CORNEAL CROSSLINKING FOR TREATMENT IN OPERATED PATIENTS,OF KERATOCONUS AND LASEK. To 2 YEARS EXPERIENCE IN 98 EYES.

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SUMMARY

Corneal Crosslinking for treatment in operated patients,of Keratoconus and Lasek. To 2 years experience in 98 eyes.

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OBJECTIVE: To describe the clinical and surgical experience after corneal Crosslinking in 98 eyes with a history of prior Intacs and Keratoconus patients undergoing LASEK.

MATERIALS AND METHODS: A case series of 98 eyes treated with corneal Crosslinking. We evaluated topography, pachymetry and astigmatism before and after the procedure, and hysteresis of the cornea measured by Pentacam, anterior chamber of ORA and OCT.

RESULTS: 34 eyes of 18 patients treated with crosslinking after INTACS and 64 eyes of 32 patients after LASEK. Visual acuity improved an average of 0.67 lines of vision in the Intacs group and 0.14 lines in LASEK.34 eyes of 18 patients treated with crosslinking after INTACS and 64 eyes of 32 patients after LASEK. Visual acuity improved an average of 0.67 lines of vision in the Intacs group and 0.14 in LASEK lines. The astigmatism measured by keratometry (differences between meridian plane and curved) showed a change of -1.77 to 3.47 (average 0.77) diopters in keratoconus and -2.29 to 2.74 (average 0.28) diopters in LASEK.The keratometry media, decreased 1.54 diopters in keratoconus and 0.85 diopters in LASEK. There was an increase in the pachymetry of 1 to 43 microns (mean 12.94) in keratoconus and -4 to 32 microns (mean 12.28) in LASEK. Corneal hysteresis measured by ORA (Ocular Response Analyze) increased by more than 1 mm Hg in all patients in both groups.

CONCLUSSIONS: The changes produced by crosslinking are reflected in the hysteresis's increase of the cornea. Certain not significant changes can be seen about topography , pachymetry and keratometry given by flattening and thickening of the cornea following the procedure.

SUMMARY

Corneal Crosslinking After INTACS for Keratoconus and LASEK. To 2 Years Experience in 98 Eyes.

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PURPOSE: To describe clinical and surgical experience in 98 eyes that underwent corneal crosslinking after INTACS for keratoconus and LASEK.

METHODS: Case series of 98 eyes that underwent corneal crosslinking. Corneal astigmatism, topography, pachimetry and hysteresis were measured before and after the procedure.

RESULTS: 34 eyes of 18 patients that underwent crosslinking after INTACS and 64 eyes of 32 patients after LASEK. Visual acuity improved 0.67 lines in INTACS and 0.14 lines in LASEK. Keratometric astigmatism showed a change of -1.77 to 3.47 (0.77) diopters (d) in INTACS and -2.29 to 2.74 (0.28) in LASEK. Median keratometry decreased 1.54 d in INTACS and 0.85 d in LASEK. Pachimetry increased 1 to 43 (12.94) microns in INTACS and -4 to 32 (12.28) in LASEK. Corneal hysteresis measured by ocular response analyzer (ORA) increased more than 1 mm Hg after crosslinking in all patients.

CONCLUSIONS: Corneal changes after crosslinking reflected an increased hysteresis. There is no significant change in corneal keratometry, topography and pachimetry after the procedure.

Corneal Crosslinking for treatment in operated patients, of Keratoconus and Lasek. to 2 years experience in 98 eyes.

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INTRODUCTION:

The biomechanical characteristics of corneal stromal result from its structure which is formed by organized collagen fibers and joined to one another.The three dimensional configuration of the collagen lamellae determine its resistance.[1].

A technique of photo-oxidative crosslinking or "crosslinking" corneal using ultraviolet light and riboflavin was developed to handle the thinning of the cornea presented by patients with keratoconus [2] With this crosslinking, additional covalent bonds are formed between the collagen molecules, which stabilizes and modifies the structure of the cornea. Exposure to ultraviolet light and riboflavin creates an increase in the corneal rigidity and increased resistance to proteolytic enzymes..

The hysteresis and viscoelasticity, is a new measure of ocular rigidity [3]. The ORA (Eye Response Analyze) measures the hysteresis, recording the response to biomechanical corneal indentation produced by air [4].

