Accurate fitting of progressive lenses

Phil Gilbert offers advice on how best to fit progressive lenses. **C6255, one standard CET point suitable for OOs and DOs**

Within the optical profession, progressive lenses form an increasingly important part of everyday practice. These lenses make it even more important for practitioners to ensure that patients are measured accurately and the spectacles fitted well. This is not just to make best use of the available technology that is built into progressive lenses, but also to ensure the patient receives the visual acuity they expect, having paid what many consider a substantial fee for the product.

This article will examine areas that practitioners can effectively influence at the time of dispensing in order to ensure good vision on collection and minimise the risk of non-tolerance.

TABLE 1

PD measurements for a sample of northern Europeans

PD	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Male	0	0	1	2	3	5	8	11	13	14	13	11	8	5	3	2	1
Female	1	2	3	7	10	12	14	13	12	10	7	5	2.5	1	0.5	0	0

Semi-finished ray path parameters

It is worth bearing in mind that when manufacturers produce semi-finished progressive blanks, certain 'average' ray path conditions are pre-designed into the progressive format.

These include the average pupillary distance (PD), which is taken as 65mm, back vertex distance of 12-14mm and a pantoscopic angle of around 9 degrees. Because manufacturers are unaware of the resulting real 'position of wear' measurements regarding the patient's PD and new frame, these averages are built in to take account of the vast majority of patients.

Looking at Table 1 it can be seen that average northern European PD varies considerably, especially the difference between the average male PD at 65mm and the average female PD at 62mm. Taking 65mm as the average will put a high number of progressive lens wearers outside of this averaged ray path parameter.

Although this factor, in itself, may not have a detrimental effect on visual performance, a combination of other factors can increase the potential for a non-tolerance situation. There are a vast number of frame designs available today – ranging from rimless frames which sit a long way from the eye, to frames with thick sides that are difficult to angle. Coupled with the physiological aspects of the PD, this means that patients fitted with progressive lenses where the measurements vary dramatically from these averages do run a higher risk of less visual performance from their new spectacles.

Patients with very wide or narrow PDs, long or short back vertex distances or very raked or flat pantoscopic angles should be looked at more closely than the 'average' patient.

Cylinder influences

All semi-finished progressive lenses are held in a variety of base curves which are used depending on the Rx ordered by the optician.

It is important to remember that the higher the cylinder incorporated into the Rx, the less visual performance the patient will receive from the progres-

