Simple Limbal Epithelial Transplantation (SLET) for Chemical Injury: A Case Report from National Eye Centre, Kaduna

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ABSTRACT

Chemical injury to the eye is a sight-threatening emergency that can result in limbal stem cell deficiency (LSCD), which may lead to persistent epithelial abnormalities, corneal opacity and eventual vision loss. Simple Limbal Epithelial Transplantation (SLET) has evolved as a successful, one-stage, minimally invasive surgical approach for restoring the ocular surface in LSCD. We report the case of a 21-year-old male who suffered a serious alkali burn to his left eye after being accidentally exposed to herbicide. Despite initial treatment with extensive irrigation, topical nonsteroidal anti-inflammatory drugs and antibiotics, the patient acquired chronic epithelial abnormalities and corneal conjunctivalization.

Following a diagnosis of unilateral LSCD, autologous SLET was conducted using about 2 × 2 mm limbal sample from the contralateral healthy eye, spread over an amniotic membrane put on the corneal surface with bandage contact lens. Topical antibiotics, corticosteroids and preservative-free lubricants were administered postoperatively. The patient was observed for the first three months. Within three weeks, the ocular surface had stabilized and epithelialized completely. There was no recurrent conjunctivalization or irritation. Best-corrected visual acuity had improved from counting fingers to 6/12 as at the first year post-SLET.

This case demonstrates the safety, ease of use and efficacy of SLET in recovering corneal epithelial integrity and visual function in young individuals with unilateral LSCD following chemical injury. Early referral and adequate surgical intervention are critical for the best results.

Keywords: Limbal Stem Cell Deficiency (LSCD), Simple limbal epithelial transplantation (SLET), conjunctival-limbal autografting (CLAU) and Amniotic Membrane Graft (AMG).

INTRODUCTION

Corneal blindness remains a significant global health challenge, especially in developing nations[1]. Among its causes, Limbal Stem Cell Deficiency due to chemical injuries is particularly prevalent in our environment[2]. Simple limbal epithelial transplantation SLET is a surgical treatment option for unilateral limbal stem cell deficiency[1,3]. It involves the harvesting of healthy limbal stem cells from the healthy contralateral eye and autologous transplantation into the diseased eye to restore vision, improve corneal transparency and prevent conjunctivalization. In the year 2012, SLET was first described by Sangwan and colleagues[4] as an improvement of existing techniques of conjunctival-limbal autografting CLAU and cultured limbal epithelial transplantation CLET[5]. SLET has a success rate that is comparable to the CLAU with similar biopsy size, is more cost-effective due to single -day harvest and transplantation, and eliminates the need for specialized culture media[3].

The aim of this report is to demonstrate the cost-effectiveness of simple limbal epithelial transplantation in reducing avoidable blindness in this part of the world and the need to train our ophthalmologists to acquire the skills to perform SLET.

CASE PRESENTATION

A 21-year-old man from Tegina, Niger State presented to our facility following an accidental alkaline injury to his left eye one year previously while applying herbicides 'Gramazol' (Paraquat dichloride). His main complaints were essentially those of dry eye symptoms, namely: redness, pain, tearing and photophobia. Ocular examination of the right eye at presentation revealed essentially normal findings (Figure 1). The left eye had a best corrected visual acuity of counting fingers at 1m with symblepharon, shallow superior and inferior fornices with nearly 360-degree thick vascularized fibrotic pannus extending from the periphery to the visual axis (Figure 2).

There was only a glimpse of a deep anterior chamber and faint iris details under slit lamp examination. He underwent simple limbal epithelial transplantation by taking an autologous limbal biopsy from the superior limbus of the right eye, which was divided into 10-12 pieces and disseminated on the corneal surface after delicate and comprehensive pannus dissection with a crescent blade (Figures 3-5). A 40mm × 40mm dry amniotic membrane was tucked between the superior and inferior fornices and fastened with nylon 10/0 nylon sutures at the left eye's bulbar and forniceal conjunctiva. Multiple pieces of limbal biopsy from the contralateral healthy eye were evenly distributed on the amniotic membrane, which served as a scaffold for the graft over the cornea (Figure 6). A soft bandage contact lens with a diameter of 16mm was used for mechanical protection against tears and topical medication washout.

The eye was then padded for about 18-20hours while he was administered oral analgesics. On the first post-operative day, the eye pad was gently removed, followed by 4-hourly topical steroids, 6-hourly antibiotics and preservative-free tears supplement using the standard regimen. Follow-up visits were at 1 week (Figures 7 and 8), 2 weeks, 1 month, 3 months and 1 year (Figure 9). At the 2nd week post-operative visit the bandage contact lens, and conjunctival nylon sutures were removed. Topical steroids were tapered for one month, and refraction was performed three months later. This resulted in a stable ocular surface, and visual acuity increased dramatically to 5/60 one week after SLET. The best corrected visual acuity one year after SLET assessment was 6/12 with a refractive correction of -0.25Ds/-0.50Dcyl x 150. Specular microscopy (Figure 10) was performed to evaluate endothelial cell count and morphology at 1 year post SLET (Table 1).

Table 1: Summary of Specular Microscopy results at 1 year follow up

Parameters	Right Eye	Left Eye
CCT	530	526
ECD	2878	2862
CV	26	24
HEX	73	68

CCT-Central Corneal Thickness,
ECD-Endothelial Cell Density,
CV-Coefficient of Variation, HEX-Hexagonality.

