

MyoRing Treatment for Cases of Myopia not eligible for Laser Vision Correction

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ABSTRACT

Purpose: MyoRing implantation has been shown to be able to mechanically stabilize ectatic corneas like a bone-nail for broken legs do. Here I present typical cases of MyoRing treatment for Myopia which were not eligible for LASIK.

Materials and methods: Four eyes of four patients suffering from moderate to high myopia and showing risk factors for postoperative ectasia have been treated by MyoRing implantation. Two of them have been combined with laser vision correction (LVC).

Results: The refractive results are comparable to those published for LVC. The cases with combined MyoRing LASIK treatment performed slightly better postoperatively than those treated with MyoRing only.

Conclusion: MyoRing implantation is safe and effective in myopic cases presenting with manifest signs of keratoconus. In myopic eyes without manifest keratoconus but risk factors for post-LASIK keratectasia the combination of MyoRing implantation with Excimer Laser Surface Ablation may be a good treatment option.

Keywords: Myopia, MyoRing, LASIK, LVC, Keratectasia, PocketMaker, Wavelight, CISIS.

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INTRODUCTION

Laser vision correction (LVC) is an effective and safe treatment for myopia. However, there is also a risk for long-term and vision threatening complications, such as corneal ectasia. Corneal ectasia can occur after both, LASIK or surface ablation.^{1,2} Studies report a prevalence of post-LASIK keratectasia of up to 0.66%.^{2,3} It is unknown, however, how many cases are unreported.² Assuming that some 5 Mio LVC surgeries are performed annually, an incidence of, e.g. 0.6%

for post-LASIK keratectasia results in more than 25,000 keratectasia cases annually. Risk factors for the development of keratectasia after LVC include abnormal preoperative topography, such as asymmetric bowtie or skewed radial axis with or without inferior steepening, low residual stromal bed, young age, low preoperative corneal thickness of less than 500 microns and high myopia.^{4,5} However, keratectasia after LVC has been found also in cases without such risk factors, in cases of low myopia⁶ and even in cases of hyperopia.⁷ More invasive surgical alternatives may also result in significant long-term complications, such as cataract, glaucoma or endothelial decompensation.⁸ Corneal intra stromal implantation surgery (CISIS) with MyoRing implantation have been demonstrated to be a safe and effective treatment for high myopia, keratoconus, and post-LASIK keratectasia.^{9,10} Here, I shall present the refractive results of different cases of myopia which were not eligible for LVC and which were treated by means of MyoRing implantation.

MATERIALS AND METHODS

Four myopic eyes of four patients not eligible for LVC were treated by means of MyoRing implantation. The age of the patients ranged from 21 to 45 years (mean 26 years). Postoperative follow-up time ranged from 7 to 24 months (mean 12 months). CISIS was performed by means of PocketMaker Ultrakeratome (Dioptex GmbH, Austria) and implantation of MyoRing (Dioptex GmbH, Austria) as described elsewhere (Fig. 1).^{9,10} Two of these eyes (3 and 4)

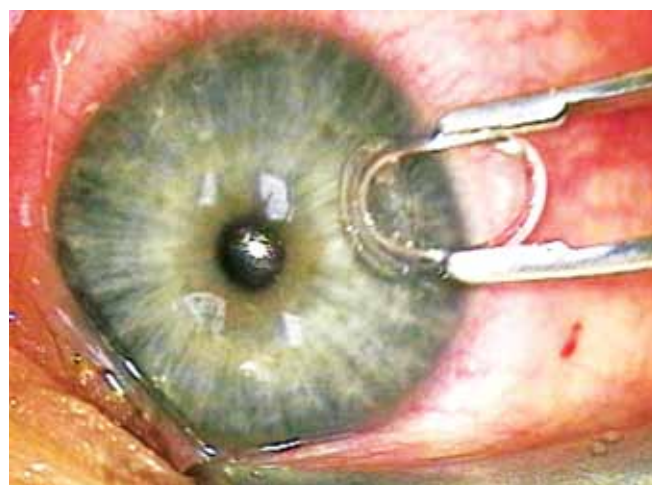


Fig. 1: Implantation of MyoRing into a corneal pocket

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had MyoRing implantation combined with LVC. Later vision correction was performed using Wavelight Allegretto (Wave light GmbH, Germany) as superficial photorefractive treatment after alcohol assisted removal of epithelium and covering the stroma after laser keratectomy with the previously removed epithelium (LASIK).

A new protocol (Austrian Protocol) was used to perform this combined MyoRing LVC treatment. The Austrian protocol is characterized by the following steps:

1. Excimer laser ablation to change the refraction to a predefined post-LVC value.
2. Creation of a corneal pocket of at least 8 mm diameter at 300 microns depth either by means of the PocketMaker Ultrakeratome or a suitable Femtosecond laser.
3. MyoRing implantation into the corneal pocket.

The predefined post-LVC refraction in the present study was 5 diopters. This means the surface ablation was performed that way that after LVC, 5 diopters of myopia remained and a 5 diopter MyoRing was implanted after surface ablation into the corneal pocket.

