

EXTENDED WEAR SOFT CONTACT LENSES

Essay

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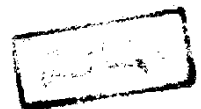
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A C K N O W L E D G E M E N T

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INTRODUCTION AND HISTORY

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The germ of the idea of contact lenses was conceived by Leonardo da Vinci about 1508 who suggested immersing the eye (or eyes) in a hollow glass bowl containing water to neutralize (eliminate the refractive power) the cornea. He developed the concept that the front of the contact lens replaces the optical power of the cornea. (Hofstetter and Graham, 1953).

In 1636, René Descartes (France) described a tube of water placed on the eye neutralizing the power of the human cornea and using the exposed end of the tube as the new optical surface (Lowther 1982).

In 1801, Thomas Young used the principle described by Descartes to study the principles of accommodation, astigmatism and refraction (Lowther, 1982).

In 1827, John Herschel (England) described how a glass contact lens could be ground to match the shape of the cornea to neutralize its power (Lowther 1982).

In 1888, A. Eugene Fick (Switzerland) described the first glass contact lens to be worn to correct vision. He experimented with both corneal and scleral lenses. He found the scleral lenses to be better supported and more comfortable. He designed the lenses based on molds taken of animal and cadaver eyes (Lowther 1982).

In 1888, E. Kalt (Germany) designed and fitted glass corneal contact lenses. The fitting of these lenses was based on measurements of the corneal curvature using an ophthalmometer (Lowther 1982).

In 1933, Dallos (Budapest) made the first contact lens by using prints from living eye which ~~does~~ not deform after its production (Dawoud, 1980).

In 1936, William Feinbloom (U.S.A) utilized a new synthetic plastic in the fabrication of contact lenses. He manufactured a scleral lens with a central optical portion made of glass while the surrounding portion was made of a translucent acrylic plastic. At about the same time the polymethylmethacrylate plastic (PMMA) was introduced in U.S.A (Lowther 1982).

In 1938, Mullen and Obrig (U.S.A.) constructed the first all plastic scleral contact lens (Lowther 1982).

In 1947, Norman Bier (England) designed a lens with a minimum clearance corneal fit which increased the wearing time and comfort of the lenses (Lowther 1982).

In the same year Kevin Touhy (U.S.A.) developed the first all-plastic corneal contact lens (Lowther 1982).

These lenses were eventually suitable of all day wear (Sabell 1980).

The work of Dallos (1946) and of Bier (1948) in developing the fenestrated scleral lenses allowed increasing the wearing time (Sabell 1980).

By the late 1950s, 75% of patients were able to achieve 12-16 hours of continuous daily wear with the multicurve hard corneal lenses (Sabell 1980).

In 1952, Wilhelm Sohnges (Germany) made the first micro-corneal lenses which permitted greater tear circulation over the cornea (Graham 1981) which is so important for the corneal epithelium (Taher 1973).

In 1960, Wichterle and Lim (Czechoslovakia) developed a new type of plastics, called "hydrogels". The most extensively used hydrogel is the hydrophilic polymer 2-hydroxy-ethylmethacrylate (HEMA), also known as glycol monomethacrylate, crossed-linked with a small amount (usually less than 3%) of ethylene glycol dimethacrylate. The structure of HEMA closely resembles that of PMMA except that the pendant OH group in HEMA gives it the ability to absorb water molecules which causes its swelling to a soft and supple state.

Many names have been given to the hydrophilic lenses, among which are the following : Gel contact lenses, Gel-Kontakt flexible lenses, Hydrogel contact lenses, hydragel contact lenses, Soflenses and Gelatin contact lenses (Hartstein, 1973).

In 1964, HEMA was introduced to U.S.A (Lowther 1982).

In 1971, the Soflen HEMA lens was approved by the U.S. Food and Drug Administration (F.D.A.) (Lowther 1982).

There are certain patients who cannot wear conventional daily wear contact lenses. Some of these patients can benefit from the extended wear contact lenses which are used increasingly nowadays.

Extended wear contact lens means placing a contact lens on the eye 24 hours a day for days, weeks, or months without removal. Stark et al., (1979) stated that it should be worn for more than 60 hours at a time.

