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The use of anterior segment optical coherence tomography (AS-OCT) in the imaging diagnostics of intracorneal foreign bodies

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Abstract: Background: Eye injuries are a serious problem and may result in reduced visual acuity. The most common eye injuries include corneal damage, often involving the presence of a foreign body. OCT examination of the anterior segment — AS OCT — may be a valuable test in the diagnostics and follow-up of patients in whom the presence of a foreign body after eye trauma is suspected.
Case presentation: The authors present the case of a young man diagnosed with multiple, glass, intrastromal corneal foreign bodies. A 30-year-old patient visited an ophthalmologist a few days after an eye injury accompanied by the breaking of a glass object. Initially, only a non-penetrating corneal wound was diagnosed. During the examination, the ophthalmologist noticed a small shard of glass coming from the wound. The small glass foreign body was removed and the patient was advised to consult a center of higher reference. The patient reported to the Department of Ophthalmology and Ocular Oncology at Jagiellonian University Medical College in Kraków, Poland, 2 weeks after the injury. Slit lamp examination did not provide a clear answer as to the presence of glass fragments in the cornea. The wound was healed. The eyeball showed no signs of irritation. Anterior segment optical coherence tomography (AS-OCT) was performed, which revealed small pieces of glass. The patient did not consent to wound revision. The patient's follow-up lasted 4 years. During this time, no signs of post-traumatic eye irritation or corneal edema were observed, and visual acuity did not deteriorate.
Conclusions: AS-OCT examination enables accurate diagnosis of the presence and location of glass foreign bodies in the cornea. Glass, as an inert material, does not tend to cause inflammation of the cornea and anterior segment. The patient requires further regular ophthalmological follow-up.

Key words: foreign body, glass, cornea, AS-OCT, ocular trauma.

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Introduction

Ocular trauma is the cause of blindness in approximately 0.5–1.6 million people worldwide, and many more have suffered partial loss of sight [1–3]. The most common injuries include corneal damage, often with the presence of a foreign body [4–7]. A glass foreign body in the anterior segment of the eye may pose diagnostic difficulties due to its transparency and lack of reaction from the eye tissues. Small glass fragments may not be noticed with a cursory examination, but in some cases, even a thorough slit lamp examination may not provide a clear answer regarding the presence and location of the glass fragments. A thorough interview regarding the circumstances of the injury can provside us with certain information. However, the patient does not always remember all the details of the event well, which may make diagnosis even more difficult. Diagnosis may be facilitated by a non-invasive examination such as anterior segment OCT (AS-OCT) [8–10].

Case presentation

A 30-year-old patient visited an ophthalmologist a few days after an injury to the left eye, which was accompanied by the breaking of a glass object. Initially, only a non-penetrating corneal wound was diagnosed. During a follow-up examination, the ophthalmologist noticed a small shard of glass coming from the wound. The small glass foreign body was removed and the patient was advised to consult a center of higher reference to clarify whether there were still pieces of glass in the corneal structure. The patient reported to the Department of Ophthalmology and Ophthalmic Oncology in Krakow 2 weeks after the injury. He complained of slight deterioration of vision. The best corrected visual acuity of the right eye was 1.0 and best corrected visual acuity of the left eye was 0.5. Refraction examination showed high astigmatism in the left eye, reaching up to 8.5 D. Intraocular pressure was normal. Slit lamp examination did not provide a clear answer as to the presence, quantity and exact location of possible glass fragments in the cornea. The wound surface was healed. The eyeball showed signs of slight irritation. The fundus of the left eye showed no post-traumatic changes.

AS-OCT examination revealed the presence of intrastomal glass foreign bodies and enabled their precise localization. The interstromal glass foreign body is visible in AS-OCT picture as a hyporeflective area with well-defined margins (Fig. 1–3).

The patient did not consent to wound revision. During follow-up examinations, visual acuity gradually improved. At follow-up 2.5 months after the injury, the best corrected visual acuity was 1.0. Astigmatism decreased to 2.5 D. The improvement in visual acuity can be associated with the reduction of astigmatism. In the AS-OCT examination similar location and shape of the foreign body was seen (Fig. 4, 5).

A photograph of the anterior segment of the eye was also taken (Fig. 6).

At follow-up 6 months after the injury, astigmatism had further decreased and amounted to 1.25 D. Corrected visual acuity was 1.0 in both eyes. The lower part of the wound — the area without glass fragments, was more transparent. Examination of the corneal endothelium showed a symmetrical density of corneal endothelial cells — approximately 2,600 cells per 1 square mm, which proves the lack of influence of the presence of intrastomal foreign bodies on the endothelial layer.

In the AS-OCT examination similar location and shape of the foreign bodies was seen (Fig. 7).

