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Case Report

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Refractive Use of Intrastromal Corneal Rings in Penetrating Keratoplasty

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Abstract

Intrascleral ring implants appeared in the 1950s with the aim of altering the curvature of the cornea promoting the correction of refractive errors. More recently, corneal rings have become more important in ophthalmology for the remodeling of irregular corneas, in which the excimer laser would be contraindicated.

Corneal transplants have several indications and currently have a wide range of options depending on the underlying pathology. The postoperative management of keratoplasty, especially regarding refractive errors, can be very difficult. Some situations, such as anisometropia and intolerance of contact lenses, require surgical procedures for visual rehabilitation.

Among the surgical option have the procedures with use the excimer laser, when the biomechanical conditions of the cornea allow, and in specific cases of contraindication the possibility of using the intrastromal ring implants, or even implants of intraocular lenses (phakic or pseudophakic).

In 2011, the studies were started using large arc length segments with very positive results. They have numerous advantages among them the maintenance of every implant in a single plane allowing greater regularity of the surface of the cornea and with the advent of femtosecond laser the implant of these segments became possible.

The option of a ring implant is based on the fact that the procedure has the possibility of being reversible without corneal consumption.

Keratoplasty is aimed at obtaining the visual rehabilitation of the patients, so the simple fact of obtaining a good transparency of the corneal button can not be considered as success, therefore the final visual acuity should always give the final word on the result.

Introduction

The main refractive errors seen after a penetrating transplant are myopia and astigmatism [1]. As treatment options more indicated to be followed as glasses and as contact lenses. However, not all patients tolerate such methods or obtain the best corrected visual acuity (BCVA), which makes surgical techniques a good way to achieve satisfaction and good visual outcome for patients [2].

A correction of myopia gained another therapeutic option when in 1949 Jose Ignácio Barraquer began the use of intracorneal implants in order to correct the curvature of the cornea promoting a correction even of this type of ametropia [3].

The Brazilian ophthalmologist Paulo Ferrara de Almeida Cunha perfected these implants and developed what they know today as Ring of Ferrara [4].

In recent years, single-segment rings with more than 180 degrees have been developed, reaching 355 degrees of arc length [5].

With the advent of the femtosecond laser it was possible to facilitate a surgical technique for an introduction, more new devices [6].

Nowadays, horn rings have become an important therapeutic option in ophthalmology for irregular corneal remodeling and ametropia repair.

Objective

To report a case of adolescent patients submitted to corneal transplantation, evolving in the late postoperative period with significant residual ametropia, using a 340-degree intraestromal ring implant in order to flatten the corneal curvature and thus reduce myopia generated.

Case Report

TCF, a 12-year-old female patient, attended the Ophthalmology Service at the Center Laser and Ocular Diagnosis, with a prior history of kerathoplasty at 2 years of age because corneal scar secondary to herpetic keratopathy. In the biomicroscopic examination, the presence of the transparent corneal button without sutures and no other relevant changes was observed in the left eye. He had a clear refraction in the right eye of [plane -0.75 x 155°] with visual acuity of 20/20 and [-12.00 -1.50 x 75°] with visual acuity of 20/200 in the left eye.

The preoperative examinations consisted of specular microscopy **(figure 1)** and pentacam **(figure 2)**. Central pachymetry showed 537 µm in right eye and 544 µm in left eye. The pentacam of the right eye did not observe relevant changes and the left eye had a pachymetry with a thinnest point of 444 microns and Kmax of 56.9 D.

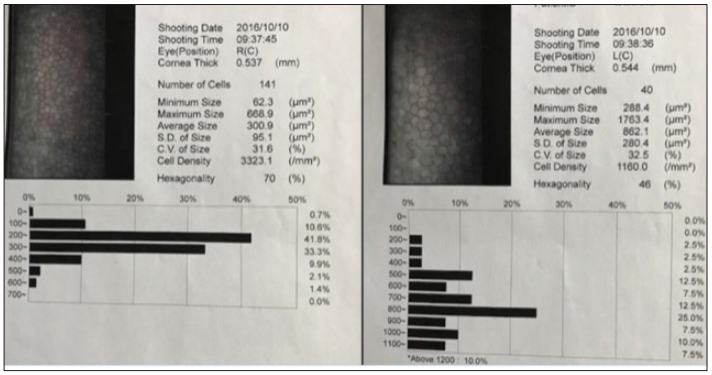

Figure 1. Preoperative specular microscopy

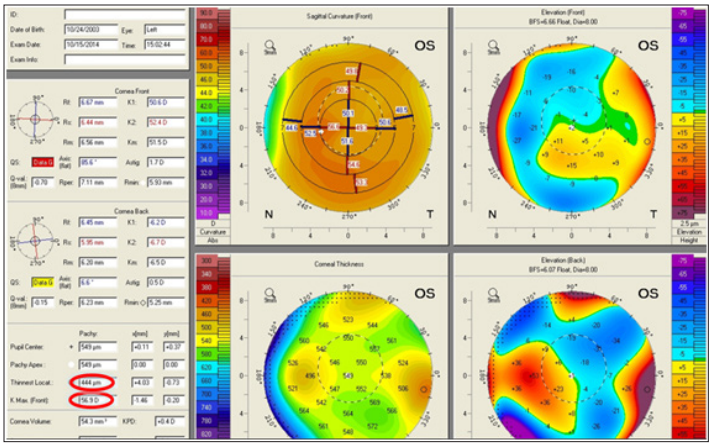

Figure 2: Preoperative Pentacam

In view of the data obtained, a 340-degree ring implant was indicated in the left eye.

