BIFOCAL CONTACT LENS

FIELD OF THE INVENTION

This invention relates to soft contact lenses, and, more particularly, to multifocal, soft contact lenses having specific areas for distance and near-vision correction and adapted to translate in a controlled vertical movement between the distance vision mode and the near vision mode.

BACKGROUND OF THE INVENTION

Multifocal contact lenses of the hard type have been available for a number of years, while soft multifocal lenses have been under investigation and development. Multifocal contact lenses, most usually bifocal lenses, are designed to correct presbyopia, a condition which develops with advancing age and causes the eye to lose its ability to focus at near distances such as the normal reading distance. Contact lenses designed to correct presbyopia are generally of two types designated as concentric and nonconcentric or segmented.

The concentric contact lens is characterized in that a material having a different refractive index than that of the principle material surrounds the geometric center of the lens in a generally concentric ring. Alternatively, a portion of the lens may be ground to a shorter focal length in a generally concentric pattern relative to the geometric center of the lens. The concentric contact lens is intended to remain centered on the cornea at all times. Distance vision is obtained through the center portion of the lens which may have a diameter of from 1 to about 4 mm. Near vision is obtained through the peripheral concentric portion of the lens. While a portion of the actual perceived image is always out of focus in such a bifocal lens, the user is generally able to mentally reject the out-of-focus portion of the image in favor of the in-focus portion.

The nonconcentric or segmented contact lens is generally characterized in that the near vision element having a different refractive index or ground to provide a shorter focal length, generally referred to as the bifocal segment of the lens, is located in the lower sector or portion of the lens away from the geometric center which comprises the distance vision portion of the lens. Most segmented contact lenses are intended to translate, i.e., move vertically relative to the pupil of, the eye when shifting between the distance vision mode and the near vision mode. Such lenses have an advantage in providing a greater proportion of in-focus image at both far and near distances, but have a disadvantage in that the lens must be designed for controlled translation and for maintaining translation and orientation during use.

Segmented bifocal lenses and other contact lenses which require a predetermined orientation on the eye, such as the toric lens which is intended to correct astigmatism, have commonly utilized two basic techniques to assure correct orientation. The lens may be provided with a base-down prism to increase the mass of the lower portion of the lens and create a weighting effect to orient the lens. The lens may also be provided with horizontal truncation or beveling along the lower and/or upper edges so that the combination of eyelid forces and scleral shaping effectively prevent the lens from rotating on the cornea.

It is an object of the present invention to provide a segmented, soft, multifocal contact lens of improved design. It is a further object to provide a soft, multifocal contact lens which is readily translated by the user in a controlled, vertical direction so that the pupil of the eye is presented with differing optical portions of the lens for distance vision and near vision. A still further object is to provide a multifocal contact lens which maintains its orientation and translation during normal use. It is a yet further object of this invention to provide a soft bifocal contact lens wherein the pupil of the eye is presented with a single, optical portion of the lens over at least 65% of its area in both near and distance visual modes.

SUMMARY

The multifocal contact lens of the present invention comprises a lens body of a conventional soft contact lens composition, having a generally spherical concave inner surface adapted to fit the cornea of an eye, a generally convex outer surface, and at least two optical zones having different focal lengths. The upper half of the lens is equiangularly truncated to provide a lens apex having a width of from about 2 to 8 mm, with the truncations extending to about the horizontal axis of the lens. An optical zone for distance vision is provided with at least a major portion thereof included within the upper half of the lens, while the lower half of the lens includes an optical zone of shorter focal length for near vision.

Truncation of the upper portion of the lens lowers the center of gravity of the lens and acts to stabilize the lens in its correct vertical orientation. Further ballast may be provided in the form of lens prism or an included weight near the lower edge of the lens to assure correct vertical orientation. In the case of a prism lens, the lower edge of the lens is beveled or otherwise contoured to control edge angle and to provide a surface which assists in effecting lens translation during use.

Lenses of the present invention are characterized by the ability to translate vertically up to 4 mm or more when the wearer shifts between far vision and near vision. This high degree of translation ability results primarily from the equiangular truncation of the upper half of the lens which reduces the forces normally acting to maintain centration of a soft contact lens on the cornea. Additionally, the truncated portion of the lens responds to the movement of the upper eyelid in a manner which assists in the vertical movement of the lens while simultaneously counteracting the usual tendency of a soft contact lens to rotate when displaced from a central position on the cornea.

The ability of the lens to translate vertically may be further enhanced by special treatment of the perimeter of the lens wherein the apex portion of the lens between the areas of truncation is provided with an edge on the ocular surface having a greater radius of curvature than the lower half portion of the lens to reduce angular contact of the apex portion against the sclera during vertical translation.

In a further embodiment, the upper portion of the lens is provided with a horizontal area of reduced thickness such as a surface channel in the area of truncation above the distance vision optical zone. The effect of this modification is to provide hinge-like means by which the apex portion of the lens is allowed to flex during vertical translation and thereby further reduce resistance to such translation.

The unique, equiangularly truncated lenses of the present invention may be bifocal or higher multifocal,