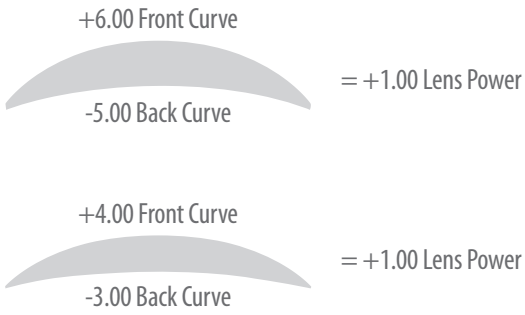
ASPHERIC LENSES

Technical Education

LENS CURVES AND LENS POWERS

Lens power can be achieved with an almost infinite variety of front and back curves. For example, a lens with a power of +1.00 can be made by grinding a -5.00 back curve on a lens with a +6.00 front curve (+6.00 + -5.00 = +1.00) or by grinding a -3.00 back curve on a +4.00 front curve (+4.00 + -3.00 = +1.00). But due to aberrations in the periphery of the lens (oblique astigmatism, power error, distortion) there are limits to which curve combinations will provide acceptable results. Refer to figure 1 for example. Each lens power requires a unique base curve to eliminate astigmatic errors. Aberrations increase away from the center of the lens. The off-axis, or peripheral, optical performance varies with the base curve. Refer to figure 2 for example.

FIGURE 1



BASE CURVE SELECTION

Several factors affect base curve selection such as, magnification, lens bulge, thickness, weight and peripheral optical performance. The form of the lens, including the base curve and center thickness, will affect magnification and patient adaptation. The manufacturer's recommended base curve should be used for best performance.

FIGURE 2

Vision through a Best Form Spherical Lens

Vision through a Flattened Spherical Lens

BEST FORM SPHERICAL VS. FLATTENED SPHERICAL LENS

Best form spherical lenses (ground on the ideal base curve) are designed to reduce lens aberrations and provide a wide field of view, though they cannot eliminate all lens aberrations simultaneously. They are, however, often cosmetically inferior to a flattened spherical lens. Flattened spherical lenses (spherical lenses ground flatter than ideal base curves) protrude less, reduce the bulbous appearance and "bug-eye" effect and are more easily retained in frames. Since flatter lenses are thinner, they are also lighter in weight. Flatter lenses can be fit closer to the eye; the "minification" of minus lenses are also slightly reduced. Flattened spherical lenses are, however, optically inferior because they greatly reduce peripheral visual acuity for patients. Refer to figure 3 for an example of a best form spherical lens vs. flattened spherical lens.

FIGURE 3

Best Form Spherical Lens

Flattened Spherical Lens

VISION-EASE LENS
WORLDWIDE

ASPHERIC LENSES

Aspheric lenses utilize surface astigmatism to neutralize the oblique astigmatism produced by off-center refraction. As a result, a more ideal lens form can be used without compromising the peripheral visual acuity for the patient. Aspheric lenses offer less magnification for plus power wearers and less minification for minus power wearers. They are also thinner and lighter in weight than standard spherical lenses. In plus lenses, the surface becomes flatter away from the center. In minus lenses, the surface becomes steeper away from the center. The result is a lens with both the visual advantages of a best form lens and the cosmetic advantages of a flat lens.

This is a comparison of lens designs for a +4.00 D lens:

	Best Form Spherical	*Flattened Spherical*	*Aspheric*
FRONT CURVE	10.00 D	6.00 D	6.00 D
CENTER THICKNESS	6.9 mm	5.9 mm	5.0 mm
WEIGHT	21.7 g	17.7 g	14.6 g
PLATE HEIGHT	15.3 mm	6.0 mm	5.1 mm
OBL. ASTIGMATISM	0.07 D	0.98 D	0.07 D

MEASURING ASPHERIC SURFACES

Keep in mind that sag gauges and lens clocks cannot accurately measure aspheric surfaces. The change in curvature from the center to the edge is often subtle. The error for a 50mm sag gauge is quite significant and cannot be used for surfacing. The manufacturer's sag data should be used.

PATIENT BENEFITS

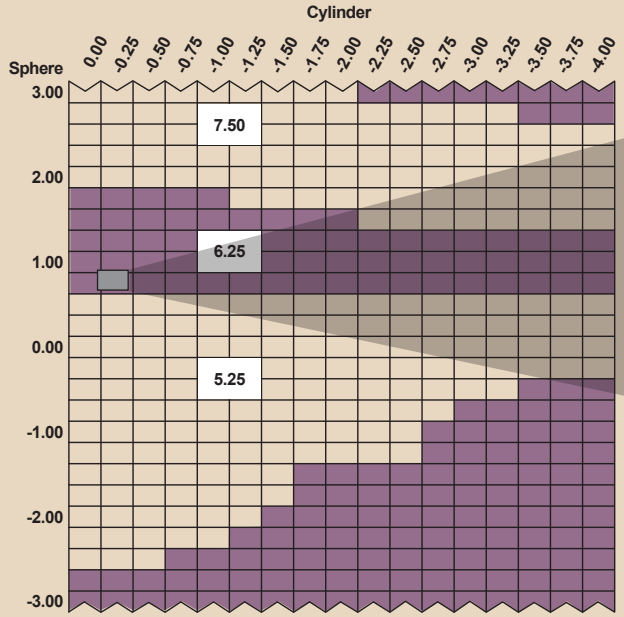
It's not always easy to explain the benefits of aspheric lenses to your patients. Tell them, "Aspheric lenses were designed to give you better vision and better looking lenses at the same time. As compared to old lens designs, the new lenses will be more comfortable because they will be lighter. They will also look better on you because they will be thinner and they will improve the way that your eyes look through the lens when people look at you."

MATCHING BASE CURVES

With advanced aspheric lens designs it is not possible for the laboratory to match a base curve. In advanced designs, the front curve is an integral part of the design of the optical system formed by the patients' eye and the new technology lens. It cannot be altered without serious visual consequences. As a result, many laboratories will not accept a request for a specific base curve on an aspheric lens.

SPHERICAL VS. ASPHERIC BASE CURVE SELECTIONS

Spherical Power Base Curve Selection



As you can see, a +0.75 -0.25 lens would call for a 6.25 base lens if a spherical lens where chosen, and a 4.25 base lens if an aspheric lens were chosen.

Aspheric Power Base Curve Selection