LETTER TO THE EDITOR

The management of corneal melt occurring after collagen cross-linking for keratoconus

Gestion de la fonte cornéenne intervenue après le cross-linking du collagène pour le kératocône

Introduction

Riboflavin and ultraviolet-A induced corneal collagen cross-linking (CXL) is a new treatment method described by Wollensak et al. [1] to slow down or stop the progression of keratoconus. CXL increases the rigidity of the corneal tissue by creating extra cross-links in the anterior corneal stroma [2]. It has been considered as an effective and safe procedure, except some serious side effects that are mainly associated with postoperative infections [3]. Besides, a few cases of corneal melting following CXL have been reported [4,5]. All of the cases with this rare and sight-threatening complication required penetrating keratoplasty due to corneal perforation. In this report, we describe a case of severe corneal melting after a standard CXL procedure that we managed using autologous serum without the need of keratoplasty.

Case report

A 26-year-old man with keratoconus presented to our department complaining of progressive visual impairment in his right eye. Progression of keratoconus was documented in his right eye by serial corneal topography over a period of 18 months. There was no history of ocular inflammatory disorders or systemic illness. At presentation, his best corrected visual acuity (BCVA) was 20/30 (−2.25 (−3.25 × 70°) in the right eye. Mean central corneal thickness (Pachy Apex) measured by a Scheimpflug camera (Pentacam, Oculus, Heidelberg, Germany) was 458 μm, and the thinnest reading was 443 μm. Pentacam keratometric values were K1: 44.6 D and K2: 47.2 D, and K-Max was 53.0 D. Based on these findings, the patient was diagnosed with progressive keratoconus and scheduled for CXL. After informed consent, he underwent right standard CXL treatment in attempt to stop the progression.

A standard Dresden protocol was performed for CXL under topical anesthesia: after mechanical debridement of corneal epithelium over the central 9–10 mm, 0.1% riboflavin in 20% dextran solution (Ricrolin, Sooft, Montegiorgio, Italy) was instilled topically every 2 minutes for 30 minutes. The cornea was exposed to UVA light of 366−374 nm at an irradiance of 3.0 mW/cm² for 30 minutes (Vega CBM-X-Linker, CSO, Florence, Italy). Meanwhile, riboflavin instillation was continued every 2 minutes. At the end of the procedure, antibiotic and corticosteroid drops were administered and a therapeutic soft contact lens was placed on the cornea. Postoperatively, moxifloxacin hydrochloride 0.5% (Vigamox; Alcon), diclofenac sodium 0.1% (Voltaren ophta; Alcon), and dexamethasone 0.1% (Maxidex; Alcon), four times a day were prescribed.

On the first postoperative day, ophthalmic examination was unremarkable except for mild corneal edema and central epithelial defect of 6 mm. On day 3, the patient presented with pain, redness and vision loss in his right eye. Examination of the right eye revealed severe conjunctival hyperemia, central corneal epithelial defect, and melt with ectasia (Fig. 1a). Multiple foci of corneal infiltration were also observed at the margin of epithelial defect (Fig. 1b). Corneal scraping was performed for microbiologic examination. The bandage contact lens was removed and dexamethasone and diclofenac were stopped. Ciprofloxacin 750 mg · doxycycline 100 mg oral twice per day, and moxifloxacin drops hourly were prescribed. Cultures and smears were negative for all microorganisms. So, patient was started again on twice hourly topical dexamethasone 0.1% drops.

On day 10, although much of corneal infiltration had improved, the other findings such as central corneal epithelial defect, melting and ectasia remained the same. A bandage contact lens was placed again and the patient was started on two hourly autologous serum drops for promoting epithelial wound healing. On day 15, a remarkable healing in epithelial defect was observed. During the following two months, a gradual improvement in corneal epithelial defect and melting has occurred leaving irregular areas of stromal thinning and central haze (Fig. 2). At the last follow-up visit (4 months after CXL), his BCVA was 20/50 (+2.50 (−3.25 × 70°)) in the right eye. Pachy Apex measured by a Scheimpflug camera was 427 μm, and the thinnest reading was 403 μm. Pentacam keratometric values were K1: 46.8 D and K2: 50.5 D, and K-Max was 56.2 D.

Discussion

Corneal collagen cross-linking has gained popularity in recent years as a promising treatment method for
progressive keratoconus. It has been reported that the procedure is safe and harmless to corneal endothelium, crystalline lens, and retina if certain rules are followed [6]. However, some sight-threatening cases of corneal melting have been observed despite all these safety measures taken [3–5].

In one of these reports, Gokhale et al. [4] have presented a case of acute corneal melting after standard CXL procedure and the postoperative use of topical diclofenac and proparacaine drops. They suggested that corneal melting may be the result of delayed wound healing, activation of matrix metalloproteinases, and the toxic effect on stromal keratocytes due to the use of topical diclofenac and proparacaine eyedrops. CXL procedure itself has been shown to cause keratocyte loss in the anterior corneal stroma [6,7]. So, the postoperative topical use of nonsteroidal anti-inflammatory and anaesthetic drugs may enhance this toxic effect. In our case, we also used topical diclofenac as part of our routine postoperative treatment that may be the cause of corneal melting.

In our case, we observed multiple foci of sterile corneal infiltration at the margin of epithelial defect. Sterile corneal infiltrates probably occur as a result of enhanced cell-mediated immunity to staphylococcal antigens deposited at high concentrations in areas of static tear pooling [8]. Marginal infiltrations due to deposition of staphylococcal antigens are reported to develop in rosacea keratitis, after laser in situ keratomileusis, and in contact lens users [9,10]. Sterile corneal infiltrates may have a role in the occurrence of melting in our case due to staphylococcal antigen deposition in areas of static tear pooling beneath the bandage contact lens.

Autologous serum eye drops have been reported to be beneficial in dry eye syndrome and persistent epithelial defects [11]. It may be helpful because of the presence of essential substances such as epidermal growth factor, fibroblast growth factor, fibronectin, vitamins, and bacte-riostatic components (IgG, lysozyme etc.). These substances have been shown to enhance corneal epithelial growth and healing [11]. In our patient, we used autologous serum eye drops for the purpose of promoting epithelial healing from the 10th day after CXL. We observed a remarkable healing in epithelial defect in five days. The corneal epithelial defect and melting improved gradually over two months without corneal perforation. We assumed that the use of autologous serum had a positive effect against the corneal melting along with epithelial healing.

In a recent study, Said et al. [12] have evaluated the efficacy of CXL in the treatment of infectious keratitis with melting. Although they concluded that CXL may be an effective adjuvant therapy in severe keratitis with melting, there was no statistically significant difference of results between CXL and control groups. CXL was proposed for the treatment of keratitis and corneal melting based on the in vitro study results, however, it is known also to lead to keratocyte loss which may result in increased virulence of the infection and corneal melting. So, in our opinion, CXL may be a dangerous treatment option in the management of infectious keratitis.

In summary, although CXL has been described as a safe procedure, the devastating complication observed in our case illustrates the need for a close follow-up of patients until corneal epithelial healing is complete.

**Figure 1.** a: the patient presented with pain, redness and vision loss in his right eye on the third day after cross-linking procedure. Examination of the right eye revealed severe conjunctival hyperemia, central corneal epithelial defect, and melting with ectasia; b: multiple foci of corneal infiltration were also observed at the margin of epithelial defect.

**Figure 2.** The corneal epithelial defect and melting improved gradually over two months without corneal perforation by leaving irregular areas of stromal thinning and central haze.
Disclosure of interest

The authors declare that they have no conflict of interest concerning this article.

References


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