

Innovative technique of mini-simple limbal epithelial transplantation in pediatric patients

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In this article, we introduce a modified technique of minor ipsilateral simple limbal epithelial transplantation (mini-SLET) in pediatric patients of limbal stem cell deficiency (LSCD). Two children with unilateral partial LSCD underwent the innovative technique of mini-SLET, where harvested limbal tissues were placed over the raw cornea and were covered with amniotic membrane. Both patients were followed till 9 months. Both cases showed favorable outcome and uneventful recovery. Results were comparable with the classical technique. This innovative modification of mini-SLET is safe, feasible, and an effective alternative with favorable visual outcome especially in pediatric population. It can be a breakthrough for LSCD management in developing countries with limited resources.

Key words: Limbal stem cell deficiency, sandwich technique, simple limbal epithelial transplantation

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Traditional minor ipsilateral simple limbal epithelial transplantation (mini-SLET) technique, pioneered by Sangwan *et al.*,^[1] comprises gluing limbal biopsy pieces over the amniotic membrane. Along with all complications of mini-SLET seen in adults, children exhibit an additional risk of displacement/dislodging of limbal pieces due to various causes. According to earlier studies, the success rate of classical mini-SLET among pediatric patients^[2] is truncated in comparison with adults.^[3,4] To circumvent all these complications, the surgeon innovated a modified technique of mini-SLET, especially for pediatric population.

Herewith, we report two cases of this novel mini-SLET technique making a significant breakthrough in the field of pediatric mini-SLET.

Surgical Technique

Case 1

A 6-year-old male child presented with a history of lime injury in left eye 8 months back. On ocular examination, the best-corrected visual acuity (BCVA) in his left eye was 20/120 with astigmatism of -3.5 D cylindrical at 70°. Slit-lamp examination showed partial LSCD with wet corneal surface. Superonasal symblepharon involving 2 O'clock of limbus was also noticed. Fundus examination was normal.

Case 2

A 7-year-old male child presented with history of lime injury in left eye 10 months back. On ocular examination, BCVA in his left eye was 20/200 with astigmatism of -4 D cylindrical at 65°. Slit-lamp examination showed partial LSCD with wet corneal surface [Fig. 1a]. Posterior segment examination was normal.

Both cases were planned for mini-SLET (left eye) under GA (general anesthesia), after complete anesthesia checkup. The right eye was cleaned and draped. The process of retrieving limbal biopsy from the right eye was similar to the classical SLET technique. A 3 mm area was marked in superior limbus of the right eye (donor eye). Conjunctiva was incised 2 mm posterior to the limbus and a subconjunctival dissection was done till 1 mm in clear cornea using a crescent blade. A 2 mm × 2 mm limbal tissue was excised using Vannas Scissors and forceps. The biopsy site was then covered with conjunctiva and glued. The left eye (recipient eye) was cleaned, draped, and a 360° peritomy was done. The cornea was freed of all vascular pannus by superficial keratectomy using the crescent blade [Fig. 2a]. The corneal surface was later smoothed properly and all the blood vessels were cauterized. The donor limbal tissue was divided into pieces using Vannas Scissors. The *vital/crucial* step of this novel technique was the placement of these limbal pieces directly over the raw cornea [Fig. 2b]

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and covering them with human amniotic membrane [Fig. 2c] instead of placing the limbal pieces over amniotic membrane as per the conventional mini-SLET technique. All the pieces were evenly sited over the involved part of the cornea (superiorly in the first case and nasally in the second case) and finally sealed with fibrin glue. Because only the involved/affected cornea was covered with limbal pieces instead of the complete cornea, this technique qualifies as mini-SLET. Stringent overhaul was taken to spare visual axis of these limbal tissues. Amniotic membrane was then carefully glued and tugged under conjunctiva in the periphery. Conjunctival autograft was placed at the site of symblepharon in addition to human amniotic membrane in Case 1. To conclude, the eye was patched after instillation of antibiotic drops. Postoperatively, topical moxifloxacin 0.5% eye drops were prescribed till epithelization in the left eye. Prednisolone acetate 1% eye drops six times a day were prescribed in both eyes with weekly tapering in the right eye (donor eye) and monthly tapering in the left eye (recipient eye) in both cases. Post-op follow-up was done at 1,

2, and 4 weeks and then monthly till 9 months. At 9 months post-op, visual acuity in the left eye was 20/20 with -0.5 D cylindrical at 85° in Case 1 and 20/40 with -0.75 D cylindrical at 115° in Case 2 [Fig. 1b].

