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Mini-scleral lenses in the visual rehabilitation of patients after penetrating keratoplasty and deep lamellar anterior keratoplasty

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ABSTRACT

Objective: To evaluate fitting feasibility, efficacy, and safety of mini scleral contact lenses in correcting post corneal graft vision.

Methods: Prospective interventional case series, 56 visually unsatisfied post corneal graft eyes of 45 patients were fitted with miniscleral lenses (15.8 mm).

Keratometric values, UCVA and BSCVA, fit, best corrected vision with the lens, decision to order lens, comfortable daily wearing time (CDWT), contact lens handling issues, and contact lens related complications were documented.

Results: The mean age was 34.6 years (SD: 10.9), ranging from 8 to 63 years. Forty-three eyes had history of full thickness corneal graft, 12 eyes had deep anterior lamellar graft (DALK) and 1 eye had the rotational graft. The mean UCVA was 1.05 logMar (SD: 0.54), ranging from 0.30 to 2.52 logMar. The mean BSCVA was 0.73 logMar (SD: 0.50) ranging from 0.09 to 2.00 which improved to 0.17 logMar (SD: 0.19) with the miniscleral lens. All eyes had ideal (40 eyes) or acceptable (16 eyes) fits. Nineteen patients (23 eyes) ordered their lenses of whom 11 (14 eyes) continued using the lens with a mean follow up time of 21.92 months (SD: 6.8). These patients reported a mean CDWT of 9.62 h/day (SD: 4.5). Five eyes of 4 patients discontinued the lens. Four eyes were lost to follow-up. The main reported barriers for ordering the lenses were economic and handling concerns.

Conclusion: Miniscleral contact lenses can be considered helpful in the visual management of post corneal graft patients. Other factors may influence the acceptance of the lenses.

1. Introduction

Keratoplasty – either penetrating or lamellar [1–3] – has many indications which are mostly optical. In corneal scars, removing optical barriers is the only way to improve vision [4–7]. Management of highly irregular corneas such as advanced stages of keratoconus or repaired cornea after full thickness laceration is challenging with few options available other than keratoplasty [4,8–11]. Unfortunately, however, the unaided visual result of keratoplasty in a significant percentage of these patients is still far from satisfactory. Up to 4 diopter (and even more) astigmatism, both regular and irregular, is very common [1,12,13]. Although femtosecond laser assisted surgery seems promising [14,15], many post graft patients need some means other than spectacles to improve their vision [16,17]. Re-suturing, astigmatic keratotomy – either manual or femtosecond laser assisted, corneal inlays, toric IOLs, and keratorefractive surgery are surgical options that can be used for improving vision [16,18–24] but further surgical interventions are neither effective/feasible nor acceptable (at least from patients' point of view) in many cases.

Corneal RGP contact lenses have been used for correcting these refractive errors [17,25] which have proved effective in some patients and ineffective in others due to the high level of irregularity of the cornea or astigmatism; therefore, contact lenses with a special back surface design have been proposed [26,27]. Reverse geometry lenses are the most popular types of these lenses which should be used for flat corneas [28,29]. Considering the fact that the pattern of irregularity is not similar in these patients [25,30], and fitting procedure is time consuming and difficult, these types of contact lenses have not gained wide clinical acceptance.

Miniscleral GP lenses, with their potential to vault the whole cornea, have the ability to correct refractive errors and even many higher order aberrations resulting from the irregularity of the anterior surface of the cornea in challenging situations such as advanced keratoconic patients, post-Intacs patients, and post-penetrating

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keratoplasty patients [31–33]. Fitting of these lenses is relatively easy [32] and because of their large diameter (15–18 mm), they are very well centered in the eye and usually well tolerated. In this manuscript, we reported the results of miniscleral contact lenses for correcting unsatisfactory visual outcomes of post corneal graft patients. Tolerance and safety in those patients who continued to wear the lenses are also reported.

2. Methods

In this prospective interventional case series, 56 post corneal graft eyes of 45 visually unsatisfied patients who were referred to Farabi Eye Hospital Contact lens Clinic for contact lens fitting were fitted with miniscleral lenses.

The parameters of the trial set were as follows:

- Mini scleral design (MSD) (Blanchard Contact Lens Inc., Canada); non-fenestrated; diameter: 15.8 mm.
- Sagittal vault ranging from 3.80 mm to 5.60 mm; each in three different profiles (decreased, standard, and increased).
- Material: Boston XO DK/T: 100 (ISO/Fatt), 141 (gas to gas).

These patients had neither acceptable visual acuity with spectacles, nor could be fitted with corneal RGP lenses (diameter ranging from 9.30 to 11 mm).

The fit was assessed by a single contact lens practitioner experienced in this field after 5 min and then again after at least 30 min of wearing and was evaluated as:

- Ideal: no touch over the entire cornea in the fluorescine pattern viewed under a cobalt light, vaulting between 100–200 μm evaluated by a 30° oblique slit lamp beam (from the midline), no impingement over conjunctival vessels.
- Acceptable: no corneal touch and minimal scleral impingement, i.e. less than 3 h mild conjunctival impingement.
- Bad: corneal touch with maximum available sagittal vault and/or more than 3 h conjunctival impingement.

