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ORIGINAL ARTICLE

MyoRing Treatment for Keratoconus: DIOPTEX PocketMaker *vs* Ziemer LDV for Corneal Pocket Creation

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ABSTRACT

Purpose: To compare the results of MyoRing implantation for keratoconus using two different techniques for corneal pocket creation.

Materials and methods: Seven eyes suffering from keratoconus were treated using Ziemer LDV for corneal pocket creation and seven eyes suffering from keratoconus were treated using DIOPTEX PocketMaker for corneal pocket creation.

Results: Both groups did not show any statistically significant difference, neither in the severity of the disease nor in the results.

Conclusion: Ziemer LDV and DIOPTEX PocketMaker give equal results for MyoRing implantation for keratoconus.

Keywords: MyoRing, CISIS, PocketMaker, Ziemer, Femtosecond Laser, Intracorneal ring, Keratoconus, Cornea.

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INTRODUCTION

Corneal intrastromal implantation system (CISIS) using PocketMaker microkeratome (DIOPTEX GmbH, Austria) and MyoRing intracorneal implant (DIOPTEX GmbH, Austria) is safe and effective.[1-4] A pilot study using IntraLase Femtosecond laser (AMO, USA) instead of PocketMaker microkeratome for the creation of the intracorneal pocket for MyoRing placement to treat keratoconus showed comparable results.[5] However, no study comparing the results of MyoRing implantation for keratoconus after corneal pocket creation using femtosecond laser *vs* PocketMaker microkeratome is available. Here, we present the first data comparing the results of MyoRing keratoconus treatment between Ziemer LDV femtosecond laser (Ziemer AG, Switzerland) and DIOPTEX PocketMaker microkeratome corneal pocket creation.

MATERIALS AND METHODS

Fourteen eyes suffering from keratoconus were treated by MyoRing implantation into a corneal pocket and compared in a retrospective comparative study according different techniques for corneal pocket creation. The cases were divided in two groups. In the first group (7 eyes) the corneal pocket for MyoRing placement were created using the DIOPTEX PocketMaker microkeratome. In the second group (seven eyes) the corneal pocket were created using the Ziemer Femto LDV. Both groups consisted of moderate and advanced keratoconus cases with comparable severity of the disease measured in preoperative central average K-readings of 52.06 ± 6.51 Diopters (D) (mean ± SD) in the PocketMaker group and 51.65 ± 3.18 D in the LDV group, respectively. Both groups showed no statistically significant difference in the severity of the disease measured in preoperative central K-readings. Both groups have also comparable age structure and sex distribution. The patients enrolled in the present study belong ethnically to the arabic middle East population.

The corneal pockets were created at 300 microns depth with a diameter of 9 mm. Table 1 shows the nomogram for the selection of the right implant diameter and implant thickness. It depends only on the central average K-reading (average Sim K) and is optimized for the arabic population. A similar but not identical nomogram is available for the European population. In contrast to intracorneal ring segment (ICRS) nomograms, the CISIS nomogram is very simple and does neither consider cone type nor cone location or astigmatic axis, etc.[6] The only important inclusion criteria is a corneal thickness at the thinnest point of more than 350 microns for the PocketMaker microkeratome and 400 microns for the Ziemer LDV. The access to the pocket is self-sealing and does not require suturing.

Table 1: Nomogram for middle east

Average central K (D)	*Implant diameter (mm)*	*Implant thickness (micron)*
ACK < 44	7	280
44 < ACK < 48	6	240
48 < ACK < 52	6	280
52 < ACK < 55	5	280
55 < ACK	5	320

RESULTS

The preoperative and postoperative data for the manifest refraction are shown in Table 2 and the visual acuity in Table 3. Each group shows statistically significant improvement between preoperative and postoperative data ($p < 0.05$). The mean improvement in central K-reading was 6.75 D in the PocketMaker group and 7.98 D in the LDV group. The difference between both groups was not statistically significant ($p > 0.05$) for all preoperative and

Table 2: Preoperative and postoperative refraction

		Sphere (D)	*Cylinder (D)*
Preoperative	PocketMaker	–5.14 ± 4.38	–4.43 ± 1.57
	Ziemer LDV	–2.11 ± 3.62	–3.89 ± 1.35
Postoperative	PocketMaker	–0.39 ± 1.65	–1.61 ± 1.50
	Ziemer LDV	–1.07 ± 1.37	–1.71 ± 0.77

Table 3: Preoperative and postoperative visual acuity

		UDVA (logMAR)	*CDVA (logMAR)*
Preoperative	PocketMaker	1.12 ± 0.24	0.42 ± 0.21
	Ziemer LDV	1.08 ± 0.25	0.37 ± 0.14
Postoperative	PocketMaker	0.49 ± 0.27	0.20 ± 0.22
	Ziemer LDV	0.45 ± 0.17	0.22 ± 0.11

postoperative parameters including K-reading, sphere, cylinder, uncorrected visual acuity (CDVA) and best corrected visual acuity (UDVA), respectively. However, there was a significant improvement of all these parameters ($p < 0.05$) between preoperative and postoperative data within every group. In particular mean UDVA improved by 6.4 lines in the DIOPTEX PocketMaker group and also 6.4 lines in the Ziemer LDV group. The improvement of mean CDVA was 2.2 lines in the PocketMaker group and 1.5 lines in the LDV group. All postoperative data were obtained from the last follow-up at 1 year or later after surgery. None of the eyes underwent enhancement surgery after primary implantation following the middle East nomogram. No significant intra- or postoperative complications were observed. Every single eye improved in UDVA.

DISCUSSION

The visual outcome after MyoRing implantation for keratoconus does not depend on whether the corneal pocket for MyoRing implantation is created by the Ziemer LDV femtosecond laser or by the DIOPTEX PocketMaker microkeratome. Following the current nomogram a mean improvement of more than 6 lines can be expected in UDVA and some 2 lines in CDVA for MyoRing treatment of keratoconus. However, allowing postoperative enhancement for obtaining an optimal result in every given case by either changing the implant for a stronger or weaker one or by repositioning the implant within the corneal pocket according to the appearence of the postoperative tangential topography map, a mean improvement of more than 10 lines in UDVA and of about 3 to 4 lines in CDVA can be achieved.[2,6] Since, MyoRing treatment as well as ICRS treatment[7] are mainly biomechanical treatment methods for remodeling the corneal shape from an irregular to a regular one, the predictibility of the postoperative visual result by nomograms have to have intrinsic limitations in a real cornea. Therefore, in a given case the MyoRing nomogram work very well for 80 to 90 % of the cases. In 10 to 20% of the cases, however, the result can be further improved after primary implantation by a simple postoperative enhancement intervention to achieve the best possible result in every given case. A big advantage of the current MyoRing technology over ICRS is the postoperative access to all three theoretically possible degrees of freedom (implant thickness, implant diameter and implant position) for achieving the best possible result in a given case[3] compared to only one degree of freedom (implant thickness) in ICRS. ICRS allow mean improvements of 2 to 4 lines in UCVA and some 1 to 2 lines in CDVA in mild to moderate cases and less in advanced cases.[7-11]

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