

## APPENDIX

When designing shape magnification into a lens, the two main parameters that can be manipulated are the base curve and center thickness. High index lenses are also important considerations as they allow thinner and flatter lenses for a given magnification.<sup>1</sup> The relationship between shape magnification, base curve, center thickness and refractive index is described by the following formula:  $M = 1 / 1 - (t/n)F_1$ , where  $t$  is the thickness (in m),  $n$  is the refractive index and  $F_1$  is the base curve of the lens, in diopters. A nomograph (see Figure A1) is a simple graphic way to represent the relationship between magnification, thickness and base curve for a given refractive index.<sup>2</sup> Published nomographs for higher index materials are available from Stephens and Polasky.<sup>1</sup>

**Step 1.** After determining the amount of aniseikonia to correct, the lens for the eye with larger perceived image is designed first. This lens must be made as flat and as thin as possible. The optical laboratory can be consulted to determine how thin a particular lens can be made given the power and the eye size (which should be kept at a minimum). The amount of shape magnification that this lens design creates is determined from the nomograph: a ruler is used to connect the base curve and center thickness on the nomograph, and the shape magnification is read off the magnification scale – see Figure A1, Step 1. For this patient, a base curve of 5.25D and center thickness of 2.5 mm, results in shape magnification of 0.9%.

**Step 2.** Determine how much shape magnification is required in the other lens. This will be the amount of aniseikonia that is to be corrected plus the amount induced by the first lens (see Figure A1, Step 2). For this patient, 3.5% (the desired aniseikonia to correct) is added to 0.9% (the amount of shape magnification in the first lens) to determine the amount of shape magnification (4.4%) that must be designed into the second lens.

**Step 3.** Design the lens for the eye with the smaller perceived image. For a given amount of shape magnification to be designed into the lens (from Step 2), multiple combinations of center thickness and base curve are possible. To find these combinations, the ruler edge is anchored at that magnification on

the nomograph (for this patient, 4.4%) and the ruler is pivoted to find all combinations of base curve and center thickness that result in that amount of shape magnification (Figure A1, Step 3). The combination that provides the best cosmetic appearance is prescribed. Polasky<sup>3</sup> has provided some guidelines that may help in this selection. These include (1) keep BC powers within the range of +2 D to +10.50 D, (2) keep BC of the two lenses within at least 6 D of each other, and (3) don't change any BC more than 6 D from standard form lenses.

The Aniseikonia Inspector incorporates the same formula within its program, which allows the user to vary lens parameters while showing the effect on magnification and lens profile as lens parameters are changed.

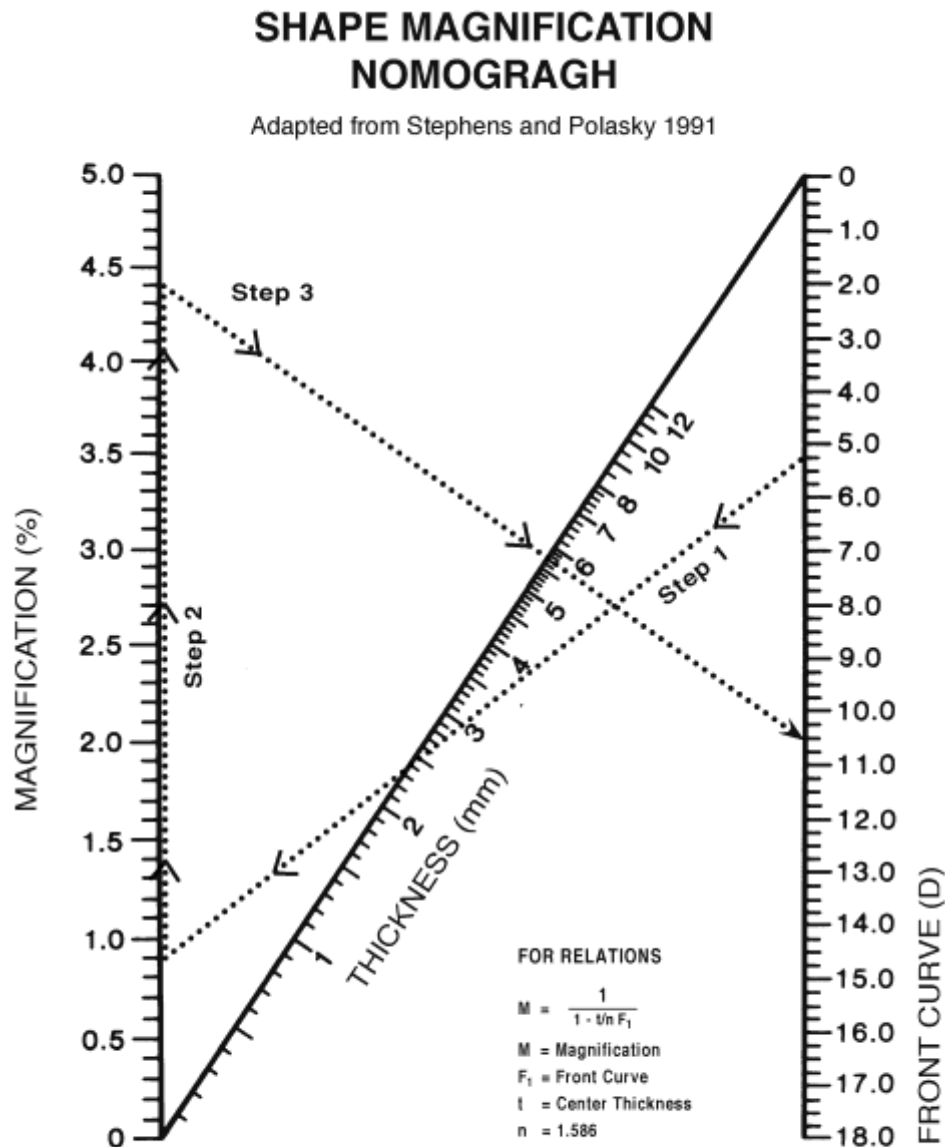
In higher myopic corrections, problems arise when increasing the base curve in order to get more magnification. When the base curve is steepened, in order to maintain the correct power, the back curve also needs to be steepened. However, this increases the vertex distance causing greater *minification* from the minus power, offsetting the benefit of the base curve change.<sup>4</sup> In this case, increasing the center thickness alone (without steepening the base curve) will result in magnification, but edge thickness then becomes a limiting factor. High index materials will help reduce thickness. The position of the bevel can also be changed to increase or decrease the vertex distance and affect the power magnification of the lenses. Good and Polasky<sup>4</sup> discuss the management of aniseikonia in high myopia.

## REFERENCES

1. Stephens G, Polasky M. New options for aniseikonia correction: The use of high index materials. *Optometry and Vision Science* 1991;68(11):899-906.
2. Rayner AW. Aniseikonia and magnification in ophthalmic lenses. Problems and solutions. *Am J Optom Arch Am Acad Optom* 1966;43(10):617-32.
3. Polasky M. *Aniseikonia Cookbook II*. Ohio: Instructional media Center, The Ohio State University 1990:15

4. Good G, Polasky M. Eikonic lens design for minus prescriptions. Am J Optom and Physiol Optics 1979;56(6):345-9.

**Figure 1A.** Nomograph for polycarbonate lenses illustrating how to determine base curve and center thickness for the lens requiring added shape magnification. Reproduced with permission from: Stephens GL, Polasky M. New options for aniseikonia correction: the use of high index materials. Optom Vis Sci 1991;68:899-906. ©The American Academy of Optometry 1991.



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