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Contact Lens in Keratoconus: A Review

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Abstract:- Keratoconus, a non-inflammatory corneal ectasia, is characterized by progressive corneal thinning and apical protrusions. Due to the cornea ectasia, optic problems can occur and the contact lens plays very important role in the correction. Increased irregular astigmatism due to the corneal ectasia, specialized CL designs are required to improve the vision.With recent advances in materials and design technology, treatment of Keratoconus with contact lens have developed greatly and there are various types of contact lenses are available. In this review, we will know about the wide variety of contact lens such as rigid and soft lenses, hybrid lenses, scleral lenses, piggyback contact lens (PBCL), softtoric lenses.

In this article, we discuss about selection of the contact lens depending on the type of Keratoconus and fitting technique of different types of contact lenses.

Keywords:- *Keratoconus, contact lens, rigid gas permeable lenses, soft lenses, piggyback lenses, hybrid lenses, scleral lenses, toric soft contact lens.*

I. INTRODUCTION

Keratoconus (conical cornea) is a non inflammatory bilateral (85%) ectatic condition of cornea in its axial part. It usually start at puberty and progresses slowly. It is a bilateral conical protrusion of the central part of the cornea with thinning of its central and inferior paracentralareas. In patients with Keratoconus irregular astigmatism occurs due to thinning of the cornea that results in poor vision or defective vision. When astigmatism is mild in the early stagesofkeratoconus, spectacles are helpful. Spectacles have a very limited function in advanced keratoconus, and contact lenses are essential for vision correction and play a significant role. Depending on the severity of the cone and any accompanying conditions, one can choose any one of the numerous contact lens alternatives as a starting lens.[1,2,3,4]In individuals with keratoconus, fitting contact lenses can be difficult. This article aims to make the process of choosing the best contact lens easier while also improving vision.

II. PRE-REQUISITES FOR THE FITTING

In order to choose the parameter for the initial trial lens indices, keratometry and corneal topography are crucial instruments in the management of keratoconus.[5,6] For patients with keratoconus, a trial lens (diagnostic) approach is required to get a good fit for their contact lenses.[7] The corneal apex become stepper in the very severe cases of keratoconus, and so fitting will become more challenging. In the end, fitting contact lenses for those with keratoconus becomes complicated, requiring more chair time and multiple diagnostic fitting sessions. When fitting RGP or Rose K lenses for keratoconus patients, the characteristics from corneal topography help shorten chair time and ensure a good fit.[1] Buxton et al., have classified keratoconus based on the keratometry values at the apex of the cone: Mild if less than 45.00 D, moderate if >45.00 D and <52.00 D, advanced if > 52.00 D and < 62 D, and severe if > 62.00 D. Based on the morphological shape of the cone, they can also be classified as round or oval cones.[8] The morphology of the cones, such as the nipple cone, which is small, paracentral, steeper, and located inferiorly or inferonasally, the oval cone (which has a cornea that is inferiorly or inferotemporally steeper), and the globus cone, which is located in the corneal topography, are known by the severity of the condition (overall steeper cornea). The globus cone, which covers more than three-quarters of the cornea up to the limbus, is substantially larger. [9]

III. HOW DO WE CHOOSE A LENS?

The basic objective of contact lens fittings is to increase visual acuity while maintaining comfort and corneal health. Barr et al. has demonstrated that adjusting the contact lens fit can lessen corneal scarring. [10]

If possible, a lens is chosen based on the manifest refraction and the severity of the keratoconus. A soft or soft toric contact lens can be chosen for moderate keratoconus, but if the condition worsens, RGP is the recommended lens. The comfort of soft contact lenses (SCL) is well known. [11]. The diameter of the contact lens, the base curve, and the power are the three crucial factors in the fitting of any contact lens. For mild keratoconus, a low minus power lens should be used, and for progressed to severe keratoconus, a high minus power lens should be utilised, even in cases where refraction is impossible and base curves are steeper.

The cone's position, size, and steepness all affect the diameter. Generally speaking, it is wise to begin with a lens with a small diameter, like 8.7 mm. Nipple cones are easy to fit because of their small diameter. It is challenging to fit patients with an inferotemporal oval or sagging cone because these people require lenses with a widediameter.

IV. SOFTSPHERICAL/ SOFT TORIC LENSES

Soft lenses are most effective in earlier stages of keratoconus. In patients with keratoconus, high myopia is related sometimes and soft contact lens are advantageous in those patients.

During the time of selection of soft contact lens, to neutralize the irregular astigmatism thicker lenses with low water content should be used. Lenses with a big diameter should be chosen for severe apical displacement, globus cones, or cones with a large diameter. [12]

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HydroKone (Medlens Innovations), Soft K (Advanced Vision Technologies), Solus Soft K (Strategic Lens Innovations), SpecialEyes 59/54 Toric (SpecialEyes), and Ocu-Flex Toric are some of the different soft toric lenses that are offered (Ocu-Ease). These lenses can be ordered with more acute base curves. [12,13]

V. RIGID GAS PERMEABLE LENSES IN KERATOCONUS

Rgp lens are commonly used to treat people with keratoconus.

"Gas permeable" means that these lenses provide oxygen flow through the material to the eyes.

Rgp lens also provide better vision and durability.

