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Patient going for PRK treatment for refractive error in Al-Jouf region, Saudi Arabia

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Abstract

Introduction: Photorefractive keratectomy (PRK) has been widely used as an efficient, secure, and cost-effective method for treating patients with low to moderate myopia. This study was aimed to evaluate the prevalence of accepted and rejected reasons candidates going for PRK treatment for refractive error in Aljouf region, Saudi Arabia.
Material and Methods: This retrospective study was conducted among 255 candidates going for PRK treatment for refractive in the department of ophthalmology at tertiary care hospital in Aljouf region, Saudi Arabia from August 2023 to October 2023.The following measurements of eye were noted for the enrolled patients in the study: visual acuity (VA) sine correction (SC) Visual acuity cum correction (CC), refractive error (RE) Central corneal thickness (CCT), Pentacam Astigmatism, keratometry (K1 and K2), spherical, cylindrical, and axis power in diopters, cycloplegic refraction, and pupillary diameter in normal daytime illumination in a room.
Results: Total 255 patients were included in this study among them 119 (46.67%) male and 136 (53.33%) female with average age of 26 in both male and female. Total 160 were fit and 95 were not fit. Visual acuity cum correction (CC) ocular dexter (OD) and Visual acuity cum correction (CC) ocular sinister (OS) reported both statistically significant with p value <0.001. Both K Max OS and K Max OD are statistically significant. The dry eye was evaluated by using Schimer test with mean of 15.00 and 10.00 with p value <0.001 were found significant.
Conclusion: This study concluded that 62.74% were reported fit and 37.26% were not fit for PRK treatment for refractive error because of the dry eye,

Keratoconus, rocotane, amblyopia, hyperopia, diabetics and pregnancy in Aljouf region, Saudi Arabia. The Pentacam Astigmatism and dry eye was found statistically significant in both fit and unfit group.

Key words: Photorefractive keratectomy, Refractive error, Myopia, Dry eye, Visual Impairment

Introduction:

Current advances in refractive surgery have caused dramatic changes in ophthalmology. Since 1983, photorefractive keratectomy (PRK) has been widely used as an efficient, secure, and cost-effective method for treating patients with low to moderate myopia. [1-3] Excimer laser photorefractive keratectomy (PRK) is acknowledged as a successful and desirable method of treating refractive error. [4,5] A wide range of refractive errors, such as low to moderate myopia, hyperopia, and astigmatism are treated with PRK. [4,6] Light rays from an object at infinity are focused in front of the retina in myopia when accommodation is relaxed, and in the case of hyperopia they are focused behind the retina. In astigmatism, however, the light rays do not focus at a single point because of variations in the corneal or lens curvature at various meridians. [7] Refractive errors may make it difficult for a person to carry out vision-related daily activities. Treatment options for refractive errors (RE) include surgical procedures like LASIK (laser-assisted in situ keratomileusis) or PRK (photorefractive keratectomy), as well as optical treatments like corrective lenses and eyeglasses.

According to studies carried out in various regions of Saudi Arabia, RE are one of the main causes of visual impairment (VI). [8-10] In Saudi Arabia, studies on RE either focused primarily on the pediatric population or on specific population groups, such as individuals pursuing higher education. [11-15] Algorinees et al reported the prevalence of refractive errors was 18.5% for males and females in Saudi Arabia. [16] According to Teh et al, Poor quality of life, social status, psychological and financial factors are the main risk factors for myopia. [17]

Small optical zones [18–20], flap thickness [21], high correction [22], keratometry readings [23], substantial astigmatism [18, 24], and age over 40 [23] are all variables that can lead to the necessity for retreatment after LASIK surgery. The use of mitomycin [25], refractive correction > 5.00 D, a narrower optical zone (6.00 mm), and unstable fixation after laser ablation [26] are examples in PRK.

Possible problems after PRK include overcorrection, under correction, and regression. Depending on the type of refractive defect, corneal thickness, and corneal haze, these persistent and recurrent refractive errors are managed accordingly. There is paucity of data. This study was aimed to evaluate the prevalence of accepted and rejected reasons candidates going for PRK treatment for refractive error in Aljouf region, Saudi Arabia.

