MİYOPİ VE MİYOPİK ASTİGMATİZMA TEDAVİSİNDE UYGULANAN PRK VE FS-LASİK PROSEDÜRLERİNİN KIYASLANMASI

Comparison of PRK and FS-LASIK Procedures in Treatment of Myopia and Myopic Astigmatism

Servet CETİNKAYA (0000-0003-3795-5356)

Konyagoz Eye Hospital, Konya, Turkey

Servet CETİNKAYA, Op. Dr.

ÖZET

Amaç: Miyopi ve miyopik astigmatizma tedavisinde uygulanan fotorefraktif keratektomi (PRK) ile Femtosaniye Lazer in situ keratomileusis (FS-LASIK) prosedürlerinin sonuçlarının kıyaslanması.

Gereç ve Yöntem: Miyopi ve/veya miyopik astigmatı olan ve PRK prosedürü uygulanan 57 hastanın 114 gözü ile, FS-LASİK uygulanan 57 hastanın 114 gözü retrospektif olarak kıyaslandı.

Bulgular: İki grup arasında yaş ve cinsiyet açısından anlamlı bir farklılık yoktu. Yine iki grup arasında preoperatif ve postoperatif sferik değer, slendrik değer ve sferik eşdeğer, düzeltilmemiş görme keskinliği ve düzeltilmiş görme keskinliği açısından anlamlı bir farklılık yoktu. Öngörülebilirlik, etkinlik ve güvenilirlik endeks değerleri her iki grupta yüksekti ve benzerlik göstermekteydi. PRK grubunda iki gözde haze gelişti, ancak bu gözler 6 ay sonra düzeldi, ve üç gözde -1.00 D ye kadar regresyon gelişti. Ancak bunlar istatistiki olarak anlamlı değildi.

Sonuç: Miyopi ve miyopik astigmatizma tedavisinde , hem PRK hem de FS-LASİK etkin, güvenilir ve öngörülebilir prosedürlerdir. Yüksek dioptrilerde PRK uygulanan gözlerde haze ve regresyon gelişebilir.

Anahtar kelimeler: *PRK; FS-LASİK; Haze; Regresyon*

ABSTRACT

Aim: To compare the results of photorefractive keratectomy (PRK) and femtosecond-assisted laser in situ keratomileusis (FS-LASIK) procedures in treatment of myopia and myopic astigmatism.

Material and Methods: One hundred and fourteen eyes of 57 patients with myopia and/or myopic astigmatism who had undergone PRK procedure were compared retrospectively with 114 eyes of 57 patients with myopia and/or myopic astigmatism who had undergone FS-LASIK procedure.

Results: In respect to age and sex, there were no significant differences between PRK and FS-LASIK groups. Regarding preoperative and postoperative spherical, cylinderical and spherical equivalent values, uncorrected distance visual acuity (UDVA) and corrected distance visual acuity (CDVA), there were no significant differences between two groups. Predictability, efficacy and safety index values were high and similar in both groups. Haze developed in two eyes in PRK group, but they recovered 6 months later and regression occured up to -1.00 D in three eyes in PRK group. However, these were not significant statistically.

Conclusion: Both PRK and FS-LASIK are efficient, safe and predictable procedures for correction of myopia and myopic astigmatism. PRK may induce haze and regression in high diopters.

Keywords: *P-PRK; FS-LASIK; Haze; Regression*

İletişim:
Servet Cetinkaya, Konyagoz Eye Hospital, Sancak Mah. Unluer Sok. No:13, Selcuklu, 42000, Konya, Turkey.
Tel: 00905322303421
e-mail:
drservet42@gmail.com

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INTRODUCTION

The Excimer Laser uses a high-voltage electrical charge to transiently combine atoms of excited Argon and Fluorine, when the molecule or dimer reverts to its separate atoms, a charged photon is emmited. The word excimer comes from 'excited dimer'. Excimer Laser radiation ruptures the collagen polymer into small fragments, expelling a discrete volume and depth of corneal tissue from the surface with each pulse of the laser without significantly damaging adjacent tissue [1].

