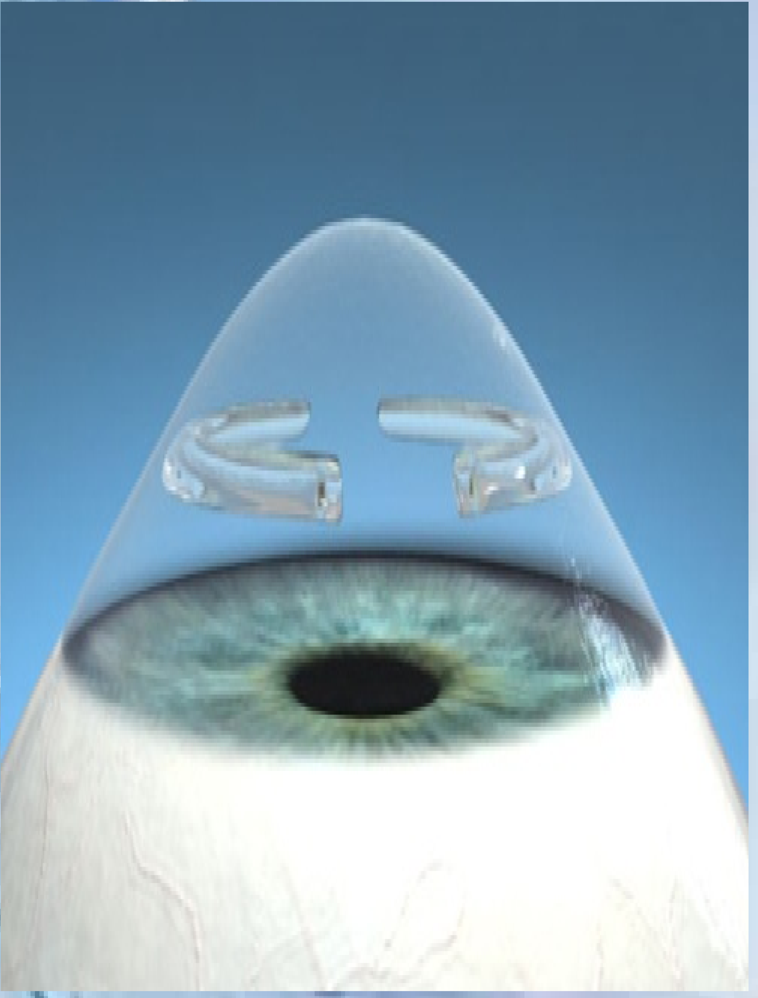

Visual, Keratometric And Corneal Biomechanical Changes After Intacs SK implantation For Moderate To Severe Keratoconus

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Overview:

In a prospective interventional study, Intacs SK was implanted using a Technolas femtosecond laser platform; comprised 32 keratoconic eyes of 25 patients with a clear central cornea and contact lens intolerance. Uncorrected (UDVA) and corrected (CDVA) distance visual acuity, refraction, manifest refraction spherical equivalent (MRSE), keratometry, central corneal thickness (CCT), corneal hysteresis (CH) and corneal resistance factor (CRF) were measured preoperatively, and at 1, 3 and 6 months postoperatively. Generally, visual, refractive and keratometric indices improved remarkably in a parallel fashion. CRF was inversely correlated with CCT. Fluctuations in corneal hydration might explain trends of changes in biomechanical parameters and CCT during the early postoperative months.

Introduction:

Intracorneal ring segments (ICRS) have impressed so far as a promising surgical alternative to at least postpone, if not entirely remove the necessity for lamellar or penetrating keratoplasty in moderate to advanced KCN. Prior to recent realizations, numerous studies revealed the efficacy of different ICRS to correct low myopia thanks to an "arc-shortening" effect of these segments on corneal lamellae. Recently few studies had focused on assessing corneal biomechanical variations in keratoconic eyes after ICRS insertion. Some stated that there is no change in viscoelastic corneal biomechanical parameters while a few studies showed some minor.

