

Corneal Collagen Cross-Linking Outcomes: Review

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Abstract: Keratoconus is a condition characterized by biomechanical instability of the cornea, presenting in a progressive, asymmetric and bilateral way. Corneal collagen cross-linking with riboflavin and UVA (CXL) is a new technique of corneal tissue strengthening that combines the use of riboflavin as a photo sensitizer and UVA irradiation. The studies showed that CXL was effective in halting the progression of keratoconus over a period of up to four years. The published studies also revealed a reduction of max K readings by more than 2 D, while the postoperative SEQ was reduced by an average of more than 1 D, and refractive cylinder decreased by about 1 D. No eyes lost any line of BCDVA. Moreover, there was no significant decrease in endothelial cell density. It was also found that CXL treatment was effective with reducing corneal and total wavefront aberrations. Corneal cross-linking has also led to an arrest and/or even a partial reversal of keratectasia in the treatment of iatrogenic ectasia after excimer laser ablation. A primary intervention such as CXL should be considered to potentially increase the biomechanical stability of the corneal tissue and postpone the need of lamellar or penetrating keratoplasty.

Keywords: Cornea, collagen, keratoconus, riboflavin, ultraviolet radiation.

INTRODUCTION

Keratoconus is a condition characterized by biomechanical instability of the cornea, presenting in a progressive, asymmetric and bilateral way. The prevalence in general population is 50-200 per 100 000 [1]. A 20% of keratoconic patients will suffer of severe visual deterioration due to irregular astigmatism, myopia and corneal scarring, and optical means such as spectacles and rigid gas permeable contact lenses do not offer any visual rehabilitation [1].

Corneal collagen cross-linking with riboflavin and UVA (CXL) is a new technique of corneal tissue strengthening that combines the use of riboflavin and UVA irradiation. Riboflavin works as a photo sensitizer for the induction of cross links between collagen fibrils and at the same time act as a shield from the penetration of UVA in the underlying tissues [2]. A primary intervention, such as CXL should be considered to potentially increase the biomechanical stability of the corneal tissue and postpone the need of lamellar or penetrating keratoplasty.

CLINICAL RESULTS

The first *in vivo* controlled clinical study by Wollensak *et al.* included 23 eyes with moderate or advanced progressive keratoconus. The study showed that CXL was effective in halting the progression of keratoconus over a period of up to four years [3]. In this study, a mean preoperative progression of keratometry (max K) by 1.42 D in 52% of eyes over a 6-month period immediately prior to the treatment was

followed by a postoperative decrease in 70% of eyes. The statistics also revealed a reduction of max K readings by 2.01 D, while the postoperative SEQ was reduced by an average of 1.14 D. At the same time, 22% of the untreated fellow control eyes had a postoperative progression of keratectasia by an average of 1.48 D.

In another study, conducted by Jankov *et al.*, it was found an arrest in the progression of keratoconus in a group of patients after CXL treatment. In a period of six months prior to the treatment all patients of this group presented a deterioration in terms of astigmatism and corneal stability. Max K readings decreased by more than 2 D (from 53.02 ± 8.42 to 50.88 ± 6.05 D), SEQ in less than 1 D (from -3.27 ± 4.08 to -2.68 ± 3.02 D), while refractive cylinder decreased by less 0.5 D (from -2.29 ± 1.77 to -1.86 ± 0.92 D). No eyes lost any line of BCDVA, 12 maintained the preoperative BCDVA, 7 gained one line, 5 gained two lines, and 1 patient gained three lines of BCDVA [4].

Agrawal, in his study found similar results among an Indian population of 37 eyes after one year of follow up, with 54% of the eyes gaining at least one line of BCDVA, astigmatism decreased by mean of 1.2D in 47%, K value of the apex decreased by mean of 2.73 D in 66% eyes and maximum K value decreased by a mean of 2.47D in 54% of eyes [5].

In their preliminary results Wittig-Silva *et al.*, found similar results regarding BCDVA and K reading, with no difference in spherical equivalent and endothelial cell density between treated and control eyes after 12 months follow-up [6]. Vinciguerra *et al.*, also found CXL treatment effective with reducing corneal and total wavefront aberrations one year after treatment [7].

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