components. Retinal damage is particularly serious since it is irreparable, whereas the lens for instance may be replaced surgically by an artificial lens implant, and vision may be restored.

We shall now look at other regions of the electromagnetic spectrum which can affect our eyes. The main forms of radiation encountered, and hence from which protection is sought, are UV and infrared (IR, heat) radiation.

Ultraviolet radiation

The primary source of UV radiation is the sun. Therefore sailing and skiing (on snow or water) are sports which increase the risk of radiation effects due to reflection of UV from the surface of the water or snow. Other UV sources include welders' flash, fluorescent lighting, and high-intensity mercury vapour lamps (such as those used in sports floodlights and in high crime areas).

UV radiation is particularly dangerous since it does not trigger an immediate reaction. Therefore acute symptoms are usually delayed for 4–12 hours. The chief ocular effects are an itching sensation in the region of the eyes, profuse watering, acute sensitivity to light, swelling of the conjunctiva producing puffiness in the lid area, and an impaired ability to adapt to the dark when light conditions change. Some of the long-term effects of prolonged UV exposure are:

- snow blindness – painful temporary loss of vision
- age-related cataract
- cancer of the skin around the eyes

Infrared radiation

Thermal lesions are produced in the tissues of the eye by their absorption of IR radiation. Unlike UV, IR exposure is accompanied by a sensation of warmth, making it a perceptible hazard. The principal effect of exposure to IR radiation is the clouding of the transparent media of the eye. Prolonged exposure will result in 'heat cataract' in the lens, an effect similar to that of heating the white of an egg. The pigment cells of the iris strongly absorb IR and therefore act as a secondary source of exposure. The main sources of excessive exposure to IR, other than the sun, are industrial furnaces.

12.4.2 Protective Tints: Filters

The effects of UV and IR radiation can be reduced or avoided by the use of appropriate tints or filters. In situations where protection is required for the eyes against undesirable radiant energy it must be provided in the form of a filter. A filter is simply a device which alters the intensity of the radiation which passes through it. Filters may be divided into two types: those which obstruct or modify radiation by absorption, and those which obstruct or modify by reflection.

12.4.3 Industrial Safety Spectacles

All safety spectacles must conform to EN166 and 167. There are three recognised types of lenses meeting this standard:

1. CR39
2. Toughened glass
3. Polycarbonate

The testing procedure for these standards is the drop ball test. For the lens to pass, it must withstand the relevant impact:

- For general purpose category: A 5/8 inch diameter steel ball bearing dropped on to the lens from a height of 39.4 inches.
- For high-impact category: A 7/8 inch diameter steel ball bearing dropped on to the lens from a height of 50 inches.

These materials were discussed in detail in Chapter 5. Please refer to this Chapter and ensure you understand the characteristics of each material.

Specific uses

If the spectacles are required for grinding then CR39 should be chosen, since any sparks will cause pits in glass lenses, whereas it should merely bounce off CR39.

If the spectacles are to be used in a dusty environment then, depending on the use, glass will probably be the best option, since CR39 will scratch very easily.

12.5 Summary

There are many lens types available to customers and often this can make the process of buying glasses very complicated. As a dispenser it is your job to make things simple and know how to select the best lens for each individual customer. This is often based on the use of their spectacles and so things like the distance specific tasks are performed at will be a factor in the selection process. Progressive lenses are the most common lens type for customers requiring vision at multiple distances.

Chapter 13

Dispensing Progressive Lenses

Introduction

Being that progressive lenses are one of the most commonly dispensed lens types, this chapter will expand on the information given in the previous chapter and ensure you have an in depth knowledge of all aspects involved in a progressive lens dispense.

By the end of this chapter you will be able to:

- Assess customer needs to select the most beneficial lens design
- Advise patients on the use of progressive lenses
- Guide patients on appropriate frame choice
- Understand lens markings and designs
- Take accurate varifocal measurements
- Advise patients how to get the most out of their lenses during collection
- Focimeter progressive lenses

13.1 Assessing Customer Needs

Familiarity with lens design is not enough. It is important to assess the patient's needs before making an informed decision on the most suitable lens.

All patients who require help for near visual tasks are potential PPL wearers. The dispensing assistant may be asked by the dispensing optician or optometrist to explain some of the features and benefits of these lenses to patients and you need to be able to use your knowledge to advise patients what may be best for their individual needs. In order to make a recommendation, we need to establish what the patient's needs and expectations are. Remember that PPLs are a compromise lens in that their design has to balance the requirements of different focal lengths, minimise distortion and improve cosmetic appearance. The most common reason for PPL non-tolerance is a failure to explain their limitations. It is far easier for patients to adapt to limitations if they know what they are.

When you consider dispensing PPLs the following series of questions will enable you to take all relevant factors into account.

1. Has the patient worn PPLs before?

If so, which type and was he/she happy with them?

If the patient is happy, they may wish to avoid changing the lens design unless absolutely necessary or they may wish to upgrade to the latest design. Be sure to consider their occupation and lifestyle requirements either way.

If the patient is unhappy, was it because it was an inappropriate lens design?

For example, a patient doing extensive close work may be unhappy with a soft design, while a patient doing extensive work at an intermediate distance may be unhappy with a hard design.

2. What are the patient's occupational and recreational requirements?

Is the patient doing predominantly distance, near or intermediate work, or any combination of these? Choose a PPL that is suitable:

It would be impractical to dispense a hard design to someone who does a lot of computer work.

If the patient works at a wide desk it is important to stress that he/she will need to move the head from side to side to view things clearly.

3. Are there any prescription issues or pathological issues?

The higher the near addition, the smaller the reading area will be, and the higher the cylinder, the more patients are aware of prescription changes at the periphery. The patient needs to be advised about this.

If the field of view is limited towards the periphery, a patient with a condition like age-related macular degeneration or with one functioning eye may find it harder to adapt to a PPL.

4. Are there any physical or mental conditions?

Neck problems limit head posture and therefore may make it difficult to make the movements required for PPL wear.

Vertigo sufferers will find it difficult to adapt to the distortions in peripheral vision that may be observed on head movement.

5. Is the patient undecided or unsure?

Do not try to convince patients to buy something which they are uncertain about. If patients seem uncertain about making a decision, you need to clarify what they believe their needs are and whether they understand how far the lens will meet those needs. Sit them down and explain the benefits again. Ask them if they feel that this is what they would like. Be aware that patients who are particularly happy with an existing bifocal or trifocal (particularly one with a wide reading area) may be less satisfied with PPLs.

Conclude by detailing the overall costs of opting for PPLs compared with the options for other multifocal lenses or separate near/distance pairs, and by giving details of any exchange guarantee offered by the manufacturer or your practice.

The success of PPL dispensing lies in giving a balanced and accurate picture of the advantages and limitations of these lenses, and what they mean to the patient. Make sure your advice is consistent with that of the dispensing optician so you do not undermine the patient's confidence in the practitioner's advice.

Exercise 13.1 Use of PPLs

To ensure the patient fully understands the use of progressive lenses, rehearse using the Varifocal Tutorial Module. It is important you can fully explain what is happening during this module and can encourage the patient to get familiar with the head movements required.

13.2 Frame Choice

Once patients have opted for PPLs, they need careful guidance when choosing frames. Manufacturers of most modern lenses suggest a minimum depth of between 17 mm and 24 mm below the centre of the pupil to accommodate the progression from distance to near. It is always best to check using the appropriate marking-up charts or product information. Recently, as very shallow frames have become common, new PPLs designed to fit in these frames have been launched. The Pentax Independence 15, for example, recommends a minimum depth of only 15 mm. This is achieved by having a shorter progression corridor of around 13 mm. This does however have a bearing on the intermediate area, so be careful when dispensing these lenses – especially for computer users. There should also be at least 10 mm from the pupil centre to the top of the frame to allow for an appropriate amount of distance. This means when helping a customer select a frame you must make sure the frame measures at least 25 mm from top rim to bottom rim.

