INTRODUCTION
The most common reason patients seek ophthalmic care is to optimize visual acuity. Estimates suggest that about 50% of the population utilize some form of refractive correction, and the natural history of presbyopia indicates that virtually everyone, who lives long enough, will benefit from one form of optical correction or the other.

The use of contact lenses (CLs) to neutralize refractive error has lasted for over 100 years, but clinical success in the use of CLs for visual correction came much later. The original CLs were almost exclusively of large or haptic design, and all were made from glass. Feinbloom made a scleral CL with glass optics and a plastic carrier in the late 1930s, but the first practical plastic (polymethyl methacrylate or PMMA) CL was developed by Tuohy in the late 1940s. Hydrogel CLs were invented by Wichterle in the late 1950s. In the 1970s, after recognition of the role of corneal oxygenation in achieving physiological tolerance, hydrogel CLs with enhanced oxygen transmissibility and rigid gas permeable (RGP) CLs became available. These advances and other improvements in both materials and designs have resulted in CLs that are applicable for most forms of refractive errors and are both safe and effective for most patients.

A random sampling of some major C. L. Clinics in Nigeria suggests that approximately, out of about 100,000 (0.1%) Nigerians who use CLs, the vast majority (about 95%) wear hydrogel CLs.

The majority of complications encountered with daily wear CLs are manageable by discontinuing their use. Inconvenience, minor physiological and allergic problems and interruptions in wear are commonplace.

More severe, vision-threatening complications are rare. Hypoxia contributes most to the complications of CL wear. Minimization of extended or over night-wear along with attention to compliance in lens care reduces the risk of complications associated with CL wear.

DISCUSSION

CONTACT LENS WEAR AND THE OXYGEN ISSUE:
A REVIEW
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ABSTRACT
A review on contact lenses (CLs) and the importance of oxygen permeability (DK) and transmissibility (DK/L) in contact lens (CL) wear was undertaken. Motivation is a primary factor in determining a good candidate for CLs. Ocular consideration; systemic consideration and non-compliance of patients limit a patient's suitability for CL wear. The majority of complications encountered with CL wear are manageable by discontinuing their use. More severe, vision-threatening complications are rare. Hypoxia contributes most to the complications of CL wear. Minimization of extended or over night-wear along with attention to compliance in lens care reduces the risk of complications associated with CL wear.

KEYWORDS: Contact lenses, Oxygen transmissibility, Rigid gas permeable lenses, Hydrogel contact lenses
Contact lenses improve visual function by neutralizing ametropia, or minimizing distortion, especially when the patient suffers from more than a modest spherical refractive error or astigmatism. Myopic patients benefit from CLs, compared with their spectacle corrections. The reverse is true for both hyperopic and aphakic patients; however, such patients benefit from enhanced field of vision with CLs. For anisometropic patients, aniseikonia and prismatic effects may be reduced or eliminated with CL wear.

Although many patients with presbyopia wear CLs, presbyopia is not specifically an indication for CL correction. Presbyopic patients may wear distance CLs and use additional reading spectacles of various types to address their presbyopia. Most presbyopes often use mono-vision correction, in which one eye wears a CL to correct for distance vision and the other wears a CL to correct for near vision. Various bifocal CLs are available in either RGP or hydrogel materials.

Aphakia and binocular vision problems especially accommodate esotropia and convergence excess can be managed with the use of CLs. Rigid CLs can provide optically smooth anterior corneal surface made irregular by disease (example keratoconus or corneal microbial infection), trauma, or surgery (example penetrating keratoplasty or ineffective refractive surgery). Hydrogel lenses are used as ophthalmic bandages following corneal trauma or refractive surgery. Rigid CLs can be used to manage or reduce myopia. Correcting ametropia by placing a lens directly on the corneal surface improves cosmesis by eliminating the need for a spectacle frame and often-unattractive corrective ophthalmic lenses. Some patients elect to wear colored CLs simply to change the appearance of their eye color. Opaque CLs also may be used for their prosthetic effect (like, masking an unattractive corneal scar or damaged iris or providing an artificial pupil in the treatment of aniridia).

