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Photorefractive treatment of myopic astigmatism by laser-assisted in situ Keratomileusis and Photorefractive Keratectomy

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ABSTRACT

Aim: To compare the refractive correction among patients with myopic astigmatism either by laser-assisted in situ keratomileusis (LASIK) or photorefractive keratectomy (PRK) after 6 months.

Methods: Comparative retrospective study of 356 eyes of 196 patients were treated by laser photorefractive correction at AL BASIRA eye Centre, Basra, Iraq to correct their refractive error with a mean age of 26.8 years (range: 18–45). Of those, 213 eyes were treated by LASIK and 143 eyes were treated by PRK. The correction of a refractive error was done by Carl Zeiss Mel 90 machine and all operations were done by two surgeons. The study period lasted from October 2017 to October 2019.

Results: All patients were followed for a period of 6 months, assessed their refractive correction, and found all values to be statistically significant ($P < 0.001$). The refractive correction was better for the PRK group with less undesirable effect of under correction or overcorrection.

Conclusions: Our study shows relatively superior refractive correction in patients undergoing PRK. However, many patients suffer from postoperative pain and gradual refractive stability.

Keywords: *myopic astigmatism; laser-assisted in situ keratomileusis (LASIK); photorefractive keratectomy (PRK)*

INTRODUCTION

Astigmatism is a common refractive error that leads to vision distortion because of the decreased ability of the eye to make a sharply focused image on the retina, and it accounts for approximately 13% of patients suffering from refractive errors.[1]

In addition, the patient may have blurred vision at distance and near with asthenopia or ocular fatigue, headache, and squint.[2]

We have a variety of treatment for myopic astigmatism, non-surgical correction with either eyeglasses or contact lenses if prescribed properly, and surgical correction including two types of photorefractive surgery which are photorefractive keratectomy (PRK) and laser in situ keratomileusis (LASIK). The fast recovery of vision and mild postoperative pain associated with LASIK put this procedure as a preferred option compared with PRK that associated with postoperative pain and delay in visual recovery.[3]

At present, there is new concern about PRK due to complications associated with LASIK, including dryness of the eye, the possibility of corneal ectasia, and flap complication.[4–7]

In our study, we compared the visual outcome in both types of photorefractive procedures after 6 months. To our knowledge, this is one of the few reports comparing the photorefractive treatment of astigmatism and visual outcome between LASIK and PRK in Iraq**.**

PATIENTS AND METHOD

A retrospective analysis of 356 eyes (196 patients) that underwent LASIK and PRK at the AL BASIRA eye center, Basra, Iraq with a mean age of 26.8 years (range: 18–45). Of these, 213 eyes (118 patients) underwent LASIK and 143 eyes (78 patients) underwent PRK. The study period lasted from October 2017 to October 2019.

Patients and Examination Protocol

All patients were examined preoperatively to obtain a complete medical and ophthalmic history included name, age, gender, past medical history, past ophthalmic history, history of wearing glasses, and contact lens then examinations of uncorrected and best-corrected visual acuity by projector E chart, subjective refraction by Topcon autorefractor-keratometry, intraocular pressure with Tomey air puff and sometimes by Goldman applanation tonometer for suspected cases, anterior segment examination by Haag-Streit slit-lamp biomicroscopy then Sirius corneal topography which combines Placido as well as Scheimpflug principles to provide information about pachymetry (corneal thickness), elevation, curvature and dioptric power of both corneal surfaces and then cycloplegic refraction and fundus examination.

Inclusion criteria

Age more than 18 years with stable refraction for at least 1 year, central corneal thickness (CCT) greater than 500 μm, and discontinuing contact lens use for more than a week.

Exclusion criteria

Ocular diseases, like keratoconus, glaucoma, cataract, and retinal disorder, dry eyes with a Schirmer's two-test value below 2 mm, and previous ocular surgery and trauma were excluded. Compromised immunity, pregnancy, lactation, or chronic systemic diseases were also excluded.