Material and Methods:

This retrospective study was conducted among 255 candidates going for PRK treatment for refractive errors (myopia, hypermetria, or astigmatism) aged 21–31 years in the department of ophthalmology at tertiary care hospital in Aljouf region, Saudi Arabia from August to October 2023 The ethical approval was taken from institutional ethical review board. The demographic information of patients included age, gender, and medical history were taken from the records.
The surgeries were performed only if stable refraction was noted for at least one year prior to scheduling surgery. In all patients, contact lens usage was discontinued for at least three weeks, and postoperative residual corneal thickness of all eyes was more than 350 μm at the thinnest location.

The patients were categorized into Fit and Not Fit groups. Patients with a history of ocular surgery, active ocular diseases, corneal dystrophy, retinal disease, dry eye, severe eye trauma, irregular astigmatism, or suspected keratoconus, systemic ailments like diabetes mellitus, autoimmune diseases, pregnant or lactating ladies were categorized in group of not fit.
Refractive surgery is indicated for refractive error up to 10 D of myopia, 6 D of hyperopia, and up to 4 cylinders of astigmatism.[27] The inclusion criteria for subjects included in this study were myopia spherical equivalent ≤10.5 D, hyperopia spherical equivalent ≤4.50 D, and astigmatism ≤6.00 D. [28]

The following measurements of eye were noted for the enrolled patients in the study: visual acuity (VA) sine correction (SC) ocular dexter (OD), visual acuity (VA) sine correction (SC) ocular sinister (OS), Visual acuity cum correction (CC) ocular dexter (OD), Visual acuity cum correction (CC) ocular sinister (OS), Refractive error (RE) ocular sinister (OS), Refractive error(RE) ocular dexter (OD), Central corneal thickness (CCT) ocular dexter (OD), Central corneal thickness (CCT) ocular sinister (OS), Pentacam Astigmatism ocular dexter, keratometry (K1 and K2), spherical, cylindrical, and axis power in diopters, cycloplegic refraction, and pupillary diameter in normal daytime illumination in a room.

Statistical analysis was performed using SPSS software (version 20). The retrospective data were analyzed using Mann–Whitney U test to compare the fit and Not Fit groups. P- values less than 0.05 were considered as statistically significant.

Result:

Total 255 patients were included in this study among them 119 (46.67%) male and 136 (53.33%) female with average age of 26 in both male and female. Total 160 were fit and 95 were not fit. 65 (54.6%) and 54 (45.4%) in male while 95 (69.9%) and 41 (30.1%) in female were fit and not fit respectively (p value 0.012). No one reported pregnancy or feeding among 160 fit patients while 2 were reported pregnant among 95 patients of unfit patients (p value 0.065). History of medication were not reported in fit group while 11 patients were reported history of medication in unfit group (p value <0.001) shown in table 1.

Table 1: Association of gender, pregnancy and medication with groups

Variable	Category	FIT	NOT FIT	Total	Chi-square, P-value
Gender	Male	65 (54.6%)	54 (45.4%)	119 (100.0%)	6.299, 0.012
	Female	95 (69.9%)	41 (30.1%)	136 (100.0%)	
Pregnancy or Feeding?	Yes	0 (0.0%)	2 (100.0%)	2 (100.0%)	3.395, 0.065
	No	160 (63.2%)	93 (36.8%)	253 (100.0%)	
Medication History (HX)?	Yes	0 (0.0%)	11 (100.0%)	11 (100.0%)	19.362, <0.001
	No	160 (65.6%)	84 (34.4%)	244 (100.0%)	

Statistically significant if P<0.05

Comparing the fit and not fit group the mean age was 26 years in both with p value 0.668. visual acuity (VA) sine correction (SC) ocular dexter (OD) reported 0.50 with p value 0.579 while visual acuity (VA) sine correction (SC) ocular sinister (OS) reported with p value 0.275 in both fit and not fit group. Visual acuity cum correction (CC) ocular dexter (OD) and Visual acuity cum correction (CC) ocular sinister (OS) reported both statistically significant with p value <0.001 (figure 1).

Refractive error (RE) ocular dexter (OD) axis recorded significant 20 and 80 with p value 0.049 while Refractive error (RE) ocular sinister (OS) was reported nonsignificant with p value 0.280 (Table 2).

