·Clinical Research·

LASIK surgery in patients with residual refractive errors after radial keratotomy

Abolghasem Rastegar

Department of Ophthalmology, Sadoughi Hospital, Yazd Medical Sciences University, Yazd, Iran

Correspondence to: Abolghasem Rastegar.Department of Ophthalmology, Sadoughi Hospital, Yazd Medical Sciences University, Yazd, Iran. arastegar@ssu.ac.ir

Received:2010-03-24 Accepted:2010-05-03

Abstract

• AIM: To study the results and complications of LASIK surgery after radial keratotomy.

• METHODS: This descriptive study was carried out in Yazd LASIK Center, Yazd, Iran. Cases included all patients who had been operated between April 2003 and September 2006. Data were collected via a special questionnaire and analyzed by SPSS software and paired *t*-test.

• RESULTS: Samples included 33 eyes of 23 patients of whom 11 (47.8%) were women and 12 (52.2%) were men. Their age ranged from 28 to 49 years old and the mean age was 31.6 years old. Two cases (6.1%) had openings of the previous radial keratotomy incisions during flap lifting and one case (3%) had moderate non-infectious keratitis. The mean preoperative spherical equivalent (SE) was -2.17D± 0.94SD, while the postoperative SE was -0.17D ± 0.19SD, the difference of which was significant (P=0.0001). Mean preoperative uncorrected visual acuity (UCVA) was 0.07± 0.02SD (logMAR) and the postoperative was 0.880.16SD (log MAR), the difference of which was also significant (P= 0.0001). The mean best spectacle corrected visual acuity prior to the operation was 0.930.08SD (log MAR) and 0.920.08SD (logMAR) after the operation, the difference of which was not significant (P=0.268).

• CONCLUSION: LASIK surgery could improve residual myopia after the radial keratotomy without major complications during or post operation, but necessity of the second procedure must be pondering and require careful case selection and assessment.

• KEYWORDS: LASIK; radial keratotomy; refractive surgery; residual myopia

DOI:10.3980/j.issn.2222-3959.2010.02.19

Rastegar A. LASIK surgery in patients with residual refractive errors after radial keratotomy. *Int J Ophthalmol* 2010;3(2):172-174

INTRODUCTION

Radial keratotomy (RK) was previously the most common refractive surgery for correction of myopia and undoubtedly is still performed today in certain parts of the world. The most important problem of this operation is undercorrection or overcorrection of the initial refractive error, unstable vision and hyperopic or myopic shift [1]. The methods used for correction of post RK refractive errors include use of spectacles, contact lenses, repeated RK, laser epithelial keratomileusis (LASEK), photorefractive keratectomy (PRK) and laser *in situ* keratomileusis (LASIK) surgery. In the present study LASIK surgery post RK has been studied, even though PRK and LASEK are also appropriate choices. The effects of LASIK surgery for correction of primary refractive errors have opulent resources, but there are limited studies on the usefulness of LASIK in treatment of residual refractive errors in patients undergoing refractive surgeries for their primary problems [1,2]. The aim of the present study was to study the results and evaluate complications if happened of LASIK surgery in patients with residual refractive errors (myopia & myopic astigmatism) following radial keratotomy. If the first and foremost inclusion criterion is patient demand, thus patients who are not satisfied with outcome of RK should be considered for LASIK or surface ablation enhancement. Considering that refractive keratotomy has developed since 1980s, the procedure has several modifications since its introduction. If the outcomes have been satisfactory in many cases and also a great number of complications and unwilling results are a reality, this problem is contrary to expectation of those who underwent the procedure and wished to do as possible as to gain better condition of vision. What's more, the surgeon has moral obligation to his patients, if the necessity of second procedure is controversial and pondering.

MATERIALS AND METHODS

This was a descriptive study, and the population under study included all the patients undergoing LASIK surgery for correction of residual myopia mostly, as well as myopic astigmatism not hyperopic shift for its less predictability following RK due to regression or under correction at the LASIK center of Yazd, Iran from April 2003 to September 2006. In the study, 33 eyes of 23 patients who had undergone RK only for myopia correction without major complication intra- and post-operatively, ranging from -2.00 to -5.50 spherical equivalent diopters with 8 incisions and 90% depth,

