Contact Lens and Anterior Eye xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Contact Lens and Anterior Eye

journal homepage: www.elsevier.com/locate/clae

Case report

On-eye breakage and recovery of mini-scleral contact lens without compromise for the ocular surface

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ARTICLE INFO

Keywords:
Mini-scleral contact lens
Impacting object
Protection
Lens breakage

ABSTRACT

Purpose: To report the on-eye breakage of a mini-scleral contact lens in a healthy cornea after being hit by a speeding object, without causing any severe corneal damage.
Case report: A 24-year-old Caucasian male involved in a clinical study reported the in situ breakage of a mini-scleral contact lens during motorbike maintenance. The patient reported eye redness and irritation that significantly decreased after all the pieces of the lens were recovered from the eye. Ocular examinations within 48 h showed absence of corneal damage other than superficial punctate keratitis inferiorly and no fragments of the lens were found in the conjunctival sac. The patient was wearing a 15.2 mm mini-scleral lens in a high Dk material. The evolution of rigid materials towards higher Dk values has resulted in a decreased hardness and modulus values, so these materials are more elastic when subjected to mechanical stress, which could be a beneficial aspect in absorbing the energy of an impact before breaking in pieces.
Conclusion: This case report shows that ScCL could have a protective effect to the corneal surface from the direct impact of a high-speed object. Mechanical material properties, wide supporting area and post-lens tear volume acted as protective factors helping to absorb and distribute the kinetic energy of the impacting object.

1. Introduction

The role of mini-scleral and scleral contact lenses (ScCL) for correction of irregular corneas with a wide range of etiologies and for ocular protection in cases of ocular surface diseases has been widely reported in the literature [1–4]. The excellent comfort, vision quality, centration and on-eye stability promoted by ScCL fittings comprise a series of advantages over other kind of contact lenses (CL). [5,6] These are the main reasons why practitioners are now prescribing ScCL beyond irregular corneas, namely to correct moderate to high refractive errors in normal corneas, accounting over 10% of the total ScCL fits [7].

Some concerns about the long term effects of ScCL wear have been raised, and the risk/benefit ratio of fitting ScCL in normal corneas is not well established [8]. To minimize the potential risks, like hypoxic stress of the cornea[8], ScCL are made of high oxygen permeability polymers which promote a better oxygen availability minimizing the corneal hypoxia [9]. However, these materials with higher Dk have a decreased hardness which is potentially related with the higher content of permeable monomers in the bulk of the material. As consequence, modern ScCL could hypothetically break more easily compared to PMMA thicker designs. When on-eye, ScCLs are entirely supported by the conjunctiva and sclera outside the corneal and limbal area [5]. Compared to other kind of CLs, a relatively thick liquid reservoir is trapped between the lens and the cornea, acting as protecting environment to avoid direct contact with the ScCL.

The following case report shows a 15.2 mm mini-scleral lens potentially acting as a protective shield to the cornea against the impact of a high-speed object and the safety procedures followed to ensure the recovery of the contact lens fragments, ocular health assessment and hypothesizing on the mechanical behavior of the contact lens during the impact.

2. Case report

A 24-year-old Caucasian male with a refraction of S + 3.75 = C −3.75 × 10° right eye (RE) and S + 3.75 = C −3.75 × 160° left eye (LE), participating in a mini-scleral lens clinical study reported the breakage of his right ScCL on eye during motorbike maintenance. The patient was bilaterally wearing mini-ScCL manufactured from Procornea (Eerbeek, Netherlands): the lenses were dispensed the day before the incident, so the subject was wearing the lenses just for one day. The technical details of the contact lens are presented in Table 1.

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https://doi.org/10.1016/j.clae.2017.12.009
Received 18 July 2017; Received in revised form 12 November 2017; Accepted 1 December 2017

Table 1
Characteristics of the scleral contact lens.

Parameter	Value
Material	Boston XO (hexafocon A)
Dk	100 barrer
Central Thickness	400 µm
Diameter	15.2 mm
Back Optic Radius	8.20 mm
Power	+1.00 D (sphere)
Sagittal Depth	3948 microns
Refractive Index	1.425
Hardness	81/112 (Shore/Rockwell)
Density	1.27
Contact Angle	49

