Intracorneal Ring Segments
Implantation Update

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Financial Disclosures: Alcon/Wavelight

Cairo (Egypt) – 26/01/2018

Intrastromal Ring Segments

Advantages
• Improve spectacle corrected vision or contact lens tolerance
• Reversible procedure
• Delay or eliminate the need for a corneal transplant

Disadvantages
• Not eliminate the ectatic disease
• Not have a consensus in terms of nomograms
Two surgical methods have been described for ICRS implantation:

- **Mechanical**
- **Femtosecond laser assisted**

**Femtosecond-assisted ICRS**

Compared to Mechanical method:

- Easier and faster surgery
- Centration
- Create a more uniform and accurate stromal dissection plane
- Less complications rate

**BUT…**

- Not resulted in superior visual/refractive outcomes compared with the manual technique.
Femtosecond-assisted ICRS

Monteiro T. et al – accepted in Journal of Refractive Surgery

OBJECTIVE:
To compare the accuracy and the predictability of Ferrara-type ICRS between the mechanical manual technique and the femtosecond laser assisted technique using a swept source OCT (Casia SS-1000 (Tomey®, Nagoya, Japan)).

Study Groups
Manual Group: Hospital de Braga, Portugal
Femto Group: Instituto Oftalmologico Fernandez-Veja, Oviedo, Spain

Femtosecond vs Manual

Parameters evaluated:
Difference between the desired depth and obtained
Depth obtained 3 points: proximal / central / distal
Femtosecond vs Manual

Measurement:
Distance between the epithelial border and the hypereflectivity external line that marks the intrastromal tunnel

Parameter | Mean ± SD Mechanical | Mean ± SD Femtosecond
---|---|---
Eyes (n) | 105 | 53
Intra-op Pachymetry | 514.13 ± 35.43 | 525.38 ± 36.41
The difference between intrastromal depth intended versus achieved was **significantly shallower in the manual group, for all three locations** (p<0.05)

- **57.14%** of eyes had a superficial implantation shallower than 10 µm from the intended
- **27.61%** of eyes had a deeper implantation above 10 µm from the intended
- **15.24%** of eyes reached an achieved depth within ± 10 µm from the intended

The difference between intrastromal depth intended versus achieved was **not significantly different for all three locations** (p>0.05)

- **22.64%** of eyes had a superficial implantation shallower than 10 µm from the intended
- **9.44%** of eyes had a deeper implantation above 10 µm from the intended
- **67.92%** of eyes reached an achieved depth within ± 10 µm from the intended
Faria-Correia MD, PhD

**Femtosecond vs Manual**

The implantation of ICRS for the treatment of Keratoconus assisted by Femtosecond laser is a *more precise and reproducible* technique, compared to the manual technique;

The femtosecond technique is a *safer* technique: associated with a lower incidence of mechanical complications (late extrusions of the implant), it allows obtaining a more precise implant in the corneal stroma.

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**Different Phenotypes of Keratoconus**

![Table of Keratoconus Phenotypes](image)
**Adjustment of ICRS to the phenotype**

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Adjustment of Intrastromal Corneal Ring Segments After Unsuccessful Implantation in Keratoconic Eyes.
Morterio T1,2, Mendes JF1,2, Faria-Correia F1,2, Franqueira N1,2, Madrid-Costa D, Alfonso JF2.
Author information

Abstract

PURPOSE: To evaluate visual, refractive, and corneal topography outcomes in eyes with keratoconus that have undergone exchange/adjustment surgery with a new intrastromal corneal ring segment (ICRS) combination after unsuccessful visual and/or refractive outcomes after primary ICRS surgery.

METHODS: A retrospective nonrandomized case series was conducted including consecutive eyes of patients with keratoconus that underwent ICRS adjustment after an unsuccessful visual outcome. Patients were divided into 2 groups: group 1 was made up of patients with Intacs ICRSs that were exchanged for the Ferrara ICRS type, and group 2 consisted of patients who maintained the same ICRS type after undergoing ICRS adjustment surgery (change of the arc length or thickness). Uncorrected distance visual acuity, best-corrected distance visual acuity (CDVA), keratometry, asphericity, higher-order aberrations, and corneal regularity indices (ISV and IHD) (Pentacam HR; Oculus) were assessed preoperatively and 12 months after each procedure.

RESULTS: Twenty-six eyes from 26 patients were included. Eight eyes in group 1 and 18 eyes in group 2. The eyes in both groups improved their CDVA values after ICRS exchange, in group 1 from 0.27 ± 0.11 preoperatively to 0.54 ± 0.17 postoperatively (P = 0.001), and in group 2 from 0.34 ± 0.22 to 0.61 ± 0.15 (P < 0.0001). In both groups, there was also a significant improvement in the refractive cylinder, topographic cylinder, and coma after ICRS adjustment (P < 0.05).

CONCLUSIONS: ICRS implantation has been shown to be a reversible and adjustable surgical procedure for keratoconus treatment. Good outcomes can be obtained after ICRSs are exchanged.
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Clinical Case 1

- Male
- 34 years-old
- KC
  - Penetrating keratoplasty OS
  - Contact lens intolerance OD

- VA OD: 5/10? cc -13.00 (does not improve with cylinder)
- VA OS: 5/10 sc 8/10 cc +1,00 -3,00 x 35°
- BIO OD: no scars; Vogt striae
- BIO OS: PK transparent and well-centered

Preoperative Exam
Surgical procedure

- Keraring 340° / 300 microns
- Femtosecond-assisted implantation (FS 200 - Wavelight)
  - Inner diameter: 4.8 mm  
  - Outer Diameter: 6.2 mm
  - Depth: 340 microns
  - Incision 90° (1.4 mm x 1.4 mm)

Postoperative Visit

- 6 months postop
- VA OD: 7/10 + cc -8.00
  - Contact lens Bausch & Lomb Purevision 2 -7.0 D/8.6 mm/14.0 mm
  - Tolerant to CL
  - VA: 8/10
- BIO OD: ICRS well centered and incision OK
• Indications:
  • Asymmetric topography, in which a more pronounced flattening effect on one end of the ICRS is beneficial.
## Take-home Messages

- ICRS have a definitive role in the treatment of Ectatic Corneal Diseases
- New **nomograms** and ICRS design allow **customization**
- **Femtosecond** laser offers more safety and efficiency to the procedure
- Can be **combined** with other treatment modalities (CXL, PRK, phakic IOL)
  - Indication should be considered based on individual patient characteristics, including UDVA, DCVA, ectasia progression and should **NOT** be generalized.
Thank you for your attention!

Cairo (Egypt) – 25/01/2018