Discussion

Limbal stem cell deficiency (LSCD) is characterized by the loss or damage of vital stem cell pool in limbus resulting in the compromise of homeostasis of cornea.^[5] LSCD can be classified as partial or total based on the extent of involvement. Due to the requirement of smaller limbal biopsy, simultaneous harvestation, and transplantation with no requirement of expensive lab facility, mini-SLET (simple limbal epithelial transplant) has replaced the conjunctival–limbal autograft (CLAU) and cultured limbal epithelial transplantation (CLET) as the most preferred technique for the management of LSCD.^[6] LSCD is more common in pediatric age-group than in adults, and SLET

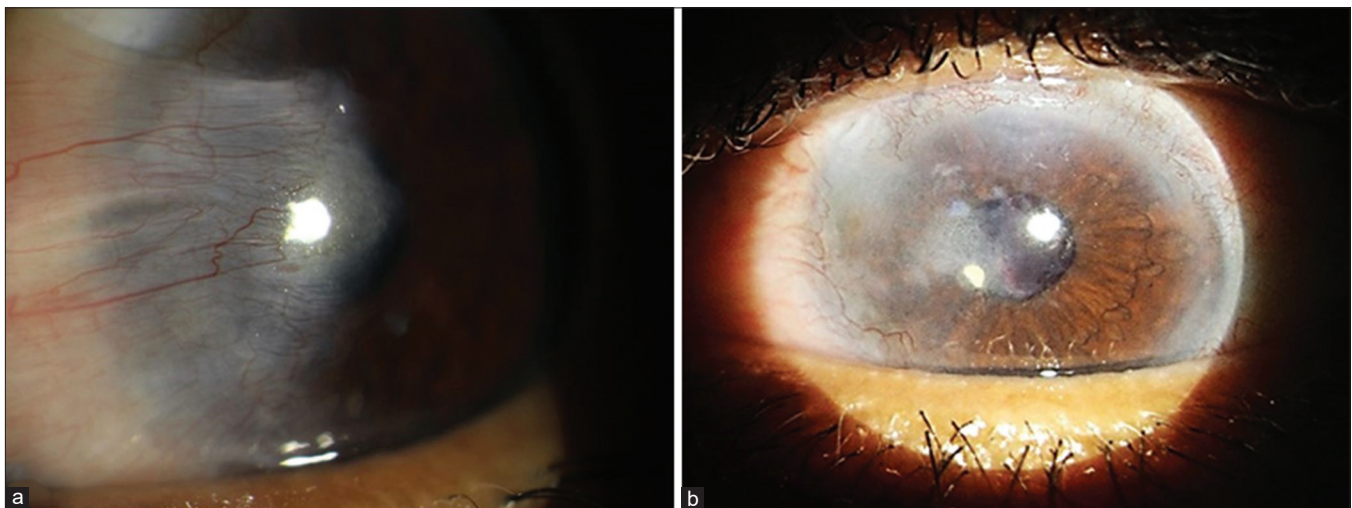


Figure 1: Preoperative photograph suggestive of partial conjunctivalization of cornea at the nasal aspect secondary to chemical injury in Case 2 (a). Postoperative photograph in same patient after modified technique of SLET with no recurrence of conjunctivalization of cornea at 9 month after surgery (b)

