Oxygen Permeable Scleral Contact Lens

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Scleral lenses have evolved from glass lenses to lenses made from high Dk oxygen permeable materials. PMMA material replaced glass as the material of choice for scleral lenses in 1948. The advantage of PMMA over glass is that it is a much easier material to make lenses with than glass and modification is possible with ease.

Dallos and Bier in 1948 described how fenestration allows for the interchange of tears, resulting in an increase of lens wearing time to all day lens wear. To further assist with the exchange of tears, manufacturers made various modifications in the contact lens in the forms of vents and channels. As high DK oxygen permeable materials became available, it was logical to use them for scleral lens designs.

Donald Ezekiel first described the results of fitting 43 patients with gas permeable scleral lenses, that included traumatic, injured corneas, keratoconics, pediatric scleral lenses with a ptosis bar and protective lenses, at the Annual Meeting of the British Contact Lens Association at Harrogate in 1983.

Since that time the oxygen permeable scleral lens has become an accepted mode of treatment for serious contact lens practitioners for some of their patients otherwise deprived of the only optical device that would provide useful vision.

Although the oxygen permeable scleral contact lenses that we fit our patients is with fenestrations, there are scleral lens practitioners, such as Ken Pullen in

London and Perry Rosenthal in Boston, who fit oxygen permeable scleral contact lenses without fenestrations and achieve excellent results even with a scleral lens of some thickness.

Learning the fitting techniques and meeting the individual needs and design of each haptic lens is time consuming. It is not a volume sales product and therefore has not attracted the favour of large contact lens companies.

The advantages that a haptic lens offers over other lenses are well documented.

Ocular conditions that are especially suited for oxygen permeable scleral contact lenses include:

1) Advanced Keratoconus particularly those with a decentered cone.

2) Highly irregular cornea resulting from a) Trauma, b) corneal erosions

c) corneal dystrophies and d) corneal grafts that may have very marked irregular astigmatism.

3) Numerous pathological eyes.

4) Corneas that are disrupted, distorted or dry due to lid deformities may be protected with oxygen permeable scleral contact lenses.

5) For ptosis, a bar can be formed on the front surface to hold lids open.

6) Patients with lens handling problems when extended wear lenses would be appropriate.

7) Clear pupil, iris painted corrective oxygen permeable scleral contact lenses for patients with lost iris or large button hole iridectomy done or patients with aniridia.

8) Post LASIK problems

9) Pediatric uniocular aphakia.

10) With higher refractive errors, an oxygen permeable scleral contact lenses that combines a large front optic with lens stability will often give vision unequalled by any other lens. These and other indications have been described by haptic lens authorities like Bier & Marriott We use PMMA material for trial fitting till patient is comfortable wearing lenses for at least seven days for 4 hours daily wear; once satisfied we give oxygen permeable scleral contact lenses made up of FSA97 : poly

(fluorosilicone- acrylate w/ hydrophilic monomers) with Hardness (shore D):

D/81, Light Transmittance (>400 nm):> 95%T, Oxygen Permeability (Fatt Units, 32

C): 97 Colors: clear

Fitting is evaluated using FLOM technique as decribed by Bier, with a diagnostic lens that ensures full corneal

clearance. The radius and diameter of the scleral portion is chosen to give as even and large bearing zone over the sclera as possible. The overall size of the lens is large enough, but not so large to ride against the caruncle forcing the lens to move temporally when patient looks in the nasal direction, that results in nasal corneal touch. Similarly overall diameter should not be so wide that it rests against the lower cul-de- sac causing vertical displacement or discomfort on down gaze.

The fit of the scleral can be evaluated using white light. Any areas of excessive bearing will cause the blood to be forced from the conjunctival vessels causing this region to appear whiter than the surrounding conjunctiva this is called bleaching. By using diagnostic lenses on the eye with different scleral radii the lens that results in no bleaching gives proper radius.

The Corneal Fitting is evaluated using Fenestrated Lenses for Optical Measurement (FLOM) and florescein. The bubble formed between lens and eye is observed to determine correct corneal height or the back optic height. The correctness of the back optic curve and diameter is predetermined by its clearance, position and alignment.

Digital pressure test is performed to assess minimum corneal clearance of not less that 5-7/100 mm and not more that 10-12/100 mm.

Scleral lens completely clears the limbal area in all gaze. Scleral lenses will have three evenly positioned fenestrations placed within the transitional curve of the lens. Modifications can be done after the lens is ordered and tried on the patient's eye. Details required for gas permeable scleral lens order are Back Optic Radius / Back Optic Diameter / Scleral Radius / Scleral Diameter / Lens Power / FSA97 or PMMA.

The practical advantage of FSA97 oxygen permeable corneal lenses are a) A large lens can be fitted resulting in a more stable lens. B) The lens will not cause spectacle blur as PMMA usually will and thus it can be inferred, does not significantly disturb normal corneal function. C) The lens has much lower wetting angle and is therefore subjectively very much comfortable and more readily adapted to than a PMMA lens. It seemed a logical extension that these advantageous properties demonstrable with corneal lenses would also be beneficial to our haptic lens patients.

Woodward in his chapter on preformed scleral lens fitting techniques commented, "The advent of gas permeable haptic lens material could well increase the number of scleral lenses fitted".

There are two techniques for fitting a scleral lens 1) impression 2) preformed technique.

There are two variations of the preformed lens technique. These are lathe cut preformed lens and the type-shell method, described by the late Herman Tressman published in The Contact Lens Journal. Both the impression and type –shell method required the moulding of the material to manufacture the lens. Oxygen permeable materials are sensitive to heat and could not be moulded. Hence we use preformed technique. Fenestrated lenses gives more tear exchange and do not give suction effect like sealed lens. Three equidistant fenestrations ensures that one fenestration is always in the zone of palpebral fissure even if the lens rotates during eye blink.

So far we have fitted 21 eyes

Keratoconous – 14 eyes

Keratoplasty – 4 eyes

Pediatric aphakia –1eye

Pediatric penetrating injury with iris loss clear pupil with iris painted – 1eye

A lens fitted with no corneal clearances caused oedema and lens intolerance.

Patients complain of "sattlers veil" i.e. haloes around light and misty vision. This happens especially with PMMA lens material. It is found that FSA97 material can give comfortable vision even with less or no air bubble (minimum corneal clearance), also can be used on extended wear basis on guarded prognosis.

The number of visits to obtain a final lens fit varied from 3 to 7 visits.

Patients find comfortable wearing if lenses are soaked over night in the Flexilens GP MPS solutions. We are not sure whether the oxygen permeability or the low wetting angle of the FSA97 material is the reason why lens is so comfortable and acceptable for the eye. We suspect that both contribute.

Conclusion:

The FSA97 oxygen permeable scleral contact lens is advantageous for patients with compromised cornea.

For the practitioner the lens is very much easier and quicker to fit. For the patients the lens appears to be more comfortable and acceptable than PMMA scleral lens. These factors suggest that the scleral lens could once again play a role for those patients for whom it still remains the lens of choice.

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