Topography and Pachymetry was performed by means of Pentacam (Oculus GmbH, Germany).

The details and background of the surgery, possible alternatives as well as risks were explained to patients before signing informed consent.

RESULTS

The preoperative data are shown in Table 1 and the postoperative data in Table 2. Eye no. 1 and 2 was treated by means of MyoRing implantation only and Eyes no. 3 and 4 were treated by means of MyoRing implantation combined with LVC (surface ablation). These two eyes (3 and 4) presented preoperatively with corneal thickness of less than 500 microns, high myopia and steep cornea. Eye no. 1 also showed 3 different risk factors for keratectasia after

LVC: high myopia, low corneal thickness, and asymmetric topographic bow tie pattern.

All eyes had CDVA of 1.0 preoperatively as well as postoperatively.

Tables 1 and 2 show a postoperative increase of corneal thickness in both cases treated with MyoRing only (Eye no. 1 and 2). But, even in those cases where MyoRing implantation was combined with LVC (Eye no. 3 and 4), corneal thickness was reduced by 34 microns only despite successful treatment of -8.25 diopters SE (Eye no. 3) and by 44 microns only despite successful treatment of -9.125 diopters SE (Eye no. 4). Performing LVC alone in these cases would result in more than 150 microns ablation depth and in the case of LASIK it would leave a stromal bed under the flap of some 200 microns only.

DISCUSSION

The presented data of MyoRing implantation for the treatment of myopia with or without additional astigmatism show similar refractive results as LVC.¹¹ In comparison to LVC and in particular to LASIK, where the biomechanics of the cornea may be significantly altered, the implantation of MyoRing, which is much more rigid than the corneal tissue and which has no open endings, can stabilize the corneal framework biomechanically. This has been demonstrated in the MyoRing treatment of mild, moderate and advanced keratoconus and post-LASIK keratectasia. MyoRing implantation can not only achieve visual rehabilitation in keratoconus. Latest data show, that it may even be able to stop progression of the disease resulting in a permanent effect of the treatment and a 'healing' of keratoconus.¹²

It is important to note, that the effect of the MyoRing in stabilizing the corneal biomechanics comes from 2 apriori competing qualities of the implant: rigidity to strengthen the cornea and flexibility to be able to implant the MyoRing

Table 1: Preoperative sphere (SPH), cylinder (CYL), spherical equivalent (SE), corrected distance visual acuity (CDVA), and corneal thickness at the thinnest point (PACHY)

Eye no.	SPH	CYL	SE	CDVA	PACHY
1	-10	-0.25	-10.125	1	510
2	-9.25	-2.25	-10.375	1	514
3	-7	-2.5	-8.25	1	468
4	-8	-2.25	-9.125	1	478

Table 2: Postoperative sphere (SPH), cylinder (CYL), spherical equivalent (SE), corrected distance visual acuity (CDVA), uncorrected distance visual acuity (UDVA) and corneal thickness at the thinnest point (PACHY)

Eye no.	SPH	CYL	SE	CDVA	UDVA	PACHY
1	0	-1	-0.5	1	0.9	539
2	0	-0.75	-0.375	1	0.9	520
3	0	0	0	1	1	434
4	0	0	0	1	1	434

through a small incision of about 5 mm or less, in order to avoid weakening of the tissue via a large incision. Therefore, it is also important to keep the incision of the pocket as small as possible.

It is known that the higher the myopic correction the smaller the optical zone have to be.¹³ This may be a limitation for both, MyoRing implantation and LVC. In LVC, however, tissue is removed while in MyoRing implantation rigid volume is added, which may have a positive impact on the long-term stability of the cornea. However, the right combination of both, MyoRing implantation and LVC, as demonstrated in Eye no. 3 and 4 cannot only stabilize the cornea with minimal tissue removal and a tissue-strengthening MyoRing in place, but also increase the optical zone since the optical zone has to be calculated from each of the two treatment parts separately. For instance if the eye has 10 diopters, the optical zone for LVC only have to be calculated from the 10 diopters. The same is true if the 10 diopters are treated by MyoRing implantation only. However, in the case of combination of 5 diopters LVC and 5 diopters MyoRing, the resulting opticals zone of the combined treatment is only that of a 5 diopters treatment, which might improve the optical quality.

MyoRing implantation without additional LVC is recommended for manifest keratoconus and post-LASIK keratectasia. In all other cases, presenting with more or less significant risk factors for the development of postoperative keratectasia, such as high myopia, thin cornea or atypical topography, LCV (surface ablation) in combination with implantation of MyoRing (MyoRing LASIK, MyoRing LASIK) may be a good option to avoid vision threatening long-term complications. My personal treatment regimen is as follows:

1. LVC only in nonsuspect myopia cases.
2. MyoRing implantation combined with LVC in suspect myopia cases and generally in all myopia cases with average central K-reading of 45 diopters and above and in any case where the patient or the doctor takes particular care about the safety of the treatment.

3. MyoRing implantation only in cases of manifest keratoconus and post-LASIK keratectasia.

Studies on a larger number of cases over a longer postoperative follow-up period are required and already conducted.

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