Paradigm shift

Measure visual, not pupillary, axis for accurate PAL placement, OD says

Practitioner makes a case for rethinking how measurements are taken to fit progressive add lenses

By Thomas H. Clark, OD

The most frustrating part of fitting glasses, as most any optician or dispensing optometrist will tell you, is fitting progressive addition lenses (PALs) and the resulting problem with lens wearer rejections, non-adaptation, and high re-do rates caused by ill-fitting PALs.

It seems that no matter how accurate the pupillary distance (PD) measurements taken with a corneal reflection pupilometer (CRP), a significant number of PAL wearers report feeling uncomfortable with their new lenses.

PAL wearers have made complaints, such as "not being able to find an area that had good vision" or being "able to see with only one eye at a time." These and other disparaging remarks stem from wearers' frustration with never being visually comfortable with the PAL-style bifocal.

Misplacement of PDs

Lens manufacturers have wrongly assumed that one of the major problems with PAL fitting was having segment placement errors produced by using inaccurate PD measurements, causing the lens wearer's rejection of this type of lens.

The PD measurement has been used since the beginning of the optical industry as a guide to placement of ophthalmic lenses in a frame, giving each lens wearer a customized pair of lenses. Today, however, the PD measurement has little value where accurate placement of a PAL is essential for success.

Take-Home Message

The optical industry could benefit from a paradigm shift for successful placement of progressive addition lenses (PALs) in an eyewear frame. The new perspective recognizes that the right measurement for PAL placement gauges the lens wearer's visual axis, rather than the pupillary axis. Getting the job done right the first time would reduce re-do rates and non-adapt issues while increasing profits and reducing time losses industry-wide.

The right tool for the job

The need for a more accurate PD measurement was addressed by developing the corneal reflection pupillometer (CRP). This device, still widely used today, measures the distance between two pinpoints of light reflected off the corneas, determining the distance between the lens wearer's two pupillary axes.

The CRP produces a very accurate and repeatable measurement of the spacing of the pupillary axes of a lens wearer's eyes. This is the most common measurement used to place a progressive add lens in an individual's frame. The end result of using this CRP measurement is that the progressive lens segments end up centered on the lens wearer's pupillary axes.

The fundamental flaw in this process is that the PAL segment needs to be centered on the visual axis, not the pupillary axis, to achieve a successful fit with this style of lens with narrow segments.

A revolutionary discovery

What researchers have discovered, and which could revolutionize the optical industry, is that the pupillary axis and the visual axis—the line of sight—of the eye are rarely the same. In physiological optics, this difference is known as angle kappa (see Figure 1).

In a study published in the *Journal of Refractive Surgery*, January 2011, 800 eyes were tested using an Orbscan ll (Bausch + Lomb). Angle kappa was measured to be as great as 9 degrees with the mean angle kappa being 5.56 degrees (Figure 2).

The placement error of a progressive add lens segment in a client's frame when using a corneal reflection pupillometry measurement will be dictated by that lens wearer's unique angle kappa. The greater the individual's angle kappa, then the greater the linear error. This displacement error at the spectacle lens plane can be determined with the formula:

