Sutureless lamellar keratoplasty with lenticule from small incision lenticule extraction for treating limbal dermoid: A case report

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Received November 5, 2022; Accepted August 15, 2023

DOI: 10.3892/etm.2023.12345

Abstract. The present study reports the case of a superficial limbal dermoid surgically treated without suture by using a new technique of lamellar keratoplasty with allogenic lenticule from small incision lenticule extraction. The limbal lesion area was circumscribed by a trephine marker and lamellae were peeled off the anterior corneal stroma and sclera. After excision of the dermoid, the liquid on the bed was dried as much as possible and an appropriate stromal lenticule was attached to the implant bed without fibrin glue or suture. A bandage contact lens was applied to fix the graft. During postoperative follow-ups, the anterior segment optical coherence tomography, corneal refractive power, corneal topography and best-corrected visual acuity were examined to evaluate the surgical results. On the first day after the operation, the patient reported tearing and pain at the site. At one week after the operation, the patient reported no discomfort and conjunctival sutures were removed. At one month after the operation, the thickness of the lesion area was similar to that of the adjacent cornea, and the corneal curvature and refractive power of the lesion area were higher than that of the adjacent cornea. At three months after the operation, the patient was satisfied with the cosmetic outcome and no sign of corneal neovascularization, graft rejection or pseudo-pterygium formation was observed. The astigmatic error remained at 2.50 D. The present case provides insights into a potential treatment option for patients who need lamellar keratoplasty and may provide its benefit in contrast to conventional lamellar keratoplasty.

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Key words: sutureless, lamellar keratoplasty, lenticule, limbal dermoid, small incision lenticule extraction

Introduction

Epibulbar dermoid is a common congenital tumor located on normal tissues (1). It contains tissues from various layers of the eye and skin, such as follicles, sweat glands and sebaceous glands, covered by epithelium (1). Most cases of epibulbar dermoid occur at the inferior-temporal part of the limbus. Occasionally, the lesions can involve the anterior chamber, lens, iris and ciliary body (2). If limbal epibulbar dermoid is combined with other diseases, such as auricle deformity, maxillofacial dysostosis or vertebral abnormality, it is known as Goldenhar's syndrome.

Epibulbar dermoid can cause astigmatism-related amblyopia, ocular surface disturbances as well as cosmetic concern in children (3). Management of epibulbar dermoid should consider age, tumor size, tumor depth, growth speed and psychological issues (1-4). Various surgical techniques were reported for the treatment of epibulbar dermoid, including simple excision for small dermoid (Grade I, <50 μm in thickness and <1 mm in diameter) and lamellar keratoplasty with corneoscleral graft for moderate dermoid (Grade II, <100 μm in thickness and <1 mm in diameter) (2,4,5). In other previous studies, new techniques were developed, including excision, grafts (6,7), amniotic membrane transplantation (8,9), mitomycin C (10) and fibrin glue-assisted lenticule (11). The aforementioned approaches are considered more convenient in terms of surgical complexity and associated complications. The present study reports on the case of a superficial limbal dermoid surgically treated without suture using a new technique of lamellar keratoplasty with an allogenic lenticule obtained by small incision lenticule extraction (SMILE). A novel surgical approach is thus introduced for treating dermoid cysts, utilizing post-operative SMILE lenticules without sutures, achieving satisfactory surgical outcomes.

Case report

Case. All procedures performed in the current study were approved by the Ethics Committee of Shanxi Aier Eye Hospital (Taiyuan, China; approval no. 2020QYSXAEYK01). A 20-year-old male patient had a whitish mass in his right eye since birth, which progressively grew. The patient was admitted into the Shanxi Aier Eye Hospital in July 2020 and

the surgery was performed the next day. Systemic examination showed that the patient had an auricular anomaly, a history of mandibular and facial plastic surgery (details unknown) and vertebral anomalies (Fig. 1). Ophthalmic examination revealed a solid, white and ovoid mass located at 6 to 8 o'clock below inferotemporal limbus of the right eye, and the lesion was ~7 mm in diameter and 200 μm in depth. The visual acuity test indicated that the best corrected visual acuity (BCVA) was 20/40 with astigmatic error -2.00 D ax 50. A mild limitation of movement was observed for the right eye when looking at the inferotemporal direction. Anterior segment optical coherence tomography (Visante OCT; Carl Zeiss Meditec, Inc.) revealed superficial corneal involvement by the tumor but no signs of anterior chamber invasion. Due to increasing astigmatic error and cosmetic concerns, the decision to perform surgical excision was made. The surgical procedure and possible postoperative complications were known to the patient and his legal representatives.