The extended wear of contact lenses received a great deal of experimentation during 1970s. John De Carle (England) was the leader in this field with his high water content lens (Lowther 1982) made of Perfilcon A. Polymer (Lembach and Keates 1982).

Lenses for extended wear are usually designed to maximize the oxygen transmission. Other characteristics are typical of hydrogel lenses that are used for daytime wear (Mandell 1981).

Up till now, there have been a number of lenses that appear to have a capability for extended-wear:-

1. Hydrogel lenses

- * High water-content lenses, more than 70%.

Fig(1) shows that oxygen permeability increases with increased water uptake. For this reason, high water content lenses are often used for extended wear.

- * Ultra-thin lenses, less than 0.05 mm. central thickness.

Fig. (2) shows that some hydrogel lenses are also made very thin (0.04 to 0.08mm) to increase oxygen transmission.

2. Silicone lenses.

3. Gas permeable rigid lenses

- * Silicone-acrylate.
- * Silicone-resin. (Stein and Slatt 1984).

There are several types of continuous wear lenses, some of which are the following:

- * Sauflon 70 has high water content of 68% and high oxygen permeability.
- * Sauflon 85 has a higher water content, 79% and higher oxygen permeability. It is suitable for therapeutic uses usually or where a lens is desirable, but the patient is unable to handle it, because of infancy or old age.

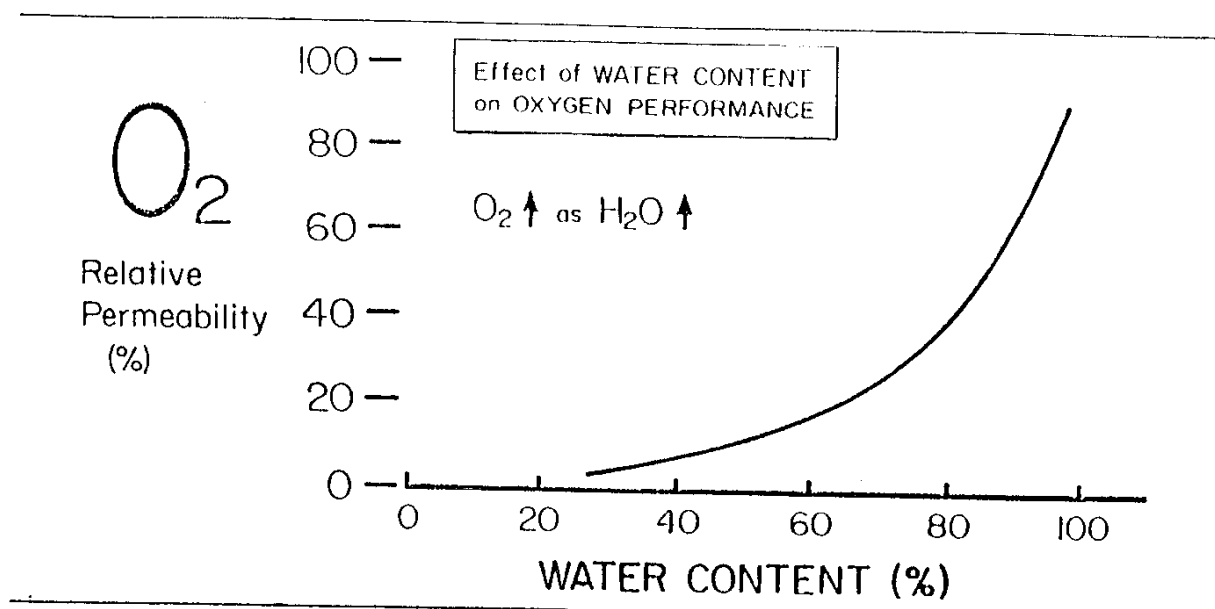


Figure 1: The effect of lens water content on oxygen performance. From Hill R.M. International Contact Lens Clinic, Vol 11, Number 3, P.191, Fig. 1 (1984).