LINEAR ERROR = THE SINE OF KAPPA-

Figure 1

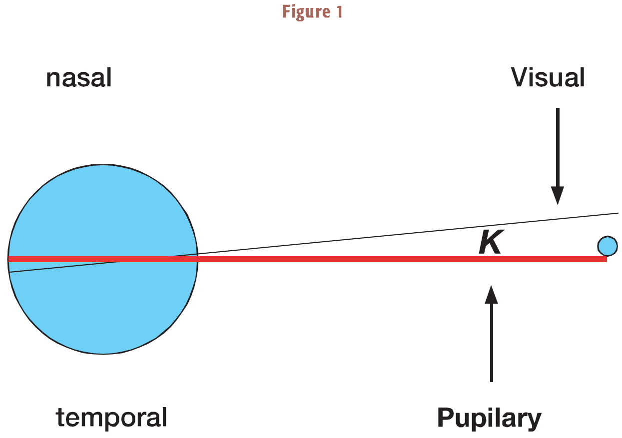


Figure 2

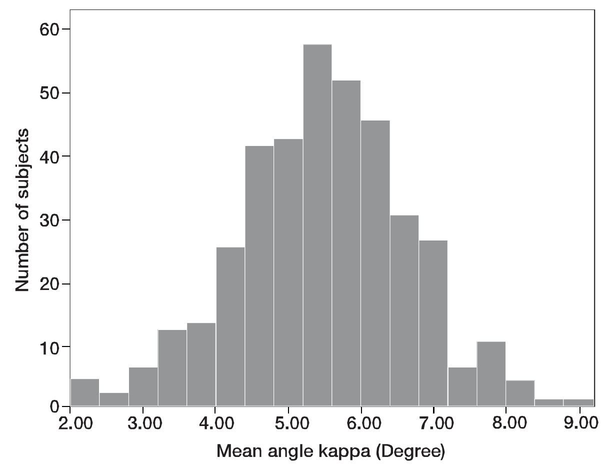


Figure 3

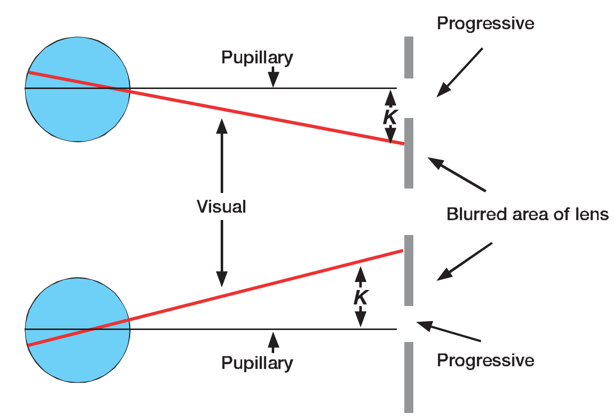
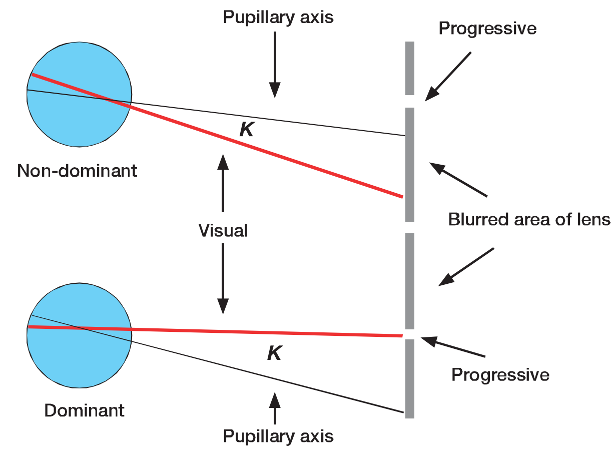


Figure 4



Graphs provided by Thomas H. Clark, OD

X- (VERTEX DISTANCE + ANTERIOR CHAMBER)

An example using the mean angle kappa from the Hashemi study would be: sine 5.56 degrees (0.102) x 20mm (approximate) = 2.0mm. This error is for one eye.

Using a CRP to determine PAL placement will result in a total of a 4 mm error of placement for the average binocular lens wearer (Figure 3).

PALs and binocular vision

The next factor causing the high non-adapt and re-do rates of PALs is an issue of binocular vision. A lens wearer with binocular vision has a dominant eye and a non-dominant eye. In situations where a person with binocular vision has to choose to see clearly with one eye, the dominant eye will always—unconsciously—be chosen.

When placing a pair of PALs that have the placement errors in front of a binocular lens wearer, that person has to choose to see best with the dominant eye by placing its visual axis in the center of the dominant eye's PAL segment for the best vision. This automatic visual response will result in the non-dominant eye's visual axis aligned further away from the center of that PAL. The error will be the sum of the measurement errors for both eyes.

Using the example of a 2 mm error, the dominant eye will have a zero error with the clearest vision, and the non-dominant eye will have a displacement error of 4mm with blurry vision (Figure 4).

Focal Point

The optical industry needs to investigate why the correct measurement for successful PAL placement is the one that measures the lens wearer's visual axis, and then use this information for the correct placing of PALs in the lens wearer's frame.

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The final factor causing the high non-adapt re-do rate with PALs is the issue of blur suppression of the non-dominant eye and stereoscopic disruption. The obvious place where these issues have been observed and studied has been in the correcting of presbyopia with the fitting of contact lenses using a technique called monovision. This is the technique of prescribing a correction for near vision in the non-dominant eye, thus blurring the distance vision in that eye. Studies show that 50.1% to 60% will tolerate the blurred vision in the non-dominant eye and be successful with mono vision. However, 40% to 50% cannot suppress this blurred image or tolerate stereoscopic disruption and will not tolerate at different levels the blurred vision in the non-dominant eye.

Combine the measurement errors caused by using a CRP with a lens wearer that has not only a high angle kappa, but also has poor blur suppression and strong stereoscopic vision, and you will have a very dissatisfied patient/customer who will need a re-do, costing extra time and money to the optical industry.

Suffer in silence

In addition to the PAL wearer that comes back with complaints, a large number of people are silently unhappy—always struggling, complaining to friends, and going from optometrist to optometrist looking for a better solution to their visual needs.

The optical industry could benefit greatly with a paradigm shift from presuming that a CRP measurement is the correct measurement for PAL placement. Instead, the industry needs to investigate why the correct measurement for successful PAL placement is the one that measures the lens wearer's visual axis, and then use this information for the correct placing of PALs in the lens wearer's frame.

Reducing re-do rates and non-adapt issues in the optical industry would increase profits and reduce time loss industry wide from the dispensing practices to the optical laboratories. **OP**

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