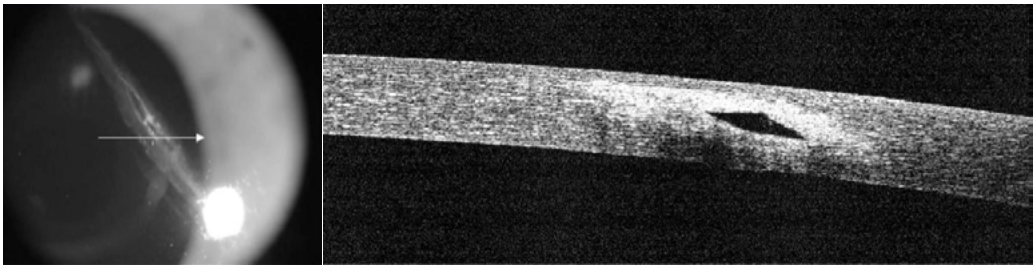

Fig. 1. AS-OCT CS-Line, projection across the wound. Examination 3 weeks after injury. The interstromal glass foreign body is visible as a hyporeflective area with well-defined margins.

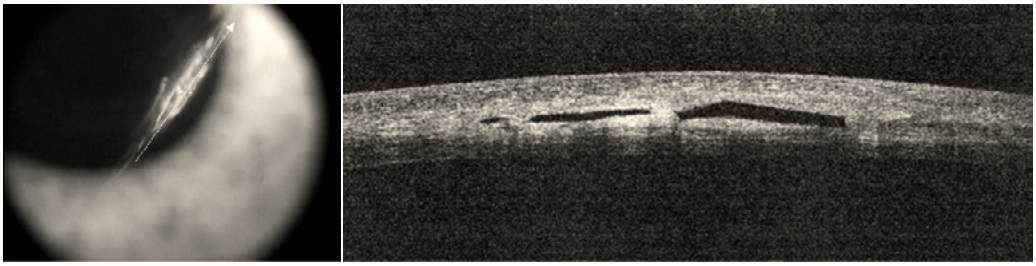

Fig. 2. AS-OCT CS-Line, Cornea — projection along the wound. Examination 3 weeks after injury. Several foreign bodies are visible.

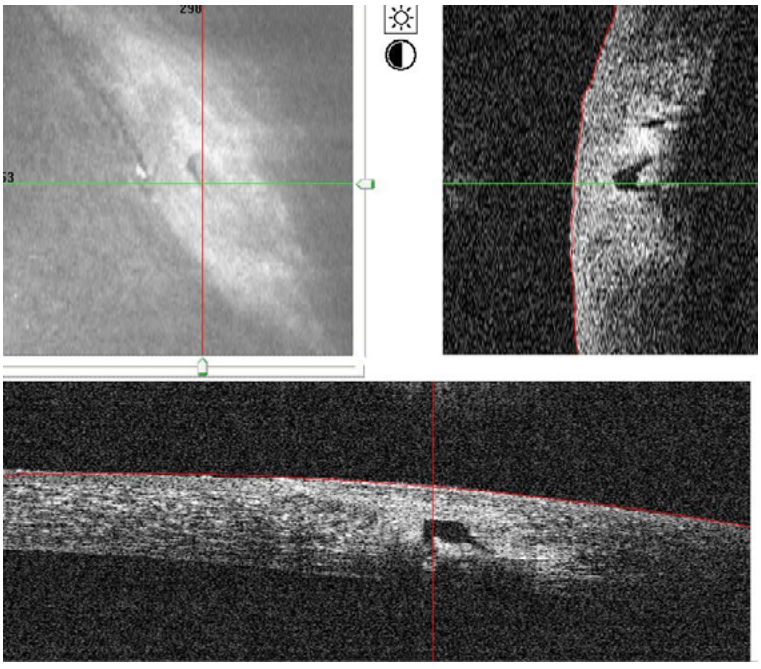

Fig. 3. AS-OCT CS 3D Cornea. Examination 3 weeks after injury.

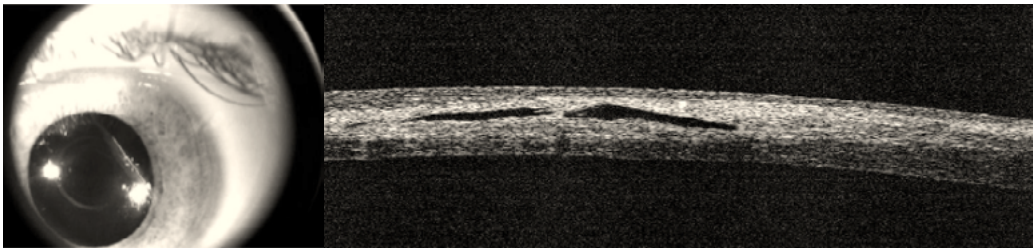

Fig. 4. AS-OCT CS-Line, Cornea — projection along the wound. Examination 2.5 month after injury.