Photorefractive keratectomy (PRK) is a surface ablation procedure, in which after removal of epithelial layer of cornea, laser ablation is applied to corneal stroma to change the refractive power [2]. After 1990, when laser in situ keratomileusis (LASIK) was first performed, the popularity of PRK decreased due to slower recovery of vision and higher postoperative discomfort than LASIK. However, in recent years, the application of PRK has increased, because it is an attractive alternative for specific indications including irregular or thin corneas, epithelial basement membrane disease and previous corneal surgery [1,3]. PRK also eliminates flap-related complications and may have a decreased incidence of postoperative dry eye. The major risks of PRK are corneal haze and regression in high diopters. The use of Mitomycine-C markedly decreases the development of corneal haze [4].

LASIK is currently the most frequently performed keratorefractive procedure because of its safety, efficacy, quick recovery of vision and minimal patient discomfort. LASIK combines two refractive technologies, one is the Excimer laser stromal ablation and the other is the creation of a stromal flap. In FS-LASIK procedure, femtosecond laser is used to create corneal flaps. Its main advantage over mechanical microkeratomes is that femtosecond laser allows surgeons to customize the parameters of corneal flap, such as diameter, thickness and hinge position, which may reduce the incidence of intraoperative complications, including irregular or button-holed flaps and epithelial defect. The femtosecond laser-created flaps also show stronger adhesions at the interface and flap edge than microkeratome flaps [5,6]. However, LASIK can not correct preexisting high-order aberrations (HOAs) and may induce HOAs postoperatively. HOAs are responsible for postoperative symptoms like halos, glare, monocular diplopia and decreased contrast sensitivity after successful refractive surgery. Wavefront-guided LASIK has been shown to correct preexisting aberrations and to result in less postoperative HOAs [7,8].

In this study, retrospectively PRK procedure is compared with FS-LASIK in treatment of myopia and myopic astigmatism.

MATERIAL AND METHODS

The study protocol was confirmed by the local ethics commitee. An informed written consent was taken from the patients before the surgery. The study was designed according to the tenets of Declaration of Helsinki.

One hundred and fourteen eyes of 57 patients with myopia and/or myopic astigmatism who had undergone PRK procedure between February 2017 and October 2017 comprised Group I. Their mean age was 25.33 ± 4.98 (18-40) years. Twenty–eight of them were males (49 %) and 29 (51%) were females. One hundred and fourteen eyes of 57 patients with myopia and/or myopic astigmatism who had undergone FS-LASIK procedure between February 2017 and October 2017 comprised Group II. Their mean age was 26.24 ±5.13 (18-40) years. Twenty-nine of them were males (51%) and 28 (49%) were females. All of the surgeries were performed by a single surgeon (SC). Patients included in the study did not have Diabetes Mellitus, Connective tissue diseases or any ocular diseases that might affect the vision. Patients wearing soft contact lenses were instructed to stop wearing them at least 1 week prior to the surgery. This duration was four weeks for hard contact lens wearers.

In PRK procedure, under topical anesthesia, firstly epithelial layer is removed, then the ablation was performed with Wavelight EX500 (Alcon Laboratories, Inc. Fort Worth, TX, USA) Laser system.

FS-LASIK procedures were performed by the Visumax

femtosecond laser system (Carl Zeiss, Meditec AG, Jena, Germany) with a repetition rate of 500 Khz and a pulse energy of 150 nj, for flap creation. The ablation was performed with Wavelight EX500 (Alcon Laboratories, Inc. Fort Worth, TX, USA) Laser system.