Methods:

Examination

Complete ocular examination included visual acuity,keratometry (AutoKR 8900, Topcon, Japan), Corneal topography (Orbscan II Topography System, Bausch & Lomb) ,Ultrasonic pachymetry (Micropach 200 P+, Sonomed, Cleveland, Ohio, USA) , Orbscan II , Pentacam pachymetry map And Ocular Response Analyzer (ORA; Reichert Ophthalmic Instruments, Buffalo, NY)

Surgical Technique

We employed the Colin's approach for creating radial incisions. To reduce irregular astigmatism and associated myopia induced by keratoconus, both segments (Intacs SK 450 µm, arch length 150°) were inserted asymmetrically.

Results:

The mean UDVA improved at post operative 6 months (P<.001). MRSE was better significantly only in eyes with moderate KCN (P<.001). A significant improvement in sphere (D; P<.001) and mean keratometry reading (P<.001) was observed. Mean CCT increased at 6 months (P<.001). CRF decreased at 6 months (P=.02). CDVA, cylinder and CH did not change significantly (P = .48, .203 and .55 respectively). 19 eyes (60%) gained ≥2 lines of UDVA while 5 eyes (16%) lost ≥2 lines of UDVA.

Preoperative and postoperative (month 1, 3 and 6) data of 32 keratoconic eyes with Intacs SK implantation, [Mean ± SD].

Parameter*	Mean ± SD				Change† (Mean ± SE)	P value‡
	Preoperative	Month 1	Month 3	Month 6		
UDVA, logMAR	0.81 ± 0.3	0.67 ± 0.4	0.57 ± 0.3	0.53 ± 0.2	-0.28 ± 0.07	<.001
CDVA, logMAR	0.37 ± 0.2	0.38 ± 0.2	0.33 ± 0.2	0.32 ± 0.2	-0.04 ± 0.06	.48
Sphere, D	-2.55 ± 3.1	-0.15 ± 2.6	-0.21 ± 3.1	-0.62 ± 2.6	1.92 ± 0.37	<.001
Cylinder, D	5.95 ± 2.7	6.36 ± 3.4	6.04 ± 3.5	5.42 ± 2.8	0.43 ± 0.33	.20
MRSE, D	-5.05 ± 2.6	-2.91 ± 2.7	-2.21 ± 2.5	-2.97 ± 3.1	1.94 ± 0.67	.008
Anterior BFS	7.36 ± 0.3	7.84 ± 0.3	7.88 ± 0.4	7.80 ± 0.4	0.44 ± 0.04	<.001
Posterior BFS	6.03 ± 0.3	6.10 ± 0.4	6.18 ± 0.4	6.25 ± 0.4	0.20 ± 0.04	<.001
Irregularity (3mm zone), D	5.55 ± 2.4	7.03 ± 2.4	6.63 ± 1.9	6.46 ± 1.5	1.46 ± 0.33	<.001
Keratometry, D						
Minimum	48.62 ± 3.6	44.06 ± 3.8	43.53 ± 3.7	44.34 ± 4.1	-4.19 ± 1.37	<.001
Maximum	54.57 ± 3.9	50.67 ± 4.0	49.49 ± 2.8	49.73 ± 4.4	-4.35 ± 2.07	<.001
Mean	50.50 ± 2.9	44.98 ± 2.8	44.07 ± 2.7	44.62 ± 3.0	-5.73 ± 1.64	<.001
CCT, µm	446.1 ± 38	470.1 ± 57	455.3 ± 37	462.2 ± 50	13.53 ± 4.03	<.001
CH, mmHg	8.0 ± 1.3	7.8 ± 1.1	7.5 ± 1.0	7.9 ± 1.0	-0.14 ± 0.23	.55
CRF, mmHg	6.5 ± 1.6	6.2 ± 1.4	5.6 ± 1.2	5.9 ± 1.1	-0.64 ± 0.27	.02

* UDVA= Uncorrected distance visual acuity; CDVA= Corrected distance visual acuity; MRSE= Manifest Refraction Spherical Equivalent; BFS= best-fit sphere; CCT= central corneal thickness; CH= corneal hysteresis; CRF= corneal resistance factor; D= Diopter.