had optical zone diameter of 3 to 4 mm. Factors should be considered included situation of refractive error, age, gender, intraocular pressure, corneal thickness and up to 5 years before the secondary procedure. These eyes were operated upon by standard method using an automatic microkeratome (Hansatome) and Technolas excimer laser machine. Thirteen cases had 160μm flap thickness and twenty cases had 180μm flap thickness with a diameter of 8.5-9.5mm. Since the RK incisions never heal completely and the cornea never regains preoperative strength, the flap creation was handled with a wide spatula and extreme care was taken to avoid splitting open of the incisions and flap devastation. In patients whose both eyes required LASIK operation (10 cases), each eye was operated upon separately with a gap of at least 2 months after the initial eye was stabilized. Medication after the operation included topical antibiotic and corticosteroid 4 times daily applied between one to two weeks according to patient procedure condition. Each case has been followed 3 days, one week, two weeks, one month and then monthly for 6 months. Patients enrolled in the study met the conditions which included consultation and full discussion regarding the risks, benefits, alternatives of the operation and an accurate clinical examination using a slit lamp. The examination involved the previous incision site, epithelial plaques, optical zone, regularity or irregularity of the gaps, fundus assessment and intraocular pressure measurement, as well as the best vision with and without spectacles correction and degree of refractive error. Excluding criteria included epithelial defects, unstable cornea, macro or micro corneal perforations during RK, deep vascularization, unstable refraction, flat cornea (K<40D) and corneal thickness less than 500μ m. In this study 8 patients (11 eyes) were excluded from the study for the causes of irregular astigmatism, more than 8 incisions, flat cornea and deep vascularization. The mean pachymetry of the patients under the study was 549μm (533-611μm). A specially formatted questionnaire for the purpose as well as the consent letter was filled and data were evaluated and analyzed through SPSS software program and paired *t* test was used. $P<0.05$ was considered statistically significant.

RESULTS

The patients underwent LASIK surgery and were followed up for correction of their residual myopia from April 2003 to September 2006. Of the total subjects, 11 (47.8%) were men and 12 (52.2%) were women. Their age ranged between 28 and 49 years old and the mean age was 31.6 years old. According to statistical consultant recommendation instances for better analysis of age and sex were divided into 3 age groups: 28-31 years, 32-34 years and 35-49 years. The maximum number of cases was in the 28-31 years age group and the minimum number was in the 36-38 years age group.

The mean preoperative spherical equivalent (SE) was -2.17±0.94SD and the mean cylindrical errors was -1.05±0.43SD, while the postoperative SE was -0.17±0.19SD and by using Paired *t* test, the difference was significant ($P=0.0001$). The mean preoperative uncorrected visual acuity (UCVA) was 0.07±0.02SD and the postoperative visual acuity was 0.88±0.16SD, difference of which was also significant on using paired *t* test ($P=0.0001$). The mean best spectacle corrected visual acuity (BSCVA) prior to the operation was 0.93±0.08SD and 0.92±0.08SD (log MAR) after the operation, difference of which was insignificant ($P=0.268$). In addition, 55% of the eyes were ametropic within the 0.50 diopter range. Among the total 33 eyes, only 2 cases (6.1%) had intra operative complications in the form of small and moderate openings of one or two previous RK incisions during flap lifting and postoperatively one case (3.03%) had moderate non-infectious diffuse lamellar keratitis (DLK) one week after the operation, which was treated with topical steroids. There were a few minor other early or late complications like mild burning and/or pain in the eyes, headache, sensitivity to sunlight, dry eye, glare, sight fluctuation during follow-up on day one, one week, one month, 6 months and so far post operation but none of them were important or problematic.

DISCUSSION

In the present study, the results of LASIK surgery in patients with residual myopia and myopic astigmatism who had initially undergone radial keratotomy (RK) were studied for state of refractive errors, visual acuity outcomes, patient satisfaction, difficulties and complications of LASIK procedure. There was a significant difference in regard to the mean refractive error and uncorrected visual acuity (UCVA) before and after LASIK, whereas the difference between preoperative and postoperative best spectacles corrected visual acuity (BSCVA) was not significant. In terms of intra operative complications, only two cases had openings at the site of the incision of the previous operation; one incision in one case and two incisions in the other case. There was no other noticeable intraoperative complication. During postoperative follow-up, only one case had non-infectious DLK one week after operation that was treated completely with topical steroid application. Besides, a few transient minor complications were seen.

In the study by Munoz *et al* [3] in Spain in the year 2006 on 11 eyes of 7 patients with residual myopia after RK, all of the sites of the incisions of the previous operation opened during flap lifting using laser (femtosecond), but the operation was successful. The mean refractive error prior to the operation was -2.51±0.62D while the mean refractive error after the operation was -0.52±0.28D. Of the total, 63.6% (7 eyes) were within the 0.50 diopter range, 100% (11 eyes) within 1.00 diopter range and 2 eyes (18.1%) lost one line of the vision chart. The reduction in residual refractive

error and correction range of the study were in line with the present study, but the openings of the site of the previous incisions during flap lifting were not in accordance with the present study. In the study of LASIK operation by Agarwal *et al* [4] on 10 eyes of 5 patients in 2000 for correction of residual myopia after RK, there was a significant difference in respect of the mean refractive error and UCVA before and after the operation, while the difference in BSCVA before and after operation was not significant, which is totally in line with the present study. In the study by Agarwal *et al*[5] in 2001 on 10 eyes with residual myopia after RK, LASIK surgery was performed and there was a significant difference in the mean refractive error before and after operation. There were no postoperative complications except 2 eyes (20%) required replacement of the flap due to irregularities and folds of the stroma. There was no decrease in the BSCVA during postoperative follow-up. The results of this study are similar to the present study with regard to the degree of refractive error, UCVA and BSCVA. In the present study, there was no need for flap replacement but 2 eyes had openings of RK incisions during flap lifting intraoperatively and one case had moderate non-infectious DLK after the operation.