Figure 1: Pre-operative picture of Right Eye

Figure 2: Pre-operative picture of Left Eye

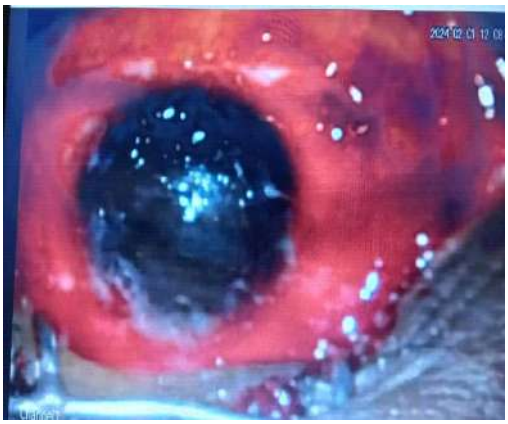

Figure 3: Intraoperative picture after dissection of fibrovascular pseudopterygium in Left Eye

Figure 6: Intraoperative picture showing Amniotic Membrane Graft and freshly harvested Limbal Epithelial Tissue over Left Eye

Figure 4: Intraoperative picture after dissection of fibrovascular pseudopterygium and placement of Amniotic Membrane Graft in Left Eye

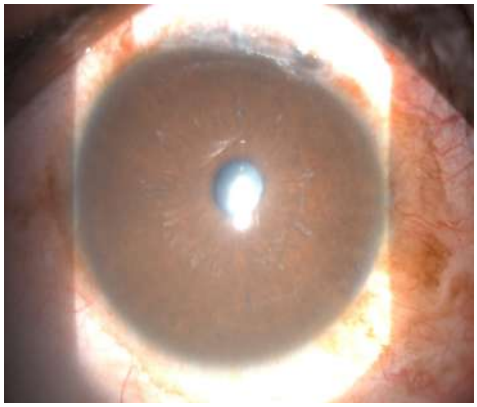

Figure 7: One Week Post-operative picture of Right Eye

Figure 5: Harvesting Limbal epithelial tissue from the Right Eye at 10 - 2 O'clock position

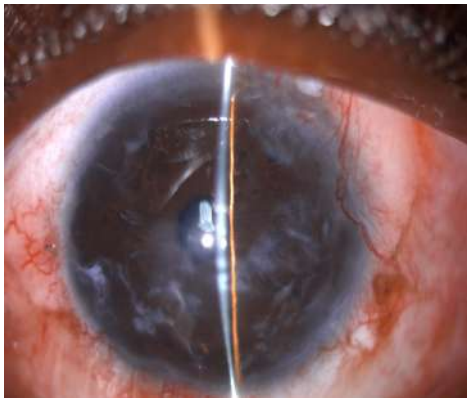

Figure 8: One Week Post-operative picture of Left Eye

Figure 9: 1-year Post intervention picture of Left Eye

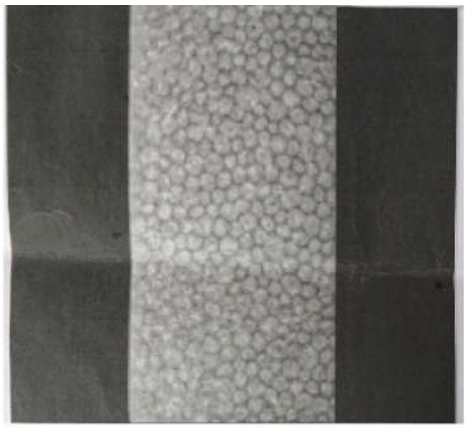

Figure 10: Left Eye Endothelial Cells

DISCUSSION

Accidental chemical burns are still very common in our environment[2] and can result in severe ocular surface injuries. Alkaline agents, which are found in most household chemicals cause rapidly progressive damage due to their characteristic ability to penetrate and result in saponification of cellular membranes.

The advent of cost-effective procedures like SLET and the replicability of its results has made life significantly easier for corneal specialists[4] in restoring vision caused by unilateral LSCD from chemical burns. The success of SLET has also been adapted by other specialties like oculoplastic to treat LSCD following large ocular surface squamous neoplasia excision. However, very little of this procedure is done and reported in this part of the world. The reason for this low uptake may be due to lack of skill among ophthalmologists as well as lack of motivation to acquire the skills for such vision-saving procedures. It may also be due to the lack of availability of affordable bandage contact lenses, and processed dry amniotic membrane graft.

The reports from most studies on SLET showed up to 70-85% stable epithelialization and visual improvement of eyes with chemical-related injury leading to LSCD[6]. Like in our case, complete epithelialization and residual corneal opacity occurred within the first three months post-operatively, with improved best-corrected visual acuity, while recurrence of conjunctivalization was not observed. These findings were in keeping with prior studies reporting excellent anatomical and functional outcomes in young adults with unilateral LSCD[7]. According to most studies done in Asia, there is a long-term decrease in total endothelial cell count in eyes affected by unilateral chemical injury leading to LSCD. This was not so in our case. Specular microscopy done one year post SLET showed normal findings although a longer follow up with a repeated specular microscopy is necessary for long-term evaluation.

In conclusion, SLET procedure is simple, cost-effective and does not require sophisticated instrumentation like other corneal surgical procedures.[8] However, the procedure is not commonly done in Nigeria hence there is a critical need for training and re-training of ophthalmologists in Nigeria to improve skills particularly in performing SLET. Such efforts are crucial in reducing widespread causes of avoidable corneal blindness.

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