# Working with variable corridor progressive lenses



Philip Gilbert FBDO

Variable length corridors in progressive lenses can benefit patients by improving their intermediate and near visual performance. This article looks at the difference between fixed corridor lengths and compares them to the variable corridor products available today. It explores the terminology used when fitting progressive lenses in relation to minimum fitting height and recommended minimum fitting height. It also looks at the equipment available to ensure that variable corridors are used effectively when dispensing these lenses to patients.

## Course code: C-33557 | Deadline: November 1, 2013

General Optical Council – Approved CET For Optometrists

### Learning objectives

Understand how to use dispensing tools to educate patients on the benefits of variable corridor progressive lenses (Group 1.2.1)

Understand the principles of fixed and variable progression corridors, their measurement and fitting (Group 4.1.3)

Understand the need for variable corridors to provide better visual performance for the patient (Group 4.1.6)

COMMUNICATION

OPTICAL APPLICANCES

General Optical Council – Approved CET For Dispensing Opticians

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### About the author

**Philip Gilbert** is a qualified dispensing optician with over 40 years of experience. He currently works as an ophthalmic lens consultant for Carl Zeiss Vision UK. He is a committee member of BSI TC/172 ophthalmic lenses and the chairman of the Standards Panel of the Federation of Manufacturing Opticians (FODO). He has produced many articles for the benefit of educating ophthalmic professionals and is the editor of ABDO's, *Ophthalmic Lenses Availability*, which lists and describes every spectacle lens available in the UK.

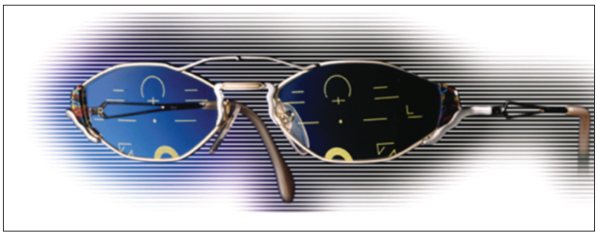

**Figure 1** Restriction in reading area when dispensing lenses at minimum fitting height

Historically, progressive lenses have been offered by lens manufacturers with fixed, standard or short-corridor lengths, often restricting the patient's frame choice or available reading area. More recently, there has been an increase in lens manufacturers offering progressive lenses with variable corridor lengths, enabling practitioners to stipulate the position of the reading area within the frame, independent of the required progressive fitting heights. This article considers the restrictions of using short and long corridor lengths, and explores the advantages that variable corridors can offer modern practitioners.

## Advances in progressive lens design and technology

In the early days the corridor length, and subsequently the minimum fitting height of progressive lenses, were fixed by manufacturers and only offered in one length. Traditionally, this minimum fitting height was 18mm, affecting frame choice, with practitioners steering patients towards styles suitable for progressive lenses, rather than cosmetic preference. Improvements in progressive design technology and surfacing techniques heralded the arrival of lenses with shorter corridors. However, high levels of peripheral distortion restricted the success of these early designs. It wasn't until the turn of the millennium that the technology existed to produce more successful, short-corridor progressive lenses, revolutionising the choice of frames for patients. By this time, the majority of lens manufacturers offered the same progressive lens design in two corridor lengths, generally with minimum fitting heights of 18 mm and 14mm.

## Common dispensing difficulties with variable corridors

Although variable corridor lengths have been available for several years, useage has generally been confined to premium, individualised, free-form products. Variable corridor lengths for mid-priced lens types have only emerged into the market more recently. Consequently, practitioners with little exposure to fitting variable corridor products have experienced some difficulties when using them for the first time. Some of these difficulties are listed below:

- Choosing a corridor that is too long for the frame, thus creating a very small area for reading
- Choosing a corridor that is too short, creating a restricted and narrow intermediate area
- Choosing a short-corridor for a very deep frame, creating distortion at the bottom of the lens
- Allowing the lens manufacturer to choose a corridor length that may be unsuitable for the patient
- Insufficient tools or information to allow measurement of the correct corridor.

