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Two Year Interval Changes in Corneal Topography in Eyes with Keratoconus with RGP Lens Wear

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ABSTRACT

Rigid gas permeable contact lens can induce progression of keratoconus eventually leading to keratocyte apoptosis. The aim of the study is to find out changes in the corneal topography following the use of multicurve rigid gas permeable contact lens on Indian eyes with Keratoconus. 50 eyes of 33 subjects with clinically diagnosed mild to moderate Keratoconus wearing RGP contact lens for a period of at least two years were included in the study. Corneal topography measurement was done using the Orbscan IIz topography system for baseline and after 2 years of RGP lens wearers. The parameters compared were Anterior Best Fit Sphere, Posterior Best Fit Sphere, Sim K astigmatism, 3mm and 5mm zone irregularity and thinnest point on the pachymetry. The mean anterior base fit sphere changed by 0.8481D from the baseline to the follow up visit (p=0.001). The difference in the mean posterior base fit spheres was 1.0276D. The Sim K astigmatism decreased by 0.768D at the follow up as compared to the baseline. There was a change in the 3mm and 5mm zone irregularity by 0.446D and 0.1080D respectively. Significant differences were found in the anterior best fit sphere, posterior best fit sphere and corneal topography parameters over a period of two years in keratoconus eyes with RGP lens wearers.

Keywords: Corneal topography, Orbscan, RGP Lens, Keratoconus.

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INTRODUCTION

Keratoconus is characterized by thinning and ectasia of the central cornea. As the condition progresses it results in an irregular astigmatism and causes blurred vision, which requires rigid gas permeable contact lenses (RGP CL) for correction. Keratoconus characteristically is asymmetric and involves the central cornea with the apex of the cone just below the visual axis [1,2] .The disease often starts in puberty and slowly progresses over decades and then stabilizes. Its underlying pathogenesis and its cause remain poorly understood [3]. Sensitive techniques such as corneal topography often detects keratoconus in both eyes in cases thought to be only in one eye based on clinical examination and on refraction [4,5,6]. As the cases progress, severe irregular astigmatism and scarring may require a corneal transplant in order to restore vision. Typical findings in Keratoconus include protrusion of the cornea, Vogt's striae, superficial scarring of the anterior cornea, staining of the corneal surface epithelium with Fleischer's ring and corneal hydrops in severe cases. RGP CL provides uniform anterior refracting surface for the improvement vision, so it is widely accepted for the management of Keratoconus, where as in severe cases Penetrating Keratoplasty indicated [7]. Assessment of the corneal topography in keratoconus provides valuable information to the practitioner. It can help determine the location, steepness, and size of the cone, as well as the corneal eccentricity value. The Orbscan IIz (Bausch & Lomb, Rochester, USA) is a multi dimensional diagnostic system that provides a complete analysis of the eye's corneal optical systems by utilizing slit scan technology with an advanced placido disc system. It measures the anterior section of the eye from anterior surface of the cornea to the anterior surface of the lens. The Orbscan topography system provides more information about corneal refraction because the refraction of posterior surface is also calculated [7].

There are reports to show RGP CL has induced keratoconus progression [8]. In literature there are contradictory reports on the effects of RGP CL on keratoconus progression and also the causes for the RGP CL induced progression associated with epithelial trauma when followed up with RGP CL wearers resulting in keratocyte apoptosis [9,10,11]. Recent RGP designs with multi curve lenses provide minimal apical touch which enables the patients to wear the lenses comfortably for long hours. Hwang et al. reported that the multi curve CL significantly reduced the Sim Kmax, apical power, anterior and posterior elevation topographic indices in CL wearing and in control group where as apical power and 3mm zone irregularity index (IR) increased significantly [10]. Kim et al. reported that wearing of RGP lens is not significantly associated with Keratoconus progression while rubbing eyes, but inferior and superior thinning are associated with Keratoconus progression [11]. In the present study we aim to study the changes in the corneal topography following the use of multicurve RGP CL on Indian eyes with Keratoconus.