It was instilled in the left eye proximetacaína 0.5% (topical anesthesia) then the optical center (the Purkinje reflex) was defined through manual marking to facilitate the centralization of the laser after the docking. The incision (programmed for the axis of the more curved meridian) and the corneal tunnel were made with the femtomecond laser; the tunnel diameter was enlarged to 2.4 mm to facilitate the introduction of the ring. The procedure went without preoperative accidents. Finally, the segment was implanted without intercurrences.

In the postoperative, Zypred® (gatifloxacin and prednisone) was used every 6 hours and Hyabak every 4 hours for 7 days. The result after one month of segment **(figure 3)** showed a considerable improvement with regression of refraction [-0.50 -3.50 x 85°] and improvement of visual acuity to 20/100, which was not better due to the already installed amblyopia.

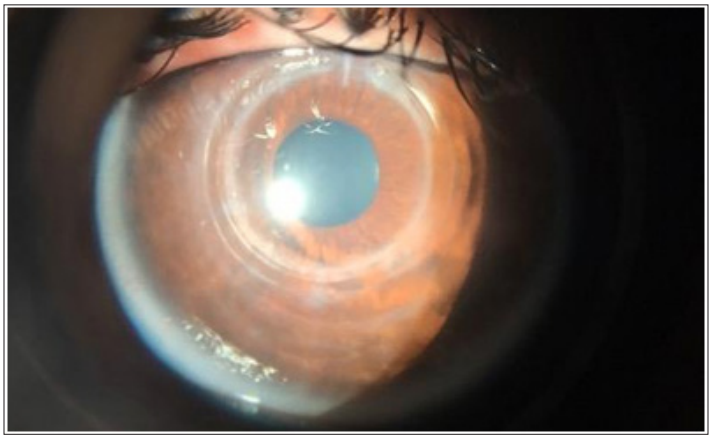

Figure 3: Segment after 1 month

In the postoperative pentacam the flattening was observed with Kmax of 51.4 D **(Figure 4)**, but in the 3 mm central the flattening was more evident. In the miscroscopy the endothelial count in the left eye remained low as previously identified in the preoperative period.

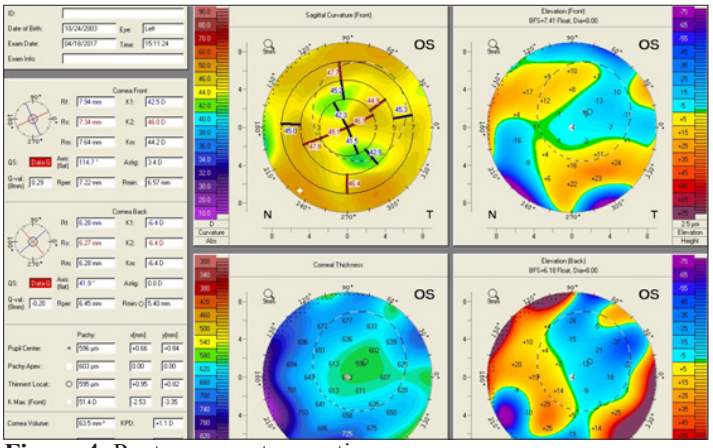

Figure 4: Pentacam post-operative

Discussion

After penetrating keratoplasty 15-31% of patients develop astigmatism greater than 5 diopters [1]. Inherent factors to the recipient, trepanation technique, inadequate repair of the eye during surgery, suture technique, post-operative care, topical corticosteroid time, and removal of precocious suture may be culprits not developed by astigmatism after penetrating keratoplasty [3].

Today, the treatment options available for correction of ametropias are: photorefractive keratectomy (PRK), laser in situ keratomileusis (LASIK), laser assisted subepithelial keratectomy (LASEK), wedge resection, intraocular lenses (IOL), relaxing incisions and intrathromal corneal segment, this latter option does reduced myopia generating partial visual rehabilitation for the patient [1,2,4,7].

The intra-stromal ring implant acts on the corneal lamella generating

a central corneal flattening [8]. The main benefits are technical operations, safety and stability, and when compared to other invasive techniques (photorefractive keratectomy (PRK), Laser Excimer in situ keratomileus (LASIK), laser assisted subepithelial keratectomy (LASEK), Cunha resection) the possible ring has the advantage of being reversible, does not consume corneal tissue and does not reduce an endothelial count [9].

The patient in this case did not present a good indication to perform relaxing incisions since the procedure presents high rates of recurrence, is less predictable, and more invasive when compared to the ring implant, as we were in front of a transparent corneal graft of 10 years of implantation, we opted for a more conservative procedure with lower chances of developing an inflammatory reaction and consequently lower chances of leading to late failure [1,10].

Although there are reports in the literature of the use of intraocular lenses (IOL) for the correction of high myopia after penetrating keratoplasty, there is a risk ratio for reducing cell density, which the patient in the case already had such a reduction. In Brazil the exchange of the lens without cataract for an IOL is not allowed, so the option for younger patients, such as the one reported, would be the implantation of phatic lenses with a 35% chance of endothelial reduction and 8.3% of corneal failure [11,12].

In the case of keratorefractive procedures such as PRK, LASIK, knowledge of low predictability and opportunities for haze and refraction development and complications with the flap preparation with lamellar procedure.

Despite the partial resolution of myopia, with gain of two lines, the result was not better due to the probable amblyopia that may prevent a satisfactory view in this patient.

There are a number of patients to determine the efficacy of long-arch intrastromal ring implantation in eyes after PKP to standardize the procedure.

Although the case described has partially reversed the patient's ametropia, our approach requires standardization in a large number of patients to determine the efficacy of long-arch intrastromal ring implantation in eyes after PKP to standardize the procedure.

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