The objective of this study is to describe our clinical experience and surgical patients with a history of Intacs for keratoconus and LASEK surgery for correction of refractive error, who underwent corneal crosslinking after the initial procedure.

MATERIALS Y METHODS:

Retrospective and descriptive case series comprised by 98 eyes treated with corneal crosslinking. Patients with a clinical history of Intacs formed group 1, while patients undergoing LASEK formed group 2.

For the crosslinking treatment was instilled initially topical anesthesia, the epithelial tissue was removed in three parallel vertical lines, this was done to ensure that riboflavin penetrate the corneal stroma and to achieve a high absorption of UV light. Thirty minutes prior to irradiation was applied in the stroma riboflavin to ensure adequate saturation; subsequently initiated with ultraviolet light irradiation with a wavelength of 370 mm which lasted thirty minutes, at which time was applied a drop of riboflavin, the concentration necessary to ensure and maintain wet the cornea. All patients underwent corneal crosslinking treatment after 3 months after the initial procedure.

Patients were evaluated at the first day, first week and third month postoperatively. We evaluated visual acuity, corneal astigmatism (difference between meridian flatter and curved), topography, pachymetry and corneal hysteresis before crosslinking in the latest revision. For the measurement of these variables using the Pentacam (Oculus, Optikgeräte GMBH, Wetzlar, Germany), anterior chamber OCT (Carl Zeiss Meditec, Dublin, CA, USA) and ORA (Ocular Response Analyzer, Reichert Ophthalmic Instruments, Buffalo, NY) respectively.

RESULTS:

The results are shown in Tables 1 and 2. Thirty-four eyes in group 1 and 64 in group 2. Follow-up time of 26.3 months in group 1 and 25.2 in group 2. Average age of 29.14 years in group 1 and 32.34 in group 2. 21 right eyes in group 1 and 37 in the 2. Visual acuity improved an average of 0.67 lines of vision in the Intacs group and 0.14 in LASEK lines. The astigmatism mean measured by keratometry decreased from -1.77 to 3.47 (average 0.77) diopters in keratoconus and -2.29 to 2.74 (average 0.28) diopters in LASEK. The half keratometry decreased 1.54 diopters in group 1 and 0.85 diopters in group 2. There was an increase in the pachymetry of 1 to 43 microns (mean 12.94) in group 1 and -4 to 32 microns (mean 12.28) in group 2. Corneal hysteresis measured by ORA (Ocular Response Analyze) increased by more than 1 mm Hg in all patients in both groups.

DISCUSSION:

Collagen fibers forming the structure of the corneal stroma level are responsible for their biomechanical characteristics. Their three-dimensional configuration and the way in which these fibers are attached and determine intersect tissue resistance to deformation. It is well known that these characteristics are affected in patients with keratoconus, since the enzyme deficiency and increased protease activity causes the tissue lose its strength and resilience. This phenomenon is also observed in patients who have undergone refractive procedures where the ablation exceeds 100 microns, in this circumstance the cornea lose the lamellae which are located in the anterior third of the stroma and that are responsible for its biomechanical strength .

The technique for crosslinking, in which covalent bonds are formed between the collagen molecules through corneal stromal interaction with riboflavin and ultraviolet light, has been developed to handle the thinning of the cornea shown by patients with keratoconus. One way to measure the changes caused by the crosslinking is through the hysteresis or viscoelasticity of the cornea which reflects the resistance of the tissue to deformation that is produced when is stimulated by an injection of air.

Furthermore, our study provides information about changes in curvature and corneal thickness after the crosslinking, as well as variation in visual acuity. We observed no significant changes in visual acuity before and after the procedure. While there is a slight improvement in visual acuity, the non-significant of these changes shows that this procedure does not affect the visual ability of patients. This should be explained to individuals who undergo crosslinking and that expectations should be realistic. Furthermore we observed decrease in visual acuity in 20.58% in group 1 and 26.56% in group 2. Although we do not know the explanation for this decrease in visual acuity, our results are similar to those reported worldwide [5]. Appreciate a slight flattening of the cornea after the procedure, this explains the eventual improvement in uncorrected visual acuity experienced by some patients after crosslinking, these changes are not significant and are not always so in keratometric and corneal astigmatism nor are objective parameters to measure the benefits of crosslinking.

