

Refractive Outcomes with Contact Lens Followed by the Procedure of Corneal Cross Linkage

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ABSTRACT

Objective: To determine the visual acuity in keratoconus patient after the contact lens implantation through cross corneal linkage process.

Study Design: Experimental study.

Place and Duration of Study: This study was conducted at the Cornea clinic, Isra Postgraduate Institute of Ophthalmology, Al-Ibrahim Eye Hospital, Karachi from January 2019 to August 2019.

Materials and Methods: 74 patients with progressive keratoconus of age 12 years to 40 years, central corneal thickness more than 400microns and without prior history of CXL corneal procedure were included in the study. Preoperative assessment was based on history, examination and investigations. Operative procedure was performed and postoperative assessment of visual outcomes and complications were noted. Statistical analysis was done by SPSS version 20.

Results: Statistically significant difference at p-value <0.001 of Best corrected visual acuity with contact lens (BCVACL) was observed in 93.2% of the patients with 6/6 visual acuity at 3rd month follow up after the contact lens implantation through corneal cross linkage.

Conclusion: Significant improvement observed in the visual acuity, Best Corrected Visual Acuity with Contact Lens (BCVACL) of keratoconus patient treated with corneal cross-linkage process with no complications.

Key Words: Visual Acuity, Keratoconus, Contact lens, Corneal Collagen

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INTRODUCTION

Keratoconus is a bilateral and symmetrical progressive medical condition in which the cornea is focally thinned and protruded, ultimately then escalating to a cone-shaped surface¹. Various studies reported that Asian population are at much higher risk of Keratoconus patients then the others it also suggests that males are more prone to this disease²⁻⁵.

Prior to start the treatment, full ophthalmic examination is required, most importantly corneal topography and tomography which gives the real time corneal steeping and epithelial imaging⁶⁻⁷. Studies showed that the time lapsed from the onset of the disease without treatment gotten this worse and early

keratoconus, contact lens are very promising treatment⁸⁻⁹. Keratoconus patient have various pathological conditions such as high irregular astigmatism and significant anisometropia because of these spectacles does not achieve adequate vision acuity then the contact lens¹⁰. Advances in medical sciences has led to the development of modern operative techniques such as Deep Anterior Lamellar Keratoplasty (DALK) and Penetrating Keratoplasty (PK). Both have their pros and cons. DALK is associated with decreased incidence of graft rejection, endothelial cell preservation, avoidance of an open-sky procedure, and brief duration of post-operative administration of steroids, as compared to PK. Long-term use of steroid could lead to cataract and glaucoma¹¹. By 1990s, the emergence of Cornea collagen cross-linking (CXL) procedure has proved to be a milestone in the management of Keratoconus¹². Wollensak et al. were the pioneers of the procedure which proved to slow or halt the development of Keratoconus¹³. In CXL, riboflavin (vitamin B2) is introduced in conjuncture with ultraviolet A (UVA, 365 nm). The interplay of riboflavin and UVA results in the production of reactive oxygen species, which in turn leads to the formation of additional covalent bonds between collagen molecules, thus helping to give strength and reinforcement to the cornea¹⁴.

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The inception of CXL has resulted in the drop of annual number of keratoplasties performed as has been reported in recent literature¹⁵⁻¹⁶ with greater than 90% success rate observed in the stabilization of disease advancement¹². CXL with Topography Guided-photorefractive Keratectomy (T-PRK) is also one of the treatment algorithm which has proved to be fruitful for the keratoconic population with contact lens intolerance. T-PRK causes the cornea to be regularized which helps in bringing about better vision with spectacles in addition to CXL which causes cessation of Keratoconus progression¹⁷. Thus, new modalities of CXL have provided new horizons in the management of Keratoconus¹⁸.

With each passing day, there has been a boom in the introduction of more promising techniques for Keratoconus management. This has lead to the shift in focus of treatment from improving visual acuity with Keratoplasties to those aiding in the stopping of disease evolution or those supporting contact lens tolerance like CXL, ICRS or a recently developed Bowman Layer transplantation procedure described by GerritMelles¹⁹.