Surgical technique. Local anesthesia was achieved by subconjunctival injection of 0.3 ml lidocaine into the inferior fornix. The border of the limbal dermoid was marked using a 7 mm in diameter trephine and lamellar dissection of the corneal limbal dermoid was performed using a surgical knife. Following the complete excision of the dermoid, residual dermoid fibers were scraped from the corneal stroma using a 57 straight beaver blade knife. Subsequently, redundant liquid on the corneal stromal bed was absorbed with a cotton pad.

A fresh donor lenticule was obtained from a refractive patient who underwent SMILE. This refractive patient was negative for anti-HIV-1 and anti-HIV-2, as well as for hepatitis B and C viruses. The lenticule was 6.5 mm in diameter, its cap thickness was 129 μm and its periphery thickness was 20 μm. The lenticule was lied within the margins of the defects and the scleral part of the lenticule was carefully trimmed by scissors to keep the lenticule within the limbus. A 3x3 mm conjunctival flap was dissociated from the superior limbus, put on the defect area of the limbus and sclera, and then sutured with adjacent conjunctiva using a 10-0 nylon suture (Alcon, Inc.). Finally, no obvious bubbles or liquids were found at the interface between lenticule and stroma bed. A bandage contact lens (Bausch & Lomb, Inc.) was applied to the eye, and tobramycin and dexamethasone eye ointments (S.A. Alcon-Couvreur N.V.) were applied in the conjunctival sac. Then, the surgery was completed.

Postoperative medication and results. After surgery, the patient was given topical loteprednol etabonate ophthalmic suspension (Bausch & Lomb, Inc.) four times a day, deproteinized calf blood extract eye drop (Qixin Pharmaceutical Co., Ltd.) four times a day, and levofloxacin eye drop (Santen Pharmaceutical Co., Ltd.) four times a day.

On the first day after the operation, the patient reported somewhat tearing and pain. Slit-lamp examination showed mild conjunctival hyperemia, and the graft exhibited moderate edema (Grade 2, iris detail could not be recognized). BCVA was 30/40 (refractive correction, -2.75 Dcy ax 50). Corneal topography (OCULUS Pentacam®; OCULUS Optikgeräte GmbH) showed that the thickness of the lesion area was higher than that of the adjacent cornea and corneal curvature and refractive power of the lesion area was less than that of the adjacent cornea.

At 1 week after the operation, the patient reported no discomfort and conjunctival sutures were removed. Slit-lamp examination showed mild conjunctival hyperemia around the limbus of the graft. In addition, the graft showed mild edema (Grade 1, iris detail could be recognized) and corneal re-epithelization overlay the graft. BCVA was 30/40 (refractive correction, -2.50 Dcy ax 50). Anterior segment optical coherence tomography (AS-OCT) showed that the graft was tight and closed on the stroma bed. In addition, the thickness of the graft was from 238-279 μm and the total cornea thickness was from 590-636 μm (Fig. 2).

At 1 month after the operation, BCVA was 30/40 (refractive correction, -2.50 Dcy ax 50). AS-OCT showed that the thickness of the graft was from 95-192 μm and the total cornea thickness was from 483-536 μm (Fig. 2). Corneal topography showed that the thickness of lesion area was similar to that of the adjacent cornea, and corneal curvature and refractive power of the lesion area were higher than that of the adjacent cornea (Fig. 3).

At 3 months after operation, the patient was satisfied with the cosmetic outcome and no sign of corneal neovascularization, graft rejection or pseudo-pterygium formation was observed. The astigmatic error remained at 2.50D.

Discussion

Various techniques can be used to remove limbal dermoid, including simple lamellar dissection, reconstruction with lamellar corneoscleral graft, anterior corneal button from DSAEK donor tissue, pericardial patch graft and multilayered amniotic membrane graft (2,5-9). Additionally, recent advances in the use of fibrin glue in conjunction with amniotic membrane transplantation have significantly enhanced the application of tissue adhesives in ocular surface reconstruction (9). Simple excision and/or keratectomy of smaller lesions were shown to lead to pseudo-pterygium and conjunctival symblepharon formation due to surface tear fluid irregularities (12). At present, using dried preserved donated cornea for lamellar keratoplasty is the mostly used surgical procedure in China, due to a great lack of donation of cornea (13-15). Using donated intrastromal SMILE-extracted lenticule has been proven an alternative because it is fresh and easy to obtain (16). The present case report discussed a novel technique that had not been performed before.

