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Outcomes of vitreoretinal surgery for retinal detachment after LASIK for myopia

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PURPOSE. *To report and compare outcomes of vitreoretinal surgery for repair of retinal detachment in myopic patients with and without previous laser-assisted in situ keratomileusis (LASIK).*
METHODS. *This is a descriptive retrospective observational study with a control group for comparison that consisted of the analysis of clinical and surgical charts of patients who underwent vitreoretinal procedures for retinal detachment at the Fundación Oftalmológica Nacional between January 1995 and December 2002. The authors identified those myopic patients who had previous history of LASIK and an age- and myopia-matched control group without refractive surgery.*
RESULTS. *The sample contains 24 myopic eyes of 22 patients with previous LASIK and 23 myopic eyes without previous LASIK in the control group, matched by age and myopia. Mean refractive error was -9.4 D before LASIK for the cases group and -11.2 for the control group. Poor preoperative best-corrected visual acuity was present in 71% of cases and 61% of controls (p=0.489). Macula off retinal detachment was found in 17 eyes in both groups. Five eyes required at least two procedures, achieving 91% (20 eyes) reattachments at the end of follow-up in each group. Final best-corrected visual acuity was better than 20/100 in 15 eyes (62.5%) in the LASIK group and 17 eyes (74 %) in the control group (p=0.659).*
CONCLUSIONS. *Retinal detachment in patients with previous myopic LASIK has similar characteristics as in myopic patients without refractive surgery. Current vitreoretinal surgery is of good prognosis as the retina was successfully reattached in most cases in both groups. (Eur J Ophthalmol 2006; 16: 435-9)*

KEY WORDS. *Laser* in situ *keratomileusis, Retinal detachment, Vitreoretinal surgery*

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INTRODUCTION

Pioneering investigations on refractive surgery were developed by Barraquer in his proposal of keratomileusis for the correction of ametropia (1).

During the past two decades it has been the subject of extensive studies that have changed the management of most refractive errors. Ruiz's keratomileusis in situ and Trokel's discovery of the ablation power of the excimer laser led other investigators such as McDonald, Pallikaris, and Burato to design experimental studies and apply surgical techniques like photorefractive keratectomy (PRK) and laser in situ keratomileusis (LASIK) on humans in the early 1990s (2). Important advances have recently been made and the techniques have undergone modifications such as phototherapeutic keratectomy (PTK) and laser-assisted epikeratomileusis (LASEK), avoiding the use of the microkeratome (2).

Currently, LASIK is the most practiced ophthalmic surgical procedure in the world. An estimate of 900,000 to 1.1 million surgeries per year are performed in the United States and about 300,000 in Latin America, with good visual and refractive results (3).

Publications regarding vitreoretinal complications after LASIK have recently increased, and a common association has been proposed. Vitreous hemorrhage, retinal

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holes, tears, and detachment (RD), macular holes, and choroidal neovascular membranes have been reported (4-6). The prevalence for RD is of 30 in 100,000 people per year. The high risk groups are aphakic (2.2%), pseudophakic (1 to 2%), and myopic patients (6 to 7%).3 The risk for developing RD is four times greater in the population with myopia between -1.00 and -3.00 diopters, and increases to 10 times in myopia greater than -3.00 diopters. This is attributed to the increase of axial length in these patients (3).

Rodriguez and Camacho, in 1992, reported 14 cases of RD in patients who underwent keratomileusis and radial keratotomy (7). Ozdamar et al reported the first case of bilateral RD with giant tears in a patient with bilateral LASIK for the correction of myopia (-17.00 and -16.00 D) (8). In the largest case series reported, Arevalo et al, reviewing 38,823 LASIK procedures for the correction of myopia, found 33 RDs, with an incidence of 0.08%, and an average follow-up of 16.3 months and mean myopia of -8.75 D (9). The purpose of our study was to compare the surgical results of a group of patients with previous LASIK and RD and a control group. The popularity and results of LASIK are not questioned, but the discussion about their relationship with potential vitreoretinal effects increases. The functional and anatomic prognosis for those RDs in patients with excellent functional outcomes achieved through refractive surgery is also of great concern.

PATIENTS AND METHODS

This is a descriptive retrospective observational study with a control group for comparison in which the clinical and surgical charts of patients with diagnosis of preoperative RD were analyzed, searching for myopic patients with and without previous LASIK used for the correction of myopia performed at our institution and elsewhere. Reparative RD surgery was performed on these patients between January 1995 and December 2002, at the Fundación Oftalmológica Nacional by several surgeons. All patients had a complete ophthalmologic evaluation with retinal drawings and ultrasound when necessary. The main purpose of our search was to identify patients with history of LASIK before the onset of RD and compare them with a control group of myopic patients who had no history of excimer laser refractive surgery and matched for age and myopia with the cases group. Variables such as time between the refractive procedure and diagnosis of RD, time of onset of symptoms of RD, severity of pre LASIK myopia and refractive error in non LASIK cases, preoperative best-corrected visual acuity, macular involvement in RD, primary procedure and its results, need and results of additional procedures, vitreoretinal surgery complications, final visual acuity, final refractive result, and time of follow-up were assessed.