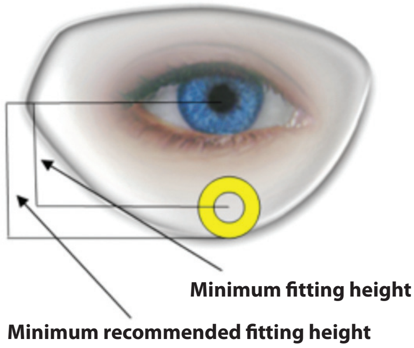


**Figure 2** Minimum fitting height relative to minimum recommended fitting height

## Minimum fitting height

Before exploring the benefits and useage of variable corridor lengths, it is necessary to discuss the limitations of conventional fixed-corridor lengths and the difficulties they can create for the patient and practitioner. With conventional progressive lenses, the manufacturer stipulates a minimum fitting height – the measurement from the fitting cross to the centre of the reading area. If a pair of progressive lenses are measured and fitted at the manufacturer's minimum fitting height (see Figure 1), the patient could be deprived of up to 50% of the actual available reading area. This creates problems for patients with excessive near-vision demands, particularly for those with higher additions. Further challenges for the practitioner arise when obtaining minimum fitting heights for frames that slope away in an upward direction towards the nasal area. Practitioners need to consider that the fitting height is taken from pupil centre to the lower rim; they also need to account for the inset of progressive lenses. The upward slope towards the nasal area of many frames can dramatically reduce the physical reading area due to the inset being contained within this zone. The use of variable corridors to address this potential problem will be discussed later.

## Minimum recommended fitting height

Some lens manufacturers have previously adopted the 'minimum recommended fitting height' system. Here, a value was given that ensured the full reading area would be contained within the frame at this height.

| Minimum fitting height | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|
| 85% corridor length | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Intermediate height | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 |
| Intermediate width | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 |
| Minimum near width | 11 | 11.25 | 11.5 | 11.75 | 12 | 12.25 | 12.5 |

**Table 1** The numerical relationship between parameters for variable-corridor lenses (mm). Reproduced with permission from Carl Zeiss Vision

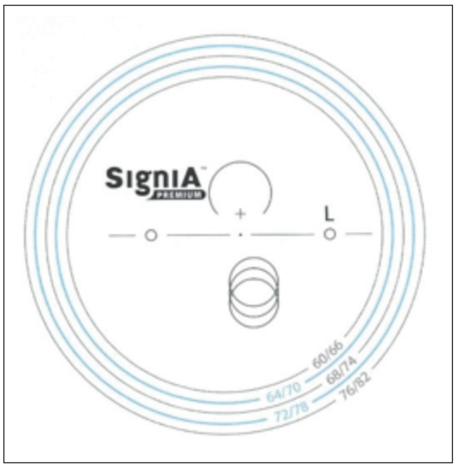


**Figure 3** Sizing chart for a multiple corridor progressive lens

This value has largely been dropped in favour of following other manufacturer's minimum fitting heights to maintain industry consistency. Figure 2 demonstrates the principle of the recommended minimum fitting height in relation to the manufacturer's quoted minimum fitting height. In principle, it is generally accepted that fitting a progressive lens into a frame that gives a fitting height 4mm longer than the manufacturer's minimum fitting height will ensure that the full reading area is contained within the patient's frame.

According to a recent White Paper written by Darryl Meister,[1] the corridor length of a progressive lens, or the vertical distance to the near zone, significantly influences optical performance and wearer satisfaction. If the corridor is too long for a given frame size, reading utility is greatly reduced. On the other hand, if the corridor is too short, the optics of the lens design must be essentially 'compressed.' Due to the mathematical constraints of progressive lens surfaces, the rate of change in unwanted astigmatism across a progressive lens design must increase as the corridor length decreases. This results in narrower central viewing zones, reduced intermediate utility and higher levels of unwanted peripheral astigmatism.