General points on selecting frames for PPLs are:

- The frame should not rest on the patient's cheekbones.
- The frame should fit as close to the face as is comfortable, to maximise the field of view.
- The bridge should fit well and nose pads should be adjusted correctly.
- The pantoscopic tilt should be 10°.
- The length of side should be adjusted correctly.
- Check that the frame looks level.
- Ask patients if they are happy with the frame.

Check all of the above before you take any measurements. Otherwise you may alter the position of the lens by mistake.

13.3 Identifying and Marking up Progressive Lenses

If a patient comes in with a problem or if you need to identify a new patient's PPLs, it is important to be able to locate the micro engravings on the lens and to identify the particular lens type. All manufacturers produce marking-up charts for each lens they make. Ask your supervisor to show you an example.

When you hold the lens up against a light background, the engravings will appear and they can be highlighted with a permanent marker. The lens can then be overlaid on the chart and all other relevant markings can be applied. It may be very difficult to locate these engravings on scratched lenses.

- The two small circles at the nasal and temporal side indicate the horizontal axis of the lens.
- The marking under the nasal circle indicates the manufacturer's brand.
- The marking under the temporal circle gives the reading addition. This may be in a short version, i.e. 20 equals +2.00 D, 15 equals +1.50 D add.

The fitting-cross should sit directly in front of the pupil. Above the fitting-cross is a semicircle. This is where the focimeter reading should be taken. Below the fitting-cross is a small dot, known as the prism reference point, where any prescribed prism should be checked. All modern manufacturers use prism thinning to keep the bottom section of the lens thin. This means prism is removed to reduce thickness at the bottom of the lens where there is increased plus power. Therefore, unless the lens is specifically ordered without prism thinning, if you place the focimeter on the prism reference point it will show the amount of prism thinning used. This amount is normally two-thirds of the reading addition. From this any unwanted prism can be spotted. This also means that it is important to specify the amount of prism thinning required when ordering a replacement PPL.

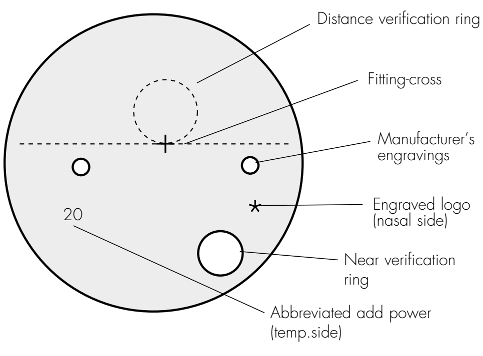

Figure 13.1 Engravings on progressive lenses

13.4 Taking Accurate Measurements

Having selected the lens design and appropriate frame, you must take the measurements to minimise any distortion from the periphery and ensure that the distance prescription is in front of the patient's pupil when looking straight ahead in a natural posture. Accuracy is vital.

13.5 Collection

Use this time to show patients how their lenses work and address any concerns which have arisen since the dispense.

- Check the fit of the frame and that the fitting-crosses have been centred correctly.
- Ask the patient to look straight ahead and slowly tilt the patient's head backwards – he or she should see distant objects go out of focus.
- Ask the patient to look at the floor. It should be blurred, but when you ask the patient to lower their chin towards their chest, it should become clear.
- Do the same with the patient viewing a reading chart and the opposite should happen.
- Demonstrate the soft focus at the edges of the lens by getting the patient to look out of the sides of the lens at an object.

You have now demonstrated to the patient very simply how to get the best from these lenses. Finish by saying: 'So just remember, whatever you want to look at, point your nose at it and move your head up and down'. More information on reassuring the patient is given in the next module.

Chapter 14

Lifestyle Dispensing

Introduction

The role of Optical Assistant is to assist customers in selecting the right product to meet their needs. Without creating a profile of their lifestyle, it can be impossible to know exactly what their needs are. It is easy to ask routine questions like "What is your occupation?" but does that actually provide the level of detail required to assess their eyewear needs?

A good lifestyle dispense will involve information relating to the specific tasks the customer would like their eyewear to assist with. Gathering this level of information will allow the dispenser to make informed product recommendations individual to that customer and their lifestyle. This chapter will help you to do just that.

By the end of this chapter you will:

- Know how to dispense to meet the visual requirements of a customer's lifestyle.
- Know the lens types with particular occupational applications
- Know about the manufacture and uses of common tints and coatings
- Understand the key questions for dispensing safety eyewear.

14.1 What is Lifestyle Dispensing?

Vision plays a vital role in everyday life and most routine activities place emphasis on certain aspects of visual performance. Our patients have many different occupations and recreational activities. These influence their needs and we need to consider this when making dispensing recommendations. It is important to establish these needs early in the dispensing process. Lifestyle dispensing is a vast topic which covers many visual requirements and there may be a variety of ways of meeting the same need. Bear this in mind as we discuss different lens types and surface treatments that can be combined or applied individually to provide optimum individual correction.

It is worth noting that it is not always appropriate to apply all the possible treatments to one lens. Often patients prefer several pairs of spectacles – using them for different activities – as they would do with shoes. For example you wouldn't play tennis in shoes designed for evening wear.

Lifestyle dispensing can be divided into two categories – occupational and recreational dispensing – and in each category there are visual and safety requirements.

It is useful to use a lifestyle questionnaire to construct a profile of the customer. This should include details of their occupation and hobbies and any tasks they perform on a regular basis.

Exercise 14.1 Customer profiling

Discuss with your supervisor and manager ways of profiling your customers and gaining the relevant information to perform a lifestyle dispense.

14.2 Useful Lens Designs

14.2.1 Occupational Progressive Power Lenses (PPLs)

These lenses offer intermediate vision (IV) in the top half of the lens, progressing down, as in a normal PPL, to near vision (NV) for close work. They are aimed at people who require IV and NV for prolonged periods and do not need to see into the distance beyond a few metres. There are obvious applications for people who work at a computer terminal, and other activities may also be relevant, e.g. playing an orchestral instrument, when you need to see the music, instrument and conductor. One advantage of these lenses over standard PPLs is that since only the IV and NV portions need to be blended together – and not distance – the result is wider, larger, more useful fields of vision, which in turn makes adaptation easier. Less head movement is required, so these lenses are ideal for office/desk-based occupations.

Examples: Hoya Tact, Sola Access and Pentax Enhance HD.

14.2.2 Occupational Bifocals and Trifocals

There are many different designs and combinations, so only a few will be illustrated (Figure 14.1).

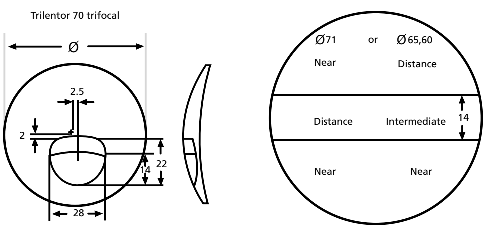

Figure 14.1 Useful designs of occupational bifocal and trifocal lenses

Any prescription can be incorporated for a given working distance into the sections of bifocals: for example, the intermediate prescription can be set in the top half and NV in the bottom half. This would be useful in the case, for example, of a mechanic who may work at intermediate distances in a garage pit all day, looking up at the underneath of cars, and may only occasionally look at the tools he is selecting close-up.

A trifocal with a double D-segment with IV in the upper segment and NV in the lower segment may be very useful in some professions. For example, a librarian who needs to look up at intermediate distances to locate books from high shelves, to read at a desk (NV) and walk around (DV). Depending on the field of vision necessary there are various designs, combining different sizes and shapes of segment.

14.2.3 Tinted Lenses

There are a number of different coloured tints available; some are for cosmetic purposes, and others are used to enhance vision. They all absorb radiation of some kind – not just visible light. At this point it is worth recalling the different forms of radiation which may affect the eye and vision. The electromagnetic spectrum is discussed elsewhere. The ultraviolet (UV) and infrared (IR) parts of the spectrum may be subdivided further. Some important divisions and their wavelengths are as follows:

UVA 320–400 nm

UVB 290–320 nm

UVC 200–290 nm

IRA 760–1400 nm

IRB 1400–3000 nm

IRC 3000 nm–1 mm

By eliminating certain wavelengths of radiation, tints may enhance vision or protect the eye from damage.

