MONOCENTRIC BIFOCAL CORNEAL CONTACT LENS

BACKGROUND OF THE INVENTION

The present invention relates generally to corneal contact lenses and more particularly, to a bifocal corneal contact lens having a number of advantages and characteristics.

Corneal contact lenses, even bifocal contact lenses, have been known in the industry for many years. However, as with other finely engineered products, there is still room for improvement in such bifocal lenses; this situation has become particularly important with the advent of new compositions, especially gas permeable compositions, which hold out the promise of making bifocal contact lenses available to a wider range of the consuming public.

In particular, bifocal contact lenses of the prior art have suffered from several drawbacks. The first of these is that, in the case of most fused bifocal contact lenses, the near vision segment, which was embedded in the lens as a whole, was of a steeper or smaller radius curvature than that of the distant vision portion, thus inherently requiring the lens as a whole to be thicker than a one-piece counterpart lens. While this difficulty has been offset to a certain extent with the advent of more highly gas-permeable lens materials, the drawback still remains, namely, that since the near vision segment must be embedded in the lens as a whole, the thickness of the lens as a whole must exceed that of the near vision segment.

Another problem with prior art bifocal contact lenses has been the location of the segment line separating the near and distant vision segments from each other. In the customary one piece bifocal contact lens, the segment "line" is actually in the form of a surface or "shelf" which has several disadvantages in use.

Other one piece bifocal corneal contact lenses, particularly non-prismatic lenses, have suffered from a characteristically frequent failure of the desired upward translation of the lens relative to the cornea when the eye moves downward to the reading position. As a result, where the lens does not translate upwardly, it moves downwardly with the eye, and the line of sight does not desirably enter the near vision segment.

Another difficulty with bifocal contact lenses is the need, in almost all cases, to achieve proper lens orientation on the eye. For example, any bifocal other than a true concentric bifocal lens must be oriented in position in the eye, or the bifocal segment will not lie in the intended area as regards the line of sight of the wearer in its movement from distant to near vision positions. Thus, a properly designed bifocal segment is of little value if it does not reliably lie directly on the bottom of the cornea where downward eye movement during reading will cause the line of sight to move into the bifocal segment for close-up viewing.

In addition, problems of astigmatism are present in both single vision and bifocal lenses. A lens having astigmatic correction must orient in use on the eye, because astigmatism is manifested in different optical powers or different focal lengths along different meridians of the eye. If the grind of the lens matches the indicated correction along the various meridians of the eye, but the lens does not orient to the desired position, the astigmatic correction is of no value or may actually hinder vision. While a prism effect may be used with the lens of the present invention for orientation or for other reasons, the present invention provides a lens which will orient itself and which will provide easy upward translation in use on the eye without being prismatic.

In the prior art, orientation of a lens on the eye, both for astigmatic correction and/or bifocal use, has taken different forms. The most common form is that of cutting the lens as a prism wherein the bottom portion of the lens is of increased thickness relative to the top portion. This causes the lower half of the lens to be more massive and to orient by gravity into the desired position as the lens as a whole floats on the lachrymal fluid overlying the cornea of the eye. According to the invention, such a prism need not always be provided to achieve lens orientation on the eye.

In view of the shortcomings of prior art bifocal contact lenses, it is an object of the present invention to provide an improved bifocal contact lens.

Another object of the invention is to provide a method of manufacturing an improved bifocal contact lens.

A still further object of the invention is to provide a one-piece bifocal contact lens which is free from objectionable flare in use, especially when the user is facing a light source during use of the lens at night.

Another object of the invention is to provide a bifocal contact lens which is free from an objectionable, generally upwardly directed segment surface separating the near and distant vision segments of the lens.

Yet another object of the invention is to provide a bifocal contact lens wherein the segment line or surface separating the near and distant vision portions of the lens is non-existent or virtually non-existent at the lens center and wherein such surface, to the extent it does exist, is directed downwardly in use so as to avoid objectionable flare.

A further object of the invention is to provide a bifocal lens construction which is ideally adapted to provide a monocentric, no-jump, one-piece bifocal lens unit.

Still another object of the invention is to provide a method of manufacturing a one-piece bifocal contact lens wherein the segment line or surface may be made in the form of a straight line or in the form of a line or surface having generally straight margins and a curvilinear center portion lying below the optical center of the lens in the center portion of the lens only.

Another object of the invention is to provide a method of making a one-piece bifocal contact lens which includes forming a distant vision front surface on the lens blank by positioning the blank in a holder forming a part of a machine having a given axis of rotation rotating the holder and the lens blank about the machine axis while cutting the front surface portion of the blank with a tool swung about a tool pivot axis through an arc of a first radius to form a lens blank with a given optical center line, then positioning the blank so that its optical center line lies substantially perpendicular to the axis of machine rotation, and such that the radially outermost portion of the lens blank front surface is spaced from the machine center line axis by an amount equal to the intended radius of curvature of the near vision segment portion, positioning a cutting tool in a pivotable tool holder such that the tool point is spaced from the tool pivot axis by a distance equal to the intended radius of curvature of the bifocal segment front surface, and swinging the tool through an arc extending from a point