Mean Central corneal thickness (CCT) ocular dexter (OD) recorded 526 and 513 with p value 0.003 while mean central corneal thickness ocular sinister reported 525 and 512 with p value 0.002 in both fit and not fit group which shows statistically significant (Table 2, figure 2).

Mean Kerato refractometry test ocular dexter (OD) K1 was 42.55 and K2 was 43.95 in fit group while in not fit group 42.80 and 44.30 with p value 0.180 and 0.110 respectively. The Mean Kerato refractometry test ocular sinister (OS) K1 was 42.55 and K2 was 44.05 in fit group while in not fit group 42.90 and 44.30 with p value 0.172 and 0.142 which was statistically not significant. The average keratometry was found non-significant in ocular dexter as well as in ocular sinister with p value of 0,085 and 0.161 respectively (table 2).

The average Pentacam Astigmatism ocular dexter was observed 1.20 and 1.50 with p value 0.0025 while the average Pentacam Astigmatism ocular sinister reported 1.20 and 1.60 with p value 0.001 in both fit and not fit group respectively which shows significant (figure 3).

Table 2: Comparison of parameters between groups

Parameters	FIT	NOT FIT	Mann-Whitney U	P-value
Age	26.00 (22.00-31.00)	26.00 (21.00-31.00)	7356	0.668
Visual_Acuity_SC_OD	0.50 (0.30-0.60)	0.50 (0.20-0.60)	7241.5	0.579
Visual_Acuity_SC_OS	0.50 (0.30-0.60)	0.40 (0.20-0.60)	6941	0.275
Visual_Acuity_CC_OD	1.00 (1.00-1.00)	1.00 (0.90-1.00)	5673	<0.001
Visual_Acuity_CC_OS	1.00 (1.00-1.00)	1.00 (0.80-1.00)	5740	<0.001
RE_ OD_SPH	-2.00 (-3.50--1.25)	-2.00 (-4.75--1.00)	7575.5	0.966
RE_OD_CYL	-0.75 (-1.50--0.25)	-1.00 (-2.00--0.50)	6545.5	0.062
RE_OD_AXIS	20.00 (5.00-160.00)	80.00 (5.00-170.00)	6486.5	0.049
RE_OS_SPH	-2.13 (-3.50--1.25)	-2.00 (-3.75--1.00)	7395.5	0.719
RE_OS_CYL	-0.75 (-1.50--0.25)	-1.00 (-2.00--0.25)	6738	0.127
RE_OS_AXIS	97.50 (6.25-165.00)	155.00 (5.00-170.00)	6988.5	0.280
CCT_OD	526 (506-547)	513 (490-536)	5900	0.003
CCT_OS	525 (505-547)	512 (489-539)	5850	0.002
KR_OD_K1	42.55 (41.70-43.50)	42.80 (41.50-44.00)	6837	0.180
KR_OD_K2	43.95 (43.10-44.80)	44.30 (43.20-45.50)	6690	0.110
KR_OS_K1	42.55 (41.80-43.40)	42.90 (41.70-44.10)	6822	0.172
KR_OS_K2	44.05 (43.10-45.00)	44.30 (43.10-45.40)	6764.5	0.142
PENTACAM_ASTIG_OD	1.20 (0.70-1.78)	1.50 (0.80-2.20)	6322.5	0.025
PENTACAM_ASTIG_OS	1.20 (0.80-1.79)	1.60 (0.90-2.50)	5793.5	0.001
AVERAGE_K_OD	43.30 (42.40-44.00)	43.60 (42.50-44.70)	6619	0.085
AVERAGE_K_OS	43.40 (42.43-44.10)	43.70 (42.40-44.80)	6802.5	0.161
K_MAX_OD	44.40 (43.50-45.50)	44.70 (44.00-46.40)	6206.5	0.014
K_MAX_OS	44.50 (43.60-45.60)	44.90 (43.90-46.60)	6289.5	0.021
Dry eye? - Using schimer test	15.00 (15.00-15.00)	10.00 (10.00-15.00)	3200	<0.001

** P-values based on Mann-Whitney U test, statistically significant if P<0.05*

This study findings revealed the eyes of all fit and not fit patients had mean K Max OD 44.40 and 44.70 with p value 0.014 while K Max OS 44.50 and 44.90 with P value 0.021 respectively (figure 4). This finding shown that both K Max OS and K Max OD are statistically significant. The dry eye was evaluated by using Schimer test with mean of 15.00 and 10.00 with p value <0.001 were found significant.