Cosmetic tints range from traditional brown and grey colours to bright fashion tints. They absorb light to provide more comfort in bright sunlight. Other tints – such as contrast filters – can be used to enhance the contrast of objects. They are often yellow or red and filter out specific wavelengths of light. This makes objects stand out more clearly against the background. They are often used for target shooting and have also been used in offices to minimise problems arising from the flickering of artificial lights.

Filters that absorb yellow light are thought to have a beneficial effect in certain colour defects and in conditions such as dyslexia as they make it easier to differentiate between blue and red light.

Tints are also available to reduce IR radiation, to which certain occupational groups are exposed, e.g. welders. IR can damage the eye and it is important to wear adequate protection. CR39 is not usually used as the heat associated with IR radiation degrades the material, therefore glass alternatives are used, often in the form of green plano goggles. UV inhibitors are important in protecting the eye from the harmful effects of short wavelength radiation, which is known to have an effect on the cornea, lens and retina after prolonged exposure. It is important to advise patients on the reason for using UV inhibitors.

When a cosmetic tint is applied to a lens it absorbs some of the incoming light. When this happens, the pupils may dilate to maximise the amount of light entering the eye and at the same time this maximises exposure to UV. UV inhibitors in the lens prevent harmful rays reaching the eye and producing ocular damage. All sunglasses that are made to national and European standards must by law absorb virtually all UVA and UVB. UVC is rarely a problem as it is absorbed by the earth's atmosphere.

Different plastic and glass materials will absorb different wavelengths of UV, so it is important to establish the specific use to which the spectacles will be put. Manufacturers' literature states the UV cut-off for each particular material. It is ideal to use materials which absorb wavelengths up to 400 nm. The main types of tinting process are described below.

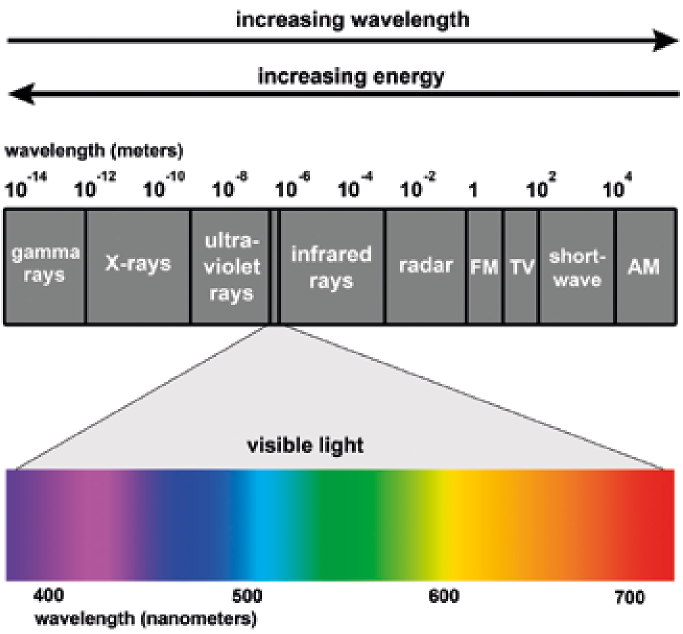

Figure 14.2 Electromagnetic Spectrum and light

Solid tinting (absorbing)

Coloured chemicals called oxides are mixed with molten glass to give the required depth of colour. There needs to be a certain thickness of glass to give the colour required. Ray-Ban's G15 is an example of a solid tint.

Although offering good all-round protection against both UV and IR radiation, solid tints have the disadvantage of uneven colour distribution on higher prescriptions. As the lens power increases, so does its thickness and hence the amount of tinted material. For example, a –6.00 D lens will be almost clear in the middle and very dark towards its edges.

Vacuum coating (reflecting)

These filters rely upon lights being reflected from a thin film of material deposited on the front surface of the lens. The tinting process is very similar to that used in the production of antireflection coatings.

Equi-tinting (absorbing)

This process involves cementing a thin layer (usually 1 mm) of solid tinted material on to the front surface of a clear base lens, which provides the required prescription. Although the finished lens is invariably slightly thicker than the equivalent clear lens, the equi-tinting process offers the distinct advantages of a solid tint with a uniform colour on all lenses, regardless of prescription. The process can also incorporate a photochromic tint within the bonded layer.

Dip-dyeing (absorbing)

Plastic lenses are immersed in hot dye, up to 2 mm of penetration into the lens is achieved in standard CR39 lenses. The longer the lens is left in the dye, the darker it will become. Consistency of tint is a major advantage. However, the higher the refractive index of the lens, the lower will be its ability to absorb the tint. For this reason, high-index lenses will rarely offer a tint any darker than 50% transmission , if tinted in store. Supply chain labs can now tint high index to 20% transmission but this is a fairly recent development.

Photochromic plastic (absorbing)

A thin layer of light-sensitive material is processed on to the front surface of a CR39 or high-index lens. The lenses are generally available in either brown or grey, and are fast-reacting, changing from their neutral colour to approximately 30% transmission within 30 seconds under normal temperature conditions. Like all photochromics, the speed of reaction is better at lower temperatures. These lenses react to UV light and offer 100% UVB protection and 99.5% UVA protection.

Photochromic glass (absorbing)

Silver halide crystals are mixed with molten glass, giving the finished lens its photochromic qualities. The lenses darken when exposed to UV light, more quickly at low temperatures. This process offers identical advantages and disadvantages to the solid tinting process, since they are fundamentally the same.

Polarising filters (absorbing)

Polarising materials are made in sheet form and contain crystals that are aligned in such a way that they absorb the light reflected from horizontal surfaces (such as road surfaces, or water) so they eliminate troublesome reflections. Polarised filters offer particular benefits to people whose leisure or work includes:

- Fishing – polarising filters enable them to see below the surface of the water
- Driving – by reducing the perception of reflections from road surfaces.

14.2.4 Polarising Lenses

These lenses are designed to reduce glare from reflecting surfaces such as snow, water and concrete, so they are very useful for skiers and people who participate in water sports or fishing. Remember also that skiers and fishermen may need safety spectacles to protect them from mechanical trauma, i.e. falls or snow particles or, in the case of fishermen, stray hooks when casting.

The lenses allow light through from one direction only – like light passing between the slats of a louvred blind – so they reduce glare. The lenses come in a range of colours, from brown to pink, and are also UV-absorbent.

14.2.5 Photochromatic Lenses

These are UV-sensitive lenses which react to UV radiation by changing from clear to a dark colour, commonly brown, green or grey. They absorb both UVA and UVB, so they are useful for people who flit from indoors to outdoors. Because they react to UV exposure, they don't darken very much when driving in bright sunlight, because car windscreens absorb UV radiation.

These lenses are available in both glass and plastic. Glass has a residual tint in the clear state which patients can come to rely on and may miss when their lenses are changed. Glass lenses react more slowly than plastic and do not darken as much. Modern plastic photochromatic lenses are almost clear when not exposed to UV and become very dark in direct sunlight. Both glass and plastic lenses are also temperature-dependent and work better in cooler temperatures. Caution may be required if they are to be used in countries with a warm climate.

Exercise 14.2 Lens options

Using the Virtual Dispensing Toolbox discuss with your supervisor ways of explaining the benefits of both polarising and photochromatic lenses to customers. Also discuss specific lifestyle requirements that may benefit from the use of such lenses.

14.2.6 Safety Eyewear

Some activities carry the risk of mechanical trauma to the eye. In occupations which pose a danger to the eye, it is the legal responsibility of the employer to supply industrial safety spectacles and to take measures to ensure they are worn in the workplace. Some leisure activities, such as DIY and gardening, and certain sports, such as shooting and squash, are a common source of eye injuries. As a dispensing assistant, you should aim to ensure that patients' needs are met regarding eye safety outside work and to advise those who do not have the benefit of employer health and safety advice, e.g. self-employed people. It is important to ask the correct questions so that you can provide maximum protection. There are a number of off-the-shelf protectors available, but some people prefer to ask the advice of their optician.