MATERIALS AND METHODS

After taken an ethical approval of concern body this experimental study was conducted at Isra Post graduate institute of Ophthalmology (Al-Ibrahim eye hospital). The duration of this study was of six months. After taken written informed consent the data was collected at pre-operative and post-operative stages through Non-probability convenient sampling. Subjects with Progressive keratoconus of ages range 12 to 40 years, Central corneal thickness more than 400microns and without prior history of CXL corneal procedure included while patients with Other corneal progressive ecstastic disorder, Severe corneal scaring or opacification on the clinical basis or history of:

attack of acute hydrops concurrent ocular infection sever ocular surface disease like dry eye were excluded in this study.

Total 74 subjects were enrolled. Pre-operative examination included detailed history of patient, detailed ophthalmic examination, and Corneal Tomography was done After that Corneal cross linkage (CXL) procedure was carried out. This process was carried out by operating microscope, CXL UV laser machine, lid speculum, corneal forceps, tying forceps, and blade number 15, Cotton bud, 10 cc syringe.

RESULTS

Equal gender distribution was observed among 74 subjects (Fig 1). Our demographic data showed that students are at higher risk and more prone to keratoconus, as in this study 51.4% were students among the 74 subjects (Table-1). Un corrected visual acuity (UCVA) in the subjects prior to the procedure (Table 2).

Best corrected visual acuity with contact lens (BCVACL) and it was observed that 93.2% of the patients showed 6/6 visual acuity at 3rd month follow up after the contact lens implantation through CXL (Table 3).

Table No.1: Showing different occupations of study patients

Variable		n	%
Occupation	House Wife	21	28.4
	Student	38	51.4
	Carpenter	2	2.7
	Teacher	4	5.4
	Self Employed	4	5.4
	Shop Keeper	3	4.1
	Accountant	2	2.7

Table No.2: Comparison of un-corrected visual acuity during pre, 1st and 3rd month post-operatively period.

Variables		Preoperative		Postoperative 1 st month		Postoperative 3 rd month		p-Value
		n	%	n	%	n	%	
Un Corrected Visual Acuity (UCVA)	1/60	8	10.8	6	8.1	6	8.1	<0.001
	2/60	20	27.0	16	21.6	15	20.3	
	3/60	4	5.4	2	2.7	3	4.1	
	4/60	0	0.0	2	2.7	2	2.7	
	5/60	3	4.1	0	0.0	0	0.0	
	6/60	6	8.1	10	13.5	9	12.2	
	6/36	10	13.5	8	10.8	7	9.5	
	6/24	4	5.4	10	13.5	8	10.8	
	6/18	5	6.8	6	8.1	7	9.5	
	6/12	8	10.8	6	8.1	8	10.8	
	6/9	3	4.1	5	6.8	5	6.8	
6/6	3	4.1	3	4.1	4	5.4		

Table No.3: Comparison of best corrected visual acuity with contact lens at pre, 1st and 3rd month post-operative follow up

Variables		Preoperative		Postoperative 1 st month		Postoperative 3 rd month		p-Value
		n	%	n	%	n	%	
Best Corrected Visual Acuity with Contact Lens (BCVACL)	6/9	4	5.4	5	6.8	5	6.8	<0.001
	6/6	70	94.6	69	93.2	69	93.2	

