AO Compact: A New Progressive Lens Designed For Small Frames

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Dr. Winthrop has been an ophthalmic lens designer for American Optical since 1967 and has become world renowned for innovative designs such as AO Pro, Truvision, Omni and now AO Compact. He has written numerous scholarly articles on lens design and has lectured throughout the United States and Europe.

Summary

As many dispensers know, the corridors of most progressive lenses are too long for today's fashionable small frames. Now, American Optical has introduced the first progressive lens designed specifically for small frames, the AO Compact. It has a 13 mm corridor that permits full reading function with a minimum frame depth of 17 mm. Yet it also retains the far and intermediate utility and comfort of a long-corridor progressive.

1. The need for a new progressive lens design

Most current progressive lenses were designed in an era of larger frames. According to the manufacturers, these designs typically require 22 mm minimum frame depth below the fitting cross. If the fitting cross of such a design is placed 4 mm above the equator of the frame, then the frame must have a B dimension of at least 36 mm to satisfy the 22 mm minimum depth requirement. But in many parts of the world–notably Europe and Asia–the B dimension of the average frame is 30-35 mm, and 25 mm is not uncommon. In the United States, smaller frames are becoming increasingly popular. This simple analysis suggests that yesterday's progressive lens designs may be incompatible with today's fashionable frames.

A consideration of the corridor length of the typical progressive lens leads to the same conclusion. Corridor length may reasonably be defined as the vertical drop from the fitting cross to the point of the corridor where the nominal add power, less one-eighth diopter, is attained. For example, in the case of a lens of nominal addition 2.00 diopters, the corridor length is the vertical drop from the fitting cross to the 1.875 diopter power point of the corridor. Such a definition accords with international standards on the addition power of multifocals. In terms of this definition, the industry average corridor length of currently available progressives is about 17 mm.

The 22 mm minimum frame depth requirement thus allows 5 mm depth of reading portion (or less if one subtracts the bevel), or about one pupil diameter. Clearly, if the average progressive is used in a small frame, that reduces this 5 mm depth even further, the reading function of the lens may be severely impaired. To illustrate, Figures 1 and 2 show, respectively, the surface mean power and astigmatism plots of a current progressive design having an addition of 2.00 diopters and a corridor length of 16.5 mm. This design is mounted with its fitting cross 4 mm above the equator of a frame having a B dimension of 30 mm and with a 4 mm inset. As shown in Figure 1, the reading portion, defined as the region bounded by the 1.875 diopter mean power line, is nearly edged off.

One is led to conclude, on the basis of corridor length, that currently available progressives are inappropriate for use in smaller frames. Of course, a manufacturer may attempt to make its product seem to have a shorter corridor by defining it differently. For example, corridor length is sometimes defined as the vertical drop from the fitting cross to the point at which 85% of the addition power is attained. But this is a misleading and optometrically unacceptable definition of corridor length. For instance, 85% of 2.00 diopters is 1.70 diopters, an entirely unacceptable reading addition if 2.00 diopters has been prescribed. It is misleading because, despite the promising definition, the true reading area may nevertheless be nearly edged off, as we saw in the example of Fig. 1.

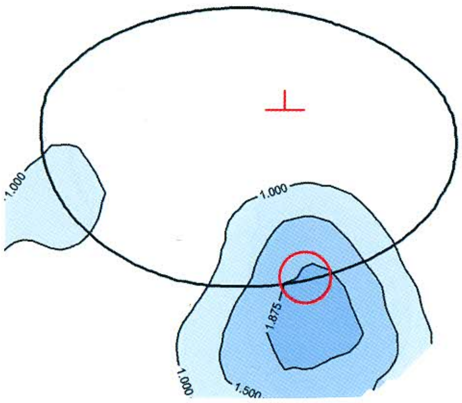

Figure 1

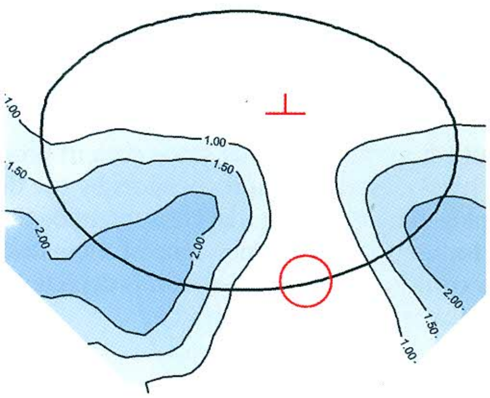

Figure 2

To cope with the very real problem of fitting current progressives into small frames, some dispensers may increase the addition power by 0.50 diopters above the value that would normally be prescribed. With this approach however, the patient is forced to read through the corridor itself rather than the designed reading portion, much of which may be edged off.