The following considerations are relevant when dispensing or recommending safety eyewear:

- From what are they to protect the eye – solids, liquids, gases or a combination?
- What impact resistance is necessary – high, medium or low?
- If particles are involved, what size are they – fine, small or large?
- Will the eyewear be subjected to different temperatures?
- Which housing will be suitable – metal frames, frames with side shields, sealed goggles or face masks?
- Is a prescription necessary?

14.3 Surface Treatments

14.3.1 Scratch Resistance

Glass lenses are known for their good abrasion resistance but, due to their increased weight and fragility, most lenses dispensed today are made from plastic. As plastic is a relatively soft material in comparison with glass, it scratches more easily. If there are many scratches they can affect the visual performance of the lens by scattering incoming light.

Plastic lenses can be treated with a hardened lacquer to prevent minor surface scratches. As a general rule, the higher the refractive index, the softer the material will be. It is therefore beneficial to provide a hard coat on all lenses. Remember however that a polycarbonate lens loses 25% of its impact resistance when a hard or antireflection coating is applied.

14.3.2 Antireflection

These coatings eliminate unwanted surface reflections. They help allow the maximum amount of light possible to reach the retina and give maximum contrast. This is particularly useful for people who work in low light conditions. There is also a cosmetic benefit for people who work in the TV/film industry or for people for whom eye contact is important for their occupation, e.g. someone who works in recruitment.

Probably the main benefit of antireflection coatings is for driving at night or when using a computer. When driving, especially at night, car headlamps from behind reflect off the back surface of the lens on to the cornea, creating ghost images which are distracting. Optically, antireflection coatings are a benefit to everyone who wears spectacles. However care needs to be taken as they seem to be more difficult to keep clean as there are no reflections to hide the marks. You may consider not recommending them to people who work in dirty environments.

14.4 Summary

Now that you know how to tailor your dispense to the customer's lifestyle, you can apply this knowledge every time you make a recommendation or select a lens type. This is especially important when dispensing for occupational application and protective eyewear.

Chapter 15

Dispensing Process

Introduction

The secret to effective dispensing is the ability to combine good questioning and listening skills with a comprehensive knowledge of the products available. Once a patient's needs and expectations have been determined, you are then able to apply your general knowledge to meeting those needs. The dispensing process does not end with the ordering of spectacles. As important, if not more so, is the collection of the completed spectacles. The patients' ultimate impression of the service performed by your practice is their satisfaction with their newly collected spectacles. To ensure that they continue to benefit from the advantages provided by their new spectacles, certain frame adjustments may be required.

By the end of this chapter you will:

- Understand the importance of the handover procedure
- Be able to describe the process of assessing patients' needs and expectations
- Be able to offer appropriate advice on frame and lens choice
- Be able to complete the transaction process confidently
- Understand the importance of the collection procedure
- Demonstrate good frame-fitting skills
- Understand frame adjustment techniques

15.1 The Dispensing Process

Dispensing is a five-step procedure:

1. The handover
2. Assessing the patient's needs and expectations
3. Choice of product and taking accurate measurements
4. Recommendation and sale
5. Collection

Good communication skills are essential throughout the five steps. Here we will give an overview of the dispensing process, briefly indicating specific communication issues. By developing a standard approach to each of these stages you will ensure that every patient receives a consistent and highly professional level of service.

15.1.1 The Handover

If you have not been involved in the pre-test routine, this is probably the first time you will meet the person whom you will be dispensing. The patient should ideally be present at the handover. The optometrist should inform you of any change in prescription and any potential problems. Finally, there should be a brief summary of the patient's requirements. A typical handover may be as follows:

'Mr Smith has had a slight change in prescription and now requires spectacles for both distance and near. I have suggested to Mr Smith that he should consider some form of multifocal lens and I have told him that you will discuss his requirements fully and talk through what is available to suit his needs.' In a busy practice, you may often have to access this type of information yourself, either before or after the examination, and this is why the assessment step is of such importance.

15.1.2 Assessing the Patient's Needs

You must always assume the patient has no knowledge of frames and lenses. You must be aware of how the prescription will affect the patient and, if relevant, what anomalies he or she can expect from the new spectacles. If these are not fully explained during the dispense, then you can guarantee subsequent problems on collection! A typical example would be the first-time progressive lens wearer who comes to collect the new spectacles without having been informed of the limitations of progressive lenses.

The crucial thing in assessing patients' needs is to use good questioning and listening skills to provide them with the product they want rather than the product which we want them to have! Follow the general principles for assessing patients in Chapter 1.

Firstly, examine the sight test record, not just the prescription. The record will always contain crucial information ranging from the patient's visual acuity to any occupational considerations, such as the working distance and conditions. Discuss with your supervisor the record cards used in your practice and remind yourself of the terms and abbreviations used to denote certain medical conditions or specific patient requirements.

Secondly, read any previous dispensing history recorded, as this may give an indication of the frames and lenses previously supplied. If the patient is currently wearing spectacles, examine them thoroughly. The knowledge you gain from this may prove invaluable in reaching a decision as to which frame/lens to select. Note the form and type of lens previously worn, the position of the optical centres, the material used and any specific coatings. Failure to check such details may prove costly further down the line.

If certain anomalies are identified in the current spectacles, which could cause problems, then it may be useful to ask patients about any problems they have had. Not only will this reinforce their confidence in your optical knowledge, but it may also address any problems identified during the examination and handover.

For example, if the optical centres of the lenses lie a significant distance away from the pupils, then the patient may have experienced double vision or diplopia. If no such problems have arisen, then you need to seek advice on whether to place the optical centres of the new spectacle lenses in a similar position.

15.1.3 Product Selection

Having established the main optical requirements of the patient and having made a mental note of a number of possible solutions to their needs, you should be ready to discuss the products most suitable for them. A comprehensive product knowledge is important at this stage as patients may ask you about the correct frame and lens for their particular needs.

The UK market offers a vast number of lenses from which to choose, and the task of recalling all products can be overwhelming. Perhaps the simplest way of building product knowledge is to acquaint yourself with the different refractive indices available for both plastic and glass lenses. This information has been covered in previous chapters.

Different manufacturers specialise in certain materials – predominantly plastic lenses. If you study to be a dispensing optician you will need a broader range of lens product knowledge. For this programme you need a thorough understanding of the Specsavers' core product range. The best way of learning about different frames and lenses is through experience. Ask your supervisor and colleagues at your practice for advice. When choosing a frame, the two most important aspects to remember are fit and suitability to the patient's prescription. An ill-fitting frame will inevitably cause problems later on, so always double-check the fit and carry out any adjustments on the frame before taking any measurements. This is of particular importance when dispensing high prescriptions, aspherics, bifocals and progressives, for which correct centration of the optical centres both horizontally and vertically is imperative.

Once you have discussed lenses and chosen a suitable frame, then you can move on to tie everything together in the final step, the sale.

15.1.4 Recommendation and Sale

Your recommendation should be that which best meets the patient's requirements. It is good practice to offer the patient some options, and these may differ in terms of cost. You should only recommend the more expensive option if you can explain its benefits to the patient.

If the patient queries the cost, do not become defensive or take it personally, but repeat and explain the benefits. Once the patient is satisfied with the choice, you should reiterate exactly what you are dispensing. Offer a realistic delivery date and, if relevant, add any comments about what to expect on collection. The service offered during the dispense should be carried through to the collection, so take personal responsibility for the job and follow the order through.

In principle, this is the procedure which should be adopted when undertaking any dispense. The skills involved are predominantly good listening and questioning techniques, a thorough product knowledge and confidence in your own abilities. Above all, remember that the only way to improve your self-confidence and knowledge is to ask, so never be afraid to approach any member of staff for help. Furthermore, always be willing to offer advice and assistance to less experienced staff members.

Exercise 15.1 The dispensing process

Write notes on the recommendations given to three different patients and why the recommendation was made,, split each account into four separate sections, the headings for which should be:

- The Handover
- Assessing the Patient's Needs
- Product Selection and
- The Recommendation and Sale.

Ideally, choose patients with different optical requirements; for instance one dispense should be single-vision, one should be a bifocal, and the other a progressive.

15.2 The Importance of the Collection

One could be forgiven for assuming that the collection is the most straightforward part of the dispense, but it is a complex and particularly important process. Quite possibly, this will be the last contact the practice will have with the patient for another 2 years. We therefore have a final opportunity to make a good and lasting impression.