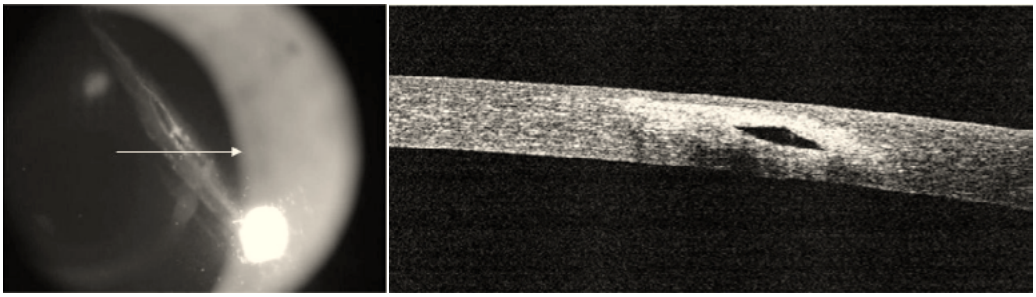

Fig. 5. AS-OCT CS-Line, Cornea — projection across the wound. Examination 2.5 month after injury.

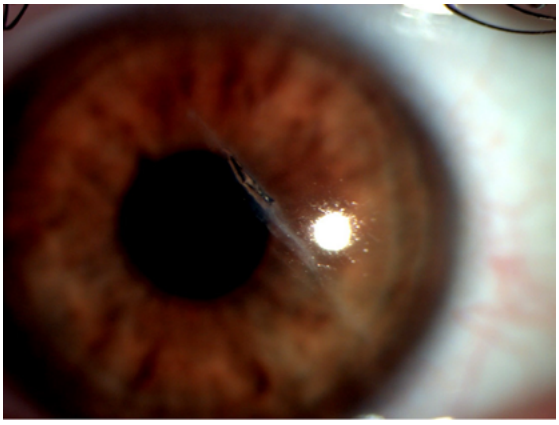

Fig. 6. Photograph of the anterior segment of the eye. Examination 2.5 months after injury.

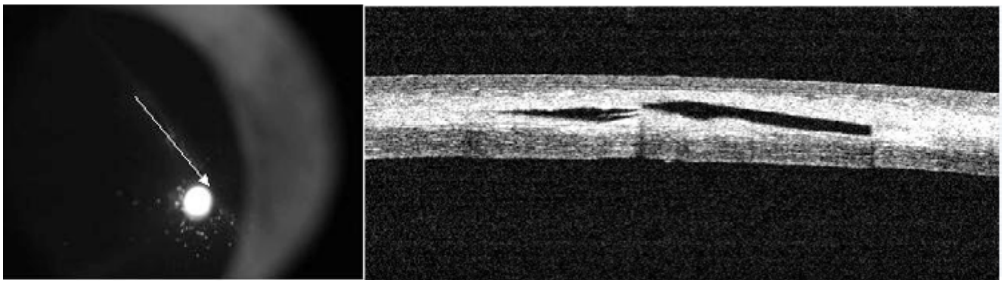

Fig. 7. AS-OCT CS-Line, Cornea — projection along the wound. Examination 6 months after injury.

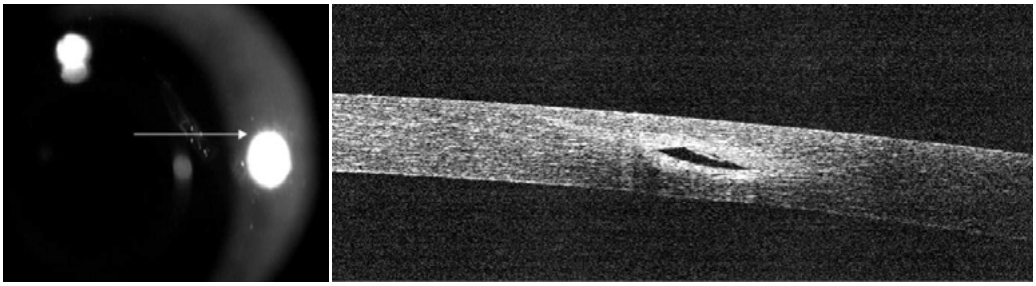

Fig. 8. AS-OCT CS-Line, Cornea — projection across the wound. Examination 4 years after injury.

