Original Research Article

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Effect of spherical rigid gas permeable lens on correction of corneal astigmatism

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ABSTRACT

Background: Objectives were to study an effect of spherical RGP (rigid gas permeable) contact lens in correcting high corneal astigmatism more than 3 diopter.

Methods: Total 48 eyes with corneal astigmatism greater than 3.00 diopter were included in study. At the first visit, routine preliminary examination, parameter assessment and subjective refraction has been carried out followed by patient counselling for RGP lens wear. Based on the corneal parameters considering keratometry as well as corneal topography, RGP lens trial was done. Post adaptation period, lens fitting analysis was done by understanding Fluorescein pattern with slit lamp and over refraction was done. Final lens has been ordered on this basis with understanding of tear lens formed, lens performance on cornea and edge width minimal of 0.80 mm to 1.00 mm. Patients were assessed at an interval of every two months from a date of lens dispensing.

Results: The spherical RGP lens did correct the corneal astigmatism of more than 3D by formation of tear lens between cornea and lens. Vision improved by 2 to 3 lines compared to the spectacle correction without compromising corneal integrity at the central or peripheral cornea. Keratoconic eye showed significant vision improvement without the use of toric lens.

Conclusions: Astigmatic eyes showed significant improvement in acuity with spherical RGP lens without compromising corneal integrity.

Keywords: Rigid gas permeable, Corneal astigmatism, Keratoconus, Keratometry

INTRODUCTION

Astigmatism is a refractive condition where variations of power exist in different meridians of the cornea. One meridian usually exhibits the greatest power and one the least, with these meridians forming the principal meridians of the eye. The major source of astigmatism is the anterior surface of the cornea. Any astigmatism produced by the posterior cornea, lenticular surface, or lenticular zonular lamellae is termed residual astigmatism. The total amount astigmatism for any one patient is the sum of all of the astigmatism produced by

the refractive system secondary to normal variations in the surfaces of different ocular media. $^{\rm 1}$

Therefore, the total astigmatism is a combination of corneal and lenticular astigmatism.¹ Both regular and irregular astigmatism are relevant to optometrists as uncorrected astigmatism causes primary visual complaints such as asthenopia, diplopia, reduced visual acuity, and headaches.

Previously many studies have shown very good option for correcting high corneal astigmatism by using RGP lenses.

Tricurve RGP lens design

In the tricurve RGP lens the two peripheral curves are present other than the central curve. The second curve has the radius 0.80 mm flatter than the back-optic zone radius (BOZR) for a width of 0.30 mm. the diameter of the second curve is 0.60 mm more than the diameter of back optic zone diameter (BOZD). The 3rd curve has the base curve of 2.5 mm flatter than the BOZR and diameter is 1.4 mm more than the BOZD.² RGP contact lens suggested option for corneal astigmatism

Spherical RGP Lens corrects corneal astigmatism by the formation of tear lens between lens and anterior surface of cornea.

Objectives

Objectives were the effect of spherical RGP lens on correction of corneal astigmatism.

METHODS

Study design

Prospective, interventional cross sectional.

Study duration

9 months (January 2011- September 2011)

After approval from nagri eye research foundatoin trust (NERF), study conducted at C. H. Nagri Municipal Eye Hospital Ahmedabad. Inform and written consent of all patient taken. The eyes with more than 3 diopters of corneal astigmatism were selected on the basis of 'K' reading, corneal topography and subjective refraction, with including Keratoconus and irregular astigmatism. All the eyes were fitted with tri-curve spherical RGP Lens to see the correcting or masking of corneal astigmatism.

Material used this study were torch, fluorescein strip, retinoscope, auto refractometer, scale, vision drum, trial set, RGP lens trial set, slit lamp bio-microscope, keratometer, corneal topograph

At the first visit, routine preliminary examination, parameter assessment and subjective refraction has been carried out followed by patient counseling for RGP lens wear. Based on the corneal parameters considering keratometry as well as corneal topography, RGP lens trial was done. After the lens wear 20 minute of adaptation time is given for the patient's comfort with looking the flour.

After adaptation time, the lens fit was examined under slit lamp. The lens fitting was examined dynamically and statically with the use of fluorescein strip. The lens fit analyzed for the proper centration, movement, edge width and the fluorescein pattern on the astigmatic corneas with good tear exchange under the lens. After, satisfactory fit finalization of lens power was carried by over refraction.

With the trial lens in situ tear lens power & lens edge width is been key feature to understand and evaluate to avoid the long-term ill effects on the toric corneas with the spherical RGP lens like 3 and 9 o'clock staining etc.

Technique used to evaluate the lens fit is as per grading guide lines which is as follows—By James Wolffsohn. This grading gave clear cut idea regarding edge width as well as central fit. Data analysis done by measuring average/standard deviation of all patients result.

Inclusion criteria

Inclusion criteria were the corneal astigmatism should be 3.00 D or more and irregular corneal astigmatic patients like keratoconus.

Exclusion criteria

Exclusion criteria were individuals with any ocular pathology, patients who have undergone any type of corneal surgery, higher amount of internal astigmatism.