Cases and controls were compared by numerical variables using Student t-test, and qualitative variables by chi square. Pre and postoperative comparisons were made using McNemar test. The level of significance used was 5%.

RESULTS

In the total RD patients considered, 24 eyes of 22 patients had previous LASIK for the correction of myopia. There was no preference for laterality. Fourteen patients were men (63.6% of cases), age ranged between 13 and 64 years, mean 38.3 (SD=11.2) years, with 10 patients between 31 and 40 years. The control group consisted of 23 eyes of 22 patients with mean age of 38.2 years (SD=15.7), range between 6 and 75 years, 12 male and 10 female (Tab. I).

In the group of cases with previous LASIK we could identify a myopic error prior to refractive surgery in 19 cases; the medical charts of the remaining five cases stated that they were myopic without specifying the amount of error. The mean refractive error for this group was -9.40 D. Myopia ranged between -2.00 and -22.00 D. Twelve eyes (50%) had myopia greater than -5.00 D, 6 of them between -5.00 and -10.00 D. The remaining eyes had greater than -10.00 D.

In the control group all pre RD refractive data were complete. We found a mean myopia of -11.20 D, range -1.00 D and -36.00 D. Eighteen eyes had myopia greater than -5.00 D, 6 of them between -5 and -9.75 and 12 of them greater than -10.00 D. Both groups had different distributions of refractive error but no significant differences (p=0.399).

Time elapsed between LASIK and the onset of RD ranged between 1.5 and 60 months, with equal amount in the groups of 7 to 12 months (5 eyes) and the group greater than 48 months (6 eyes).

Time of onset of symptoms of RD was less than 1 month in 83.3% of LASIK cases and in 52.2% of the control group. This was statistically significant (p=0.048).

We found a high number of RDs involving the macula: 17 cases (70.83%) in each group.

Scleral buckling (SB) was the primary procedure performed in both groups: 16 cases of previous LASIK and 17 without LASIK. The procedures practiced on the remaining cases of the refractive surgery group were two pars plana vitrectomies (PPV) with C3F8 tamponade, two with silicone oil, two pneumoretinopexies, one cryocoagulation, and, in one patient, lensectomy, PPV, endolaser, and silicone oil tamponade were also performed. For the control group one pneumoretinopexy and six PPVs were performed: two with C3F8 tamponade (one lensectomy) and four with silicone oil (three lensectomies).

Retinal reattachment after the first procedure for the cases and control groups was the postoperative result in 17 eyes (70.3%) and 16 eyes (70%), respectively, but the anatomic success improved to 91% (22 and 21 eyes) with a second procedure in both groups.

For the LASIK group, the main postoperative complication was retinal redetachment; two RDs were subtotal with macula on and both were reattached at the end of follow-up, but one of them developed a macular hole and a neovascular membrane that required three sessions of photodynamic therapy. Three macula off RDs had a successful outcome but in contrast, one of two total RDs required evisceration because of phthisis bulbi. Three eyes developed cataracts (two because of silicone oil) and one a band keratopathy, also secondary to silicone injection. One eye underwent successful PPV for macular hole and removal of epiretinal membranes.

For the myopic control group six of seven redetachments involved the macula; four were successfully reoperated. There were no other major complications in this group.

Best-corrected final visual acuity at the end of follow-up was considered good (>20/40) in 16 subjects, moderate (20/50 to 20/100) in 16 cases, and poor (<20/400) in 15 eyes: a similar distribution in both groups, without significant differences (p=0.833) (Tab. II).

In both groups there was an improvement in visual acuity after surgery, in the cases group (p=0.013) and in the control group (p=0.001).

We considered postoperative refractive result as successful when it did not induce more than two positive or negative diopters. This was achieved in a low number of

TABLE I - CHARACTERISTICS

		Cases	Controls	p value
Age	Mean	38.33	38.17	0.968
	SD	11.2	15.7	
Sex				
	Male	15	13	0.924
	Female	9	10	
Laterality				
	Right	12	15	0.447
	Left	12	8	

SD = Standard deviation

TABLE II - RESULTS OF VISUAL ACUITY BEFORE AND AFTER SURGERY

Visual acuity	Cases		Controls	
	Before surgery	After surgery	Before surgery	After surgery
Good				
<20/40	4	7	3	9
Fair				
20/50–20/100	3	8	6	8
Poor				
>20/200	17	8	14	6
Total	24	24	23	23
	McNemar test p=0.013		McNemar test p=0.01	

patients (12 of 47), 8 of them in the group that had previous refractive surgery.

Follow-up time after the initial vitreoretinal procedure was greater than 6 months in 34 eyes (72%).

