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Case Report

Combination of Collagen Cross Linking with INTACS for Treatment of Advanced Keratoconus CXL Plus INTACS for Keratoconus

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Abstract

Keratoconus is a chronic corneal disease that could lead to severe visual impairment or even blindness if left untreated. Advanced keratoconus is rare but difficult to manage. In this report, we present a case of an advanced keratoconus and its management with a combination of Collagen Cross linking with intra-corneal ring segments (INTACS). It summarizes how a rare condition could be halted progression and rehabilitate vision.

Keywords: Intra-Corneal Ring Segments (INTACS); Keratoconus; Collagen Cross Linking

Introduction

Keratoconus is a corneal ectasia resulting from non-inflammatory, progressive thinning of the corneal stroma [1]. It induces irregular astigmatism and myopia, and results in gradual visual impairment ranging from mild to very severe [2]. Spectacles and contact lenses are optical treatment options in mild-moderate stages of the disease [3]. Surgical management of more severe cases include implantation of intra-corneal ring segments (INTACS), photorefractive keratectomy, corneal collagen cross linking (CXL) and penetrating keratoplasty (PK) in advanced disease [4-7]. Visual prognosis in advanced cases are usually poor.

It is proven that both CXL and INTACS are safe and effective treatment. CXL has been shown to halt keratoconus progression, but its effect on visual rehabilitation may be insufficient. Intracorneal ring segments (Intacs) produce rapid and substantial improvement in visual parameters but do not halt keratoconus progression. Therefore, combining the two procedures can theoretically produce better results.

In this report, we present a case of advanced keratoconus treated with simultaneously combined procedure of INTACS with Femtosecond laser and corneal collagen crosslinking (CXL) with riboflavin and ultraviolet A (UVA). Early post-operative clinical results are compared.

Case Report

History

A 20 year old male of Indian origin was referred from a local clinic for progressive bilateral decreased vision. The chief complaint of the patient was progressive blurring of vision and increase in myopic correction over the past four years. Other associated complaints included coloured halos and watering. The patient revealed a history of several episodes of vernal keratoconjunctivitis between the ages seven to twelve. There was no history intraocular/corneal surgery or ocular injury. He had no significant family history of corneal diseases and had no known allergies.

Examination

His uncorrected distance visual acuity was 3/60 in the right eye and 6/60 in the left, best corrected by refraction to 6/36-1 with -5.00/-4.50 x 20 for right eye and 6/18 with ±/ -4.50 x 70 for left eye. Retinoscopy revealed scissor reflex and irregular astigmatism.

Anterior segment evaluation by slit lamp biomicroscope examination revealed Vogt lines and thinning of central cornea with a deep anterior chamber. On examining retina with slit lamp biomicroscopy, mild tessellation in both eyes with no retinal pathology was observed. A provisional diagnosis of keratoconus was made and corneal tomography was advised for confirmation. Corneal topography showed keratometric reading in right eye as K1: 42.1 and K2: 47.2 X 21 and OS was K1: 42.8 and 48.7 X 63. The central pachymetry was 448 µm OD and 441 µm OS. The thinnest pachymetry was 444 µm OD and 431 µm OS. On Berlin Ambrosio Ectasia maps D-values were 4.81 and 6.57 in right and left eye respectively.

Anterior segment evaluation by slit lamp examination revealed that Vogt lines and thinning of central cornea. The anterior chamber was deep. Other anterior segment findings were normal. The fundus on slit lamp biomicroscopy was observed to be mild tessellated in both eyes with no retinal pathology. Intraocular pressures were 17 mm Hg OD and OS at 11.30 a.m. with Goldmann applanation tonometry.

Extraocular motility and pupillary reactions were normal in both the eyes.

The patient was suspected with keratoconus and was advised corneal topography. Corneal topography showed keratometric reading in OD was K1: 42.1 and K2: 47.2 X 21 and OS was K1: 42.8 and 48.7 X 63. The central pachymetry was 448 µm OD and 441 µm OS. The thinnest pachymetry was 444 µm OD and 431 µm OS. On Berlin Ambrosio Ectasia maps D-values were4.81 and 6.57 in right and left eye respectively.

Diagnosis and management

Diagnosis of bilateral keratoconus was made and advised corneal collagen crosslinking (CXL) with riboflavin and ultraviolet A, combined with INTACS with Femtosecond (FS) laser in both the eyes as a simultaneous procedure. He was given appointment for the procedure. The patient underwent a thorough discussion of the risks and benefits of the procedure with the surgeon and signed a written informed consent. Routine blood examination was done.