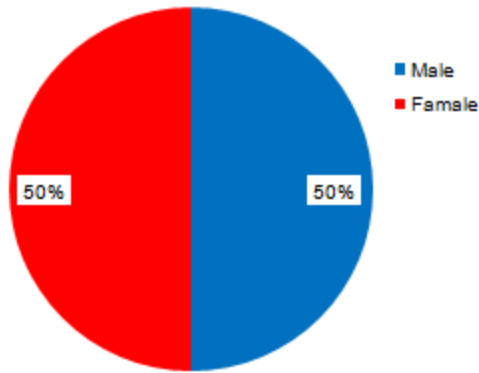


Figure No.I: Graphical representation of gender frequencies of study patients

DISCUSSION

A study conducted by Salman et al, on 22 patients having a mean age of 15.7 ± 2.1 years reported a significant improvement in UCVA, mean and maximum keratometry at 12th month post-operatively (p-value 0.05) as compared with pre-operative state²⁰. Similar to our study, Ivarsen et al in a study conducted on 22 patients from 12 to 38 years treated with CXL for progressive keratoconus reported a significant decrease in the post-operative measures of keratometry, UCVA and BCVA²¹. Vinciguerra et al also reported significant reduction in mean keratometry, BCVA and UCVA at 36 months after operative as compared with pre-operative measures²². Goldich et al in a study on 14 patients with progressive keratoconus, treated with CXL and followed up till 24 months reported a significant improvement in BCVA difference from 0.21 ± 0.1 at baseline to 0.14 ± 0.1 after 24 months having a substantial difference of 0.002. UCVA difference from 0.62 ± 0.5 pre-operatively increased to 0.81 ± 0.49 D post-operatively having an insignificant difference of 0.48. Insignificant difference was also reported in minimal corneal thickness change from pre-operative state to 24 month follow up²³. On the contrary, in our study substantial difference was observed in UCVA pre and post-operatively. Limited sample size, difference in geographic and age may have the difference in both study results. The mean UCVA change at 3rd month from baseline (0.15 ± 0.06) was reported to be significant (p-value 0.009). Similarly mean change in BSCVA improved at 3rd month (0.09 ± 0.03) as compared with baseline,

showing a significant p-value of 0.006²⁴. Similar results were also reported in the present our study (Table-5; Figure-4, Table-6; Figure-5). Goldich et al in a study on 14 patients with progressive keratoconus, treated with CXL and followed up till 24 months reported a significant improvement in BCVA difference from 0.21 ± 0.1 at baseline to 0.14 ± 0.1 after 24 months having a substantial difference of 0.002. UCVA difference from 0.62 ± 0.5 pre-operatively increased to 0.81 ± 0.49 D post-operatively having an insignificant difference of 0.48. Insignificant difference was also reported in minimal corneal thickness change from pre-operative state to 24 month follow up²³. On the contrary, in our study substantial difference was observed in UCVA pre and post-operatively. Limited sample size, difference in geographic and age may have the difference in both study results. Similar to our study, Ivarsen et al in a study conducted on 22 patients from 12 to 38 years treated with CXL for progressive keratoconus reported a significant decrease in the post-operative measures of keratometry, UCVA and BCVA²⁵. Keratoconus is typically observed to commence at puberty and progresses till the third or fourth decade of life. Variation in keratoconus progression is seen in-between individuals and usually higher in young patients. The disease tends to stabilize approximately 20 years following initial presentation. Differences of age, genetic makeup, socio-economic background, operative facilities all tend to have an impact on visual outcomes of keratoconus after CXL. Likewise, Vinciguerra et al reported a substantial 1.35 D improvement in maximum keratometry after CXL for keratoconus in 28 patients with ages ranging from 24-52 years. The maximum follow up time period was 2 years²⁶. Similar to our study, Koller et al, reported a significant improvement of 0.89 D 1 year after CXL in 192 patients of keratoconus having a mean age of 29.3 years²⁷. In accordance to our study, Derakhshan et al, in a study on 31 patients having a mean age of 22.3 years with keratoconus reported a substantial mean improvement of 0.65 D at 6 months follow up after CXL²⁸. Asri et al reported a significant mean improvement of 0.49 D 1 year after CXL due to keratoconus in 142 patients having a mean age of 24.12 years²⁹.

In another study by Hersh et al, a substantial mean improvement of 2.0 D was seen in 49 patients undergoing CXL after 1 year of follow up³⁰.

Viswanathan et al reported in their study on 51 patients of keratoconus followed up for 4 years after CXL, a significant mean improvement of 0.96 D³¹.

Age, gender, socio-economic status, genetic makeup, period of follow-up time all tend to effect in visual outcome of patients with keratoconus who have undergone CXL. But overall, all studies have reported improvements in the overall visual outcomes of patients, no matter what differences exist between each study.

CONCLUSION

It is concluded that collagen corneal cross linkage resulted in the considerable enhancements in the visual acuity of keratoconus patients. Successful improvements were observed for Best Corrected Visual Acuity with Contact Lens no complications were observed throughout the study period after the operative procedure.

Author's Contribution:

Concept & Design of Study: Ikramuddin Indhar
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Final Approval of version: Ikramuddin Indhar

Conflict of Interest: The study has no conflict of interest to declare by any author.

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