The collection is also, from the patient's perspective, the most anticipated part of the visit to the practice. Therefore, it is essential to spend an appropriate length of time with every patient, ensuring that they leave the practice completely satisfied with the fit, appearance and performance of their new spectacles. The technical fitting of the spectacles is of paramount importance both during the collection and whenever a patient presents for a routine frame adjustment. This is discussed in more detail in section 15.4. The next section deals with interaction with the patient at the collection.

15.2.1 Record Information

Always refer to the patient record before fitting spectacles, since it may contain information crucial to the collection. You must be aware of the prescription in the spectacles before putting them on the patient. There is nothing worse than asking a patient to see distance objects through a pair of reading spectacles! The sort of information which you should note from the record is:Has the patient worn spectacles before?

- Has the patient worn bifocals/progressives before?
- What standard of vision can the patient expect to obtain from the spectacles?
- Has there been a change in prescription?
- What are the spectacles for?
  - Near vision
  - Distance vision
  - Intermediate vision
- Are multifocals required?

15.2.2 Potential Problems

From the information on the record you can identify potential problems, and forewarn the patient. If you can forewarn a patient what to expect from the spectacles before putting them on, you will save yourself, and the optometrist, considerable time and effort later, explaining that such problems are normal.

For example:

- If patients are myopic and have not worn spectacles before, they should expect objects to appear sharper and clearer but slightly smaller with the new spectacles. Objects may also appear further away.
- If patients are hypermetropic and have not worn spectacles before, they should expect objects to appear sharper and larger with their new spectacles. Objects may also appear closer.
- If there has been a significant change in prescription, the patient may need time to adjust to the new spectacles.
- If there has been a change in the power or axis of the cylinder, the patient may feel slight nausea, and straight lines may appear to run at an angle. Another common problem with cyl. changes is that round objects appear to take on an oval shape. These phenomena will subside with time.
- If there has been a change in the type of lens material, the patient may experience phenomena such as colour fringing or blurring, depending on the type of material.

15.3 The Personal Touch

Competition is strong in the optical market. The main area where customer loyalty can be won and maintained is quality of service. The collection provides an excellent opportunity to offer a high level of service, thereby ensuring that the patient will choose to return to your practice in the future. If at all possible, try to fit spectacles that you have dispensed. You may have developed a relationship with the patient so that he or she feels at ease and confident in your abilities. Try to use the patient's name frequently, to make the collection more personal.

You should also take control of the collection. Rather than allowing patients to pick up and try on the spectacles, offer them a seat and stand in front of them as you place the spectacles on their face. Using this procedure, if the frame is in need of some adjustment, this should be immediately obvious to you. This enables you to remove the frame before the patient is aware of any problem, and becomes concerned that the spectacles may not be correct.

Patients assume that the adjustment is complete only when they are handed the frame by the fitter, and invited to put it on. So if this is your first move, patients tend to assume that the spectacles are ready, and that any subsequent adjustments are an attempt to rectify an error, which may lessen their confidence in the fit.

15.4 Fitting Spectacles

Fitting the spectacles will often take place during the product selection as it is important to select products which will fit the customers and their measurements.

15.4.1 Setting Up

When the spectacles are received from the laboratory, they should have already been set up by the technician. This simply means that they should be level when placed on a flat surface, all joints/angles should be symmetrical and any specifications made due to particular facial measurements have been included.

It is essential that you take responsibility for ensuring that the frame has been set up before fitting, since this should make the fitting considerably easier. Before you place the frame on to the patient's face, check the sides are parallel, the front straight and, if the frame has pads, these should be even (Figure 15.1).

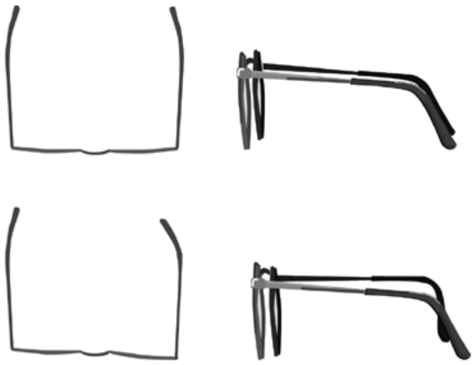

Figure 15.1 Spectacles set up. Top, correct. Bottom, incorrect

15.4.2 The Fitting Triangle

When you have checked that the spectacles have been set up correctly, place them on to the patient's face. Then stand back to gain a general impression of how the spectacles fit. By carrying out adjustments, we are trying to establish a fitting triangle (Figure 15.2), and thereby ensure that the only points of contact are on the nose and behind the ears.

The apex of the fitting triangle is the pressure point on the crest of the nose, and the base of the triangle is a line joining the two pressure points just above the ear points, one on each side of the head. Where the frame has nose pads, there will be two resting points forming the apex of the triangle. 60% of the weight of the frame is carried on the bridge.

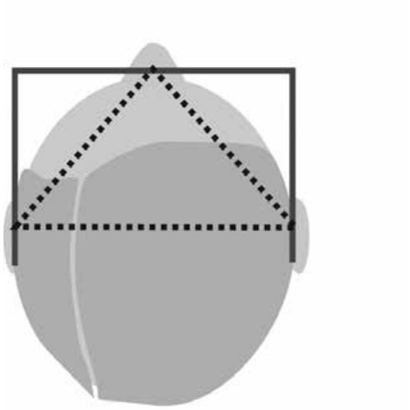

Figure 15.2 The fitting triangle: This comprises three points where the spectacles touch the face and head

15.4.3 Angle of Let-Back

The first consideration in any fitting is the angle of let-back of the sides (Figure 15.3). This angle should be such that the sides exert no pressure on any area of head other than just above the ears, which is usually at the widest part of the head.

If the sides have not been let back far enough there will be too much pressure on both sides of the head which will cause the patient some discomfort and also cause the sides to bow out (Figure 15.3, left). This will force the frame forward and as a result the spectacles will tend to slip down. As they do, the drop-end of the sides will pull against the backs of the patient's ears. If, however, the angle of let-back is too great, the sides will not exert enough pressure behind the ears and the spectacles will tend to slip forward (Figure 15.3, right).

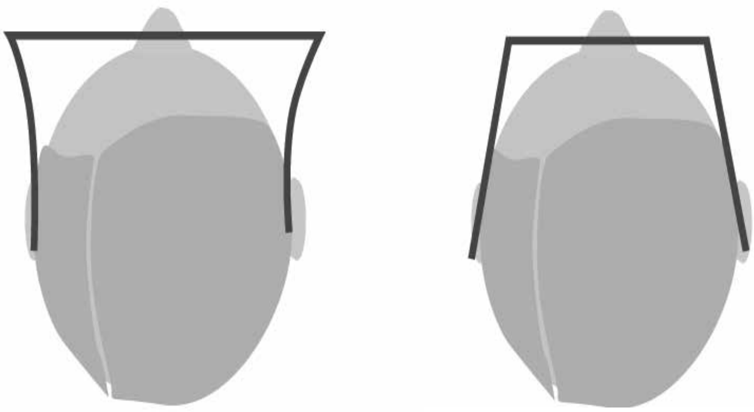

Figure 15.3 Angle of let-back. Left, too small. Right, too great

15.4.4 Equality of Lens Vertex Distance

The lens vertex distance is the distance between the back plane of the spectacle lens and the front surface of the patient's cornea. It is essential that the vertex distance of both lenses is equal. This can easily be checked by asking the patient to tilt their head forward, enabling you to view their spectacles from above (Figure 15.4). If the spectacles have been properly aligned and the wearer's head is symmetrical, then the vertex distances will be equal. If, however, the sides have been let back by unequal amounts or if one side of the patient's head is slightly wider than the other, then the vertex distances will be unequal (Figure 15.4).