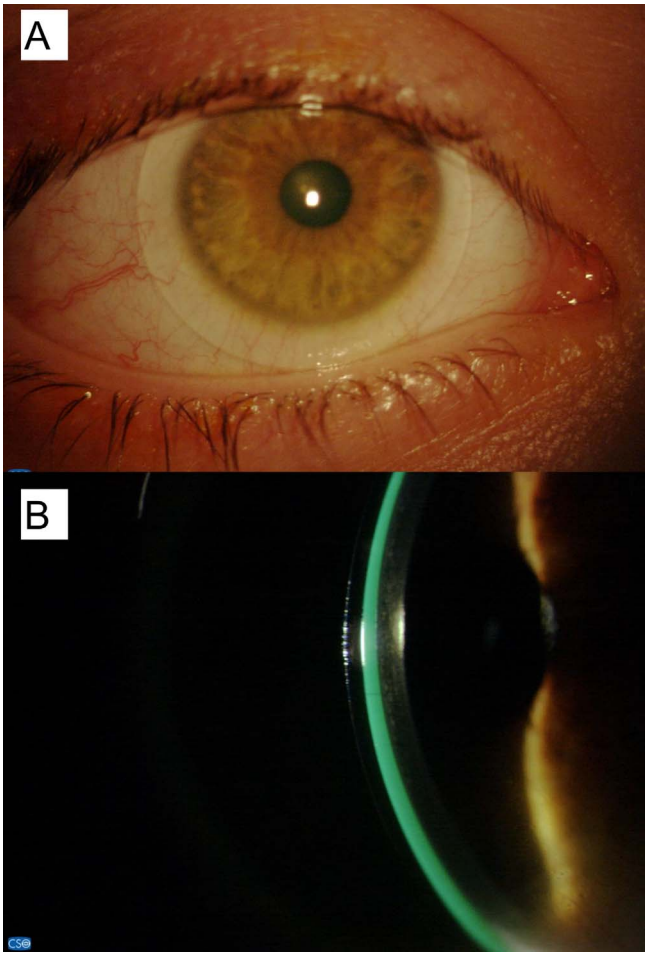

Fig. 1. Contact lens fitting at dispensing visit after 1 h of lens wear; (A) frontal view with absence of conjunctival blanching, (B) optical section with the slit lamp at central area at 16 x magnification.

The fitting of the contact lens on the dispensing visit is graphically presented in Fig. 1 depicting a central vault of approximately 370 µm after 30 min of lens wear (B). When first contacted the clinical investigator (R.A) he reported that 3 h before the lens broke after the impact of an object on his RE. The incident happened 6 h after ScCL application. He reported eye redness and irritation after the accident and confirmed to have recovered all pieces of the contact lens. He also reported a transient loss of vision after the impact what he attributed to the pieces of the contact lens floating on the eye. He further confirmed that vision was restored to normal levels and that discomfort was relieved after removal of all lens fragments.

Since the patient only contacted the clinical investigator on Friday night, 3 h after the incident and considering the relief of symptoms, normal visual perception, and patient's availability to attend the clinic, he was scheduled for a visit on Monday morning. The patient was also advised to report immediately in the event of worsening of vision, signs or symptoms and to go to a hospital emergency if necessary. Two days after the accident he showed no irritation or pain, while minor redness was persisting. Ocular examination showed absence of corneal damage other than superficial punctate keratitis in the inferior area (Fig. 2). It should be expected to see some conjunctival staining in the lens bearing points if the evaluation was done after the accident. However, since the patient was not wearing the lenses since the injury, the clinical investigator did not find any clinical differences in conjunctival health according to previous examinations. The ScCL was reconstructed from the pieces presented by the patient and apparently no fragments were observed (Fig. 3a), nor found in the conjunctival sacs.

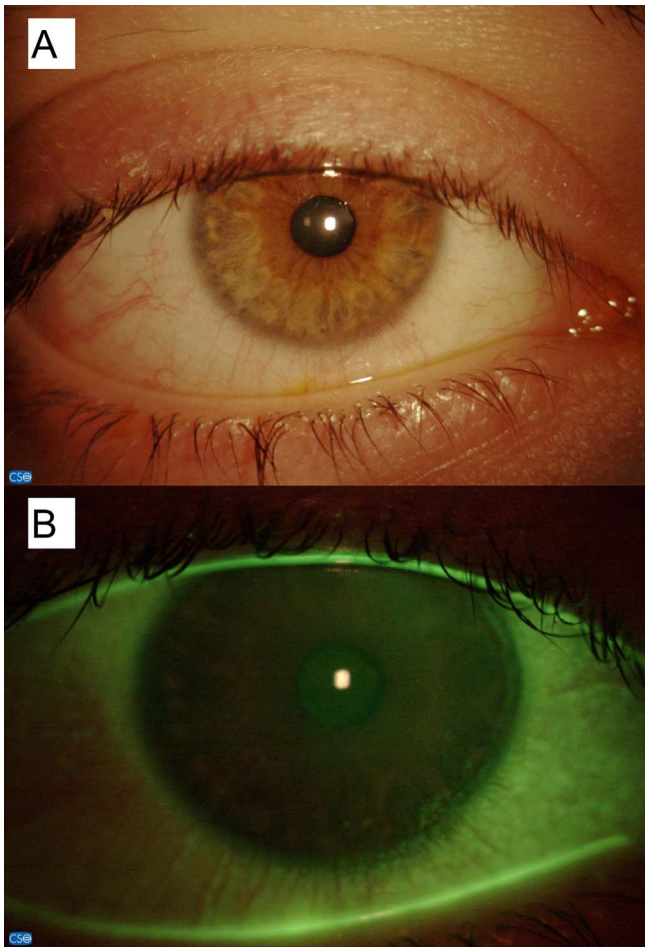

Fig. 2. Right eye of the subject 2 days after the accident; (A) increased redness in the inferior limbus, (B) positive fluorescein staining in the inferior area of the cornea.

By further investigating the accident, the object was determined to be a black rubber band with two metal square pieces attached to each end (Fig. 3b). The authors presume that one of the metal rings impacted the eye and lens when trying to pull the rubber band to fix a part of the motorbike he was repairing.

The scleral supporting area of the lens was estimated using Image J 1.51 (National Institutes of Health, Bethesda, Maryland, USA) image processing software. Considering that the cornea has 11.9 mm diameter (measured with IOL Master, Meditec, Jena, Germany) and the lens 15.2 mm and a band of 0.5 mm in width between the supporting area and the limbus, there is a 1.15 mm width supporting band representing an 50.75 mm^2 area. The same software was used to estimate the lens-cornea separation resulting in 370 µm separation, being quite uniform