Some factors limit a patient's suitability for CL wear. These include ocular considerations, systemic considerations and noncompliance of patients.

CL wear should be approached cautiously with patients who present with any active anterior segment disease, especially ocular (or adnexial) inflammation, infection, or severe dry eye conditions, because of the possible increased risk of complications, especially corneal neovascularisation (NV) or infection. Such diseases include acne rosacea, Sjogren's syndrome, atopic dermatitis, corneal exposure, severe blepharitis, conjunctival cicatrization, neurotrophic keratitis, dacryocystitis, and patent filtering blebs. Therapeutic contact lenses are occasionally used as bandages.

Placing the lens directly in the precorneal tear film increases the risk of tissue compromise. CL use should therefore be approached cautiously for either the monocular patient (because of risk to the patient's only useful eye) or for the patient who is engaged in an avocation or vocation with exposure to a particularly dirty or dry environment. Such individuals may be advised to wear protective spectacles.

The patient’s inability to manipulate and care for CLs adequately should be handled with caution. Patients suffering from immunosuppressive disease (e.g. AIDS), rheumatoid arthritis, or diabetes, which may lead to insufficient lacrimation or increased risk for corneal NV and infection, should also be treated with caution. Practitioners should exercise caution and occasionally exercise restraint, when considering CL fitting for patients whom they know or suspect will not comply with appropriate CL care and general hygiene as to place themselves at increased risk for severe complications.

TYPES OF CONTACT LENSES

Contact lenses can be classified into two main broad categories: soft (hydrogel) and rigid contact lenses. These CLs are available in a wide variety of parameters for both spherical and spherocylindrical corrections. There are also several hybrid CL designs and materials.

Spherical hydrogel CLs are indicated for the correction of myopia and hyperopia when astigmatism is limited to less than 1.00 diopter. The U.S. Food and Drug Administration (FDA) has classified all hydrogen materials into four groups, which are believed to behave the same (way) chemically. Oxygen permeability (DK) of the hydrogel materials in all groups increases with water content. Oxygen transmissibility (DK/L) is lens specific, and therefore depends on both the
water content, the DK, and the thickness profile of the lens (L)\(^23-26\). Another type of hydrogel CL material, in which silicone (for enhanced DK) is blended with hydrogel material (for comfort), is also available\(^27\). Toric hydrogel lenses\(^28-30\) are indicated for patients who have astigmatism greater than 0.75D. Standard designs frequently correct astigmatism up to 8.00D of astigmatism. Toric hydrogel lenses are more expensive than the spherical designs, and may not provide universally stable visual results\(^31\).

Variable optical results and comfort levels may occur in patient’s who have insufficient tears with all types of hydrogel CLs, especially toric lenses. On the other hand, severe previous limbal desiccation at the 3 O’clock and 9 O’clock positions (3/9 O’clock staining) from the use of rigid CLs, with or without subsequent superficial neovascularisation, is an indication for fitting both spherical and toric hydrogel CLs in patients with adequate tears\(^32\).

Rigid CLs usually provide better visual results than do hydrogel CLs in situations of either regular or irregular astigmatism of the corneal surface. Insufficient tear will not affect the optics of rigid CLs (depends on the type specified or provide reference), but this condition increases the prevalence of both intolerance and some physiological complications in rigid CLs.

RGP materials are available in a wide range of powers \(O\_2\) permeability\(^33\), plastic hardness, wettability, and specific gravity, all of which affect lens design and positioning\(^34\). Usually the more \(O\_2\) permeable the plastic, the more fragile the finished lens. The more the fluorine silicone content of the CL material, the more wettable the CL\(^35\).