† Month 6 postoperative – preoperative

‡ Comparison between preoperative and month 6 postoperative measurements; Paired-samples T test was used.

Preoperative and month 6 postoperative data of 32 keratoconic eyes regarding the severity of keratoconus (KCN), [Mean ± SD].

Parameter*	Moderate KCN (n=22)				Advanced KCN (n=10)			
	Preoperative	Month 6	Change† Mean ± SE	P value‡	Preoperative	Month 6	Change† Mean ± SE	P value‡
UDVA, logMAR	0.74 ± 0.3	0.45 ± 0.2	-0.26 ± 0.08	.005	0.99 ± 0.5	0.69 ± 0.3	-0.35 ± 0.18	.09
CDVA, logMAR	0.29 ± 0.1	0.28 ± 0.2	-0.01 ± 0.05	.98	0.56 ± 0.2	0.44 ± 0.3	-0.14 ± 0.16	.41
Sphere, D	-2.10 ± 2.8	-0.31 ± 1.6	1.80 ± 0.45	.001	-3.55 ± 3.5	-1.34 ± 4.3	2.21 ± 0.71	.017
Cylinder, D	5.28 ± 2.3	4.69 ± 2.6	-0.44 ± 0.39	.26	7.42 ± 3.2	7.25 ± 2.4	-0.42 ± 0.70	.56
MRSE, D	-4.87 ± 2.9	-2.11 ± 1.7	2.61 ± 0.54	<.001	-5.45 ± 1.7	-5.12 ± 4.8	0.25 ± 1.90	.67
Keratometry, D								
Minimum	47.06 ± 2.3	42.65 ± 2.7	-4.15 ± 1.84	<.001	51.75 ± 3.8	49.15 ± 3.7	-4.31 ± 1.35	.006
Maximum	52.34 ± 1.7	47.52 ± 2.2	-4.50 ± 1.41	<.001	59.04 ± 3.0	56.04 ± 2.4	-4.31 ± 2.77	<.001
Mean	48.94 ± 1.6	43.44 ± 1.8	-5.36 ± 1.44	<.001	53.62 ± 2.7	47.90 ± 3.4	-6.7 ± 1.81	<.001
CCT, µm	456.7 ± 37	475.0 ± 47	15.60 ± 4.9	.005	422.9 ± 27	430.1 ± 42	8.37 ± 6.8	.26
CH, mmHg	8.4 ± 1.4	8.1 ± 1.0	-0.38 ± 0.28	.18	7.1 ± 0.7	7.4 ± 1.0	0.47 ± 0.35	.22
CRF, mmHg	7.1 ± 1.5	6.3 ± 0.8	-1.01 ± 0.33	.006	5.2 ± 1.0	5.3 ± 1.3	0.19 ± 0.30	.37

* UDVA= Uncorrected distance visual acuity; CDVA= Corrected distance visual acuity; MRSE= Manifest Refraction Spherical Equivalent; CH= corneal hysteresis; CRF= corneal resistance factor; D= Diopter.

† Month 6 postoperative – preoperative

‡ Comparison between preoperative and month 6 postoperative measurements; Wilcoxon-signed rank test was used.

Conclusion:

Intacs SK implantation is an effective surgical modality for management of both moderate and advanced keratoconus. Visual, refractive and keratometric indices improved remarkably in a parallel fashion and remained stable during postoperative follow-ups. Biomechanical parameters of the cornea were inversely correlated with CCT. Fluctuations in corneal hydration might explain trends of changes in biomechanical parameters and CCT during the early postoperative months. The role of keratoconus progression and corneal biomechanical response to the tension being exerted by the rings could be better revealed through longer follow-ups.

Disclosure:

The authors have no financial interest in the subject matter of this paper.

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