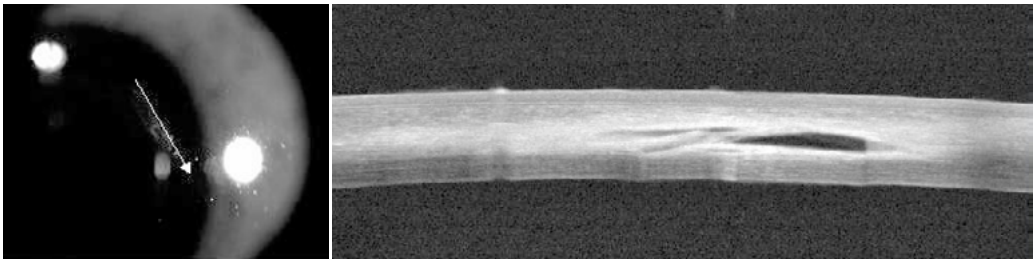

Fig. 9. AS-OCT CS-Line, Cornea — projection along the wound. Examination 4 years after the injury.

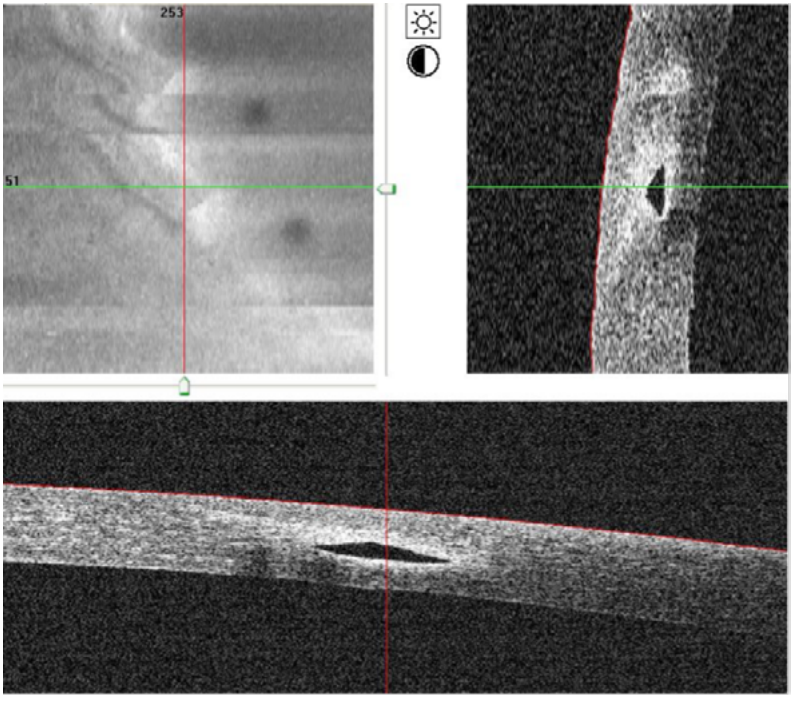

Fig. 10. AS-OCT CS 3D Cornea — projection across the wound. Examination 4 years after the injury.

The patient was followed up for 4 years. During the 4-year follow-up, the corrected visual acuity of the left eye remained at the level of 1.0. There were no symptoms of left eyeball irritation or corneal edema.

In the AS-OCT examination similar location and shape of the foreign bodies was still seen (Fig. 8–10).

The patient was advised to continue regular ophthalmological examinations.

Discussion

Glass foreign bodies are typically inert and, hence, do not elicit an inflammatory response; however, they can cause damage by mechanical irritation depending on the mobility and sharpness of the foreign body. There is paucity of literature on intracornealglass foreign bodies. Glass in the anterior chamber can result in endothelial cell damage and keratopathy [11]. In contrast, intra-stromal corneal glass foreign bodies are stationary and can be safety retained [12]. Peretz describes 4 years follow up of a retained intrastromal corneal glass foreign body in an infant, the glass foreign body has not migrated or cause inflammatory reaction [12]. However, if complications related to the presence of glass foreign bodies left in the eye are found, removal of them is required. There are few descriptions of late complications related to the movement of glass fragments in the literature. Miłkowski describes a case of spontaneous displacement of an intraocular glass foreign body 21 years after the injury [13]. Saar *et al.* describe the case of a patient with the presence of glass fragments in the vitreous body. 15 years after the injury, occurred edema of the cornea. This complication was caused by the migration of glass into the anterior chamber [14]. Jastaneiah describes corneal edema, that appeared 19 years after the injury, after which a glass foreign body was left in the corneal angle [11]. The problem when removing a deep foreign body from the cornea located near the visual axis (as in our case) is the need to place corneal sutures. Some authors describe alternative methods for removing such foreign bodies. Au describes the operation of a centrally and deeply located glass foreign body through an incision in the corneal limbus [15]. Teney describe removal of a glassy corneal foreign body using layered keratoplasty with a femtolaser [16].

Conclusion

AS-OCT examination enables accurate diagnosis of the presence and location of glass foreign bodies in the cornea. Glass, as an inert material, does not tend to cause inflammation of the cornea and anterior segment. The patient requires further regular ophthalmological follow-up.

Conflict of interest

None declared.

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