The surgical suture was the worldwide most used method to secure grafts. Suture-related complications include astigmatism, corneal neovascularization and scar formation. Postoperative persistent eye abrasion, foreign body sensation and conjunctival hyperemia are also common. On the other hand, suture removal is another burden for children and doctors. The advantage of sutureless lamellar keratoplasty is reported to minimize these issues. The use of fibrin-glue with amniotic membrane or SMILE-extracted lenticule have been reported in recent years (9,11,17). Notably, the present authors achieved similar results without using fibrin-glue to fix graft. The reason may be that the interlayer liquid was removed as much as possible during the operation and this procedure generated hydrostatic pressure to adsorb the

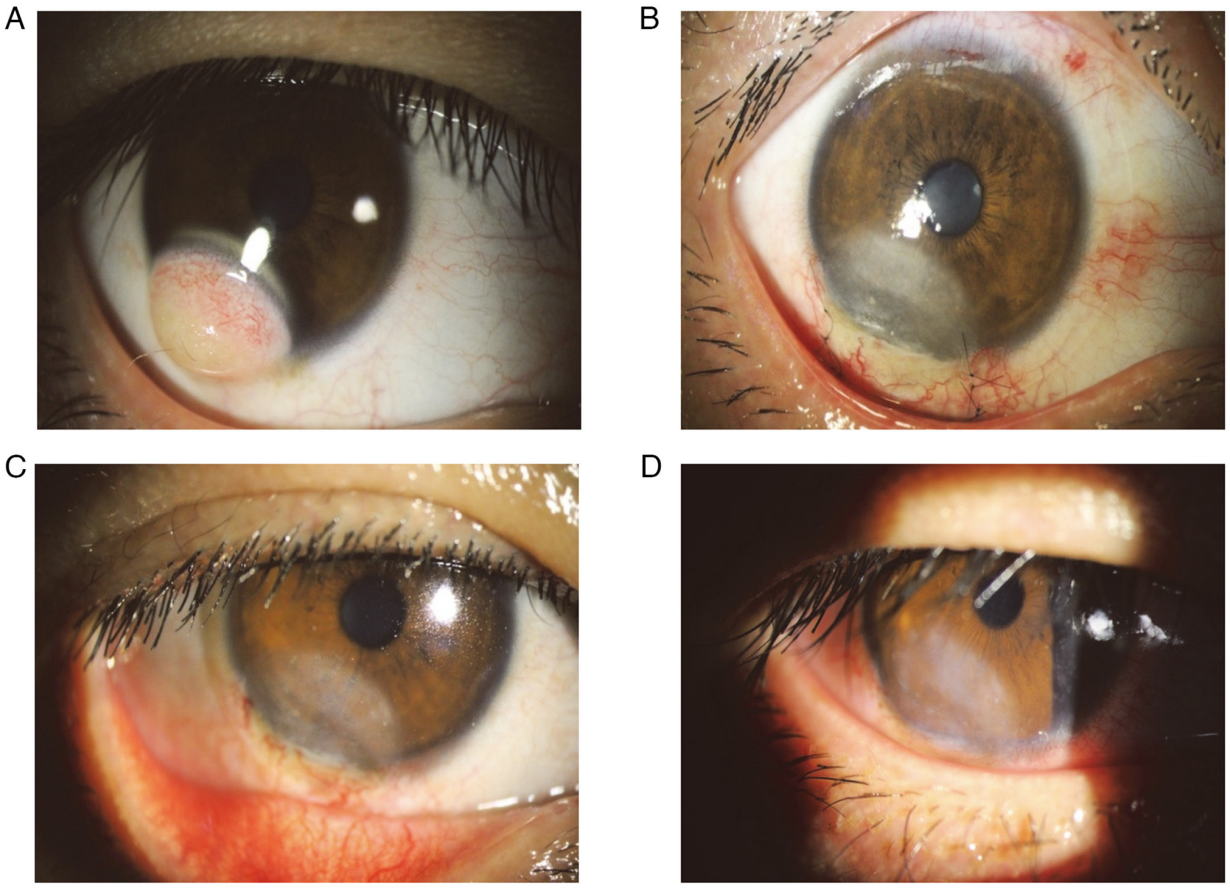

Figure 1. Slit-lamp photography of the patient's eye at different stages. Images from (A) before the operation, (B) on the first day after the operation, (C) on day 7 after the operation and (D) 1 month after the operation.