As the corridor length of a progressive lens should be sufficient to minimise unwanted astigmatism, 'standard' progressive lenses have generally been designed to work well in conservative frame styles with adequate depth. However, standard progressive lens designs often do not provide sufficient reading utility in smaller, more fashionable frame styles, since much of the near zone is cut away. This has led to the development of short-corridor progressive lenses, designed to work in extremely small frame styles. Short-corridor progressive lens designs, however, often result in significantly reduced visual comfort and utility compared to "standard" lens designs. Unless the corridor length of the lens design coincides with the optimal length required by the size of the frame, the wearer must tolerate unnecessary optical compromises.

On the other hand, the corridor length of variable-corridor lens designs is precisely customised to match the desired fitting height of the patient's frame style. By matching the optics of the progressive lens design to the wearer's frame size, optical practitioners can take full advantage of the available lens area, down to a minimum fitting height of 13 or 14mm.

Standard and short-corridor progressive lens designs both offer optimum visual performance for a relatively limited range of fitting heights and frame sizes. Further, it is often difficult for practitioners to determine which of these two lens designs will offer the best performance at various fitting heights. Unlike traditional progressive lenses, the optics of progressive lenses with variable corridors is perfectly matched to virtually any frame style. It is important to emphasise that the minimum fitting height is the measurement taken from the progressive lens fitting cross to the centre of the reading area of the lens. The corridor length of the lens is the measurement from the fitting cross to the start of the reading area. Although this can vary slightly between manufacturers, the difference between the minimum fitting height and the corridor length is generally around 4mm.

## The freeform digital revolution

Since the advent of 'freeform' or 'digital surfacing' technology, a myriad of lens designs have appeared. Practitioners are becoming increasingly aware of the benefits of lenses using bespoke optical design provided by a freeform manufacturing platform, as opposed to the traditional offering of limited semi-finished base curves.

Although many patients are satisfied with the optical performance of traditional progressive lenses, some wearers must tolerate reduced optical performance as their prescription or fitting requirements depart from the assumptions used to design the semi-finished lens blanks. In these cases, optical performance can be maximised by tailoring the optics of the progressive lens design with the use of variable corridor lengths.

## The principle of variable corridor lengths

With the advent of freeform production, the practitioner can vary the progressive corridor length irrespective of the fitting height, and provide the flexibility of moving the reading area up or down to suit the frame selected. But why is this flexibility so important? With fixed minimum fitting heights and corridor lengths the practitioner had to decide whether to use a short or a long corridor lens.

