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Post-LASIK Epithelial Ingrowth: Treatment, Recurrence and Long-term Results

Nilufer Yesilirmak, MD^{1,2}, Priyanka Chhadva, MD^{1,3}, Florence Cabot, MD¹, Anat Galor, MD MSPH^{1,4}, and Sonia H. Yoo, MD¹

¹Bascom Palmer Eye Institute, University of Miami, Miami, Florida, USA

²Yildirim Beyazit University, Department of Ophthalmology, Ankara, TURKEY

³Department of Ophthalmology, Illinois Eye and Ear Infirmary, University of Illinois, Chicago, Illinois, USA

⁴Miami Veterans Administration Medical Center, Miami, Florida, USA

Abstract

Purpose: To study outcomes after surgical removal of epithelial ingrowth (EI) in post-LASIK patients, specifically comparing visual results and recurrence rates between two different EI management techniques.

Methods: Retrospective chart review including 67 eyes of 54 patients who underwent surgical treatment for EI following LASIK between July 1999 and July 2014 at the Bascom Palmer Eye Institute, Miami, Florida. Surgical techniques, recurrence rates, visual acuity (VA), and refractive error were assessed.

Results: Of the 67 eyes, 56 eyes (83.6%) had flap lift+scraping alone and 11 eyes (16.4%) had flap lift+scraping+suturing. After a mean follow up of 2.5 years, 11 of 56 eyes (19.6%) treated with flap lift+scraping alone had EI recurrence, while no eyes treated with flap lift+scraping+suturing had EI recurrence. Visual acuity results and refractive errors were better in eyes treated with lift+scraping alone compared to lift+scraping+suturing at 1 month. In the 67 eyes with 1 year follow up, visual acuity and refractive errors improved from preoperative values and was comparable between groups.

Conclusion: Scraping alone provides significantly better initial visual outcomes but higher EI recurrence rates compared to scrape-suturing. Long-term visual outcomes are comparable between two techniques.

Keywords

Epithelial ingrowth; LASIK; flap lifting and scraping alone; scrape and suturing; recurrence

Correspondence & Address for Reprints: Sonia H. Yoo MD, Bascom Palmer Eye Institute, 900 NW 17th Street, Miami, FL 33136, USA, Phone number: 305-326-6322, Fax number:305-326-6575, syoo@med.miami.edu.

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INTRODUCTION

Epithelial ingrowth (EI) after laser in situ keratomileusis (LASIK) has been reported to occur in 0% to 20% of patients.^{1,2} While most cases are self limited, surgical treatment is required in 0.92% to 3.2% of patients when EI extends into the visual axis and reduces vision, induces astigmatism, and/or causes keratolysis or foreign-body sensation.^{1,2}

The most common surgical treatment of EI involves flap lifting followed by scraping of epithelium off the stromal bed and underside of the flap. However, a 44% recurrence frequency has been reported with this technique alone.¹ As such, adjunctive treatments have been used in an attempt to reduce EI recurrence. These include suturing of the flap, application of ethanol or mitomycin C, phototherapeutic keratectomy, and/or application of glue or sealant to the flap interface.^{1,3–6} In more severe cases, flap amputation and transepithelial topography-guided ablation has been described. In less severe cases, the Nd:YAG laser has been used in an attempt to bypass a surgical approach.^{7,8}

Among adjunctive treatments, flap suturing is the preferred adjuvant treatment as it is thought to have a reasonable side effect profile.⁹ However, no studies have compared long-term outcomes of flap scraping alone versus flap scraping with suturing. Therefore, in this study we compare short and long-term outcomes between these two techniques for treating visual significant EI.

MATERIALS AND METHODS

Patient Population:

A retrospective comparative case series was performed at a single institution with approval from the University of Miami Institutional Review Board. This review included all patients who underwent surgical treatment for EI following LASIK between July 1999 and July 2015 at the Bascom Palmer Eye Institute, Miami, Florida. Information collected included patient demographics, details pertaining to the original LASIK surgery, surgical technique for EI treatment, and visual acuity (VA) outcomes. Primary outcome measures included EI recurrence rate, uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA) spherical equivalent (SE), and cylindrical power (Cyl).

Inclusion – Exclusion Criteria:

Patients who had diagnosis of significant EI and were treated surgically as a first time in our institute included in this study (n=54). Patients who had other diseases that could effect surgical outcomes (such as glaucoma, diabetes, uveitis) (n=2) and patients who had incomplete demographic, pre-operative and post-operative information, or had short follow-up (less than 1 year) (n=5) were excluded.

Statistical Analysis:

All statistical analyses were performed using data analysis software (SPSS 22.0; SPSS Inc., Chicago, Illinois, USA). Descriptives and frequencies were used to summarize patient data. Kaplan Meier analysis was used to compare EI recurrence rate between surgical techniques. Paired T tests were used to compare UDVA, CDVA, SE, and Cyl values before and after EI

treatment. Independent t tests were used to compare these metrics between the two groups. P values less than 0.05 were considered significant.