After the surgical procedures, patients were instructed to use topical antibiotic (Moxifloxacin 0.5 %, Vigamox, Alcon, USA) 4 times a day for one week, topical steroid (Dexamethasone Na Phosphate 0.1 %, Dexa-sine, Liba, Turkey) 4 times a day for two weeks and a preservative-free topical lubricating drop (Na Hyaluronate 0.15%, Eyestil, SIFI, Italy) 4 times a day for three months.
Ophthalmological examinations including uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), intraocular pressure measurement, fundus examination and topographic measurements were performed preoperatively and 1st day, 1st week, 1st month, 3rd month and 6th month postoperatively. However, only postoperative 6th month values are taken into account for statistical analysis. Efficacy index was calculated by postoperative UDVA/preoperative CDVA. Safety index was calculated by postoperative CDVA/preoperative CDVA. Predictability was presented as percentage of eyes within ±0.50 D, postoperatively.
For statistical analysis, SPSS version 22 programme was used. For comparison of data Chi- square test and t test were used. A $p<0.05$ value was accepted as statistically significant.

RESULTS

In respect to age, sex, preoperative spherical, cylindrical and spherical equivalent (SE) values, UDVA and CDVA, there was no significant difference between the first (PRK) and second (FS-LASIK) group ($p>0.05$). These are shown in Table 1.

Table 1. Demographic Charactheristics and preoperative findings of the patients.

	Group 1 (PRK Group) n=114	Group 2 (FS-LASIK Group) n=114	P Value
Age (Years)	25.33 ± 4.98 (18-40)	26.24 ±5.13 (18-40)	0.156
Sex (Male/Female)	28/29 (49% / 51%)	29/28 (51% / 49%)	0.944
Preoperative Spherical Value (D)	-4.02±2.43 (0.00 to -6.00)	-4.37±2.44 (0.00 to -7.00)	0.676
Preoperative Cylendrical Value (D)	-1.35±1.04 (0.00 to -2.50)	-1.42±1.12 (0.00 to -3.00)	0.443
Preoperative Spherical Equivalent Value (D)	-4.56±2.10 (-2.00 to -6.5)	-4.85±2.22 (-2.00 to -8.00)	0.345
Preoperative UDVA (logMAR)	1.54±0.24 (1.00-2.00)	1.59±0.24 (1.00-2.00)	0.357
Preoperative CDVA (logMAR)	0.02±0.03 (0.00-0.10)	0.02±0.02 (0.00-0.10)	0.987

Abbrevations: PRK; Photorefractive keratectomy, FS-LASIK; Femtosecond laser in situ keratomileusis, D; Diopter, UDVA; uncorrected distance visual acuity, CDVA; corrected distance visual acuity.

In respect to postoperative spherical, cylindrical and SE values, UDVA and CDVA, there were no significant differences between the first (PRK) and second (FS-LASIK) group (p>0.05). The predictability values, efficacy and safety indexes of both groups were high and there were no significant differences between two groups (p>0.05). Haze developed in two eyes in PRK group, but they recovered 6 months later and regression occured up to -1.00 D in three eyes in PRK group. However, these were not significant statistically (p>0.05). These are shown in Table 2.

DISCUSSION

Current advances in refractive surgery have caused dramatic changes in ophthalmology. PRK is accepted as an effective and desirable method of treating refractive errors, but regression of refractive error and haze are challanges for PRK treatment especially in high diopters [1,9]. Wavefront-guided LASIK is a well-tolerated and effective keratorefractive procedure with a trend superiority [10].

Table 2. Postoperative findings of the patients.

	Group 1 (PRK Group) n=114	Group 2 (FS-LASIK Group) n=114	P Value
Postoperative Spherical Value (D)	-0.04±0.17 (0.50 to -1.00)	-0.03±0.20 (0.50 to -1.00)	0.224
Postoperative Cylendrical Value (D)	-0.05±0.15 (0.00 to -1.00)	-0.04±0.10 (0.00 to -1.00)	0.578
Postoperative Spherical Equivalent Value (D)	-0.05±0.20 (0.50 to -1.00)	-0.05±0.20 (0.50 to -1.00)	0.866
Postoperative UDVA (logMAR)	-0.03±0.05 (-0.10-0.20)	-0.04±0.05 (-0.10-0.20)	0.298
Postoperative CDVA (logMAR)	-0.04±0.06 (-0.10-0.10)	-0.05±0.05 (-0.10-0.10)	0.351
Predictability Value (Percentage)	94.93	96.23	0.197
Efficacy Index	1.11±0.11 (0.80-1.20)	1.12±0.10 (0.80-1.20)	0.377
Safety Index	1.17±0.05 (1.00-1.20)	1.18±0.05 (1.00-1.20)	0.401
Haze (Number of eyes)	2	0	0.145
Regression (Number of eyes)	3	0	0.112