PMMA CLs are occasionally useful, although the practitioner must recognize that this material has virtually no oxygen permeability and that corneal metabolism is totally dependent on tear exchange through the tear pump mechanism. Concern about hypoxia in patients with corneal grafts or previous superficial pannus, possibly from the use of hydrogel CLs of optical power in excess of 10.00D is an indication for the use of RGP CLs\(^36\). Dusty environment poses more problems in RGPCL wear.

Scleral or haptic high DK RGP (or even PMMA) CLs can be used in the management of keratoconus or other therapeutic cases such as ocular cicatricial pemphigoid or Steven-Johnson syndrome.

Hybrid and silicone lenses combine aspects of both rigid and flexible lens materials producing lenses like the piggyback systems (wherein a rigid CL is worn over a hydrogel CL on one eye)\(^37-38\), non-hydrogel flexible materials (e.g. Silsoft\(^39\) and Softperm\(^40\)). Though not in common use such lenses are extremely helpful in rare cases of regular or irregular corneal astigmatism (including keratoconus) or aphakia.

**RGP LENSES VERSUS SOFT CONTACT LENSES AND THE OXYGEN ISSUE**

While RGP lenses are recommended in situations of high visual demand, durability, ease of care, extended wear, when cylinder error is greater than sphere, in with the-rule astigmatism and when there is poor visual acuity with soft lenses, the soft contact lenses are preferable in dusty environments, contact sports, occasional wear, sphere error greater than twice the cylinder, against the rule astigmatism and poor comfort with RGP.

About 33% of contact lens wear complications are attributable to hypoxia and therefore the oxygen transmissibility of a contact lens is probably the most important single parameter in terms of maintaining the physiologic integrity of the cornea.

This therefore calls for a need for review of the DK data. Benjamin\(^41\) has divided contact lens materials into the following five categories based on oxygen transmission:

- Low: (Dk/L<12);
- Medium (Dk/L=12-25);
- High (Dk/L=26-50);
- Super (Dk/L=51-80); and
- Hyper (Dk/L>80).

The water content of hydrogel lenses typically limits them to the low and medium oxygen groups, but the tear pump activity also plays a role. While rigid lenses exchange 10 to 20 percent of tears with the blink, the soft lens tear exchange as little as one percent. Smaller diameter of RGP also improves the oxygen availability to the cornea.

Bennett\(^24\) recommended that we should reserve: Low Dk/L materials for myopic daily wear only, Medium Dk/L for myopic and hyperopic daily wears, High Dk/L for myopic flexible wear or hyperopic daily wear, super Dk/L for myopic extended wear or hyperopic flexible wear and hyper Dk/L for myopic and hyperopic extended wear. These differences in the recommended wearing schedules of myopias and hyperopias is attributable to the differences in the edge and center thicknesses of the minus and plus lenses which brings about differences in their oxygen transmissibility. Increasing the Dk of RGP CLs is often accompanied by compromises in other lens properties vital to the clinical performance of the
material. High oxygen permeability has frequently been associated with poor surface wetting, increased lens deposit, greater lens flexure and dimensional instabily.

CONCLUSION

Individuals with refractive errors seek improved visual acuity to enhance their perception and enjoyment of the world. Contact lens, which is a good alternative for the majority of the patients who are motivated to using them. So many years of research and continual advances in contact lens technology have resulted in a good understanding of many of the biocompatibility issues.

Because these lenses float within the tear layer, in intimate contact with the anterior ocular surface, great care should be taken in the prescription and application of contact lenses, and in the supervision of patients who wear them. Infection remains a significant but rare complication of lens wear. Hypoxia appears to contribute most to the complications of contact lens wear. Minimization of extended or overnight wear along with attention to compliance in lens care also reduce the risk of complications associated with CL wear. The fitting objectives of CLs remain to maximize vision, maintain comfort, and minimize interference with corneal function and structure. RGP lenses in addition to providing the cornea with more oxygen are more durable, easier to handle, and require less care than do hydrogels.

REFERENCES