The biomechanical properties of the cornea after crosslinking have been previously reported [6]. Wollensak and colleagues reported that corneal crosslinking results in an increase in the rigidity of the cornea which is maintained over time. To our knowledge, this is the first study describing changes after corneal crosslinking using hysteresis.

There were no significant intraoperative or postoperative complications. This means that at least in this no comparative case series, the corneal crosslinking appears to be a safe procedure,that is comparable to that reported worldwide [5].

Our study has some limitations as are the descriptive and comparative, and the lack of randomization. However, we can conclude that the corneal crosslinking is a safe and reproducible, and that changes after this intervention are reflected in the increase in hysteresis and some degree of flattening and thickening of the cornea. Further studies should be performed to determine whether these findings have clinical relevance.

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	Age	Change in A.V	Change in A.Q	Change Q.M	change Pachymetry	Hysteresis PreQx	Hysteresis POP	complications
1	43	0	0.5	1.25	12	8.7	9.4	(-)
2	43	-1	0.25	1.03	8	8.4	9.2	(-)
3	22	1	0.1	0.8	17	9.6	9.9	(-)
4	22	1	0.72	1.2	9	9.4	10.2	(-)
5	29	1	0	0.2	5	8.9	9.5	(-)
6	27	0	1.33	2.1	25	9.3	10.5	(-)
7	27	-2	0.1	3.42	8	9.04	9.82	(-)
8	16	1	0.05	0.3	3	8.93	9.44	(-)
9	16	2	-0.23	0.05	6	8.56	9.22	(-)
10	25	0	1.46	0.9	31	9.7	10.3	(-)
11	25	-1	0.45	1.1	7	9.51	10.22	(-)
12	31	0	-0.47	-2.32	2	8.87	9.73	(-)
13	31	2	-1.77	-1.85	4	8.94	10.01	(-)
14	19	-2	0.02	0.32	1	9.63	10.21	(-)
15	19	-1	0.06	0.01	4	9.45	10.02	(-)
16	25	2	1.25	1.32	12	9.76	10.64	(-)
17	25	3	1.73	1.01	23	9.28	10.45	(-)
18	31	0	0.71	1.03	10	9.45	11.02	(-)
19	31	2	1.22	1.76	22	9.52	10.88	(-)
20	33	2	0.64	1.03	10	9.3	10.6	(-)
21	33	1	0.22	0.97	9	9.21	10.4	QPS
22	46	2	2.05	4.33	43	9.68	10.9	(-)
23	22	0	1.09	1.49	2	8.92	9.9	(-)
24	22	0	2.89	5.06	10	9.01	9.5	(-)
25	27	4	1.76	1.4	13	9.76	10.43	(-)
26	27	-2	2.02	1.89	21	9.85	10.78	(-)
27	40	1	1.35	0.45	16	9.93	10.56	(-)
28	40	3	1.65	-1.02	26	9.4	10.71	(-)
29	26	3	0.64	1.4	12	9.66	10.98	(-)
30	26	0	3.47	7.51	22	9.24	11.34	(-)
31	33	2	-0.78	8.4	12	8.8	10.3	(-)
32	33	0	1.23	3.42	17	9.6	10.3	(-)
33	38	-1	1.33	2.02	12	9.32	10.24	(-)
34	38	0	-0.75	0.56	6	9.06	9.85	(-)

A.V visual acuity. A.Q: keratometric astigmatism. Q.M: Keratometry mean. PreQx: Presurgical. POP: Postoperative. QPS: superficial punctate keratitis.

	Age	Change in A.V	Change in A.Q	Change Q.M	Changing Pachymetry	Hysteresis PreQx	Hysteresis POP	Complicactions
1	19	1	0.01	0.34	14	10.75	11.04	(-)
2	19	1	-0.53	-0.65	4	10.45	10.89	(-)
3	19	-1	-1.43	1.08	21	10.66	11.42	(-)

