



National Journal of Medical and Allied Sciences

[ISSN Online: 2319 – 6335, Print: 2393 – 9192|Original article |Open Access]

Website:-www.njmsonline.org

CHANGES IN THE MAGNITUDE OF KERATOCONUS AFTER CORNEAL COLLAGEN CROSS LINKING WITH ULTRAVIOLET LIGHT AND RIBOFLAVIN

Muhemmed Swadique¹, Vijisha T², Jubairiya F³

¹Associate Professor, Dept. of Ophthalmology, MES Medical College, Perinthalmanna, Kerala, India.

² Consultant Optometrist, Al Salama Eye Hospital, Perinthalmanna, Kerala, India. ³Assistant Professor of Optometry, Al Salama Eye Hospital, Perinthalmanna, Kerala, India

Abstract

Background: Keratoconus is a degenerative disorder of the eye in which structural changes within the cornea cause it to thin out and change to a more conical shape than the normal gradual curve. Corneal collagen cross linking with riboflavin, (also known as CXL, C3-R, CCL and KXL), a treatment option for keratoconus ,involves a one-time application of riboflavin solution to the eye that is activated by illumination with UV-A light for approximately 30 minutes. The riboflavin causes new bonds to form across adjacent collagen strands in the stromal layer of the cornea, which recovers and preserves some of the cornea's mechanical strength. The corneal epithelial layer is generally removed to increase penetration of the riboflavin into the stroma. **Methods:** Forty eyes were recruited for this study. The refractive error and magnitude of keratoconus are compared before and after the CXL surgery. **Results:** Out of 40 eyes about 17 eyes shows decrease of magnitude of keratoconus of about 1-2 D. Statistical analysis of pre-operative and post-operative data shows that the difference in Magnitude of cone location and refractive status in the treated eye is statistically significant $p < 0.001$. **Conclusion:** Corneal collagen cross linking procedure decreases the magnitude of keratoconus.

Keywords: Keratoconus, corneal collagen cross linking, magnitude of keratoconus

Author for correspondence: Dr. Muhemmed Swadique, Associate Professor, Dept. of Ophthalmology, MES Medical College, Perinthalmanna, Kerala, India E Mail: swadique@gmail.com

Introduction:

Keratoconus is a degenerative disorder of the eye in which structural changes within the cornea cause it to thin and change to a more conical shape than the more normal gradual curve. (Figure 1) Keratoconus can cause substantial distortion of vision, with multiple images, streaking and sensitivity to light all often reported by the patient. It is typically

diagnosed in the patient's adolescent years. In most cases, corrective lenses fitted by a specialist are effective enough to allow the patient to continue to drive legally and likewise function normally. Further progression of the disease may require surgery, for which several options are available, including intrastromal corneal ring segments, corneal collagen cross-linking, and, in 25% of

cases, corneal transplantation. Corneal collagen crosslinking with riboflavin, (also known as CXL, C3-R, CCL and KXL), involves a one-time application of riboflavin solution to the eye that is activated by illumination with UV-A light for approximately 30 minutes. (Figure 2) The riboflavin causes new bonds to form across adjacent collagen strands in the stromal layer of the cornea, which recovers and preserves some of the cornea's mechanical strength. The corneal epithelial layer is generally removed to increase penetration of the riboflavin into the stroma.

In 2007, Kymionis et al¹ reported that cross-linking showed success in retarding or stopping progression of the disease. Observations made by Tomkins O² in 2008 showed stabilization in all treated eyes, and a slight correction in visual acuity in most patients. The procedure, with epithelium being removed, is approved for use throughout Europe, as observed by clinical trials in the USA by Wittig-Silva et al³ in 2014. Goldich et al⁴ reported stabilisation of keratoconus in treatment of progressive keratoconus and post LASIK ectasia. In some cases, collagen cross-linking may also be combined with other treatments to improve corneal asymmetry, optical refraction or corneal strength. Successful treatment methods include corneal ring segment inserts (Intacs, Ferrara or Keraring rings), Topography Guided Laser, Keraflex, or MyoRing Treatment. In the latter case Riboflavin is injected into a corneal pocket to bypass the epithelium, which is not required to be removed and, therefore, this treatment method is painless. Corrective lenses are normally required after these treatments, but with smaller, more normalized prescriptions. Increased corneal symmetry allows for more comfortable contact lens wear, often of daily disposable lenses. These newer methods may have an important role in limiting deterioration of vision, increasing unaided and uncorrected vision, and reducing the case for corneal transplantation. Henriquez et al⁵ reported

improvement in visual functions after cross linking in keratoconus patients. This study aims at quantifying the changes in keratometric values after corneal collagen cross linking with ultraviolet light and riboflavin.



Fig. 1- Conical protrusion of cornea in keratoconus



Fig. 2 - Cross-linking procedure, UV light source

Material and method:

It is a hospital based prospective clinical trial. The study was conducted for a period of 6 months i.e. September 2014 to march 2015. Institutional ethics committee approval was obtained. Informed consent was taken according to Helsinki declaration. 40 consecutive eyes were selected who had undergone corneal collagen cross linking treatment in our hospital. Individuals between 14-35 years were enrolled. Patients with central corneal thickness < 400 μm and those with corneal scars were excluded.

All individuals underwent a complete eye examination including assessment of visual acuity (unaided, aided, and corrected), refraction and topography, pachymetry pre operatively. Keraton Scout topographer (Fig. 3) was used to assess the magnitude of keratoconus. Post operatively the same tests were repeated at 1 month, 3 months and 6 months respectively. All the data was entered in an excel sheet and statistical analysis was done with SPSS software. Paired student test was applied and a P value of < 0.001 was considered significant.

