HIGH-MAGNIFICATION TELEPHOTO SPECTACLES FOR AGE-RELATED MACULAR DEGENERATION

This application is a continuation in part of Ser. No. 690,814 filed Apr. 23, 1991, now U.S. Pat. No. 5,088,809, which is a division of Ser. No. 141,482 filed Jan. 5, 1988, now U.S. Pat. No. 5,030,231.

FIELD OF THE INVENTION

This invention relates generally to an ophthalmic lens system and more particularly to a system which includes, in combination, telephoto spectacles and an intraocular lens having a negative lens portion.

BACKGROUND OF THE INVENTION

Macular degeneration, which is generally age-related, affects a central region of the retina known as the macula. Macular degeneration can lead to a gradual or rapid loss of vision to the level of 20/200 or less. It may affect, for example, only about ¼ to 4 square millimeters of the macula, thereby leaving 95 to 99 percent of the retina unaffected. Accordingly, central vision, such as for reading and watching television, can be lost while peripheral vision remains relatively intact.

Vision problems for the patient are compounded if macular degeneration is also accompanied by cataracts on the natural lens of the affected individual. One way of dealing with this compounded vision problem is disclosed in Donn et al U.S. Pat. No. 4,710,197. The disclosed approach is to replace the cataractic natural lens of the eye with a negative intraocular lens and to employ a single, positive lens element on a spectacle frame in combination with the intraocular lens (IOL). A positive or negative contact lens may also be used in this system to further correct the patient's vision.

Another approach is disclosed in grandparent Portney application Ser. No. 141,482 filed on Jan. 5, 1988, and entitled Teledioptric Lens System. This application is incorporated by reference herein. This latter approach is disclosed as employing an IOL with a negative IOL portion and bi-element spectacles serving as a positive lens to direct light toward the negative lens portion of the IOL. The bi-element spectacles are not telephoto, but when used with the negative IOL portion, a single telephoto lens system is provided.

Both of these approaches improve the compound vision problem referred to above. However, the contact lens-single spectacle lens combination disclosed in the Donn et al patent suffers from problems of maintaining alignment between the contact lens and the spectacle lens and other problems commonly associated with wearing of contact lenses. Also, for larger system magnification, e.g., greater than 3× for far vision and greater than 4.5× for near vision, the system of Ser. No. 141,482 requires a relatively large vertex distance, i.e., the spacing between the outer surface of the eye and the spectacle lens. This reduces the field of fixation, i.e., the maximum angle within which the eye can move and still see an object clearly and tends to make the spectacles less comfortable to wear and not aesthetically pleasing. The large vertex distance also tends to draw attention to the visual handicap of the wearer.

SUMMARY OF THE INVENTION

The present invention provides an ophthalmic lens system which generally overcomes the problems discussed above. The ophthalmic lens system of this invention includes an IOL and multiple element spectacles. For a given relatively high magnification, the vertex distance is substantially reduced as compared with the vertex distance necessary to accomplish that same magnification in the system of Ser. No. 141,482.

This invention can be embodied in an ophthalmic lens system which includes an IOL adapted for implantation in the eye and having a negative IOL portion and multiple-element spectacles which provide a positive lens system for directing light toward the negative lens portion. The positive lens system includes a positive lens and a negative lens, with the negative lens being located posteriorly of the positive lens.

By using a positive lens and a negative lens as part of spectacles rather than single or multiple positive lenses, the vertex distance can be reduced. Accordingly, high magnification with a wide field of fixation can be obtained at relatively short vertex distances.

The positive and negative lens may be the only refracting elements of the positive lens system of the spectacles or additional refracting elements may be provided, if desired. Because all of the external lenses of the positive lens system form a part of spectacles, the problem of alignment between a contact lens and a spectacle lens is avoided, and the other problems of wearing contact lenses are also eliminated.

Viewed from a different perspective, the spectacles include a telephoto lens system with the telephoto lens system including a plurality of lenses each having a power other than unity. The telephoto lens system refracts light similar to a single-element spectacle lens placed at a long vertex distance. By using the telephoto lens system, the usual advantages of spectacles can be obtained, and the vertex distance can be reduced.

A telephoto lens system is a lens system in which the focal length of the lens system is longer than the overall dimension of the lens system. With this invention, the IOL cooperates with the telephoto lens system of the spectacles to provide a second telephoto lens system. This double-telephoto lens system can be used to provide substantial magnification without requiring an excessive vertex distance.

Not only does the use of multiple element spectacles as described above provide for a relatively short vertex distance and a wider field of fixation at relatively high magnifications, but multiple-element spectacles have other advantages. For example, the lenses of multi-element spectacles can be made thinner and therefore possibly lighter than a single larger lens.

The positive and negative lens elements are preferably carried by a spectacle frame in axially spaced relationship. In a preferred construction, the axial spacing between the positive and negative lens elements can be adjusted without varying the vertex distance by which the negative lens is spaced from the eye. This axial adjustment enables the user to adjust the power of the telephoto lens system without adjusting the vertex distance between the negative or posterior lens and the eye.

Any correction for astigmatism is characteristically placed on the most posterior lens surface. By allowing the posterior lens to remain stationary, this astigmatism correction is not upset as it might be if the posterior lens were allowed to move axially.

The invention, together with additional features and advantages thereof, may best be understood by refer-