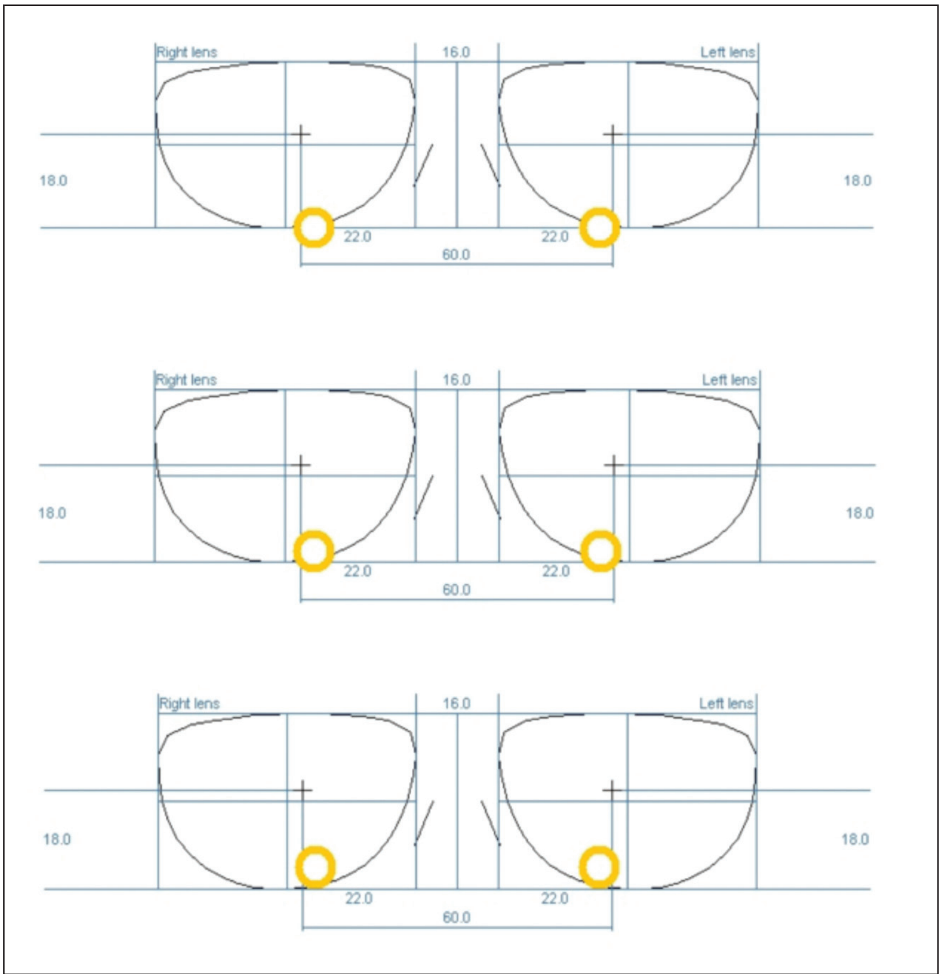


**Figure 4** The impact of different corridor lengths on useable reading area, showing the use of minimum fitting heights of 18mm (top), 16mm (middle) and 14mm (bottom)

In reality, a corridor length in between these values would have been preferable. Further, when a short corridor was selected to gain maximum reading area, this often reduced the width of the intermediate corridor, causing problems with computer work.

With variable corridor lengths, a practitioner can choose where to position the available reading area in order to maximise both the reading and intermediate visual zones within the chosen frame. Some major manufacturers offer their premium progressive lenses with three corridor lengths, generally in 2mm steps, although some now offer up to six corridor lengths with 1mm steps. Utilising digital measuring equipment, such as the iTerminal from Zeiss, the measurement accuracy and the number of corridor lengths is further enhanced with 1/10mm steps, allowing a choice of up to 60 individual corridor lengths. This is particularly useful when the practitioner is trying to balance the reading area and intermediate area in order to give the patient the best visual performance.

## Balancing the visual areas

It is understood by optical practitioners that two basic principles apply with regard to progressive lenses:

- The shorter the progressive corridor, the narrower the intermediate width
- The higher the reading addition, the smaller the reading area will become.

But how do we use this information in a practical way, without real numerical information to help our patients balance their visual areas? In 2010, Carl Zeiss Vision produced a useful chart which looked at the numerical relationship between minimum fitting height, the corridor length to 85% of the reading power, the intermediate height, the intermediate width and minimum near width (see Table 1). The chart relates to a lens with plano distance and an addition of +2.00D in a balanced design.

It must be remembered that the values shown in the chart relate to an individualised freeform lens product, and that the figures would be different for other lens designs and manufacturers' lens types. The figures would also vary considerably for different additions. The chart is useful, however, to consider the relationship between the various components of the progressive lens and their effect on a progressive lens with varying corridor lengths. In a clinical context, this data can be used to determine visual priorities for individual patients. For example, for patients with reading priority and minimal intermediate requirements, all of the reading area should be enclosed within the frame. Conversely, for patients with an intermediate priority, it may be prudent to lengthen the corridor in order to increase the width of the intermediate zone.

Progressive lenses can be fitted at the manufacturer's minimum fitting height, although this is generally regarded as acceptable only up to a +1.75D addition. For additions of +2.00D and above, the natural reduction in reading width, particularly when using shorter corridor lengths could be problematic if the full reading area was not enclosed within the frame. This is where practitioners can benefit from using variable corridor progressive products, reducing the potential for non-tolerance.