Informed consent was taken from all patients after complete explanation of the risks related to the surgery and its complications.

Procedure and postoperative care

The procedures were performed according to the cycloplegic refraction. In LASIK, we create a corneal flap of 110 μm by Med-Logics microkeratome, a flap lifter was used to raise the initial flap followed with corneal stromal ablation by excimer laser using Carl Zeiss Mel 90 machine, then flap replacement and irrigation by a balanced salt solution. We instill a drop of tobramycin–dexamethasone at the end of the procedure.

In PRK**,** epithelial debridement was 9 mm zone. Then, we did central ablation with an excimer laser using the same machine. Subsequently, we put a bandage soft contact lens and instill a drop of tobramycin–dexamethasone at the end of the procedure. After that, the patient was advised to use artificial tears with combination drops with tobramycin and dexamethasone four times a day for 4 weeks. For the PRK group, we removed the bandage contact lens after 3 days. After 4 weeks, we put the patient on artificial tears for 2 months. The follow-up schedule is done to see the patient 1 day after surgery, 3 days for PRK patients, then 2 weeks, 1 month, 3 months, and 6 months after surgery. On each visit, we did visual acuity and refraction, and slit-lamp examination.

RESULT

A total of 356 eyes of 196 patients (124 females and 72 males) were treated. Of these, 213 eyes (118 patients; 39 males and 79 females) underwent LASIK and 143 eyes (78 patients; 33 males and 45 females) underwent PRK (Table 1).

The patients were set into two groups for each type of refractive procedure according to their astigmatic error (less than –1.5 diopters and equal or more than –1.5 diopters). For the PRK group, we have 71 eyes less than –1.5 D (49.65%) and 72 eyes equal or more than –1.5 D (50.35%). For the LASIK group, we have 75 eyes less than –1.5 D (35.21%) and 138 eyes equal or more than –1.5 D (65.97%). The details areshown in Table 2.

After photorefractive correction, we followed those patients for 6 months and examined their visual acuity and refraction monthly; then, we classified them into five groups according to their refractive outcome: Emmetropia, Under correction, Overcorrection, No correction, and Increased myopic astigmatism.

The analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 23 software.

As shown in Table 3, in those patients who were treated by PRK, all 71 eyes with an astigmatic error less than –1.5 D (100%) became emmetropic after 6 months with a statistically significant association (P-value =0.000).

Whereas those with astigmatic error equal or more than –1.5 D (72 eyes), 53 became emmetropic (73.6%) and 19 patients (26.4%) became under corrected, and no patient suffered from overcorrection or no correction or increased myopic astigmatism with a statistically significant association (P-value = 0.000).

While in patients who were treated with LASIK, 70 eyes with astigmatism less than –1.5 D became emmetropic (93.3%), four (5.3%) under corrected, one (1.3%) overcorrected, no patient with no correction, and no patient with increased myopic

TABLE 1. Distribution According to the Type of Operation and Gender

	Procedure		Total
	LASIK	**PRK**	
Male	39 33.1%	33 42.3%	72 36.7%
Female	79 66.9%	45 57.7%	124 63.3%
Total	118 100.0%	78 100.0%	196 100.0%

TABLE 2. Preoperative Data

Type of procedure	Astigmatism less than -1.5	Astigmatism equal or more than -1.5	Total
PRK	71 49.65%	72 50.35%	143 100%
LASIK	75 35.21%	138 65.97%	213 100%

TABLE 3. Refraction after 6 Months/PRK Procedure

Outcome	Less than -1.5	Equal or more than -1.5	Total	P-value
Emmetropic	71 100.0%	53 73.6%	124 86.7%	0.000
Under correction	0 0.0%	19 26.4%	19 13.3%	0.000
Total	71 100.0%	72 100.0%	143 100.0%	

astigmatism with a statistically significant association (P-value =0.000), as shown in Table 4. Whereas patients with an astigmatic error equal or more than –1.5, 86 eyes became emmetropic (62.3%), 48 (34.8%) under corrected, two overcorrected, one without correction (0.7%), and one with increased myopic astigmatism (0.7%) with a statistically significant association (P-value = 0.000), as shown in Table 4.