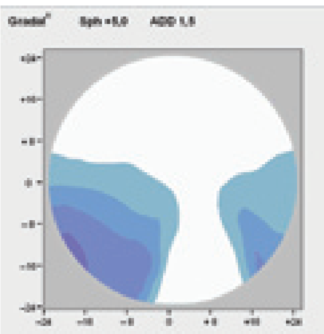

Figure 1a

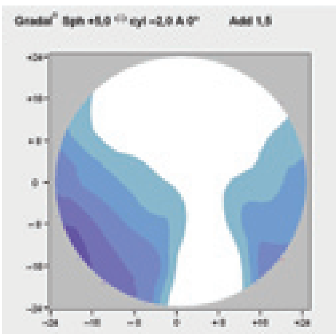

Figure 1b

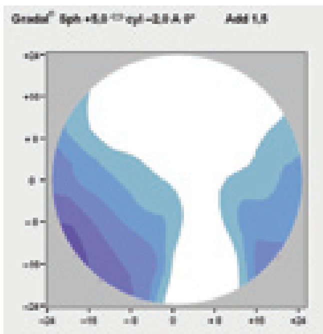

Figure 2a

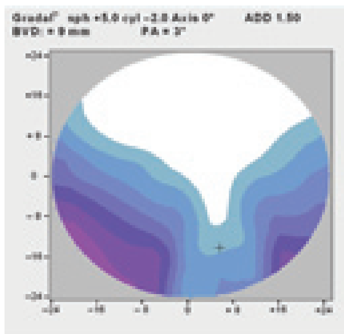

Figure 2b

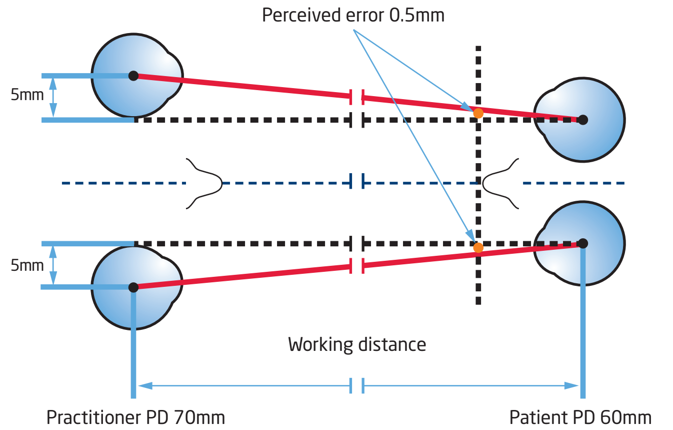

Figure 3

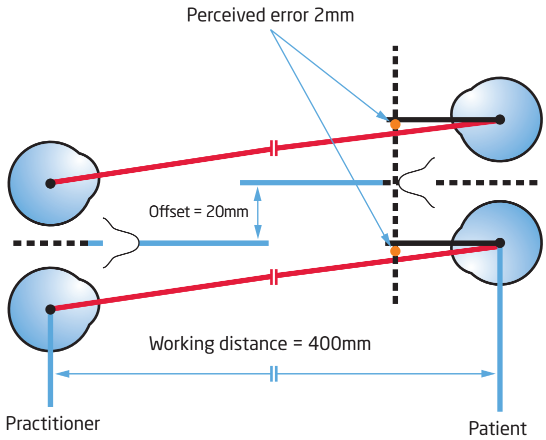

Figure 4

sive format. This is due to the resultant peripheral astigmatic distortion.

Figure 1 compares the performance of a +5.00D sphere add +1.50 (Figure 1a) with a +5.00/-2.00 add +1.50 (Figure 1b).

The influence the cylinder has on the resultant peripheral distortion can clearly be seen.

Back vertex distance

Back vertex distance (BVD) is arguably one of the most crucial factors in providing patients with good vision in all spectacle lenses.

Certainly, the BVD should be looked at whenever the Rx is ±4.50D or above. Years ago most manufacturers stopped producing progressive lenses above ±8.00D for a period. Now that production and computerised technology has developed, they are able to manufacture lenses from -17.00D through to +10.50D, which means more attention must be paid to the BVD.

With higher power lenses the BVD should be checked with the optometrist as to what mean position the trial frame was set at during the refraction and this then should be correlated with the actual BVD of the new spectacle frame chosen.

In many instances, even though a change in Rx has been prescribed, the resultant spectacle lenses dispensed without consideration of the BVD, means the new frame has resulted in the spectacles' effective power being incorrect for the patient.

For example, a prescription of +6.00D with a trial frame fitted at 14mm would need a +6.25D with a new frame fitted at 8mm. A prescription of -10.00D with a trial frame fitted at 8mm would need a -10.50D with a new frame fitted at 12mm.

Manufacturers will alter prescriptions prior to manufacture provided both the prescribing and the dispensing BVDs are written on order forms with a request to calculate the new powers. Modified power charts are also printed in most good optical text books. Good communication with the optometrist is useful in practice where higher powers are concerned and BVD alteration can make the difference between the patient leaving the practice with an improvement in their vision or leaving with effectively the same Rx as before, because the BVD for the new frame was not taken into account.

Pantoscopic angle

The pantoscopic angle can influence the resultant visual performance of progressive lenses and care should be taken to avoid fitting very flat or very raked frames, particularly with higher powers and higher cylinders.

Figure 2 shows the comparison between lenses fitted at 9 degrees (Figure 2a) and 3 degrees (Figure 2b) with an Rx of +5.00/-2.00 add +1.50. Clearly, it can be seen how the change in pantoscopic angle of only 6 degrees can have a marked effect on the visual performance of the lens, particularly in the reading area.

With modern day progressive lenses it is advisable to dot the fitting heights with the patient's head in a natural forward looking position. There does not need to be any centre of rotation requirement as the ray path parameters built into semi-finished lenses already compensate for a pantoscopic angle of around 9 degrees.

For fitting heights on frames with very flat or raked fronts an individualised lens that takes account of the real position of wear should be considered. Entering in the actual pantoscopic angle onto an order for free-form progressive lenses will result in an algorithm being used on the main surfacing programme that compensates and changes the ray path parameter to the new value rather than the averaged value.

An algorithm is a method of solving a problem by repeatedly using a simpler computational method. A basic example is the process of long division in arithmetic. The term 'algorithm' is now applied to many kinds of problem-solving that employ a mechanical sequence of steps, as in setting up a computer programme. They can be looked upon as bolt-on programmes that sit alongside the main programme that introduce the 'what if?' elements of varying parameters of the position of wear. The use of algorithms can reduce the extra computation time required to build in real 'position of wear' calculations down to as little as 20 seconds.