RESULTS

Study population:

A total of 67 eyes of 54 patients had treatment for EI after LASIK at Bascom Palmer Eye Institute during the 15-year study period. Twenty-seven (40.3%) of eyes had primary LASIK (microkeratome-assisted) at outside institutions and EI was diagnosed in all of these 27 eyes after LASIK enhancement performed in our institution. Forty (59.7%) of eyes had primary LASIK (22 of them microkeratome-assisted, 18 of them femtosecond laser-assisted) at our institution and EI diagnosed in 14 (33%) after primary LASIK and in 28 (67%) after LASIK enhancement. None of the patients included in this study had been previously treated for EI.

Mean age of the population was 48.7 ± 10.2 . Thirty-two (59.3%) were female, 29 (53.7%) self-identified as white, and 25 (46.3%) as Hispanic (Table 1).

Lift-scrape technique:

To manage the EI, 56 eyes (44 patients) underwent LASIK flap lift and scraping of epithelial cells from the stromal interface and posterior flap under topical anesthesia for EI treatment and a bandage contact lens was placed postoperatively. Forty-five eyes did not have EI recurrence during an average follow up of 2.5 ± 1.8 years. Eleven eyes had EI recurrence and all recurrences were in the first 2.5 years (55% of them were in the first 6 months). Of those with EI recurrence, all had a history of microkeratome usage for the initial LASIK compared to 62.2% in those without recurrence, $p=0.015$. Table 2 presents risk factors associated with EI recurrence in this group. All 11 eyes with EI recurrence underwent further surgery, 4 eyes with scraping only and 7 eyes with scrape-suturing. No further EI recurrences were noted during an average of 2 years of follow-up.

Lift-scrape-suturing technique:

Eleven eyes of 10 patients had LASIK flap lift, scraping, and flap suturing with 10–0 nylon sutures under topical anesthesia for EI treatment. Sutures were placed corresponding to the area of EI and remained in place 2–3 months before removal. None of these eyes developed recurrence during their follow-up of average 1.5 years.

Recurrence rates:

Figure 1 compares EI recurrence rates between scraping alone and scrape-suturing techniques. Although the curves are clearly divergent, the difference is not statistically significant, $p=0.14$, due to the small sample size in the scrape-suturing group.

Refractive outcomes:

With respect to preoperative UDVA, CDVA, SE and Cyl values, there was no significant difference between scraping alone and scrape-suturing groups ($p>0.05$). At the 1-month postoperative follow-up, Cyl value was significantly higher in scrape-suturing group than scraping alone group ($p=0.05$), while UDVA, CDVA and SE values were insignificantly

better in scraping alone group than scrape-suturing group ($p>0.05$). At the 1-year postoperative follow-up, all these values including Cyl were similar between groups again ($p>0.05$).

Table 3 shows the UDVA, CDVA, SE and Cyl in eyes treated with scraping alone and scrape-suturing before and after EI treatment. Eyes successfully treated with scraping alone showed a significant improvement in the UDVA, CDVA, SE and Cyl at their both 1-month and 1-year follow-up after treatment. At the 1-month follow up, 44% of eyes achieved 20/20 or better UDVA, 80% of eyes achieved 20/20 or better CDVA, 62% of eyes achieved 0.50 or lower SE and 67% of eyes achieved 0.50 or lower Cyl. At the 1-year follow up, 47% of eyes achieved 20/20 or better UDVA, 82% of eyes achieved 20/20 or better CDVA, 67% of eyes achieved 0.50 or lower SE and 69% of eyes achieved 0.50 or lower Cyl (Figures 2–5).

Eyes treated with scrape-suturing did not have a significant improvement in UDVA, CDVA, SE, and Cyl at the 1-month follow-up after treatment (Table 3). Only 9% of eyes achieved 20/20 or better UDVA, 36% of eyes achieved 20/20 or better CDVA, 27% of eyes achieved 0.50 or lower SE and 18% of eyes achieved 0.50 or lower Cyl. However, at the 1-year follow up, CDVA and UDVA were significantly improved compared to pre-treatment values (Table 3). 36% of eyes achieved 20/20 or better UDVA and 82% of eyes achieved 20/20 or better CDVA, 73% of eyes achieved 0.50 or lower SE and 64% of eyes achieved 0.50 or lower Cyl (Figures 2–5).

DISCUSSION

We evaluated methods and outcomes of post-LASIK EI treatment over a 15-year period at Bascom Palmer Eye Institute. Previous studies have looked at methods for EI removal; however, the aim of our study was to compare the short and long-term visual outcomes of such techniques.^{9–11} Eyes treated with LASIK flap lift and scraping showed a significantly improved visual outcomes at 1-month and 1-year follow-up. Eyes treated with LASIK flap lift, scraping and suturing did not show a significantly improved visual outcomes at the 1-month follow-up; however, they achieved significant and similar outcomes with scraping alone at 1-year follow-up. This result is attributed to the effect of sutures embedded in the cornea causing astigmatism, which then disappears after suture removal.