MATERIAL AND METHODS

The study adhered to the tenets of the Declaration of Helsinki and the study approved by the institutional review board at L.V.Prasad Eye Institute. Retrospectively the medical

records of patients with Keratoconus who are fitted with RGP CL, who had a minimum of two year follow up from base line and who had Orbscan data available on both follow ups were only reviewed. Subjects included in the study had bilateral/unilateral mild to moderate keratoconus and were using RGP lenses for a period of at least two years. The records were strictly selected using the inclusion and exclusion criteria. The medical records should have basic comprehensive eye examination including visual testing, external examination, slit lamp examination and Orbscan IIZ data. The anterior segment evaluation was done using Slit lamp biomicroscopy and the posterior segment examination was done using the indirect ophthalmoscope. Intraocular pressure was recorded by using Goldmann Applanation Tonometry. Corneal topography measured using the Orbscan IIz was compared with the baseline corneal topography of Orbscan IIz. Subjects with the history of systemic diseases, advanced Keratoconus with corneal hydrops and any contact lens related complications were excluded from the study.

The medical records of successful contact lens wearers were only selected and diagnostic fitting was used to fit all the contact lenses according to the standard clinical practice pattern at L.V.Prasad eye Institute. The lens fit is acceptable only if the dynamic fitting showed good centration with optimal post blink movement and on the static fit has minimal central touch with good peripheral clearance were included for analysis. RGP contact lens fit charts, baseline and 2 year Orbscan IIz data were only included for study purpose. In this particular study diagnosis of keratoconus is based on corneal topography measurement using Orbscan topography system based on the following parameters: posterior best fit sphere >55.00D, Sim K astigmatism steepest point > 46.5D, 3mm zone irregularity >1.4D, 5mm zone irregularity >2.4D, difference in the thickest and thinnest point on pachymetry>100μm.

The compared Orbscan parameters are anterior best fit sphere (ABFS), posterior best fit sphere (PBFS), anterior best fit sphere and posterior best fit sphere ratio (ABFS/PBFS) ratio, Sim K astigmatism, 3mm zone irregularity, 5mm zone irregularity and corneal thickness index before and after 2 years follow up with successful RGP contact lens wearers.

Contact lens Characteristics:

RGP CL (Classic Company, Bangalore, India) have central base curve with additional two peripheral curves and the lenses are made from Fluroperm 90 with an oxygen transmission of 87 (cm/sec) [(mL O2/mL.mm Hg). 10^{-11}]. All the lenses dispensed are custom made as per the requirement of diagnostic CL fitting.

Data Analysis:

Data was entered in SPSS 16 GP for analysis. The demographic data and Orbscan data were reported using descriptive statistics. The paired sample t-test was used to compare the Orbscan data of base line and the two year follow up period. Statistical significance set at p-value of 0.05

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RESULTS

The subjects mean age was 27.45 ± 7.42 yrs and 61% of them are males. At the initial visit the mean ABFS, PBFS, and ABFS/PBFS ratio, Sim K, 3mm & 5mm zone irregularity and mean thinnest point on Orbscan pachymetry are 44.40Ds ± 5.9927, 55.548Ds ± 7.9917, 0.8001 ± 0.02037, 5.6940Ds ± 3.61247, 5.81Ds ± 3.310 , 6.56Ds ± 3.5102, 392.34um ± 51.985 respectively. The mean Orbscan parameters after 2 years of successful RGP lens wearers are ABFS, PBFS, and ABFS/PBFS ratio, Sim K,3mm & 5mm zone irregularity and mean thinnest point on Orbscan pachymetry are 45.248 Ds ± 6.5371, 56.576Ds ± 8.8281, 0.8014 ± 0.02250, 4.926Ds ± 3.01715, 5.364Ds ± 2.682, 6.668Ds ± 3.0375, 397.48um ± 59.090 respectively.

Table: 1 Shows Mean baseline & two year successful RGP lens wear Orbscan parameters and statistical significance parameters in Italics.