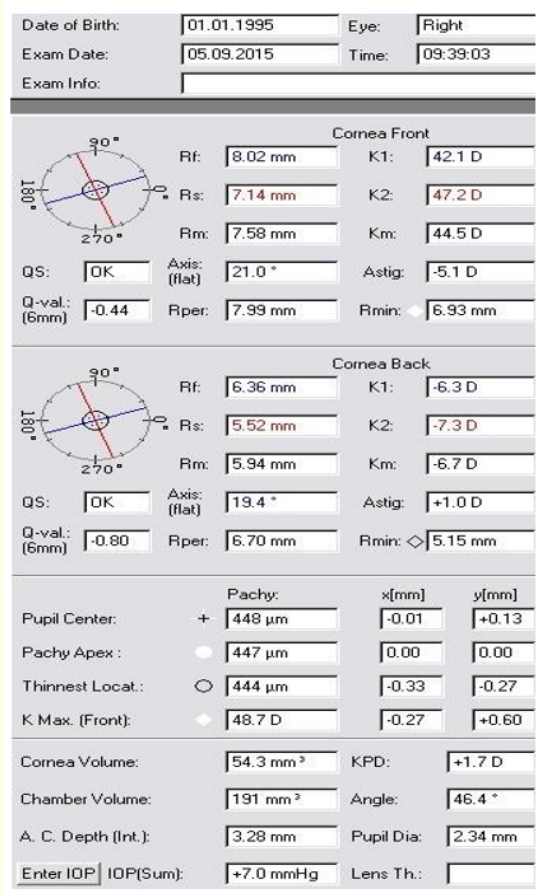

Figure 1: Corneal parameters of right eye.

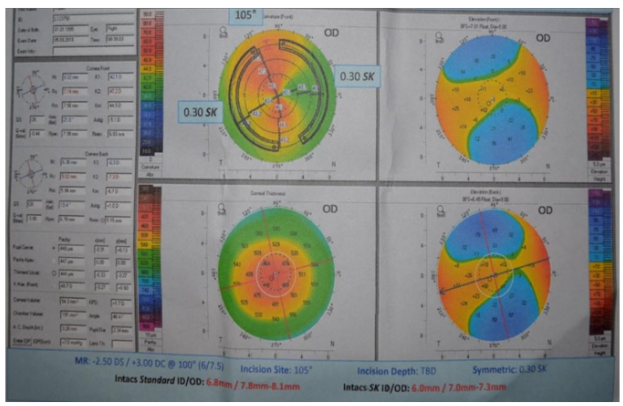

Figure 2: INTACS thickness calculated for right eye.

On 12th September 2015, Corneal crosslinking combined with INTACS with femto laser were done in both the eyes under sterile conditions using the same technique. INTACS used were 0.30 SK for right eye and 0.35 SK for left eye.

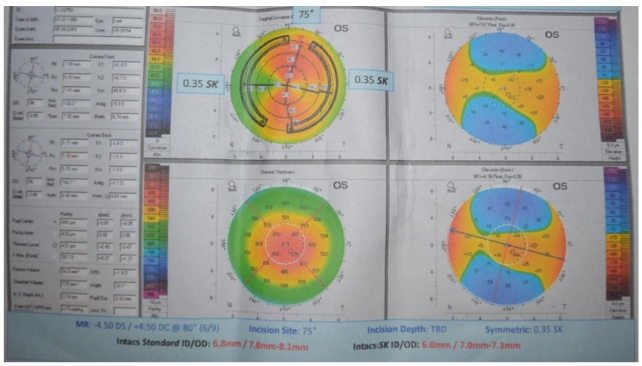

Figure 3: INTACS thickness calculated for left eye.

Postoperative medication that were Toba DM eyedrop thrice daily for 1 week and Refresh Tears eye drop four times daily for 2 weeks.

Follow up

The patient was followed up after three days on 12th September. On postoperative examination the unaided visual acuity was 6/9 on right eye and 6/12 on left eye. Retinoscopy revealed ±/-1.00 x 30 and ±/-1.75 x 60. Subjective refraction ±/-1.00 x 30 and ±/-1.50 x 60 with best corrected visual acuity of 6/6-2 and 6/9 on right and left eye, respectively.

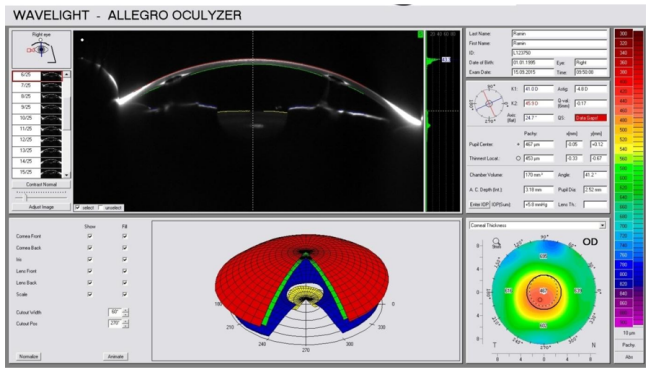

Figure 4: Post-operative Schiemflug image of right eye.