4	19	-1	1.28	1.45	12	10.42	11.89	(-)
5	29	3	1.21	1.18	13	10.32	11.08	(-)
6	29	-3	0.54	1.02	11	10.2	12.01	(-)
7	27	1	0.15	0.87	12	10.92	11.56	(-)
8	27	3	0.2	0.56	9	10.77	11.04	(-)
9	29	3	1.06	1.12	12	9.89	11.32	(-)
10	29	1	0.97	1.05	11	10.02	11.78	(-)
11	48	-3	1.54	1.89	13	10.43	11.22	(-)
12	48	-3	-0.2	-0.32	10	10.56	11.87	(-)
13	46	0	-1.5	0.45	8	10.32	11.06	(-)
14	46	0	-0.25	0.8	4	10.4	10.98	(-)
15	40	0	-0.13	0.5	-4	10.5	11.2	(-)
16	40	0	-0.17	0.12	2	10.31	11.03	(-)
17	22	2	1.95	1.23	12	10.66	11.78	(-)
18	22	3	1.71	2.08	16	10.23	11.89	(-)
19	21	-2	1	1.23	12	10.01	11.34	(-)
20	21	-1	0.8	0.97	15	10.72	11.57	(-)
21	24	-2	2.74	1.21	11	10.6	11.88	(-)
22	24	-2	0.91	1.07	10	10.43	11.07	(-)
23	33	0	0.93	1.01	8	10.55	11.43	(-)
24	33	0	-0.78	1.24	17	10.02	11.2	(-)
25	39	1	0	0	12	10.4	11.42	(-)
26	39	0	0	0	9	10.62	11.3	(-)
27	40	0	-0.1	0.86	10	10.2	11.34	(-)
28	40	0	-0.69	0.7	15	10.56	11.02	(-)
29	18	0	-0.51	1.03	18	10.26	11.47	(-)
30	18	0	0.05	1.34	23	10.26	11.2	(-)
31	50	1	0	1.9	26	10.49	11.9	(-)
32	50	0	0.82	2.23	31	10.6	12.4	(-)
33	27	1	0.11	1.2	12	10.2	10.8	(-)
34	27	1	-0.09	0.5	4	9.89	10.5	(-)
35	39	0	0.18	0.02	1	9.86	11.4	(-)
36	39	0	0.04	0.07	10	10.01	11.2	(-)
37	21	0	-0.8	0.82	8	10.2	11.37	(-)
38	21	0	-0.18	0.2	6	10.78	11.6	(-)
39	51	1	0.03	0.05	14	10.64	11.89	(-)
40	51	1	0.39	0.18	11	10.32	11.46	(-)
41	20	1	1.93	1.21	22	10.6	11.2	(-)
42	20	1	1.52	1.03	17	10.6	11.45	(-)
43	45	2	1.76	1.24	15	10.43	11.65	(-)
44	45	4	1.01	1.1	27	10.2	11.03	(-)
45	23	-1	-1.55	0.08	13	10.67	11.8	(-)
46	23	-1	-0.25	1.32	9	10.5	11.98	(-)
47	18	0	1.48	1.42	4	10.29	11.02	(-)
48	18	-2	-2.29	-2.53	7	10.27	10.86	QPS
49	32	-1	-0.25	-1.21	19	10.5	10.67	Defecto epitelial central

50	32	-1	1.21	1.06	11	10.43	11.59	(-)
51	42	1	2.12	2.06	23	10.44	11.08	(-)
52	42	1	1.4	1.83	16	10.32	11.67	(-)
53	40	-2	-1.42	1.76	12	10.6	11.72	(-)
54	40	-2	-0.18	0.81	4	10.79	11.3	(-)
55	41	0	0.43	1.32	7	9.97	11.05	(-)
56	41	0	0.59	1.02	9	10.03	11.22	(-)
57	23	1	0.82	1.93	12	10.48	11.9	(-)
58	23	2	1	2.77	16	10.2	12.03	QPS
59	34	1	-1.22	1.03	10	10.67	11.88	(-)
60	34	1	-1.48	0.87	6	10.52	11.21	(-)
61	26	1	-0.24	-0.98	6	9.89	11.45	(-)
62	26	-3	-0.12	-0.05	14	10.2	11.04	(-)
63	49	0	1.31	2.47	32	10.7	11.23	(-)
64	49	0	-0.42	0.8	12	10.15	11.06	(-)

Table 2. Results group 2.
A.V visual acuity. A.Q: keratometric astigmatism. Q.M: Keratometry mean. PreQx: Presurgical. POP: Postoperative. QPS: superficial punctate keratitis.