Since RGPCLs are the most common type in Keratoconus, they also improve the possibility of nonsurgical management because they have the highest level of optical success. [14,15].In a study involving 518 Keratoconus patients, Bilgin et al.[16] found that RGPCLs prevented 98.9% of the patients from needing surgery.

RGPCLs' optical success is primarily due to the formation of a smooth, spherical anterior optical surface that produces the primary refractive effect and the shaping of the tear layer into a liquid lens between the CL and the cornea, which hides anterior surface irregularities caused by the ectatic cornea and the elevated higher-order aberrations associated with these irregularities [17]. Although keratoconic eyes had improved corrected visual acuity with RGPCLs, Negishi et al[18]observed that their visual performance was still inferior to normal eyes with and without RGPCLs. This was based on a study of contrast sensitivity.

Because they are feasible, safe, and have a high optical success rate when used in consideration of the multiple features of Keratoconus, RGPCLs are still the first-line treatment for Keratoconus today.

VI. THE PIGGYBACK CONTACT LENS SYSTEM IN KERATOCONUS

Due to the low oxygen permeability of the lens materials employed, the piggyback CL (PBCL) system, which was first presented in 1970 as a solution for keratoconic patients who were unable to use rigid lenses, has had very modest success[19]. Due to the high oxygen permeability of both lenses, it has been demonstrated that PBCL systems produced using a combination of high-Dk silicone hydrogel and gas-permeable rigid materials allow enough oxygen to reach the cornea. In this technique, it is also feasible to take use of the oxygen that is dissolved in the tears since the movement of both lenses encourages circulation of the tear layer between the lenses [20].

For keratoconic patients who complain of discomfort and intolerance, insufficient lens stability, or apical epithelial erosion with RGPCLs, the PBCL system may be preferable [21, 22].

There are also reports of this technology offering the best CL fitting for patients who have had surgeries like intracorneal ring segment implantation or corneal transplantation but still have persistent or progressive corneal abnormalities[23,24].

The objective of an Ideal PBCL fitting is for the rigid and soft CLs to move independently but in unison. Following the soft lens's insertion and evaluation of its movement on the eye's surface, keratometric readings are taken from this lens's front surface, and the rigid lens's BC is calculated in accordance with those readings. Fluorescein is used to assess the compatibility of the lenses with the eye and one another after the rigid lens has been fitted . Many studies favour positive-powered (+0.50 to +4.0) soft CLs when using the PBCL system because of their sharper front surface curves, which improve the stability of the stiff lens [21,22,25].

The majority of patients, however, were able to wear their rigid lenses without a soft lens after a mean of 6 months (3-12 months), according to a study by Sengor et al.[21], which was explained by a reduction in sensitivity and habituation over time.

In outcome, the PBCL system is currently a successful and reliable technique that can be used in KC patients to protect the corneal surface from mechanical effects, provide better stabilisation of the RGPCL on the irregular cornea, and improve CL tolerance. This is made possible by the bandage effect provided by the soft lens.

VII. HYBRID CONTACT LENS IN KERATOCONUS

Using a unique technology, hybrid CLs (HCLs) are created by joining pieces formed of two different materials that are hard in the centre and flexible on the edges. The goal of this kind of CL is to combine the stiff lens performance and soft lens comfort[26].

The first hybrid lenses, Saturn II (OPSM, Contact Lenses, USA) and SoftPerm (Sola/Barnes-Hind Incorporated), had issues with corneal hypoxia because of their low oxygen permeability, lens damage because of structural instability (especially tears along the fusion line), and subsequent financial losses[27].

Although there have only been a few studies on hybrid lenses, it was reported that 87% of 61 eyes with KC (58 individuals) and pellucid marginal degeneration (PMD) had successful results after using SynergEyes KC, a new generation hybrid lens (3 subjects) [28].

In a different study comparing the clinical information and quality of life ratings of keratoconic patients wearing ClearKone lenses and RGPCLs, it was discovered that while both lens types offered comparable visual quality, the ClearKoneSynergEyes SCLs scored higher in terms of vision-related quality of life[29].

Fernandez-Velazquez[30], on the other hand, highlighted potential difficulties that could occur while using ClearKone SCLs and emphasised that early circular

corneal clouding may be a sign of a major issue and that SCL use should be stopped in such circumstances.

Other SynergEyes side effects include alterations brought on by hypoxia, such as vascularization and central corneal clouding. [31] After 5 hours of using ClearKone lenses, the cornea should be checked for corneal oedema. [31].

Although HCLs are a product of advance technology that blends the beneficial properties of rigid and soft materials in a single lens, further research is required on the effects they may have on the cornea and ocular surface in the long run.

CONCLUSION

People with keratoconus, contact lenses can enhance vision and postpone or eliminate the need for keratoplasty.In mild to moderate keratoconus, the lens diameter selected is usually 7.5 to 8.5 mm. Several especially designed contact lenses have been developed to facilitate fitting in advanced, difficult to fit keratoconus cases. Soper lenses are one of the best known lenses. Rigid lenses, soft lenses, lenses that combine the advantages of all of these materials, and lenses with unique designs are just a few of the many types of CL that have been developed to yet. As a result, the possibility of finding a solution to the issues KC patients experienced has significantly increased, and it is now possible to offer patients these reversible and extremely diversified options as an alternative to surgery. The preferred lens is an RGP lens, but if the patient experiences discomfort or intolerance, one may switch to a PBCL or unique soft toric lens later on, if necessary. Finally, hybrid lenses may be considered.

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