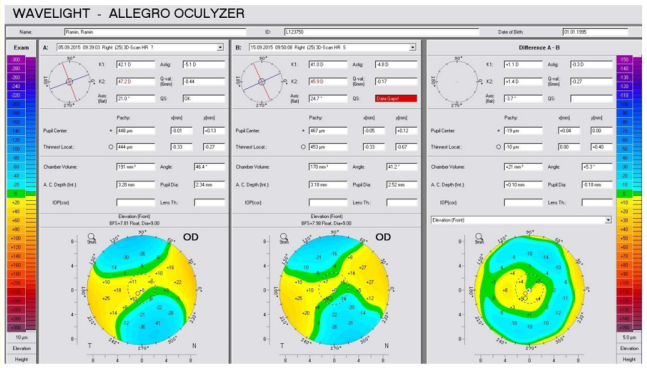

Figure 5: Comparison of pre-operative and post-operative changes in corneal parameters.

Keratometric readings decreased from K1: 42.1 and K2: 47.2 X 21 to K1: 41.0 and K2: 45.9 x 24 in right eye and K1: 42.8, K2: 48.7 X 63 to K1: 40.9, K2: 45.6 in the left eye. Kmax reduced from 49.7D to 49.5 in right eye and from 51.1 to 49.7 in left eye. There was significant reduction in astigmatism and improvement in visual acuity.

He was advised to use sunglasses for 2 weeks and continue post-operative medication. Follow up after one month was advised.

Discussion and Conclusion

Corneal collagen cross-linking (CXL) is probably the only 'true' treatment for corneal ectasia which directly addresses the disease pathology and potentially avoids the need for corneal transplantation [8]. Furthermore, is very likely to be cost effective, compared with standard management, for the treatment of progressive keratoconus [9]. Corneal collagen cross-linking is a procedure using UV-A and the photosensitizer riboflavin to stiffen the cornea.

Implantation of Intacs is another alternative for management of keratoconus. Intacs are made of polymethyl methacrylate and have a crescent-shaped arc length of 150 degrees. Their inner diameter is 6.8 mm and outer diameter 8.1 mm, when placed in the cornea. Thickness of Intacs range from 0.25 to 0.50 mm, in increments of 0.05 mm. Intrastromal ring segments were designed to achieve a refractive adjustment by flattening the central corneal curvature while maintaining clarity in the central optic zone.

Previous investigations have shown that Intacs implantations, improves corneal topography and improve contact lens tolerance and spectacle corrected visual acuity, as well as uncorrected visual acuity in some patients.

Several studies show that Corneal collagen crosslinking (CXL) with riboflavin and ultraviolet A (UVA) has been used in the attempt to enhance corneal biomechanical resistance by an increase in collagen fiber diameters [10,11]. Wollensak., *et al*. (2003) found that the collagen fiber diameter and corneal rigidity were found to increase, and as the main keratoconus characteristic is a reduced biomechanical corneal strength, CXL was proposed to halt its progression.

Implantation of Intacs is another alternative for management of keratoconus. Several studies have demonstrated the efficacy of Intacs in correcting low myopia, in post-LASIK corneal ectasia, and in keratoconic eyes [12-16]. Intacs are able to change the shape of the cornea and work by an "arc-shortening" effect of the cornea [16].

Aylin., *et al*. [17] analyzed the visual and refractive outcomes of transepithelial cross-linking treatment in eyes with pre-existing Intacs and found that Collagen cross-linking has an additive effect on Intacs implantation in these eyes and may be considered as an enhancement/stabilizing procedure. Colin., *et al*. (2007) compared the effect of inferior-segment Intacs with and without CXL on keratoconus and found that the addition of CXL to the Intacs procedure resulted in greater keratoconus improvements than Intacs insertion alone [18].

Kymionis (2014) reviewed literature and concluded that combined corneal collagen cross- linking (CXL) and refractive surgical techniques is likely to benefit many patients with corneal ectatic disorders. The appropriate combined procedure will depend on multiple factors, such as refraction, corneal thickness, and degree of irregular astigmatism [19].

In this case, INTACS and CXL procedures were combined and evaluated the clinical outcomes. It can be concluded that INTACS implantation with CXL proved to be effective in treatment of keratoconus but subjectively and objectively. On post-operative evaluation, flattening of cornea and reduction in K Max values were noted. Uncorrected visual acuity improved significantly. INTACS has additive effect on CXL in these eyes and can be considered as vision improving procedure.

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