When we compared the results of both types of procedures, we see some sort of advantage of PRK over LASIK; 124 eyes (86.7%) are emmetropic, 19 eyes (13.3%) are undercorrected, and no eyes with overcorrection or no correction or increased myopic astigmatism in PRK group. While in the LASIK group, 156 eyes (73.2%) are emmetropic, 52 (24.4%) are undercorrected, three eyes (1.4%) are overcorrected, one eye (0.5%) is with no correction, and one eye (0.5%) is with increased myopicastigmatism. These results are statistically significant associations(P-value = 0.000) (Table 5).

DISCUSSION

In this study, we used a safe and effective procedure compared to other types of photorefractive procedure. There were many reports that have demonstrated a faster and less painful recovery in patients undergoing LASIK, but finally, both procedures resulted in similar outcome.[8] Our study aimed to assess the refractive correction of these two procedures. Slade SG, Durrie DS, and Binder PS found PRK and LASIK refractive surgeries offer the same final refractive results, with diversity in practice complications.[10] The same results were given by Hersh PS, Brint SF, Maloney RK, although they

TABLE 4. Refraction after 6 Months/LASIK Procedure

Outcome	Less than -1.5	Equal or more than to -1.5	Total	P-value
Emmetropic	70 93.3%	86 62.3%	156 73.2%	0.000
Under correction	4 5.3%	48 34.8%	52 24.4%	0.000
Overcorrection	1 1.3%	2 1.4%	3 1.4%	0.000
No correction	0 0.0%	1 0.7%	1 0.5%	0.000
Increased myopic astigmatism	0 0.0%	1 0.7%	1 0.5%	0.000
Total	75 100.0%	138 100.0%	213 100.0%	

TABLE 5. Refraction after 6 Months/Type of Procedure.

	LASIK	PRK	Total	P-value
Emmetropic	156 73.2%	124 86.7%	280 78.7%	0.000
Under correction	52 24.4%	19 13.3%	71 19.9%	0.000
Overcorrection	3 1.4%	0 0.0%	3 0.8%	0.000
No correction	1 0.5%	0 0.0%	1 0.3%	0.000
Increased myopic correction	1 0.5%	0 0.0%	1 0.3%	0.000
Total	213 100.0%	143 100.0%	356 100.0%	

used a thin flap procedure, whereas we used a traditional flap procedure.[8] Nir Sorkin, Amir Rosenblatt, David Smadja, Eyal Cohen, Marcony R. Santhiago, David Varssano, and Yossi Yatziv are said PRK with the use of mitomycin-C in patients with high myopia is an effective option and a good alternative to the LASIK procedure.[10] In addition, Weldon W Haw and Edward E Manche found that PRK is a good and safe method of correction of compound myopic astigmatism.[11] Mohammad Miraftab, Hassan Hashemi, and Soheila Asgari observed better results with Femto-LASIK in the correction of different degrees of astigmatism after 2 years. The improvement in uncorrected visual acuity was better with Femto-LASIK, but both procedures did not significantly differ regarding corrected visual acuity improvement.[12] Alex J Shortt, Bruce DS Allan, and Jennifer R Evan said that LASIK gave faster visual recovery and less pain postoperatively comparing with PRK, but both types gave the same visual outcomes 1 year postoperatively.[13,15] In our study, we found relatively superior refractive correction in patients undergoing PRK with the less undesirable effect of under correction or overcorrection. However, many patients suffer from postoperative pain and gradual refractive stability.

ETHICAL CLEARANCE

Ethical approval for the study is taken from Alzahraa Medical College committee.

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