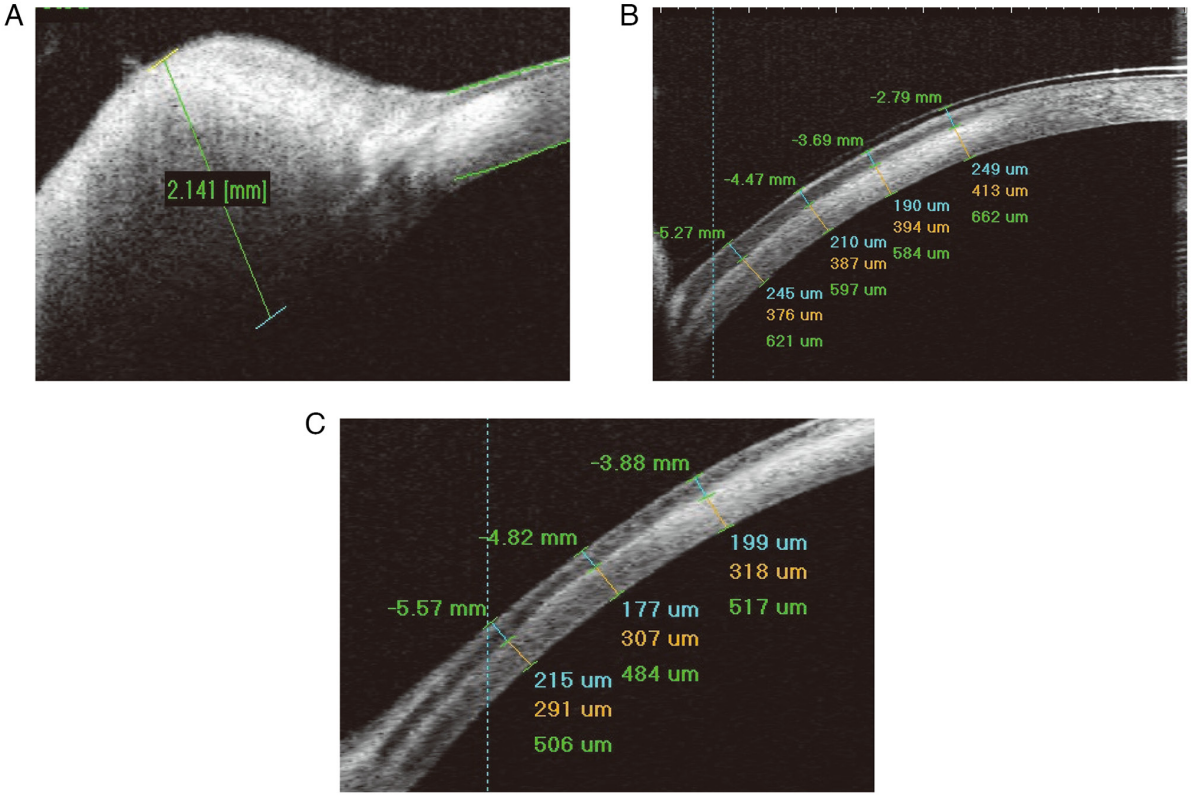

Figure 2. Anterior segment OCT images. (A) Thickness of the limbal dermoid before the operation was shown. The thickness of graft and total cornea was measured (B) on day 7 after the operation and (C) one month after the operation. OCT, optical coherence tomography.