DISCUSSION

The large number of refractive procedures performed worldwide gives importance to their possible outcomes and complications and much has been reported about the association between LASIK and RD. Previous studies have been consistent in reporting a low incidence of RD after LASIK. Ruiz-Moreno et al found 4 eyes with RD among 1554 LASIKs, an incidence of 0.25% (10). Four cases of early RD after LASIK were reported by Farah et al, all of them with preoperative myopia greater than -10.00 D (11). Aras et al identified 10 cases in 4432 eyes studied, an incidence of 0.2%, and proposed a prospective study with a minimum sample size of 65,000 LASIK procedures (12). Chan and Lawrence reported two patients with bilateral macular hole after LASIK and one after PRK (13).

Arevalo reviewed 38,823 LASIK procedures, finding an incidence of 0.08% (33 cases) (9). This study shows the greatest numbers so far, but also the lowest association. The low frequency of RD found after LASIK does not correspond with the incidence of RD found in the myopic general population.

Even though numbers are low, there are well documented and funded hypothesis on the possible LASIK mechanisms that can result in RD. Those mechanisms are stated by Lowestein in agreement with other authors (14). The principal theoretical mechanism is the mechanical trauma produced due to the rise and sudden decrease of intraocular pressure with the use of a suction ring and the microkeratome. This extreme variation can produce an increase on the eye's axial length that translates into traction of the vitreous base (14).

Two experimental models support this theory. In the first one Luna et al performed ultrasound before and after using the microkeratome device in pig eyes, documenting an increase in axial length (15). More recently, Flaxel et al, working with eye bank globes. reported an increase of 1.125 mm of axial length after the suction ring was applied (16).

The second mechanism producing traction on the vitreous base is the effect of acoustic shock waves generated by the laser energy (14). The report by Charteris et al of eight cases of RD after PRK and one following PTK supports this theory (17).

We found a low number of RDs after LASIK. This article is not a population study nor is designed to report incidence or frequency of vitreoretinal complications after refractive surgery. We intend to prove that myopic RDs have similar characteristics and surgical outcomes regardless of whether they had previous excimer laser surgery.

In 19 cases we could state the amount of myopia and most (12 eyes) of them had a refractive error greater than -5.00 D. The reported risk of RD is 10 times greater in myopia of -3.00 D or more (3).

In the time interval between LASIK and the diagnosis of RD, which ranged from 1.5 to 60 months, the study did not show an association. Five patients reported mild trauma prior to the RD, but deciding whether the detachment is secondary to myopia, trauma, or refractive surgery in these cases is difficult.

LASIK is usually a bilateral procedure, but we found only two patients with bilateral RD and other studies also show low numbers of bilateral involvement (9-12).

Most studies address concern about the development of retinal complications following LASIK but do not describe how the patients were managed and their final results (9-12). We decided to study the characteristics of myopic eyes with and without previous excimer laser refractive surgery, after repair surgery for RD, and compare their anatomic, visual, and refractive results. We intentionally matched our groups for age, but our results show both samples are similar for sex, amount of myopic refractive error, number of RD involving the macula, previous visual acuity, and surgical outcomes reattachment and visual acuity. The high number of macula off RDs (70.83%) in both groups may explain the poor best-corrected visual acuity in most patients (worse than 20/200 in more than half of the studied eyes; 66%) before vitreoretinal surgery was performed for the RD.

The main preoperative difference between groups was the time of onset of RD, from which we hypothesize that patients with previous refractive surgery had better visual acuity and notice changes earlier than those patients who had nonsurgical optical correction for their myopia. Twenty of twenty-four patients consulted the ophthalmologist before 1 month of visual loss while in the control group only 11 of 23 did before 1 month. This was statistically significant.

Surgical anatomic outcomes in both groups are good. With a primary surgical procedure we obtained an

anatomic success of 70%; the rate of success improved to 91% when a second procedure was performed.

The most common postoperative complication was retinal redetachment in seven patients in each group, five of them obtaining reattachment with a secondary intervention in the LASIK group and six in the group without previous refractive surgery. Other complications were infrequent and related to silicone oil tamponade (cataract and band keratopathy).

Functional outcomes are also good. Most of the cases had poor preoperative VA (<20/200) in 31 eyes (17 of LASIK group and 14 controls) and improved to moderate or good acuity (equal or better than 20/100) in 32 eyes (15 with previous LASIK and 17 in the control group).

We found a slight difference in the final refractive state among the two groups, identifying eight cases in the LASIK group with induced error lesser than 2 positive or negative diopters against four cases in the control group. LASIK refractive correction can be the explanation for this result, although it is not significant (p=0.191).

CONCLUSIONS

We found similar outcomes between groups of patients with and without previous LASIK. The vitreoretinal complications observed are most likely due to degenerative changes of high myopia. Vitreoretinal surgery is of good anatomic and visual prognosis in patients with RD and LASIK, as it is for myopic patients without refractive surgery, but more than one surgical procedure can be required to reattach the retina.

Good visual acuity due to previous LASIK can make patients search for care earlier, which can result in a better visual and refractive outcome after vitreoretinal surgery.

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