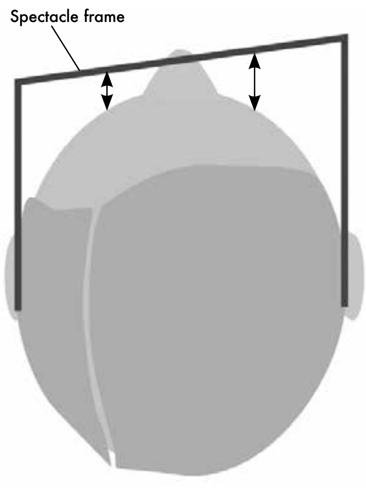

Figure 15.4 Spectacles fit viewed from above, showing unequal lens vertex distances (arrows)

The adjustment required will depend on the position of the frame. If the right lens is further away from the face than the left, there will be more pressure over the right ear than the left, forcing the right side out. This can be remedied in two ways, depending on the source of the problem:

- If the right side has not been let back far enough, making the fit too tight, the solution is to let this side back further.
- If the right side is correctly fitting but the angle of let-back of the left side is too great there is no pressure on the left side. In the absence of counterbalancing pressure on the left, the right side pushes forward the front of the frame. The solution in this case is to bring the left side inward, thereby reducing the angle of let-back.

When the angles of let-back are correct and the vertex distances are equal, you can begin to consider the two main components of the frame – the front and the sides.

15.4.5 Frame Front

The main adjustments to be carried out on the front of the frame will involve the:

- Pantoscopic angle or tilt
- Frame straightness
- Bridge

It is impossible to discuss every type of adjustment within this course. However, this section should help you understand some of the fitting problems most commonly encountered. The best way of building up confidence when carrying out any adjustment is to practise on old frames. The consequences of breakage are not as great as with patient's new spectacles!

Pantoscopic angle or tilt

This is the angle which the front of the frame makes with the normal to the side (angle A in Figure 15.5). It is generally 10–15°, but this may vary depending on the patient's face and the type of frame and lenses dispensed.

We alter the tilt of a frame primarily to ensure that the lenses are completely clear of the cheeks, eyebrows and eyelashes. However, you must be aware that an incorrect or inappropriate tilt may produce unwanted optical effects, particularly if high-power lenses, progressives, aspherics and lenses with low V-value are being dispensed.

When making adjustments to the tilt, you should be positioned so that you are viewing the spectacles from the side. This will enable you to check firstly whether the lenses are sitting clear of the cheeks. If they are touching, as in Figure 15.5, then the angle or tilt must be reduced. This is done by angling the sides upwards.

If the lenses are seen to be touching the eyebrows or lashes, as in Figure 15.5, then the tilt must be increased by angling the sides downwards.

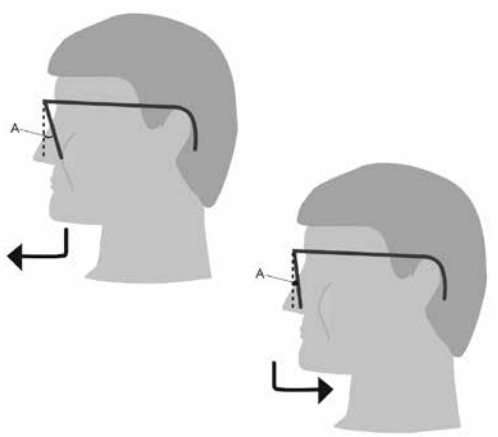

Figure 15.5 The pantoscopic angle or tilt (A). Left, tilt needs to be increased to take frame away from cheeks. Right, tilt needs to be reduced to fit frame closer to the cheeks

Ask your supervisor to demonstrate the use of pliers to adjust the tilt.

Straightness of the frame

The adjustments described above can be used to ensure that the front of the frame sits straight on the patient's face. Having lopsided spectacles is one of the most common reasons that patients seek frame adjustments, so it is important to be able to solve the problem quickly and effectively.

There are two main reasons why a frame may not sit straight on the face. The first is that the sides may not be angled equally. If the right side of the front is sitting higher than the left side then, in order to make the angles equal, either the right side should be angled up or the left side should be angled down (Figure 15.6). Similarly, if the frame front sits too high on the left, the left side should be angled up or the right side down.

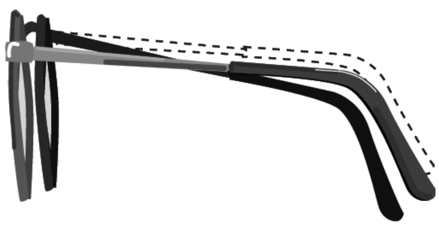

Figure 15.6 Right side of frame front sits too high, so the right frame side needs to be angled up

The second reason why a frame may not sit straight on the face is that one of the patient's ears may be slightly higher than the other. If the frame is correctly set up and the sides are completely parallel, when placed on the patient's head it will look crooked. By viewing the frame from the front, you must note which side appears to be higher and which lower, and make the appropriate angling adjustment. Note the solution is the same whether the asymmetry is in the frame or the patient's face. If the problem is due to an asymmetrical face, angle changes to the sides that straighten the frame will mean that the spectacles will wobble when placed on a flat surface. You should point this out to the patient and (tactfully) explain that no one has a symmetrical face..

Bridge

The type of frame will determine how much adjustment can be made to the bridge. With plastic frames, very few adjustments can be made except to the frontal bow. Therefore, care should be taken during the dispense itself to ensure that the bridge fitting is perfect. If the fitting is not correct, if possible a more appropriate size should be ordered. If the frame has adjustable pads then numerous adjustments can be made in order to obtain a satisfactory fit. For example, we may wish to increase the distance between the pads to:

- Lower the frame
- Lower the optical centres, segment or fitting cross
- Widen a bridge if it is too tight and exerting pressure on either side of the nose
- Bring the frame in closer to the face, thereby reducing the vertex distance

Alternatively, we may wish to reduce the distance between the pads to:

- Raise the frame
- Raise the optical centres, segments or fitting cross
- Narrow a bridge if it is too wide and slipping down the nose
- Take the frame further away from the face, thereby increasing the vertex distance

Any adjustments carried out on the pad arms should be performed using the appropriate pliers, since adjusting by hand is potentially hazardous. The frame should be firmly grasped in one hand while the pliers are used to rotate the arm in the relevant direction. Ask your supervisor to demonstrate the technique. This method should be adopted not only when widening or narrowing the distance between pads, but also for any adjustments involving pad arms. For instance, when fitting any pads on- arms frame, aim to angle the pads, using pliers, such that every point on the surface of the pad lies in contact with the surface of the nose.

Another example is adjustment of the pad arms to increase the vertex distance of the frame, without adjusting its height. In this case, reducing the distance between the pads would increase the vertex distance by pushing the frame forward, but would also increase the height of the frame. Instead pliers should be used to grasp the pad arm and then should be rotated so that the pad moves further away from the back plane of the frame. Increasing the distance from the pads to the lenses in this way will, of course, increase the vertex distance.

Every time such an adjustment is carried out, take care to re-angle the pads before handing the spectacles to the patient.

15.4.6 Frame Sides

Once all of the adjustments have been carried out on the front of the frame – the angle of let-back, the tilt, height, vertex distance and pad positions – final adjustments can be made to the sides.

Your aim is to introduce the bend just past the top of the ear. The drop-end of the side then runs parallel to the slope of the cartilage of the ear, barely touching the cartilage itself.

The side should never press into the crease between the ear and head: the drop-end should match the shape of the side of the head behind the ear. Thus the drop-end should exert even pressure throughout its length.

Side length

If the length-to-bend is too great or too small then adjustments can be made. Plastic sides can be adjusted by applying heat to the appropriate point and re-bending. Metal sides are adjusted in a similar fashion, but if the side needs to be shortened by a considerable amount, you must ensure that the drop-end does not show behind the ear because it is too long. Remove the acetate tip, cut off the correct amount with cutting pliers, file off any rough edges and replace the tip.

Exercise 15.2 Fitting of frame side

Ask your supervisor or dispensing optician to demonstrate examples of correct and incorrect frame side fitting on one of your colleagues.

Often when spectacles arrive from the manufacturer, the length-to-bend is too great and the spectacles tend to slip down the nose until stopped by the ear. The result of this is that the bend appears to be in the correct position, when in fact the length-to-bend is too great.