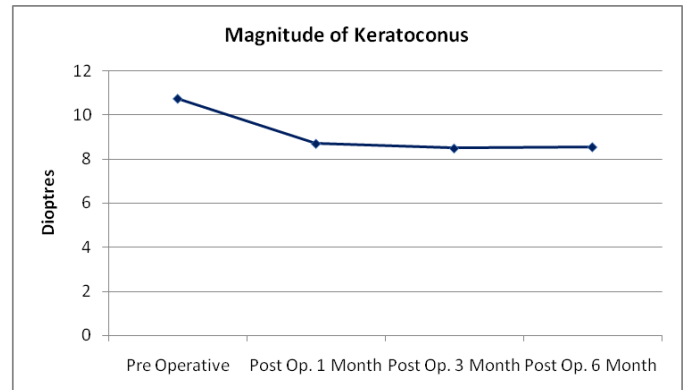


Fig. 3 - Keraton Scout Topographer

Results:

There were 28 males (70%) and 12 females (30%) enrolled in this study. The male: female ratio was 2.33:1. The age group was between 15-35 years. The spherical power were unchanged in 9 eyes (22.5%). 14 eyes (25 %) showed reduction in spherical power, and 9 (6.25 %) increment in spherical power and 17 eyes didn't show any improvement in spherical power. The cylindrical power were unchanged in 10 eyes (22.5%). 21 eyes (52 %) showed reduction in cylindrical power, and 9 (6.25 %) increment in spherical power. 21 individuals (52%) showed change in axis and 19 (48%) showed no change in axis. The axis of cylinder changed in 52% cases by about 10-20 degree. Out of 40 eyes about 17 eyes showed decrease of magnitude of keratoconus of about 1-2

D. (Graph 1). Statistical analysis of pre-operative and post-operative data showed that the difference in magnitude of cone location and refractive status in the treated eye was statistically significant $p < 0.001$. This study also showed that there was a slight decrease in the spherical component of the refractive power after CXL treatment.



Graph 1

Discussion:

Corneal collagen cross linking is known to stabilise keratoconus. Henriquez et al⁵ also reported stabilisation of keratoconus and is confirmed by our results. In our study the magnitude of the keratoconus after corneal collagen cross linking treatment decreased in a significant number of cases and in the remaining at least the progression was arrested. This aspect has not been covered or reported in any of the previous studies to the best of our knowledge. This study also demonstrated significant reduction in refractive status and in the axis of the cylindrical power of the eye after corneal collagen cross linking treatment and is consistent with the findings of Boxer Wachler B et al⁶. There was decrease in keratometric values and astigmatism in this study. These findings are consistent with those reported by Asra et al (2011)⁷, Brooks et al (2012)⁸, Greenstein et al (2013)⁹, Sliot et al (2013)¹⁰.

Conclusion:

Corneal collagen cross linking procedure decreases the magnitude of keratoconus. It decreases the astigmatism and also myopia. It also changes the axis of astigmatism. Even though the procedure is aimed at stabilising the progression of keratoconus, we have seen a minimal reversal of the condition.

References:

- 1 Kymionis G, Portaliou D. Corneal crosslinking with riboflavin and UVA for the treatment of keratoconus. *Journal of Cataract & Refractive Surgery*. 2007;33(7):1143-1144.
- 2 Tomkins O. Collagen cross-linking: Strengthening the unstable cornea. *Clinical Ophthalmology*. 2008;:863.
- 3 Wittig-Silva C, Chan E, Islam F, Wu T, Whiting M, Snibson G. A Randomized, Controlled Trial of Corneal Collagen Cross-Linking in Progressive Keratoconus. *Ophthalmology*. 2014;121(4):812-821.
- 4 Goldich Y, Marcovich A, Barkana Y, Avni I, Zadok D. Safety of Corneal Collagen Cross-linking With UV-A and Riboflavin in Progressive Keratoconus. *Cornea*. 2010;:1.
- 5 Henriquez M, Izquierdo L, Bernilla C, Zakrzewski P, Mannis M. Riboflavin/Ultraviolet A Corneal Collagen Cross-linking for the Treatment of Keratoconus: Visual Outcomes and Scheimpflug Analysis. *Cornea*. 2011;30(3):281-286.
- 6 Boxer Wachler B, Pinelli R, Ertan A, Chan C. Safety and efficacy of transepithelial crosslinking (C3-R/CXL). *Journal of Cataract & Refractive Surgery*. 2010;36(1):186-188.
- 7 Asri D, Touboul D, Fournie P, Malet F, Garra C, Gallois A et al. Corneal collagen crosslinking in progressive keratoconus: Multicenter results from the French National Reference Center for Keratoconus. *Journal of Cataract & Refractive Surgery*. 2011;37(12):2137-2143.
- 8 Brooks N, Greenstein S, Fry K, Hersh P. Patient subjective visual function after corneal collagen crosslinking for keratoconus and corneal ectasia.

Journal of Cataract & Refractive Surgery. 2012;38(4):615-619.

- 9 Greenstein S, Hersh P. Characteristics influencing outcomes of corneal collagen crosslinking for keratoconus and ectasia: Implications for patient selection. *Journal of Cataract & Refractive Surgery*. 2013;39(8):1133-1140.
- 10 Sloot F, Soeters N, van der Valk R, Tahzib N. Effective corneal collagen crosslinking in advanced cases of progressive keratoconus. *Journal of Cataract & Refractive Surgery*. 2013;39(8):1141-1145.

Conflicts of Interest: None

Funding: None

Citation: Swadique M, Vijisha T, Jubairiya F. Changes in the magnitude of Keratoconus after Corneal Collagen cross linking with ultraviolet Light and Riboflavin. National Journal of Medical and Allied Sciences 2015; 4(1):46-49