The other main concern of our study was EI recurrence. Previous reports in the literature have documented recurrence frequencies ranges from 5% to 68% with various treatment techniques.^{12,13} With LASIK flap lift and scraping, the recurrence rate was found to be between 23.3% to 44% as reported in the literature,^{12,13} whereas it was 19.6% in our study over a 2.5 years. However, few reports in the literature have documented the recurrence rate with LASIK flap lift, scrape, and suturing. Rojas et al. reported that of 20 patients undergoing this procedure, only 1 patient had recurrence of EI, and no patients required subsequent flap lifts.⁹ Moreover, Guell et al. reported 13 eyes of 13 patients who had no recurrence 1 year after flap scrape-suturing.¹⁰ Our results are comparable to these studies with no recurrence seen. However, in our study, the eyes treated for EI recurrence either with scraping only or scrape-suturing did not show subsequent recurrence during the 2-year follow-up and all achieved CVDA of 20/30 or better.

The pathogenesis of EI after LASIK is discussed in the literature, and it has been suggested that EI consists of an epithelial fistula underneath the flap with a tract extending to the edge of the flap.¹ Studies recommend treatment as early as possible to prevent maturation of this fistula.¹ Prompt and efficient treatment can close the fistula, and plays important role on the prevention of recurrence and loss.¹² Likewise, our study suggests that the placement of sutures at the site of ingrowth, both as primary and secondary forms (after the recurrence) of adjunctive treatment to flap scraping, is efficient to close the fistula and provide good long-term visual outcomes.

Moreover, the most relevant recurrence factors for EI is microkeratome usage for primary LASIK and LASIK enhancement as reported in the literature, are comparable to our study.^{14,15} All recurrent eyes in our study had a history of microkeratome usage for LASIK surgeries.

Limitations to our study include its retrospective design. Since not all patients included in this study had primary LASIK at our institute, we were not able to obtain all information including refractive error type prior to LASIK and the type of LASIK platform used. Besides, we were not able to compare other adjunctive treatment modalities used in the literature such as tissue glue application, which have shown promising results in terms of preventing clinically significant EI recurrences.¹⁶

In conclusion, this study suggest that scraping alone is suggestive of a higher risk of EI recurrence requiring re-treatment compared to scrape-suturing; however, it is less time consuming and provides good initial and long-term VA outcomes. Although scrape-suturing may not significantly improve initial visual outcomes, long-term results are comparable to scraping alone after suture removal.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1:
KM survival curve of scraping alone and scrape-suturing looking at recurrence rate

Figure 2:
Comparison of uncorrected distance visual acuity (UDVA) outcomes between scraping alone and scrape-suturing groups.

Figure 3:
Comparison of corrected distance visual acuity (CDVA) outcomes between scraping alone and scrape-suturing groups.

Figure 4:
Comparison of spherical equivalent (SE) outcomes between scraping alone and scrape-suturing groups.

Figure 5:
Comparison of refractive cylinder (Cyl) outcomes between scraping alone and scrape-suturing groups.

Table 1:

Patient demographics and clinical information in both groups.

	Flap lift and Scraping alone (n=44)	Flap lift and scrape-suturing (n=10)	P-value
Age at EI diagnosed (years; mean $\pm$ SD)	49.2 $\pm$ 10.1	47.0 $\pm$ 9.9	0.53
Gender (male/female)	20/23	4/6	0.65
Ethnicity (White/Hispanic)	25/19	4/6	0.34

EI= Epithelial ingrowth

Table 2:

Risk factors for recurrent epithelial ingrowth in patients treated with scraping alone

	Recurrent EI	No recurrent EI	P-value
Age (years; mean $\pm$ SD)	48.8 $\pm$ 10.5	50.4 $\pm$ 8.6	0.66
Male	36.4%	46.7%	0.54
Microkeratome	100%	62.2%	0.02
Enhancement	81.8%	75.6%	0.66
Time to EI (weeks; mean $\pm$ SD)	44.9 $\pm$ 58.8	8.3 $\pm$ 11.7	<0.01

EI= Epithelial ingrowth

Table 3:

Visual Outcomes of eyes in Scraping alone and Scrape-Suturing: Comparison between “Pre-treatment and 1 month FU” and ” Pre-treatment and 1 year FU” using paired t test.

		Pre-treatment Mean±SD	1 month FU Mean±SD	1 year FU Mean±SD	P-value
Scraping alone	UDVA	0.62±0.24	0.84±0.29	0.85±0.31	<0.01/<0.01
	CDVA	0.87±0.22	1.02±0.18	1.04±0.17	<0.01/<0.01
	SE	0.87±0.57	0.56±0.59	0.51±0.45	0.01/<0.01
	Cyl	1.04±0.83	0.40±0.43	0.41±0.47	<0.01/<0.01
Scrape- Suturing	UDVA	0.53±0.32	0.50±0.24	0.73±0.26	0.79/0.02
	CDVA	0.71±0.28	0.72±0.24	0.94±0.13	0.97/0.01
	SE	0.75±0.98	0.82±0.80	0.42±0.42	0.84/0.24
	Cyl	1.69±1.48	1.39±1.24	0.75±0.60	0.67/0.08

UDVA= Uncorrected distance visual acuity, CDVA= Corrected distance visual acuity, SE= Spherical equivalent, Cyl= Cylindrical power, FU= Follow-up