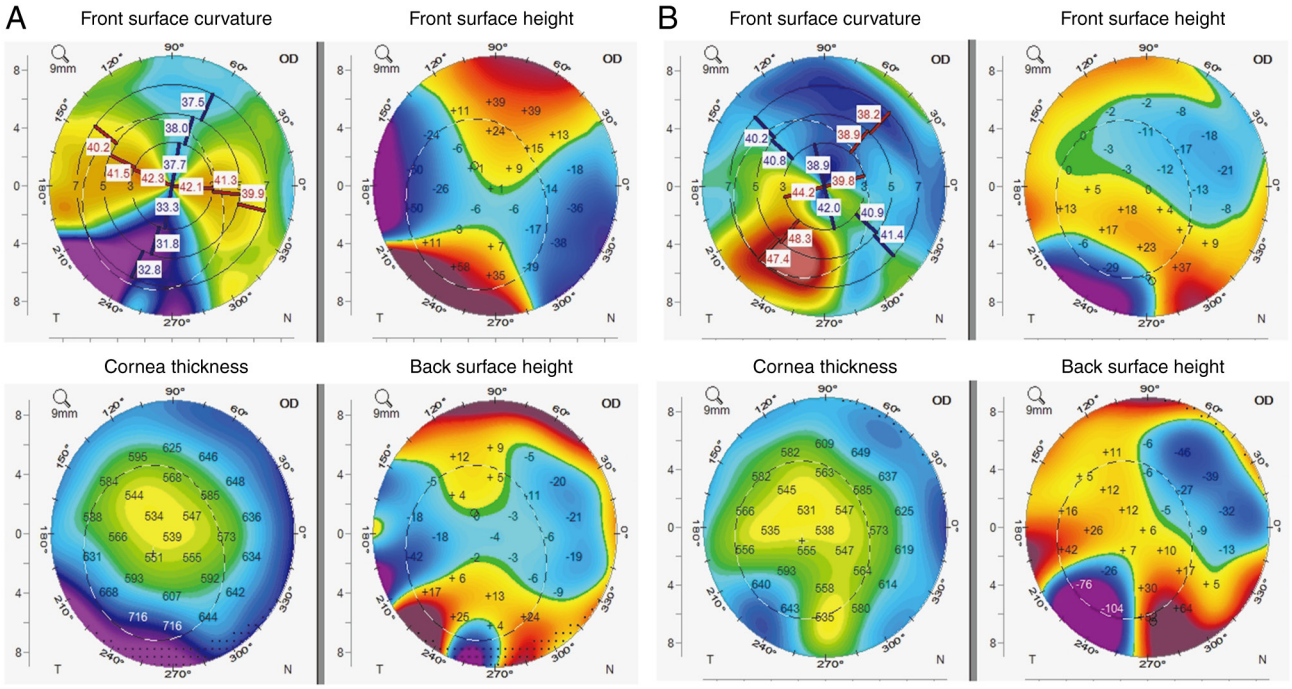

Figure 3. Corneal topography showing front surface curvature, front surface height, cornea thickness and back surface height. Images from (A) before and (B) 1 month after the operation.

graft on the stroma bed. Therefore, this technique is suitable for clinical applications in areas where fibrin glue is not available or too expensive. Moreover, the safety issue of fibrin glue cannot be ignored (18). Fiber glue production originates from human plasma and, due to contamination or low virus detection sensitivity, it may cause fiber glue to carry viruses and infect the host (18). Although the graft is fixed by a bandage lens and the corneal epithelium covers the graft 1 week after grafting, potential graft displacement needs to be taken seriously, especially in the early postoperative stage. Due to the rejection rate of LK ranging from 5-8% (19), very few cases will experience rejection after 1 year. Early dislocation of the implant may be due to normal blinking, squeezing, rubbing, etc., even with the protection of a bandage lens. After 1 week, the graft is covered by the corneal epithelium and the possibility of graft dislocation is relatively low but it can still occur after trauma. After 1 month, the possibility of dislocation is less due to fibrosis of the graft and the underlying implant bed. In this case, the use of hormonal eye drops was stopped within 3 months due to the stable condition of the eye surface. It is a common practice of the present authors to use hormones for 3-6 months after LK surgery. Although the graft was close to the corneal margin in this case, the graft area was small and relatively thin, and most rejection reactions occurred 1 week to 1 month after surgery. Most rejection reactions are recovered through local treatment. In addition, the patient's remote residence made follow-up inconvenient; therefore, hormone-based medication was stopped after 3 months post-surgery to avoid the side effects of long-term use of glucocorticoids, such as glaucoma and cataracts.

Amniotic membrane transplantation also shows an excellent surgical outcome in the treatment of limbal dermoid (8,9). However, unpredictable corneal scar or thinning after the dissolution of the amniotic membrane can enlarge the structural difference between the cornea in the lesion area and the normal cornea (20). The present case report described the changes in corneal thickness and corneal topography at different time points after the operation. These results will help surgeons to predict the outcomes of surgeries.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

YH contributed to the design of the study. BZ analyzed the data. TW performed data collection. XG designed the operation and prepared the manuscript. BZ and TW confirm the authenticity of all the raw data. All the authors read and approved the final version of the manuscript.

Ethics approval and consent to participate

All procedures performed in the current study were approved by the Ethics Committee of Shanxi Aier Eye Hospital (approval no. 2020QYSXAEYK01; Taiyuan, China).

Patient consent for publication

Written informed consent for the publication of any associated data and accompanying images was obtained from the patient and his father.

Competing interests

The authors declare that they have no competing interests.

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