Clinical & Experimental Optometry Research Lab

On-eye breakage by impacting object of mini-scleral contact lens without compromise for the ocular surface

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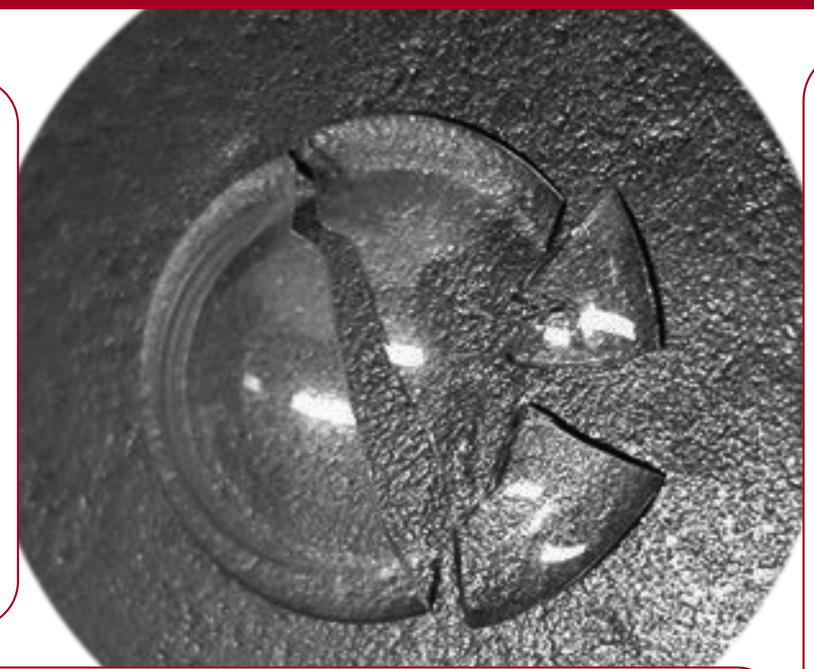
Background

The use of mini-scleral contact lenses (ScCL) for correction of irregular corneas and for ocular surface protection is widely reported in the literature. Their comfort and vision quality outcomes allowed to boost the indication range for ScCL to compensate moderate to high refractive errors in normal corneas. ScCL are now made of high oxygen permeability materials which promote a better physiological function minimizing corneal hypoxia. These materials have decreased hardness which is potentially related to the higher content of permeable monomers in the bulk of the material, which could hypothetically led to break more easily when compared to PMMA materials. When on-eye, ScCL are entirely supported by the conjunctiva and sclera outside the limbal area and form a thick liquid reservoir between the lens and the cornea, which acts as cushioning and protecting environment to the corneal surface. In the following case we report the *in situ* breakage and recovery of a 15.2 mm ScCL, which potentially acted as a protective shield to the cornea against the impact of a high-speed object while doing a mechanical repairing.



Case Description

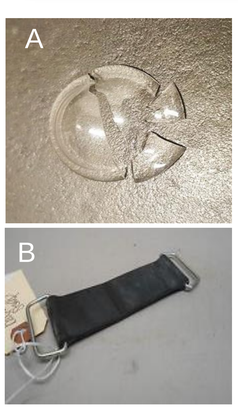


Figure 1. (A) All ScCL (15.2mm) fragments recovered by the patient. (B) object that impacted the eye, consisting of a black rubber band with two metal pieces

A Caucasian 24-year-old male with a refraction of +3.75DS -3.75DC x 10º right eye (RE) and S +3.75 =C -3.75 x 160º left eye (LE), participating in a clinical study with mini-scleral lens fitting reported the breakage of his right ScCL (Table 1) on eye during a motorbike maintenance. (Figure 1). The patient was bilaterally wearing 15.2mm ScCL manufactured from Procornea (Eerbeek, Netherlands). He reported eye redness and irritation that significantly decreased after all the pieces of the lens were recovered from the eye.

Table 1. Characteristics of the scleral contact lens.

Parameter	Value
Material	Boston XO (hexafocon A)
Dk	100 barrer
Central Thickness	400 µm
Power	+1.00 D (sphere)
Sagittal Depth	2.25 (3948 µm)
Refractive Index	1.425
Hardness	1.27
Density	81/112 (Shore/Rockwell)
Contact Angle	49

Ocular examinations showed absence of corneal damage other than a superficial punctate keratitis inferiorly and no fragments of the lens were found in the conjunctival sac (Figure 2).

Currently, the patient is wearing 15.2mm ScCL in both eyes on a regular basis (5 times per week, between 8 and 12 hours per day), reporting excellent comfort and vision (0.00 logMar). No other adverse events were reported since the described accident.

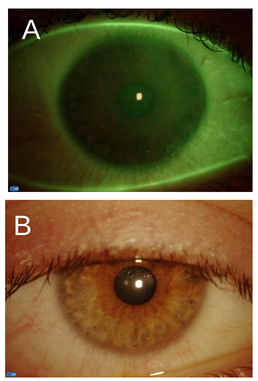


Figure 2. Injured eye 2 days after the accident: ocular examination showing abscence of corneal damage other than a superficial punctate keratitis (A) in the inferior-nasal area and inferior limbal redness (B)

Discussion

The evolution of rigid materials towards higher Dk values has resulted in a decrease in hardness and modulus values (Figure 3), so these materials will present a more elastic behavior when subjected to mechanical stress, which could be a beneficial aspect in absorbing the energy of an impact before breaking in pieces.

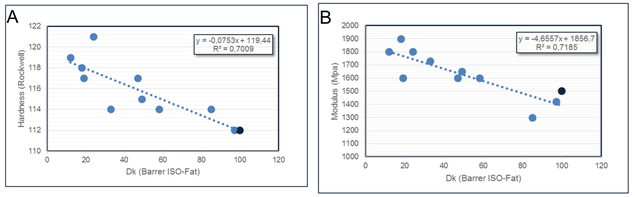


Figure 3. Changes in hardness (A) and modulus (B) of RGP Boston materials as Dk values increased. The Boston XO material is highlighted in a darker color. Values extracted from Boston Product Guide.

We hypothesize that the wide scleral supporting area and the tear film must act as cushioning elements absorbing part of the kinetic energy of the object, protecting the cornea. The potential protective barrier that ScCL could promote to the cornea and anterior segment was already described in the literature. However, ScCL couldn't be seen as a replacement of protective spectacle eyewear.

Conclusions

This case report shows that ScCL may have a protective effect to the corneal surface from the direct impact of a high-speed object. We hypothesized that the lens material, its wide supporting area and the tear film reservoir must have acted as cushioning elements that could both slow down the velocity, absorbing and distribute the kinetic energy of an impacting projectile.

This work has been recently published on Contact Lens & Anterior Eye

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