To assess the position of the bend:

- Position the spectacles so that they sit properly on the patient's face
- Gently hold the spectacles on the patient's face in the correct position, with your left hand. With your right hand, bend the ear forward to inspect the fit. If the length-to- bend is too great, the bend will occur beyond the desired point (just past the top of the ear)

It is not acceptable to take the short cut of increasing the angle of the bend so that the drop-end just touches the back of the ear. This will give only two points of contact – the top and back of the ear – which will cause the patient pain behind the ear after continued wearing.

If the length to bend is too short, the bend will occur forward of the ear point, which usually raises the sides up; the bend becomes visible along the side of the head and the end of the side pushing against the back of the ear.

Once the position of the bend has been noted, the new position should be estimated. Heat both the area around the original bend position and that around the intended new bend position. Hold the long section of the side firmly in one hand and grasp the drop-end with the other. Gently straighten the side completely and then re-bend the side in the new position by shaping it around the finger or thumb. The drop-end should slope so that its widest part is flat against the side of the head, and it should be shaped so that it follows the depression behind the ear. There should be equal pressure around the entire area.

Curl sides

Used when a standard hockey-end side will not offer enough grip behind the ears, curl sides are normally fitted to children's spectacles or specialist sports wear. The shape of the curl will depend on the shape of the hollow behind the ear, the aim being to shape the curl so that it runs parallel to the line of the ear without exerting any pressure. Towards the end of the side, full contact should be made between the side and the root of the ear since this will hold the spectacles in the required position. The final few millimetres of the side may be turned away from the ear to prevent the end tip from digging in.

Exercise 15.3 The collection

Choose three patients who call into your practice to collect their new spectacles. Ideally these should consist of one single vision wearer, one bifocal wearer and one progressive wearer. Write an account of each collection, including details of the information taken from the record card before commencing the collection, any discussion with the patient about the spectacles and the stages involved in adjusting the frame. Also include any unforeseen problems and how they were overcome.

Chapter 16

Problem Solving

Introduction

It is relatively common for patients to return to the practice for minor adjustments once they have worn their new spectacles for a brief period. Likewise, on occasion, patients return because they are experiencing difficulties (major or minor) with their new spectacles. Although the diversity of such problems may at times appear to be infinite, a set of rules can be applied to identify and solve any problem you are likely to encounter. This chapter offers some suggestions on how you should approach the process of problem solving in ophthalmic dispensing.

By the end of this chapter you will:

- understand the principles of problem solving
- be familiar with some examples of problems and their solutions
- be able to describe a process designed to solve problems

16.1 Problem Solving

The underlying reasons for the failure of a pair of spectacles to match up to the patient's, and perhaps our own, expectations are many and varied. However, experience enables us to adopt a questioning technique that identifies the root of the problem fairly quickly. Experience also shows that certain complaints are invariably due to certain ophthalmic factors. For example, if a patient reveals that he or she thinks he/she has double vision, then one of the first considerations when checking the spectacles will be the position of the optical centres. If these are correct then we can dismiss this possibility and begin to check other variables.

It is important to adopt a standardised approach to problem solving that enables us to check the spectacles to determine the underlying cause. One way of doing this is to compile a flow chart like that shown in Figure 16.1. If we follow this process for every patient, we can check every aspect of the spectacles in the most logical way to identify the factor responsible. Examples of possible patient problems are set out below, and you should note how the chart is used.

16.1.1 Examples

Problem 1

A patient presents 3 days after collecting his first ever pair of spectacles, complaining that although his vision seems to be slightly clearer, everything he views appears to be considerably larger and closer than usual. This is causing him particular difficulties when driving.

Rx RE +2.00DS LE +1.50DS

Problem 1: solution

Consult the flow chart (Figure 16.1):

1. Has the patient worn spectacles before? Answer - No
2. Were these problems expected due to first-time wear? Answer - Yes

In this case, because we are introducing a positive prescription to the patient for the first time, it is likely that he will immediately be aware that objects appear larger and closer. You should reiterate that this change is due to the magnification created by the spectacle lenses, and that it usually takes some time for the brain to adjust to the new images it is receiving. Emphasise that this is perfectly normal and the symptoms should dissipate within a short space of time.

Problem 2

A patient presents about 2 weeks after collecting her first ever spectacles. Although her vision through the spectacles is undoubtedly clearer, when she looks through the edges of the lens her vision seems somewhat distorted and she is aware of reflections on the back surface of the lens.

Rx RE: –1.50 DS/–0.50 DC x 180

LE: –1.25 DS/–0.50 DC x 170

Lens order details: CR39 lenses + Ultraclear coating

Frame order details: Metal round eye

Problem 2: solution

Consult the flow chart (Figure 16.1):

Has the patient worn spectacles before? Answer – No

Were these problems expected due to first-time wear? Answer – No

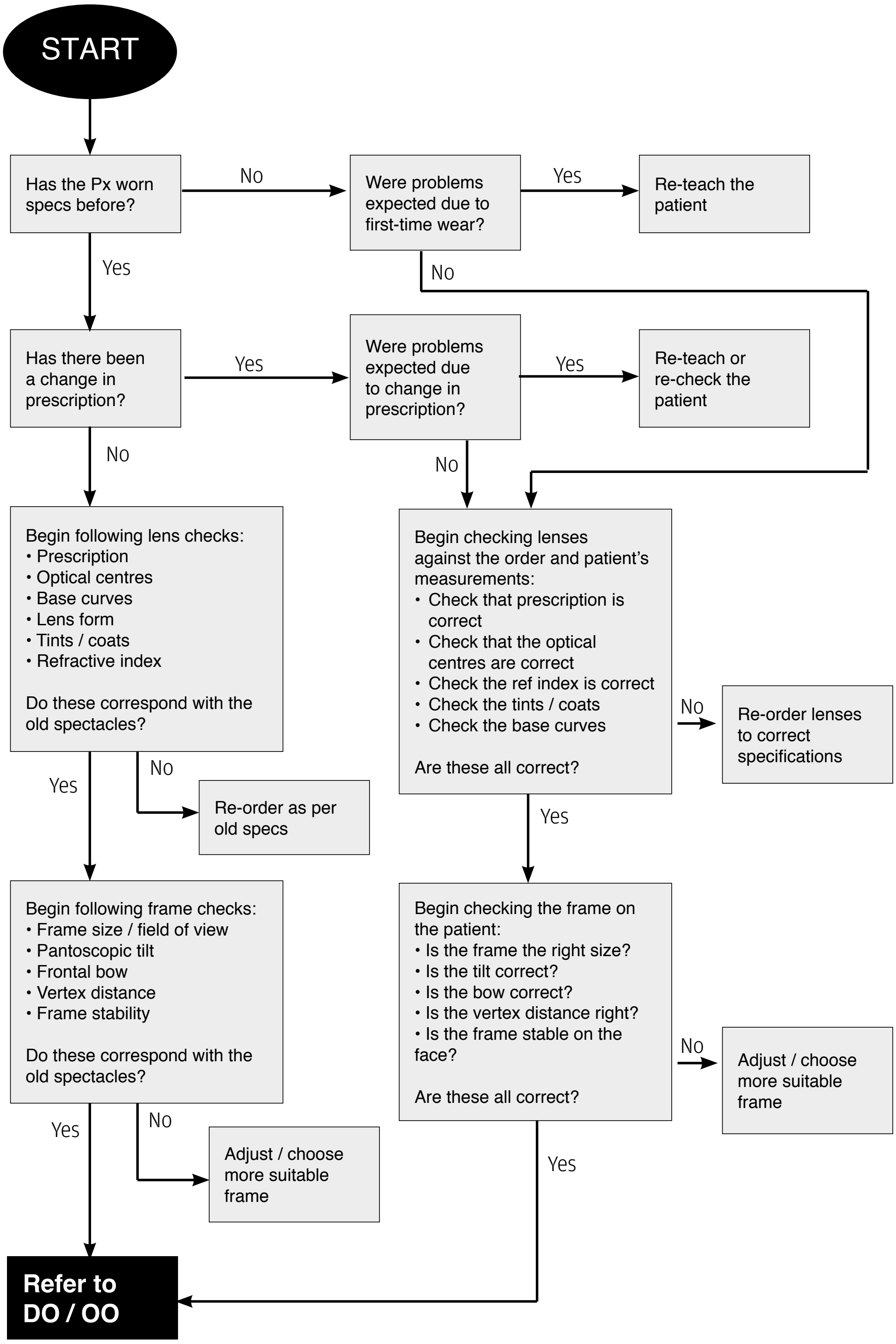

Figure 16.1 Flow diagram designed for use when confronted with patient problems.

