Outcomes and safety of accelerated collagen cross-linking in keratoconus patients

A.Zaidi, L.Fu, L.Au, F.Carley, A.Brahma

Manchester Royal Eye Hospital

INTRODUCTION

Keratoconus is the most common corneal ectatic disorder with bilateral disease progression and is often asymmetric in presentation. The increasing corneal stromal thinning due to the biomechanical instability of collagen fibres, accompanied by irregular astigmatism and apical protrusion, leads to adverse effects in the quality and acuity of vision. It remains the leading cause for corneal transplantation in several countries[1]. Collagen crosslinking (CXL) has allowed an arrest in disease progression whilst optimising cost-benefit of corneal transplantation[2]. Conventional CXL is well established with many studies demonstrating the long term effectiveness and safety of the procedure[3,4]. Our study examines long-term outcomes of accelerated collagen cross-linking in a cohort of progressive keratoconus patients.

METHODS

A retrospective review was conducted from Jan 2013- Jan 2017 of keratoconus patients aged over 18 years attending the corneal service at Manchester Royal Eye Hospital, UK. Patients were identified from the crosslinking database and their records including refraction and topography pre-and post-crosslinking were reviewed. Incidences of adverse events e.g. microbial keratitis were documented. The procedure performed was accelerated epithelium-off collagen crosslinking (ACXL) with hypotonic riboflavin (Avedro, Inc., Waltham, MA, USA) with 9-10mW/cm2 ultraviolet A irradiation for 10 minutes. Success defined by regression (Kmax <1.0D) or stabilisation (Kmax 1.0D) post ACXL. Failure defined by progression (Kmax >1.0D) post ACXL.

RESULTS

134 eyes of 122 patients underwent ACXL. Mean age was 25 ± 6.6 years at date of ACXL.

Table 1	Pre-ACXL	24 months Post-ACXL
BCVA, LogMAR	0.41 ±0.31	0.27± 0.23 (p< 0.00001)
K1	51.75 ±5.30	50.21± 5.25 (p = 0.00152)
K2	54.53 ± 5.17	54.22± 4.61 (p=0.00916)
Kmean	53.75± 5.04	52.12± 4.86 (p = 0.00132)
Kmax	66.44 ±8.77	63.82 ±8.05 (p< 0.00001)
Corneal Pachymetry	452.73 ± 33.4	435.09 ± 46.4um (p = 0.00024)

Table 2	Pre-ACXL VA	24 months Post-ACXL
CDVA≤0.3	51%	72%

Table 3 Grade	Percentage, %	Progressed Patients
1	0	0
2	6.77	0
3	3.01	1
4	90.23	14

Table 1: Visual and topographical data of patients before ACXL and at 24 months post- ACXL. Table 2: CDVA 0.3 or better LogMAR at 24 months post-ACXL. Table 3: Patient's keratoconus disease stage classified according to modified Krumeich classification with number of progressed patients (Kmax >1.0D post ACXL).

DISCUSSION

The results of this study were reassuring with regards to the safety and efficacy of the current crosslinking treatment protocol. Long-term visual outcomes were promising, with 72% of the cohort achieving CDVA≤0.3 LogMAR post-ACXL. This was despite 90% of patients having advanced (Stage IV) disease. The rate of disease progression was comparable to similar datasets in literature[5]. Our findings echo those of the Sunderland study, the main difference to note is that patients in this study had worse visual acuity and a higher degree of corneal ectasia at baseline. Moreover, complications such as microbial keratitis, scarring and perforation, which can arise following CXL, were not reported in our retrospective review.

CONCLUSION

The outcome of this study demonstrated that accelerated epithelium-off corneal CXL was effective over a 24 month period for stabilising progressive keratoconus in advanced cases.

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