

SILICONE CONTACT LENS WITH HYDROPHILIC SURFACE TREATMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of the copending application Ser. No. 517,096 filed Oct. 22, 1974 and now U.S. Pat. No. 3,959,105 issued May 25, 1976 which, in turn, is a continuation-in-part of the copending application Ser. No. 318,853 filed Dec. 27, 1972 and now abandoned.

BACKGROUND OF THE INVENTION

The invention relates generally to contact lenses.

Methods for making silicone elastomer-containing articles such as, for instance, contact lenses, hydrophilic are disclosed in applicants' prior applications Serial Nos. 318,853 and 517,096 which are commonly owned with the present application. With respect to the treatment of contact lenses, these methods basically involve subjecting the surfaces of a contact lens which contains or consists of a silicone elastomer to bombardment with charged particles, particularly ions, using a glow discharge. Application Ser. No. 517,096 is now U.S. Pat. No. 3,959,105 the disclosure of which is incorporated by reference herein.

In order to achieve optimum compatibility between such a silicone elastomer-containing contact lens and the user of the lens, the latter should be seated on the eye in such a manner that it can readily move on the eye. This is necessary since otherwise the edges of the lens may produce impressions in the eye by virtue of too firm a seating of the lens on the eye. The formation of such impressions in the eye is undesirable on physiological grounds. On the other hand, experiments have shown that the sliding of the lens on the cornea of the eye may cause a foreign body sensation to be produced when the concave side of the lens facing the cornea, and which side has been treated in accordance with applicants' above-referenced prior applications, is too strongly hydrophilic.

The same general considerations apply also to conventional contact lenses, that is, contact lenses which do not contain a silicone elastomer. Such contact lenses may also be made hydrophilic, for example, by chemical means such as disclosed in the German publication DT-OS 22 28 528 (corresponding to the U.S. application Serial No. 152,076 in the name of A. E. Barkdoll filed Nov. 16, 1971).

In addition to the above considerations, it must be taken into account that an important reason for providing a contact lens with a hydrophilic surface is to prevent soiling thereof by fatty substances liberated from the eyes. Thus, these substances, which are conveyed to the surface of the lens by the tear fluid, accumulate very rapidly on hydrophobic surfaces and will cause the lens, which is itself clear as glass, to become cloudy or opaque if the surface of the lens is hydrophobic.

The prior art has been unable to provide a contact lens which is capable of satisfactorily meeting the above requirements, that is, a contact lens which can readily move on the eye, which does not produce a foreign body sensation and which yet is not easily soiled. It is clear, therefore, that improvements in the state of the art are desirable.

SUMMARY OF THE INVENTION

It is, accordingly, a general object of the invention to provide a novel contact lens.

Another object of the invention is to provide a contact lens which enables the cloudiness or opacity described above to be substantially avoided and which, simultaneously, enables the foreign body sensation to be at least almost entirely eliminated.

These objects, as well as others which will become apparent as the description proceeds, are achieved in accordance with the invention. According to one aspect of the invention, there is provided a contact lens which comprises a body of transparent material having a concave surface portion adapted to face the cornea of an eye and a convex surface portion adapted to face the eyelid. At least the convex surface portion possesses hydrophilic characteristics and, in any event, the convex surface portion has a greater wettability than the concave surface portion. In other words, the contact angle for the convex surface portion always has a smaller value than that for the concave surface portion.

The difference between the contact angle for the convex surface portion or surface and that for the concave surface portion or surface should be about 5° at a minimum and, preferably, at least about 10°.

In accordance with the invention, the contact angle for the convex surface favorably does not exceed about 65° whereas the contact angle for the concave surface advantageously does not exceed about 75°. It is preferred when the contact angle for the convex surface is at least about 10° and when the contact angle for the concave surface is at least about 60°.

It is pointed out that the contact angles referred to herein are all as determined with distilled water.

A preferred embodiment of the invention contemplates for the material of the lens to comprise or consist essentially of a hydrophilic silicone elastomer. A particularly advantageous form of the contact lens is one wherein the lens includes a silicone elastomer or silicone rubber, and silicone dioxide as a filler. However, the invention is also applicable to contact lenses which are constituted by conventional lens materials such as, for example, polymethylmethacrylate or Plexiglass.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The single FIGURE is a greatly enlarged sectional view of one form of a contact lens in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention relates to a contact lens having at least one side or surface which possesses hydrophilic characteristics.

According to one aspect of the invention, as indicated previously, the lens is designed in such a manner that the convex outer side of the same which comes into contact with the eyelid possesses a higher degree of