3. Begin checking the lenses against the order and the patient's measurements:

- Is the prescription correct? Yes
- Are the optical centres correct (i.e. in front of the pupils)? Yes
- Are the refractive index, V-value and specific gravity correct? Yes
- Are the tints and coatings correct? Yes, the lenses have an Ultraclear coating
- Are all of these correct? Yes
- Begin checking the frame on the patient:
- Is the frame the right size? Yes, the fitting triangle is fine and the patient appears to have an adequate field of vision
- Is the tilt correct? Yes, at approximately 10°
- Is the bow correct? No, the front of the frame seems to be very flat and towards its edges seems to be running away from the patient's face
- Is the vertex distance correct? Yes
- Is the frame stable on the face? Yes
- Are all of these correct? No

In this case, the bow of the frame front seems to be incorrect, which explains why the peripheral vision seems distorted and also why there appear to be reflections towards the lens edges. The solution is to increase the bow of the frame so that it closely follows the curve of the face. This should have the dual effect of reducing the distortion and bringing the frame closer to the face, thereby reducing troublesome reflections.

Problem 3

The patient, who has worn spectacles all his life, presents 1 week after collecting his spectacles. There has been no change in prescription, yet he complains that, although the spectacles look and feel better than his previous pair, the vision is not as sharp towards the edge of the lens. Also, when driving at night, he is very aware that the headlights of oncoming traffic appear to have coloured fringes around them.

Rx RE –6.00DS LE –6.75DS

Lenses previously worn: Crown glass, Ultraclear coating

Lenses currently wearing: Nikon Lite IV

Problem 3: solution

Consult the flow chart (Figure 16.1):

1. Has the patient worn spectacles before? Answer – Yes
2. Has there been a change in prescription? Answer – No

3. Begin the following lens checks:

- Check the prescription.
- Check the optical centres.
- Check the base curves.
- Check the lens form.
- Check the tints and coats.
- Check the refractive index.
- Do these correspond with the old spectacles? No

Although the prescription and optical centre positions are exactly the same, the base curves and lens forms are different: the lens is much flatter due to its asphericity. The MLAR coating appears to be very similar to the old pair but, as we already know, the refractive index of the new lenses is higher than that of the old. These differences are likely to explain why the patient is having problems. Because the lens is aspheric, it is unlikely that he will have fully adapted to its design and, as a result, he interprets the differences as being due to a fault in the lens. Similarly, as a consequence of the increased refractive index of the lens, the V-value has fallen considerably, giving rise to the problem of colour fringeing.

These factors should be pointed out to the patient and it should be stressed that, given time, he should adapt to the new type of lens. One alternative here would be to reorder a new pair of lenses, the design and properties of which match the old pair more closely. One must point out the disadvantages of doing so – the increase in thickness and possibly weight – so that the patient can make an informed decision.

16.2 A Structured Approach to Problem Solving

Problem solving needs a logical, controlled approach. More often than not, if patients are experiencing problems with their vision they become very concerned and upset. Take a moment to put yourself in the patient's position and think what you would like to be done if it were you and how you would like to be treated. It is a common mistake to solve the problem but fail to explain to the patient what the problem was. It is vital that patients understand what has gone wrong and why they will not encounter the same problem in the future.

The following is a guide to logical problem solving:

Questioning

- Sit the patient down and away from other patients.
- Listen to the problem. Don't interrupt the patient.
- Establish if the problem is with distance, intermediate or near vision.
- Find out whether it affects the right eye, left eye or both.
- Ask how long the problem has been present.

I• s it long-standing or of sudden onset?

- Has the patient had this problem before?
- If so, what was the cause?
- Establish if there is a point on the lens where the vision is acceptable.

Checking

- Check the spectacles against clinical records in case there was an error when the prescription was copied on to the order form.
- Confirm that the correct lens design has been ordered.
- Check the correct centration has been glazed. Check the optical centres and heights.
- Compare the patient's previous spectacles, including the prescription, optical centres, heights, lens form, vertex distance and fitting of the frame.

Measurements

- Retake all measurements.
- Ensure the vertex distance has been compensated for.

If the problem is of sudden onset, e.g. double vision, it may be serious and steps should be taken for the patient to see the optometrist urgently. Make sure, however, that there are no obvious reasons such as incorrect optical centres.

Remember always to document on the patient's record card any complaint or advice given, whether in the practice or over the telephone. This not only covers you on certain legal aspects but will aid future dispensers when the patient next requires spectacles.

16.3 Common Problems

16.3.1 Problems Related to Single-Vision, Bifocals or Progressive Power Lenses (PPLs)

- **Problem**: diplopia (double vision)
  Cause: often due to incorrect optical centres, inducing prismatic effects
  Solution: check optical centres; alter if necessary
- **Problem**: distance vision blurred
  Cause: normally due to a large change in the prescription which the patient cannot tolerate or different base curves to existing spectacles
  Solution: check for differences in lens form compared with previous lenses. Check the difference between the two prescriptions and the specified vertex distance. Advise the patient to try for 1 week
- **Problem**: sloping/curved objects
  Cause: this is a classic complaint associated with cylinders often being too high for the patient to tolerate or due to a swing in the cylinder axis
  Solution: reassure the patient this is normal and will correct itself in time. If there is no improvement after 1 week, book a recheck
- **Problem**: blurred near vision
  Cause: normally due to the patient preferring a longer or shorter working distance than was specified in the consulting room
  Solution: this can easily be confirmed by asking the patient whilst wearing the spectacles to move the print backwards and forwards until it comes into focus. At this point measure the working distance and compare it to the distance at which it was tested

- **Problem**: reflections during the day and night
  Cause: frame sitting further away from the face than the previous pair, therefore allowing more light in from the side. May be due to flatter lens form. Patient may have had an antireflection coat on the previous pair
  Solution: identify cause and rectify accordingly

16.3.2 Problems Specific to Bifocals

- **Problem**: patient notices the visible line
  Cause: often associated with D-segment bifocals, due to wide horizontal line beneath the line of vision which causes reflections. May also be due to the line itself
  Solution: lower the segment height. Change segment shape to a round design. Try an antireflection coating

16.3.3 Problems Specific to PPLs

- **Problem**: patient is aware of vision distortion at edges with head movement
  Cause: new patient who hasn't adapted. Existing patient with a new lens design. Incorrect horizontal or vertical centration
  Solution: identify cause, re-educate patient on PPL use and success. Alter lens design. Retake measurements

16.3.4 Problems Related to Both Bifocals and PPLs

- **Problem**: the patient has to tilt the head down to see clearly in the distance
  Cause: the segment position or fitting-cross is too high
  Solution: lower segment/fitting-cross

- **Problem**: the patient has to tilt the head upwards to read comfortably
  Cause: the segment/fitting-cross position is too low
  Solution: raise segment/fitting-cross position

- **Problem**: the patient cannot see clearly to walk down the stairs
  Cause: the patient is not tilting the head down to view stairs through the distance portion
  Solution: re-educate the patient on the correct use of lens type

- **Problem**: the patient cannot read the width of the paper: the centre part is clear but the edges are blurred
  Cause: limited field of vision due to the nature of the lens design
  Solution: advise patient about the reasons, re-educate on lateral head movement

Note: It is very important to realise that there may be a pathological reason behind some problems. If in any doubt, consult the optometrist before the patient leaves the practice.

16.4 Summary

Now that you understand the principals of problem solving and are familiar with the solutions to some of the most common concerns, you should now be able to follow the process in store. Problem solving skills develop over time and it is important that you take the time to reflect on any problems you solve or are later solved by a colleague. This will ensure you learn from each and every one you see and can apply the knowledge the next time.