There are a number of lenses currently available that take actual position of wear into account during production, including Rodenstock Impressionist, Zeiss Gradal Individual and Sola OneEgo.

Taking the PD

This is probably the most crucial aspect of progressive lens fitting and the most likely cause of true non-tolerance. A recent straw poll indicated that around 80 per cent of opticians are still using the PD ruler as opposed to more accurate methods such as a pupillometer or a modern digital measuring device. When using the Victorin method (PD ruler) various factors must be taken into account.

Firstly, it is essential that the left eye of the patient is looking at the right eye of the optician and they are both at the same height as each other. A stable hand, and experience, is required to avoid parallax. It is also best if the optician has the same PD as the patient in order to avoid inaccuracies.

Figure 3 shows that if the optician with a PD of 70mm is taking the PD of a patient at 60mm there is the potential of a horizontal measurement failure of 1/2mm each eye. More importantly, if the optician is stood offset to the patient while taking the PD then greater errors can potentially be induced.

Figure 4 shows that if the optician is offset by only 2cm from the patient an error of 1mm each eye can be induced horizontally.

As can be seen by Figure 5, a centration error of 2mm can have a distinct impact on the visual performance through progressive lenses. A 2mm error on an addition of +1.50D can reduce the horizontal binocular vision by 40 per cent and a 3mm error on a +2.75D addition can reduce it by as much as 75 per cent.

Clearly, great care in ensuring a good face to face measurement will help to gain accurate monocular PDs which are so important for successful progressive lens dispensing.

Taking the fitting heights

Similar rules for obtaining good vertical fitting heights also apply and probably the most important of these involve relaxation techniques prior to dotting the dummy lenses on the frame.

It is understood in the human makeup that another person coming up close, face to face, causes a person to instinctively stiffen. It is, therefore, necessary to get the patient to relax to gain an accurate fitting height.

One method practitioners can use to facilitate this relaxed position is to explain to the patient what they are about to do, but then ask them to look at the floor for a few seconds, and then look back up into their eyes. By looking down, away from the practitioner's gaze, and then slowly back up, the patient becomes more relaxed, allowing for a much more accurate fitting height to be taken.

Care should also be taken to note any physiological aspects of the patient, such as posture, neck or spinal problems that

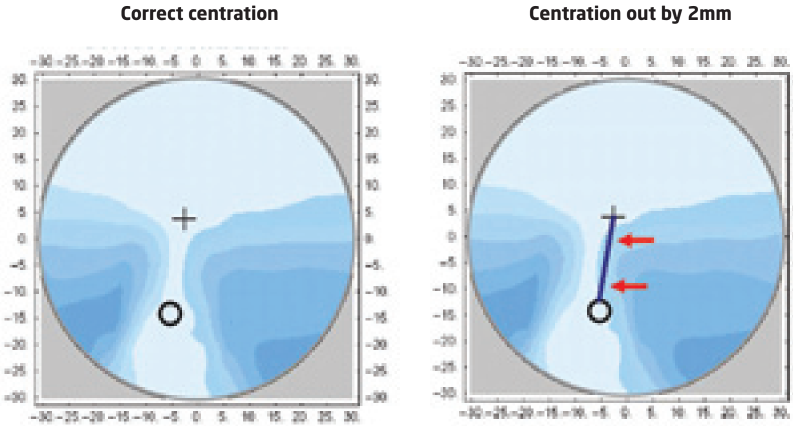

Figure 5 Centration error effect

may influence the final fitting position of any spectacle lenses. For example, if the fitting heights are taken and marked on the dummy lenses with the patient in a seated position it is then wise to request that the patient stand in order to check that the heights are still correct. This is particularly relevant for shorter or taller patients.

Adding to the addition

The practice of adding 0.25D to the reading addition used to be fairly widespread a few years ago.

The main aim of this practice was to bring the reading area further up in the lens to afford the patient a shorter transition into the reading area. This was deemed a requirement previously as earlier progression zones were quite long in comparison to modern day designs.

It was common to see minimum fitting heights of 22mm or 23mm, indicating a progression zone length of around 19mm.

Patients needed to drop their eyes further down the lens to take full advantage of the reading area. As most modern progressive lenses commonly have recommended fitting heights of around 18mm, the progression lengths are now generally around 13mm to 15mm. Patients therefore need to drop their eyes less.

Digital dispensing equipment

As progressive lens costs increase, to reflect the newer technology, it becomes even more important for practitioners to justify these increases with noticeable improvements, not just in visual acuity and progressive performance, but also the demonstration that the practice itself is keeping 'ahead of the times' with regard to the tools of the trade.