Abbrevations: PRK; Photorefractive keratectomy, FS-LASIK; Femtosecond laser in situ keratomileusis, D; Diopter, UDVA; uncorrected distance visual acuity, CDVA; corrected distance visual acuity.

Miraftab [11] et al. reported that UDVA improvement was superior in FS-LASIK when compared with PRK, but the two methods did not significantly differ in terms of CDVA improvement. Slade [12] et al. reported that at the 1-month follow-up, the thin-flap LASIK group demonstrated clinically and statistically significant better visual acuity than the PRK group. By 3 months, the vision in the two groups had begun to equalize, although the thin-flap LASIK group continued to have better vision. At 6 months, there were no statistical differences between the two groups. Ryan [13] et al reported that, wavefront-guided and wavefront-optimized PRK and LASIK procedures maintained high contrast, small letter contrast sensitivity and contrast sensitivity function twelve months postoperatively. Although the recovery period for visual performance was longer for PRK than LASIK, there was no significant difference between the groups at twelve months postoperatively. Lee [14] et al. stated that the quality of vision was better in LASIK eyes than in PRK at 1st month postoperatively. At subsequent visits, there was no significant difference in quality of vision between two groups.

Naderi [9] et al. reported that regression of refractive error was still a common complaint among the patients undergoing refractive surgery with Excimer Laser. They aimed to determine related factors of regression following PRK in different types of refractive errors and they found that, there was a positive relationship between simK, sphere value before surgery and refractive error regression. Randleman [15] et al. reported that retreatment rate for refractive regression was not influenced by age, sex, corneal characteristics or environmental factors. Eyes with hyperopic refractions or astigmatism were more likely to undergo retreatment. Jun [16] et al. reported that wavefront-optimized and corneal wavefront-guided trans-PRK are safe and effective for correcting moderate to high astigmatism. However, corneal wavefront-guided trans-PRK provides a more predictable astigmatism correction axis and fewer induced corneal aberrations. Arora [17] et al. stated that wavefront LASIK and wavefront PRK have similar efficacy, safety and predictability, though wavefront PRK induces less HOA. Faria-Correia [18] et al. found that topography-guided custom PRK treatment significantly reduced the manifest refractive sphere, cylinder and spherical equivalent and provided good early outcomes. Katz [19] et al. compared the efficacy, safety, predictability and vector analysis indices of LASIK and PRK for high myopic astigmatism and found that both techniques are comparably safe, effective and predictable. However, predictability of the correction of cylindrical component was lower than that of the spherical equivalent. Kaiserman [20] et al. reported that hyperopic and large myopic or astigmatic corrections carry higher risk of haze after PRK and longer MMC application might have beneficial haze prevention. Ang [21] et al. reported that myopia and astigmatism were associated with increased severity of haze after PRK, and older age was protective against early corneal haze development in an Asian population.

In this study, retrospectively PRK procedure is compared with FS-LASIK in treatment of myopia and myopic astigmatism. Regarding preoperative and postoperative spherical, cylindrical and spherical equivalent values, UDVA and CDVA, there were no significant differences between two groups. Predictability, efficacy and safety index values were high and similar in both groups. Haze developed in two eyes in PRK group, but they recovered 6 months later and regression occurred up to -1.00 D in three eyes in PRK group. However, these were not significant statistically. The limitation of this study was the limited number of the subjects and short postoperative follow-up time.

In conclusion, both PRK and FS-LASIK are efficient, safe and predictable procedures for correction of myopia and myopic astigmatism. PRK may induce haze and regression in high diopters.

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