## How to measure for variable corridor lengths

To specify a corridor length for progressive lenses, it is necessary to record the corridor length required on the spectacle lens order, along with the required fitting height. Firstly, the practitioner should take the fitting height from the centre of the pupil to the bottom of the lens. Bearing in mind that if this measurement corresponds to the manufacturer's minimum fitting height, it would only give the patient 50% of the available reading area. If more reading area is required, it would be necessary to record the initial fitting height, and select a shorter corridor value in order to enclose the full

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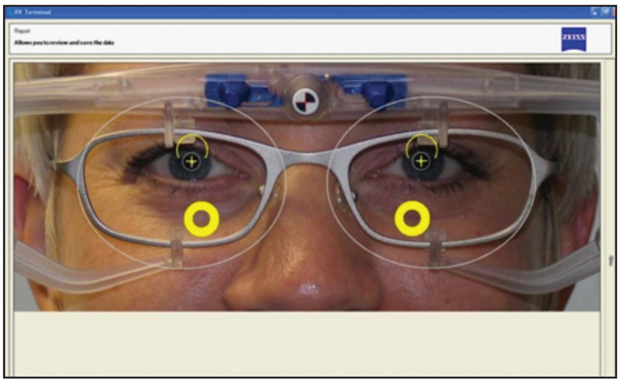

**Figure 5** Computerised measuring device

reading area within the frame. Generally, if a corridor length value is not specified on the order, this should trigger a query from the customer services department requesting this information.

### Using manufacturers' fitting charts

All major lens manufacturers supply fitting charts for their progressive lenses. Whereas previously these charts showed the standard and short minimum fitting heights, they have become more complex with the inclusion of variable corridor technology. The more corridor lengths on offer, the more complex and crowded the chart will become. However, the principle of use remains the same, and a typical sizing chart for a three-corridor length progressive is shown in Figure 3.[2] It is essential to accurately dot the pupil centre on the dummy lenses with the patient in a relaxed position, looking ahead in a zero visual direction. This will give the actual fitting height required. By laying the dotted lenses on the fitting chart, it will then be possible to select the required corridor length dependent upon the frame depth and the patient's visual priorities.

### Using computerised equipment

Many practices utilise lens manufacturer's online ordering programs, which are useful to check the positioning of the reading area within selected frames before committing and sending lens orders. Figure 4 illustrates the importance of this point. The top image shows a lens with a measured fitting height of 18mm and a corridor length equivalent to a minimum fitting height of 18mm, demonstrating that the majority of the reading zone would be removed during glazing. The middle image shows the impact of reducing the corridor length to an equivalent minimum fitting height of 16mm, allowing most of the reading area to fall within the frame. The bottom image emphasises this point, showing a further reduction in corridor length to an equivalent minimum fitting height of 14mm. By selecting different corridor lengths on screen, the practitioner can make an informed decision on the corridor length that would best suit the patient.

### Using digital measuring methods

Many practitioners have invested in the computerised measuring equipment offered by a number of major lens manufacturers. This equipment can be very useful to both patient and practitioner to demonstrate the impact of varying corridor lengths upon reading area. Figure 5 shows a screen shot of the iTerminal from Zeiss where the reading area is superimposed on the patient's chosen frame, which can be moved up or down independently from the fitting cross.

## Conclusion

The use of variable corridor technology is being introduced by more lens manufacturers, rapidly becoming a commonplace factor in ophthalmic dispensing. Lifting the fitting restrictions that have plagued the profession for many years offers substantial benefits to practitioner and patient. The frame choice for progressive lens wearers is much more open and allows practitioners to actively engage with their patients with regard to biasing the lens design to capture their critical visual areas. Variable-corridor technology, once only an option in high-priced, individualised, digitally surfaced lenses, is becoming available in more affordable lens ranges. This can only be a good thing, and as a profession we should embrace the technology for the benefit of all concerned.

### MORE INFORMATION

**References** Visit www.optometry.co.uk/clinical, click on the article title and then on 'references' to download.

**Exam questions** Under the new enhanced CET rules of the GOC, MCQs for this exam appear online at www.optometry.co.uk/cet/exams. Please complete online by midnight on November 1, 2013. You will be unable to submit exams after this date. Answers will be published on www.optometry.co.uk/cet/exam-archive and CET points will be uploaded to the GOC every two weeks. You will then need to log into your CET portfolio by clicking on "MyGOC" on the GOC website (www.optical.org) to confirm your points.

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