In the study by Yong *et al* [6] on 16 eyes of 10 patients in the year 2000, LASIK operation was done for the eyes which had been operated upon previously for refractive error correction by radial keratotomy and had residual refractive error. There was a significant difference between the mean refractive errors before and after the operation and the only complication was intraoperative opening of the previous RK incisions in 2 eyes. The results of refractive error correction and UCVA in the study of Yong *et al* [6] are in consistent with the present study. Regarding complications, the opening of incisions of the previous operation was seen in 12.5% of the cases while this figure was 6.1% in the present study. In the light of the total number of cases, the results are quite similar. There were no postoperative complications in the study, while in the present study there was one case (3.03%) of moderate non-infectious DLK one week after the operation and a few minor transient problems. In the study by Shah *et al* [7] in America, 9 eyes of 6 patients who had undergone radial keratotomy more than one year ago and had 8 or more gaps with residual myopia and astigmatism underwent LASIK surgery. The mean spherical equivalent (SE) was 0.156D ±0.174SD and uncorrected visual acuity (UCVA) post the operation was 20/25 or better respectively. There were no intra- or post-operative complications and the questionnaire showed complete satisfaction of all the patients which was quite similar to the present study. In the study by Attia *et al* [8] in 2001 on 20 eyes of 13 patients who were suffering from over and under correction of refractive errors following RK, LASIK was performed and the patients were followed up for 6 months. There was a significant decrease in the spherical equivalent in both over-corrected and under-corrected groups. 91% of eyes in the over-corrected group and 89% in the under-corrected group were within ±1.0 diopter of the intended correction. There was also a significant improvement in the uncorrected visual acuity in both groups. The results regarding refractive errors, UCVA and BCVA during the follow-up are similar to the present study.

In the study by Clausse *et al* [9] in 2001 on 80 eyes of 56 patients who had undergone radial keratotomy for myopia, hyperopia and astigmatism and had residual refractive errors, LASIK was performed. There was a significant difference between the pre- and post-operative mean refractive errors. There were no intraoperative complications, but during follow-up 6 eyes (7.5%) had BCVA reduction in one line of Snellen's chart, one eye (1.25%) had reduction in 2 lines and one eye (1.25%) had more than 2 lines reduction. There was stromal opacity in two eyes, epithelial defects in two eyes, and epithelial ingrowth in four eyes. The results of this study are similar to the present study in respect of results of refractive error correction and UCVA, but the complications of LASIK are not in line with the present study. In the study by Liu *et al* [10] in 2000, LASIK was performed on 70 eyes of 36 patients. Thirty-two eyes of 16 patients had undergone RK, and 38 eyes of 20 patients had undergone PRK. There were no major intra- or post-operative complications. The UCVA after operation in 70% of the cases was similar to the corrected visual acuity before the operation and in 100% of the cases corrected visual acuity after the operation was the same as corrected vision before the operation, which is in line from various points but not similar to the present study in certain ways.

REFERENCES

1 Buratto L, Brint S. LASIK: Surgical Techniques and Complications. SLACK Incorporated 2000:519-521,538

2 Azar DT, Tuli S, Benson RA, Hardten DR. Photorefractive keratectomy for residual myopia after radial keratotomy. PRK after RK Study Group. *J Cataract Refract Surg* 1998; 24:303-311

3 Muñoz G, Albarrán-Diego C, Sakla HF, Pérez-Santonja JJ, Alió JL. Femtosecond laser *in situ* keratomileusis after radial keratotomy. *J Cataract Refract Surg* 2006;32(8):1270-1275

4 Agarwal S, Pallikaris IG, Agarwal A. Refractive Surgery. SLACK 2000:317-322

5 Agarwal A, Agarwal T, Bagmar A, Agarwal S. Laser *in situ* keratomileusis for residual myopia after radial keratotomy and photorefractive keratectomy. *J Cataract Rrefract Surg* 2001;27(6):901-906

6 Yong L, Chen G, Li W, Chang J, Ngan C, Tong P, Qun C. Laser *in situ* keratomileusis enhancement after radial keratotomy. *J Refract Surg* 2000;16(2): 187-190

7 Shah SB, Lingua RW, Kim CH, Peters NT. Laser *in situ* keratomileusis to correct residual myopia and astigmatism after radial keratotomy. *J Cataract Refract Surg* 2000;26(8):1152-1157

8 Attia WH, Alió JL, Artola A, Muñoz G, Shalaby AM. Laser *in situ* keratomileusis for under correction and over correction after radial keratotomy. *J Cataract Refract Surg* 2001;27(2):267-272

9 Clausse MA, Boutros G, Khanjian G, Wagner C, Garabet AL. A retrospective study of laser *in situ* keratomileusis after radial keratotomy. *J Refract Surg* 2001; 17:200-201

10 Liu L. Therapeutic effects of under correction by LASIK following RK and PRK for correction of high myopia. *J Tongji Med Univ* 2000;20(4):349-350