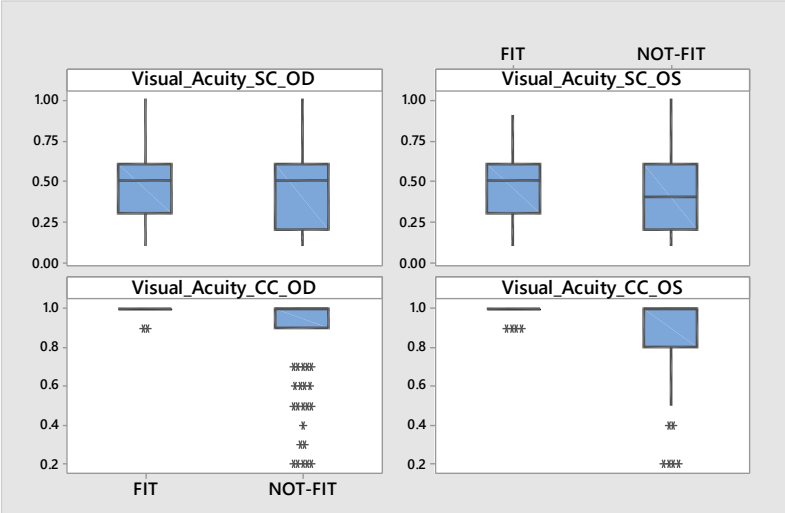

Figure 1: Visual Acuity Comparison

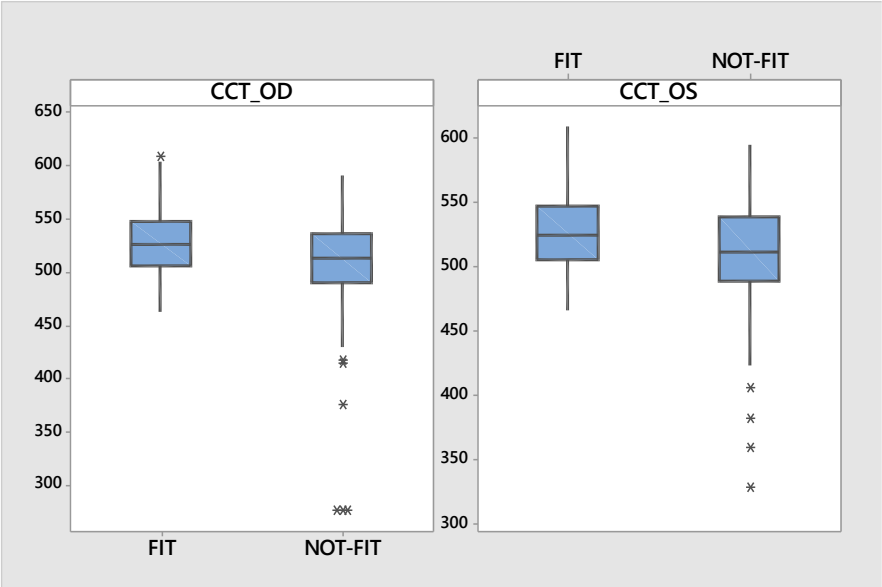

Figure 2: CCT Comparison

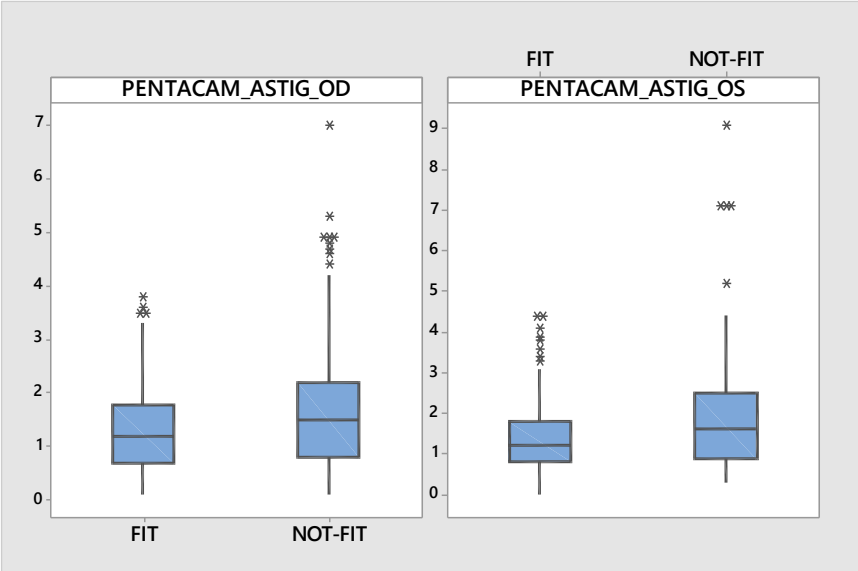

Figure 3: Pentacam Astigmatism

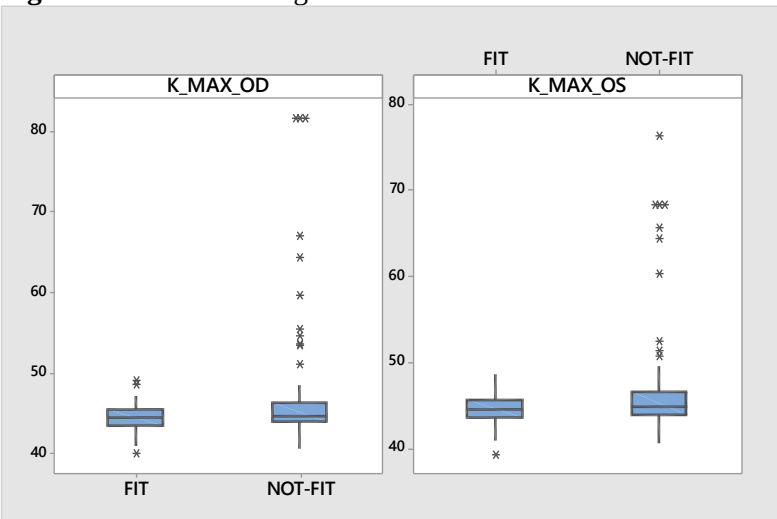

Figure 4: K MAX

The reasons behind 95 unfit patients; overall 33 (34.7%) dry eye was most prevalent reasons of unfit followed by 26 (27.3%) keratoconus, 9 (9.5%) rocotane, 8 (8.4%) amblyopia and 6 (6.3%) hyperopia while the 2 (2.1%)

pregnancy, 2 (2.1%) diabetics, 3 (3.2%) age, 3 (3.2%) high RE, 3 (3.2%) unstable RE were reported least prevalent reason of unfit (Table 3). In males' 26 (27.3%) keratoconus followed by dry eye 33 (34.7%) while in female 15 (36.6%) dry eye followed by 6 (14.6%) keratoconus and 6 (14.6%) rocotane was the most prevalent reasons of unfit (Table 3).

Table 3: Reasons for Rejections for PRK surgery for refractive error

Reason	Male	Female	Total
Age	0 (0.0%)	3 (7.3%)	3 (3.2%)
Amblyopia	5 (9.3%)	3 (7.3%)	8 (8.4%)
Diabetics	2 (3.7%)	0 (0.0%)	2 (2.1%)
Dry Eye	18 (33.3%)	15 (36.6%)	33 (34.7%)
High Re	1 (1.9%)	2 (4.9%)	3 (3.2%)
Hyperopia	4 (7.4%)	2 (4.9%)	6 (6.3%)
Keratoconus	20 (37.1%)	6 (14.6%)	26 (27.3%)
Pregnancy	0 (0.0%)	2 (4.9%)	2 (2.1%)
Rocotane	3 (5.6%)	6 (14.6%)	9 (9.5%)
Unstable Re	1 (1.9%)	2 (4.9%)	3 (3.2%)
Total	54 (100.0%)	41 (100.0%)	95 (100.0%)

Discussion:

