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CORNEAL PLASTIC CONTACT LENS WITH COLORED PERIPHERAL ZONE

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ABSTRACT OF THE DISCLOSURE

A corneal plastic contact lens having a transparent central zone and a colored peripheral zone formed with a multiplicity of spherical voids arranged along grain boundaries of the bonded granular material of which the peripheral zone consists, and much smaller than the grains. The lens is made from a rod-shaped blank obtained by curing a mixture of acrylic resin granules, coloring matter, and acrylic monomer about a rod of optically clear acrylic resin.

This invention relates to plastic contact lenses, particularly to a corneal contact lens having an iris portion differing in optical properties from the pupil portion, and to a method of making the lens.

A corneal contact lens has the approximate shape of a circular segment of a hollow sphere. The deviations from a precisely circular contour and from a uniform radius of curvature of the outer surface are normally small, and may be disregarded for the purpose of this discussion. The outer surface is continuously convex, that is, each element thereof is convex, and the inner surface is continuously concave. The substantially circular rim which connects the inner and outer surfaces is rounded to avoid injury to the eye, and the radius of curvature of the exposed rim in a plane through the optical axis of the lens is but a small fraction of the radii of curvature of the outer and inner lens faces.

Light incident on the lens rim is reflected within a transparent lens and into the pupil of the wearer in a pattern distinctly different from the normal path of light through the lens. Only few wearers of contact lenses of low dioptric power are disturbed by or even aware of the parasitic reflections from the lens rim. The reflections are a frequent source of annoyance when a contact lens of high positive refractive power compensates for aphakia.

An object of the invention is the provision of a corneal contact lens which eliminates or mitigates parasitic reflections from the lens rim into the pupil of the wearer.

According to a basic feature of this invention, the peripheral zone of the lens is colored or pigmented throughout its thickness, thereby blocking or impeding propagation of reflections from the rim toward the central portion of the lens which is optically homogeneous, and usually fully transparent and colorless.

The diameter of a corneal lens is normally about 10 millimeters, and the clear central zone in the lens of my invention is normally 4 to 5 millimeters in diameter. These dimensions may be modified somewhat under special conditions. A larger transparent center in the lens is sometimes desirable for cosmetic reasons, and a smaller center may be necessary for medical reasons to compensate for a deformed pupil of the wearer, for example, after a cataract operation.

It is known to provide corneal contact lenses with an opaque or almost opaque portion overlying the wearer's iris. The known lenses are made by laminating an annular colored disc over a body of clear plastic which constitutes the center of the lens and extends to the very rim. The known lenses cannot prevent the reflection of parasitic reflections from the rim into the wearer's pupil.

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They are relatively thick because all mechanical stresses must be carried by the clear portion alone to avoid delamination, and failure of the bond between the two components is not infrequent even with heavy and relatively rigid laminated lenses.

The contact lens of my invention is a unitary body of synthetic polymer resin whose peripheral zone has a substantially smaller light transmissivity than the central zone which is normally optically aligned with the wearer's pupil. The composition of each portion of the lens is microscopically uniform in the direction of lens thickness from one exposed face to the other.

Other features of my contact lens and the method of making the same will be readily apparent from consideration of the following specification relating to the annexed drawing in which:

FIG. 1 shows a contact lens of the invention in plan view;

FIG. 2 shows the lens of FIG. 1 in section on the line II—II; and

FIG. 3 illustrates a mold for making a lens blank in axial section.

Referring initially to FIGS. 1 and 2, there is seen a corneal contact lens having the usual meniscus shape bounded by an outer convex spherical surface **1**, and inner concave spherical surface **2**, and by a circular rim **3** which is rounded in the axially sectional view of FIG. 2 to a radius of curvature which is but a small fraction of the radii of curvature of the surfaces **1**, **2**.

The central portion **4** of the lens consists of clear acrylic polymer of optical quality. The annular peripheral lens portions consists mainly of colored acrylic resin **5** in which sections **6** of darker colored acrylic resin are embedded. As is evident from FIG. 2, the color is uniform through the thickness of the lens in the main peripheral portion **5** and in the darker section **6**. The latter are elongated from the rim **3** in a direction approximately toward the axis of the lens.

The preparation of a lens blank from which the lens of FIGS. 1 and 2 may be cut, ground, and polished in a conventional manner is illustrated in FIG. 3 which shows a mold consisting of a cylindrical sleeve **7** equipped with a bottom plug **8** and a top plug **9** movably inserted in the sleeve **7**. A central bore in the top plug **9** slidably receives a rod **10** of optical-quality acrylic resin, mainly polymethyl methacrylate, having a diameter of 4 to 5 millimeters, which extends through the mold cavity and abuts against the inner face of the bottom plug **8**. The remainder of the mold cavity is filled with a finely granular acrylic molding powder **11**.

The powder **11** is a staple article of commerce which is employed by dental technicians in the preparation of dental prostheses. It is sold together with a liquid mainly consisting of acrylic monomers, such as methyl methacrylate. The powder also contains a catalyst, or the oxidizing ingredient of a redox catalyst system whose reducing component is contained in the liquid monomer composition. When the powder and the liquid are mixed, the catalyst causes polymerization of the monomer. The American Dental Association maintains a list of Certified Dental Materials which includes acrylic compositions. The materials on that list which satisfy the above description are suitable for the purpose of my invention.

A dental acrylic material which has been used successfully in preparing contact lenses of this invention is sold under the trade name Permatone and is stated by the manufacturer to include cross-linking agents. A mixing rate of 3.5 parts powder to 1 part liquid by volume is recommended by the manufacturer, but I have found that this mixing ratio, while useful for general guidance, is not critical. The amount of monomer composition must be