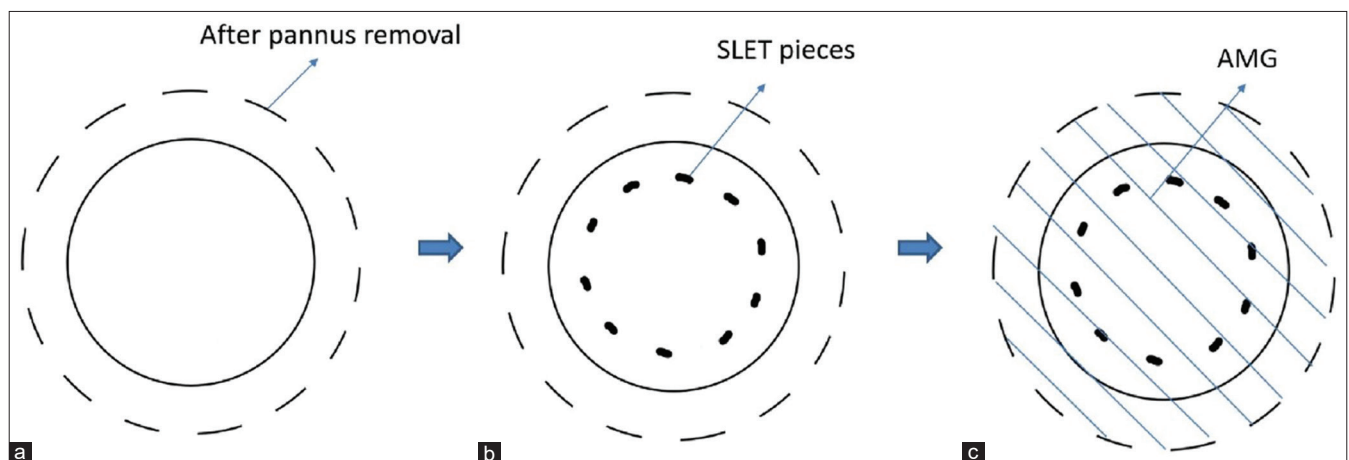


Figure 2: Schematic diagram (a-c) depicting the concept of the modified technique of SLET in children: (a) 360° peritomy with complete pannus removal from cornea. (b) Placement of limbal pieces directly over bare corneal after pannus removal. (c) Placement of amniotic membrane over the limbal pieces

is the best technique available with minimal complications. Complications of SLET includes focal recurrence of LSCD, conjunctivalization, symblepharon, keratitis, and dislodgment or loss of limbal pieces.^[7,8] Dislodgment or loss of limbal pieces and amniotic membrane are the more frequent causes of SLET failure in pediatric patients. In some studies, incidence of limbal pieces dislocation or displacement nears up to 5% to 7% in children. Unlike adults, children display a higher incidence of epithelial cell growth on contact lens^[9] along with a higher likelihood of Bandage Contact Lens (BCL) loss while playing. Both these aspects make BCL placement a less effective remedy for loss of explants in pediatric population and support the requirement of this novel technique in these patients. To reposition these pieces, pediatric patients have to undergo another OT (operation theater) session because it cannot be done in minor OT. This additional surgery predisposes them to all risk of GA along with supplementary expenses. Bearing in mind all these issues, the surgeon reviewed the literature and found a sandwich technique by Amescua *et al.*^[10] as a salvage technique. In the sandwich technique, a second amniotic membrane is used to cover limbal explants (in addition to the amniotic membrane below the limbal pieces) preventing their displacement. But this involves an additional expense of an amniotic membrane (around ₹2,500), which is not affordable for most of our clientele. To rectify all these complications, the surgeon incorporated a modified, rather novel, SLET technique in two pediatric partial LSCD cases. The surgeon placed the limbal pieces directly over the cornea and then roofed it with the amniotic membrane to avert their dislocation. Both these cases with novel intervention showed a favorable outcome with no additional negative consequences in terms of both surgical complications and financial burden. This technique is different from the mini-SLET technique used earlier by Hernández-Bogantes *et al.*^[11] as they had incorporated the sandwich technique of mini-SLET in pterygium cases.

There is no literature citing this technique as per our knowledge, and it can be a revolution in field of LSCD management in the pediatric population. This technique also indicates that limbal cells are capable of growing on raw cornea with almost similar outcome as with the amniotic membrane. It is especially a groundbreaking technique for developing countries where socioeconomic status causes higher incidence of LSCD and subsequently higher risk of displacement of limbal pieces in pediatric patients. In developing countries, the major clientele is from the middle class or lower class, and any extra expense is a massive burden in itself.

Conclusion

This modified SLET technique can be a leading light of exploration in field of LSCD management, especially in children, which is of utmost significance in developing countries with restricted resources and not-so-rich clientele.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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