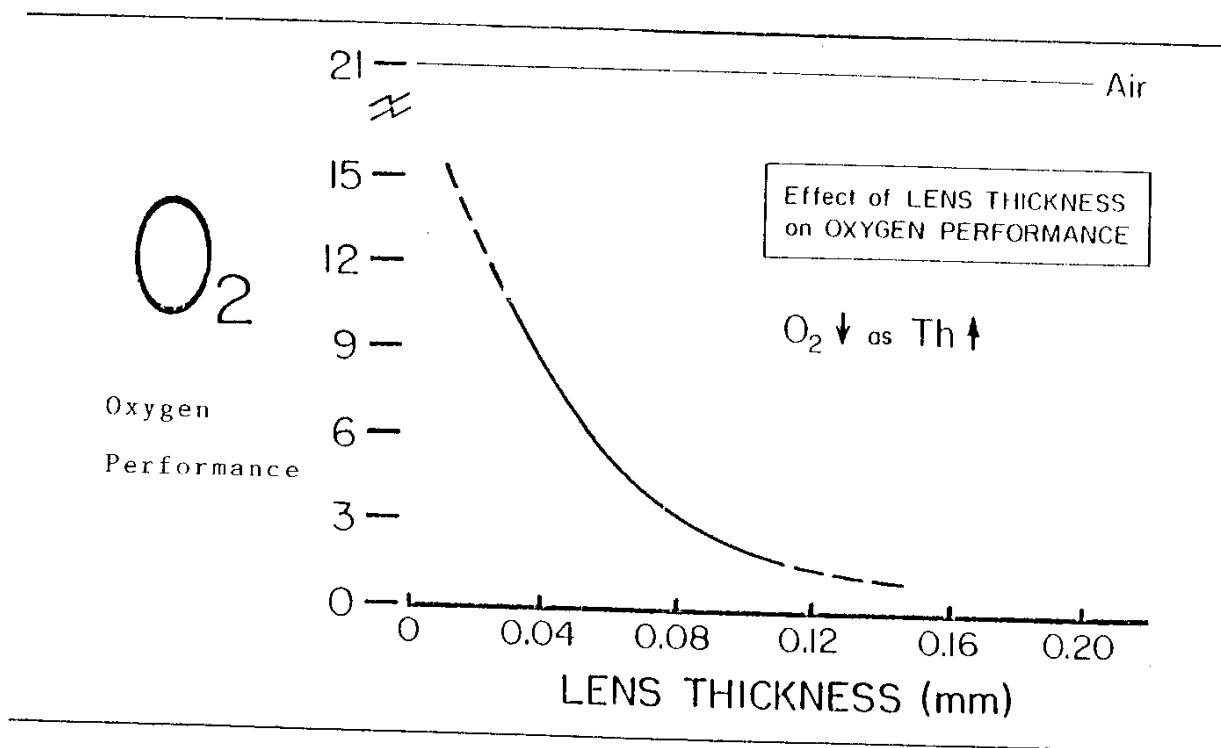


Figure 2: The effect of lens thickness on oxygen performance, using HEMA of 38.6% water content as an example. From Hill R.M. International Contact Lens Clinic, Vol 11, Number 3, P. 191, Fig.2,(1984).

- * Permalens is a similar material for continuous wear though its range of uses is restricted.
- * Duragel 75 contains less water content with high permeability and sufficient durability.
- * Hydrocurve 55% contains less water but is a very thin lens so has very high permeability (Abdel Rehim, 1978 a, b and 1979).

Abdel-Rehim (1979) reported the use of extended wear soft contact lenses for aphakia in Egypt.

The aim of this work is to review the literature in a trial to evaluate continuous wear soft contact lenses by discussing the following points :-

1. Indications of continuous wear soft lenses.
2. Advantages of continuous wear soft lenses.
3. Disadvantages of continuous wear soft lenses.

INDICATIONS
OF EXTENDED WEAR
SOFT CONTACT LENSES

INDICATIONS OF EXTENDED WEAR SOFT
CONTACT LENSES

In 1970 the hydrophilic contact lenses were introduced for bandage therapy and could be inserted for continuous wear to heal various corneal diseases. When this succeeded, the extended wear contact lenses were applied to aphakic patients, and now it is being introduced to patients with large refractive errors without pathology or previous surgery (Abel 1978).

Extended wear contact lenses are highly desirable for those who cannot handle daily wear contact lenses because of poor vision, age, tremors, deformity or lack of confidence or dexterity (Nesburn and Maguen 1982).

The indications of continuous wear soft contact lenses are classified as follows:

1. OPTICAL INDICATIONS

1. Aphakia:

- a. Unilateral
- b. Bilateral