RESULTS

The spherical RGP lens did correct the corneal astigmatism of more than 3D by formation of tear lens between cornea and lens. Vision improved by 2 to 3 lines compared to the spectacle correction without compromising corneal integrity at the central or peripheral cornea. Keratoconic eye showed significant vision improvement without the use of toric lens.

The 48 eyes of 25 patients with more than 3 diopter of corneal astigmatism were included in this study. The eyes fitted with RGP lens shows the improvement in vision than the spectacle corrected vision.

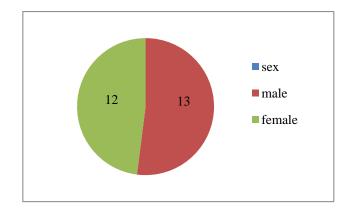


Figure 1: Demographic data.

Out of 25 patient 13 males and 12 females in the study and from all the patient having corneal astigmatism, maximum corneal astigmatism is -8.0 diopter and

minimum corneal astigmatism is 3 diopters. All patient undergoes advised RGP lens (Figure 1).

The average amount of corneal astigmatism 4.61 diopter is easily covered by the spherical RGP lens without any corneal complication.

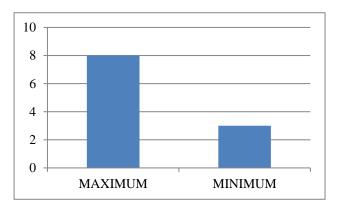


Figure 2: Corneal astigmatism.

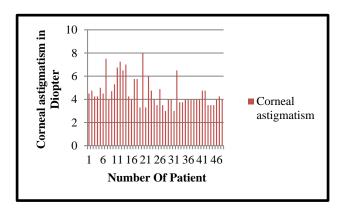


Figure 3: Corneal astigmatism in diopter.

Table 1: Average corneal astigmatism corrected by tear lens formation.

Average corneal astigmatism corrected by tear lens formation	
Flatter meridian	0.92 d (SD±0.66)
Steeper meridian	-3.68 d (SD±0.96)

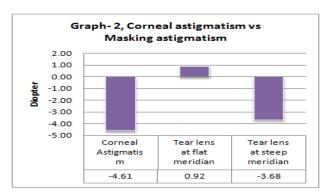


Figure 4: Corneal astigmatism vs masking astigmatism.

The average corneal astigmatism of -4.61 D (SD±1.23) is corrected by spherical RGP lens by the formation of average tear lens of 0.92 D (SD±0.66) in the flatter meridian of cornea and average -3.68 D (SD±0.96) of tear lens in the steeper meridian of the cornea (Table 1) and (Figure 4).

The study follows the 3-quarter rule for the spherical lens fit in toric corneas. The average theoretical base curve for the RGP lens was 7.36 mm (SD \pm 0.58) while the average practical base curve was 7.46 mm (SD \pm 0.58) (Figure 4).

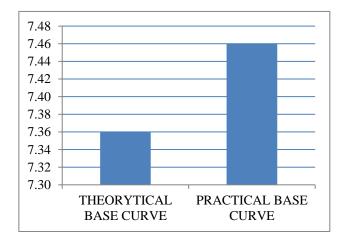


Figure 5: Base curve.

The axial edge lift at total diameter should be minimum of 1 mm. In the study we have fitted lens shows the average edge lift of 0.87 mm (SD±0.1).

DISCUSSION

Eyes with high corneal astigmatism corrected with spherical RGP lens did show significant vision improvement than the spectacle corrected vision. The corneal astigmatism of more than three diopter was easily corrected by the spherical tri-curve RGP lens by the formation of tear lens between the cornea and lens.

First study comparable to our study is Visual performance in the correction of astigmatism with contact lenses: Spherical RGPs versus toric hydrogels shown that RGP lens were give more clear vision than the toric hydrogels.³

In the second study the vision improvement was compared between the spectacle corrected and RGP lens corrected irregular astigmatism of 48 eyes of 29 patients, which shown the improvement of vision by RGP lens average about six line than the spectacle corrected irregular astigmatism.⁴

This study follows the three-quarter rule for fitting spherical RGP lens in the high corneal astigmatism with respect to base curve selection and also now - how the astigmatism was corrected by the formation of tear lens.

According to other study the average amount of axial edge lift should be 1mm to maintain the normal corneal integrity with lens wear.5 In this study average axial edge lift of 0.87 mm is been demonstrated mathematically as well fluorescein pattern reveals the same and is acceptable.

The edge clearance is good so there was very less chances of 3 & 9 o'clock staining on the cornea which has been assessed on three consequent follow-up visits at 2 months interval.¹⁷ In the follow up visits, all patients' shows good comfort with the lenses and the corneal integrity was same as the time of lens dispensing.

According to the study the spherical RGP lens is showing very good option for the correction of high corneal astigmatism as a start for patients who have hassle free option compared to RGP torics, piggyback modalities.⁶

Second factor contributed is financial, as other modalities which have been proved to be best for high astigmatism are available at high cost.

Limitations

In our study main limitation is less no of patients, RGP lens intolerance and high drop out.

CONCLUSION

Astigmatic eyes showed significant improvement in acuity with spherical RGP lens without compromising corneal integrity. But other options like toric RGP, ROSE K, sclera lenses are also very useful in advanced cases.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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