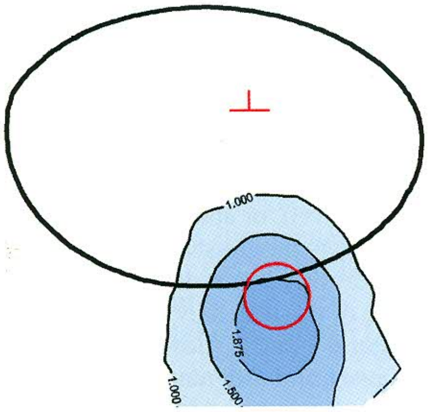

Figure 3

To illustrate, Figure 3 shows a current progressive having a 2.00 diopter addition and 18.0 mm corridor, its fitting cross located 4 mm above the equator of a frame having a B dimension of 30 mm. The reading portion is completely edged off. In Figure 4, the same design having a 2.50 diopter addition is shown, with the zone of prescribed power between 1.875 and 2.125 diopters highlighted. This effective reading portion offers only limited near vision utility.

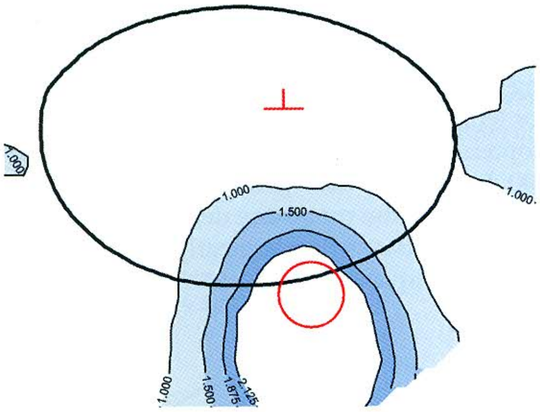

Figure 4

Finally, it may be said that some current progressives do have reasonably short corridors by the definition employed here, and on that basis might be thought suitable for use in small frames. One of these designs having a corridor length of 15.5 mm is depicted in the isocurve diagrams in Figures 5 and 6.

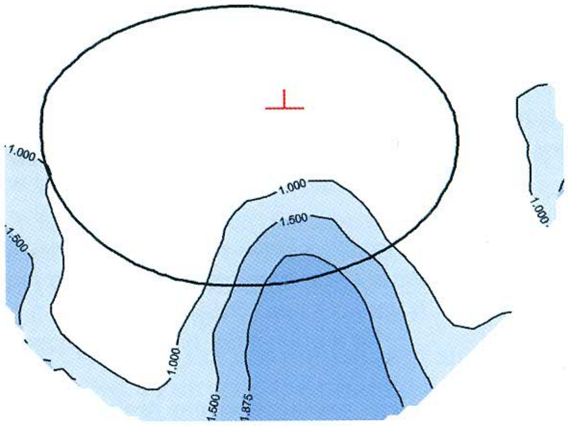

Figure 5

The fitting cross of this lens is located 4 mm above the equator of a frame having a B dimension of 30 mm. The mean power plot of Figure 5 shows a reading portion of 3.5 mm depth remaining within the frame after edging. This may provide adequate near vision utility for some patients.

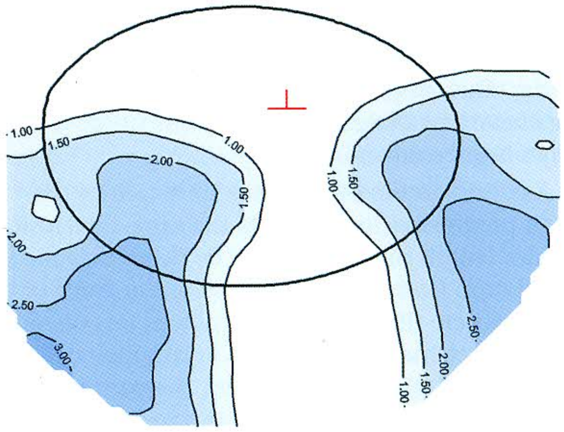

Figure 6

However, the astigmatism plot of Figure 6 reveals several undesirable features of the design. First, the magnitude of unwanted surface astigmatism is relatively strong, in excess of 2.50 diopters. These high values of surface astigmatism may lead to an unacceptable loss of acuity off axis. Second, the astigmatism on the temporal and nasal sides of the design are relatively unbalanced. The point is that a short corridor alone does not guarantee success in fitting small frames. Of equal importance is the utility and comfort of the overall design.