The patients with either ideal or acceptable fit were allowed to use the lenses for more than 1 h and were then inquired about subjective satisfaction. Then, the lens was prescribed for the patients with either ideal or acceptable fit. The patients who started wearing their lenses were followed regularly for CDWT, contact lens handling issues, visual acuity, and any subjective or objective contact lens related complication.

The recorded data was analyzed using SPSS version 16.0. For analysis, we used Mann Whitney *U* test to compare the average of the variables between DALK and full thickness graft groups. *P*-values less than 0.05 were considered statistically significant.

The study was approved by the Ethics Committee of Eye Research Center, Tehran University of Medical Sciences. As Miniscleral lenses are standard lenses for correcting highly irregular corneas, and we are reporting our routine practice pattern, there were no ethical issues to consider.

3. Results

Fifty-six eyes of 45 visually unsatisfied post corneal graft patients were fitted with miniscleral lenses. Twelve patients (17 eyes) were female and 33 patients (39 eyes) were male. Twenty-eight eyes were right eyes and 28 were left eyes (Fig. 1).

The mean age of the participants was 34. 6 years (SD: 10.9), ranging from 8 to 63 years. Demographic and keratometric data are summarized in Table 1.

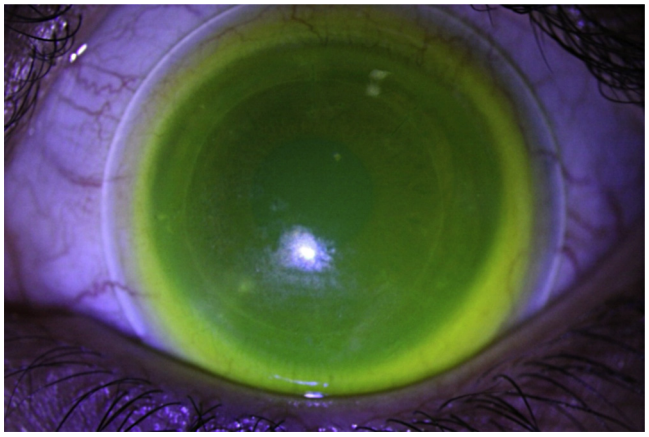

Fig. 1. Ideal miniscleral lens fit.

The background diseases leading to corneal graft were keratoconus in 36 patients (44 eyes), post Lasik ectasia in 4 patients (7 eyes), chemical burn in 2 patients (2 eyes), corneal scar due to repaired sharp penetrating trauma in 2 patients (2 eyes) and pellucid marginal degeneration in one patient (1 eye).

Forty-three eyes received full thickness corneal grafts, 12 eyes underwent deep anterior lamellar grafts (DALK), and one 8-year-old patient had a history of a rotational graft for displacing the dense scar of the visual axis (Fig. 2).

The mean uncorrected visual acuity (UCVA) was 1.05 logMar (SD: 0.54); which improved to 0.17 logMar (SD: 0.19) after MSD fitting (*P* value <0.001). The difference between two subgroups (full-thickness versus deep anterior lamellar graft) regarding in visual acuity improvement was not statistically significant. Table 1 shows more details on visual results. Table 2 summarizes fitting data based on the background.

All eyes had ideal (40 eyes) or acceptable (16 eyes) fits. The lenses were prescribed for all patients but only 19 patients (23 eyes) ordered their lenses. The three main reasons patients mentioned for refusing to order the lens were affordability, fear of difficult handling, and the long waiting period for receiving the ordered lens. The waiting period for receiving the lens is normally 2–3 months, but it raised to more than 6 months sometimes during this study due to economic sanctions. There was no significant difference in visual gain or fit assessment between those who ordered the lenses and those who refused to order.

Fourteen eyes of 11 patients continued wearing their lenses, which means a 25% success rate. The mean follow-up of these patients was 21.92 months (SD: 6.8).

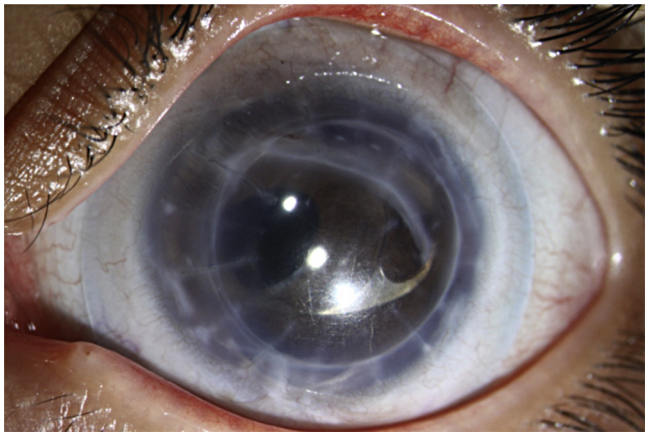

Fig. 2. Miniscleral lens on the eye with rotational graft.