This study has evaluated the prevalence of accepted and rejected reasons candidates going for PRK treatment for refractive error in Aljouf region in Saudi Arabia. Among total 255 patients 62.74% were reported fit and 37.26% were not fit for PRK treatment for refractive error. Regarding the prevalence of RE in Saudi Arabia, there are no conclusive published data. This outcome is comparable to the 62.6% that Kezirian and his colleagues had reported. [29] Out of 296 patients, 86 patients (29.1%) were rejected by Joshi R S et al. for various reasons, which was less than in our study. [30] According to earlier studies, the rejection rate ranges from 21% to 34%. [31-33]

In this study we reported 95 unfit patients, 33 (34.7%) dry eye most prevalent reasons of unfit followed by 26 (27.3%) keratoconus, 9 (9.5%) Uses rocotane medication, 8 (8.4%) amblyopia and 6 (6.3%) hyperopia while the 2 (2.1%) pregnancy, 2 (2.1%) diabetics, 3 (3.2%) age, 3 (3.2%) high RE, 3 (3.2%) unstable RE. Suboptimal corneal thickness was the most frequent cause of rejection in the earlier study (n = 28, 32.6%)in India. [30] Xu et al. did a similar study observation in which they found that 28.6% of the participants had low corneal thickness. [32] The authors found that overablation of the cornea may result in iatrogenic keratectasia, which could be difficult to handle due to the limited resources available for treating this condition. Hashmani et al. observed that an increased risk of corneal ectasia is the most prevalent reason for not performing this surgery in Pakistan. [33] Sharma et al. in their study of 338 patients had 21 patients with more than one contraindication in various combinations. [34] In Japan, Hori-Komai et al. discussed the proportion of patients who request kerato-refractive surgery but do not endure it. High myopia, suboptimal corneal thickness, and keratoconus were responsible for 20.7%, 8.2%, and 6.4%, respectively, of the excluded cases. [35] For best-corrected vision, low-contrast visual acuity losses after PRK are significantly greater than high-contrast visual acuity losses. Low-contrast visual acuity is a sensitive indicator of the efficacy and safety of refractive surgery outcomes.
As an important limitation in corneal refractive surgery planning, central corneal thickness (CCT) should be assessed as a crucial preoperative consideration before performing refractive surgery with an excimer laser. [36,37] Multiple studies have shown evidence of the development of corneal ectasia among patients who have undergone refractive surgery, demonstrating its significance. [38] Earlier studies did not establish that thinner corneas should not be used for refractive surgery. Latest study has demonstrated the effectiveness and safety of surface ablation in individuals with corneas that are less than 500 m thick, opening up new possibilities for the surgical care of these patients. [39,40]. According to a recent study by Hashemi et al [39] on the safety and effectiveness of PRK in people with myopia and thin corneas, those indices were 1.01 ± 0.05 and 1.00 ± 0.05, respectively.

Our study revealed the eyes of all fit and not fit patients had mean K Max OD 44.40 and 44.70 with p value 0.014 while K Max OS 44.50 and 44.90 with P value 0.021 respectively. This finding shown that both K Max

OS and K Max OD are statistically significant. The dry eye was evaluated by using Schimer test with mean of 15.00 and 10.00 with p value <0.001 were found significant. For individuals who had PRK, the incidence of dry eye was 38.7%. [41] This study was significant because it shows that ocular surface disease continues to be one of the most common causes of problems following refractive surgery. [42] Post-refractive dry eye disease should be adequately managed because it strongly correlates with the level of visual comfort and overall health of patients. [43]

The retrospective nature of our study and the choice of patients who visited a single clinic for spectacle-free vision are its limitations. In order to gather additional information about rejection and establish uniform criteria that would be helpful for clinical practice, we advise performing a prospective, multicenter study.

Conclusion:

This study concluded that 62.74% were reported fit and 37.26% were not fit for PRK treatment for refractive error because of the dry eye, Keratoconus, rocotane, amblyopia, hyperopia, Diabetes and pregnancy in Aljouf region, Saudi Arabia. The Pentacam Astigmatism and dry eye was found statistically significant in both fit and unfit group. The many potential problems of refractive surgery require individualized approaches to treatment based on thorough evaluation of each patient's eyes.

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