The new breed of digital measuring equipment (Figure 6) appearing on the market goes a long way to achieving this by helping the practitioner to not only take very accurate measurements but also to differentiate themselves from practices that still rely on traditional methods.

The digital measuring device is an instrument that can be used in a variety of ways within an optical practice and should not be looked upon just as a replacement for a PD ruler (or a pupillometer), and a felt tip marker pen. It has a number of applications that will enhance the profile of the practice, increase accuracy levels and improve ▶

Figure 6 Digital dispensing equipment in the practice

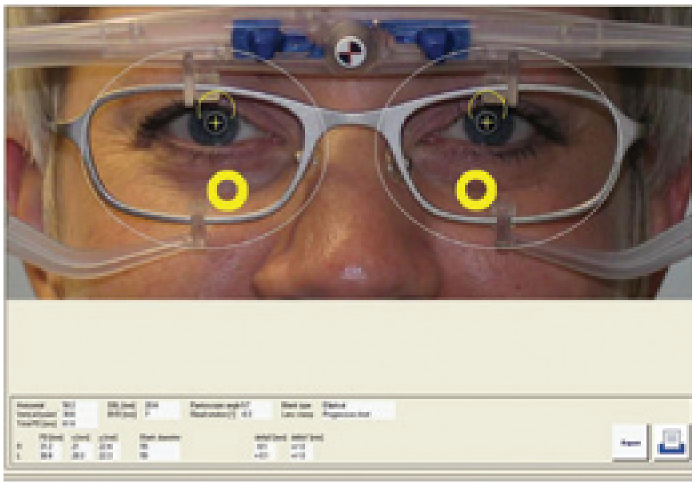

Figure 7 Final fitting screenshot from the Zeiss Relaxed Vision Terminal

the awareness of optical measurement and frame fitting to the patient.

Although these units are primarily designed to take very accurate dispensing measurements, they do help to facilitate the increase in sales and conversion of existing progressive wearers to modern individualised lenses. The digital dispensing tool can be used on all patients passing through the practice and, optically, the accuracy of these units will improve the dispensing of all spectacle lenses within the practice and help to replace outdated manual practices. Their modern appearance can enhance the image of the practice and increase patient confidence, thereby helping to justify the recommendation of better quality and higher technology lenses by the practitioner.

Clearly, the advent of digital technology within the dispensing role could be looked upon by some as a potential threat to their professional livelihood, or alternatively as an unnecessary expense. However, as with all computerised or digital equipment, they are designed to facilitate daily tasks and by embracing the technology the real benefits soon outweigh any perceived disadvantages.

Summary

All practitioners dispensing progressive lenses wish to give patients the best possible visual performance and avoid the possibility of non-tolerance.

By considering the list below, the accuracy of progressive lens dispensing could be enhanced for the benefit of practitioners and patients alike.

- Try to fit the patient's actual new frame, if at all possible, before taking measurements
- Check the BVD and alter the frame or the Rx power if required
- Check the pantoscopic angle and adjust the rake if required
- Put the patient at ease, preferably in a quiet area of the practice
- Remove unwanted distractions while taking measurements
- Practitioners should be aware of their position and notice physiological tendencies in the patient such as an unusual posture
- Use good relaxation techniques to obtain a natural line of sight
- Recommend individualised progressive lenses where the patient Rx, PD and position of wear parameters fall outside of the 'normal'
- Look closely at modern dispensing equipment that could improve measurement accuracy and differentiate the practice.

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MULTIPLE-CHOICE QUESTIONS

1 What is suggested as the average female pupillary distance in northern Europe?
A 60mm
B 62mm
C 65mm
D 68mm

2 What is the pantoscopic angle assumed by most manufacturers in designing semi-finished progressive blanks?
A 5 degrees
B 7 degrees
C 8 degrees
D 9 degrees

3 If the refractive error is measured as -10.00D in a trial frame set at a back vertex distance of 8mm, what should be the final correction set into a frame with a BVD of 12mm?
A -9.50D
B -10.00D
C -10.50D
D -11.00D

4 What overall error may result when a practitioner measures the PD of a patient with a PD 10mm less than theirs?
A No error
B 0.5mm
C 1mm
D 2mm

5 What overall error may result when a practitioner is offset by 2cm from the patient?
A No error
B 0.5mm
C 1mm
D 2mm

6 By how much might an error of centration of 2mm affect the horizontal binocular vision of a progressive lens with a +1.50D addition?
A 10 per cent
B 40 per cent
C 60 per cent
D 75 per cent

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