	Baseline	2 year follow up	Significance
ABFS	44.40Ds ± 5.99	45.248Ds ± 6.54	0.001
PBFS	55.55Ds ± 7.99	56.576Ds ± 8.83	0.02
ABFS/PBFS ratio	0.8001 ± 0.02	0.8014 ± 0.02	0.604
Sim K	5.69Ds ± 3.61	4.926Ds ± 3.01	0.019
3mm Zone Irregularity	5.81Ds ± 3.310	5.364Ds ± 2.68	0.216
5mm Zone Irregularity	6.56Ds ± 3.51	6.668Ds ± 3.03	0.781
Thinnest Point	392.34um ± 51.96	397.48Ds ± 59.09	0.237

DISCUSSION

Three Point touch being widely accepted as the optimal fitting philosophy in keratoconus, as the apical bearing would induce epithelial changes and apical clearance would increase corneal ectasia [12]. Literature suggests that in CL wearers may precipitate keratoconus irrespective of the fitting philosophy and more so in cases of ill fitted CL. In our study we have seen the increase in ABFS and PBFS compared to baseline visit. However Sim K and IR at 3mm zone reduced compared to base line visit following a two-year period of lens wearing. Of the total 7 Orbscan parameters evaluated the 3 parameters showed statistical significance and the ABFS and PBFS showed progression of keratoconus while the Sim K showed the regression of keratoconus. Sahin et al. also reported that progression of keratoconus with RGP CL also lead to progression of anterior and posterior elevation, Sim K and Min K [13]. Contrasting results were reported for Sim K , our study has shown regression where as others have shown progression.

The three point touch fitting opted allowed small progression as there is minimal bearing in the center. The wearing of RGP CL may not have precipitated the progression as only the two most important predictors of keratoconus are showing increase in posterior and anterior elevation. The minimal apical touch fit contact lenses may have contributed to progression of keratoconus, though the changes in parameters are statistically significant, they have not shown that high clinical significance when compared to other studies [13].

There are several reports on the topographic characteristics of keratoconus corneas. There were no reports regarding the changes in corneal topography parameters with the use of RGP lenses in Keratoconus eyes over years. This study evaluates the changes in the corneal topography in eyes with Keratoconus RGP lens wearers for a period of at least two years. Our study is not showing any statistically significant change in the corneal topography parameters in eyes with keratoconus after two years of RGP lens wearers. There is a debate revolving around the reputed ability of rigid lenses to retard the progression of keratoconu [7]. Many authors do assert the superiority of RGP lenses for vision correction in Keratoconus [7,14,15]. In a study conducted by Maguire LJ and Lowry JC , a change in the power at the cone in keratoconus from an average of 44.5D to 51.0D was noted after a period of two years [16]. Kemmetmuller achieved arrested progression of keratoconus in 68.4% of 55 eyes fit with large flat lenses [17]. It is also to be noted that the progression of keratoconus depends on the type of fitting of the lens on the eye. In the first technique, apical bearing, the lens support and bearing takes place on the apex of the cornea. This resulted in epithelial breakdown and hypoxia of the cornea. In the apical clearance fit the lens support and the bearing are directed off the apex and to the paracentral cornea with actual clearance of the apex. This was accompanied by intermediate touch, excessive lens flexure and poor circulation of tears. The divided support or the three-point touch system has the lens support and bearing shared between the corneal apex and the paracentral cornea. This requires a striking delicate balance between a more stable, larger and flatter lens that tends to make the cornea hypoxic and a smaller, less stable lens that allowed better oxygenation and tear circulation [7]. Though many studies evaluated the progression of keratoconus, our study did not have control subjects i.e. subjects without RGP lens wear. If both groups had been evaluated it would have given a better understanding regarding the wearing of a RGP lens could actually retards the progression of keratoconus. Keratoconus is known to progress till the mid thirties, later progression slows down and often stop [1]. Between age 12 and 35 it can arrest or progress at any time and now there is a way to predict how fast it progresses or do not progress at all. In general, young patients with advanced disease are more likely to progress to the point where they may ultimately require some form of surgical intervention. Therefore it is necessary to take age into consideration and compare the progression of the study in different age groups. The Orbscan topography was taken on the day of RGP lens removal. It takes a period of at least 4 weeks for the cornea to get back to its normal shape after the use of RGP lenses. More over our study does not have a control group to report the CL induced progression.

CONCLUSION

Clinically significant differences found in the corneal topography parameters after two years of RGP lens wearers in eyes with Keratoconus.

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