Original Article

Comparison of Corneal and Anterior Chamber Parameters between Myopic Eyes and the LASIK – Treated Eyes Using Pentacam

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ABSTRACT

Purpose: To compare the Corneal and Anterior Chamber Parameters between Myopic Eyes and the LASIK-treated eyes Using Pentacam.

Study Design: Cross sectional observational study.

Place and Duration of Study: Department of Optometry, College of Applied Medical Sciences, Qassim University from January 2024 to May 2024.

Methods: The study included 173 patients, 83 individuals with low to moderate myopia and 90 post-LASIK patients. Corneal and anterior chamber measurements were taken using Pentacam, including central corneal thickness, anterior and posterior corneal surface power, anterior chamber depth, angle, and volume.

Results: The mean spherical equivalent was -2.01 ± 1.02 D in myopic eyes and -0.51 ± 0.41 D in post-LASIK eyes (P = 0.000). Central and thinnest corneal thicknesses were significantly reduced in the post-LASIK group (P = 0.000). Uncorrected visual acuity in post-LASIK eyes (mean 1.03 ± 0.15) was comparable to the best-corrected visual acuity in myopic eyes (P = 0.098). A significant decrease in anterior corneal surface power was noted post-LASIK, while posterior corneal power remained stable. Anterior chamber depth and volume showed modest but significant reductions, with no significant difference in anterior chamber angle between the groups.

Conclusion: LASIK leads to significant thinning of the cornea and reduction in anterior corneal power, while posterior corneal curvature remains stable. Minor decreases in anterior chamber depth and volume occur without affecting the chamber angle or visual outcomes.

Keywords: Myopia, Laser In Situ Keratomileusis, Risk Factors, Follow-Up Studies, Global Health.

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INTRODUCTION

Laser-assisted in situ keratomileusis (LASIK), is widely used to correct refractive error in myopia, hyperopia, and astigmatism. The excimer laser remodels cornea, changing its refractive power and improving visual acuity.[1,2] The standard approach creates a thin corneal flap, which is lifted to reveal the stromal bed; tissue is then ablated for a sharp focus on the retina. In everyday clinics, treatment typically extends to about −8.00 dioptres of myopia and 5.00 dioptres of astigmatism. The procedure is effective, but not without risk, which is why thorough preoperative assessment remains essential.[3,4] Globally, myopia contributes substantially to visual impairment, with an estimated prevalence of 22.9 percent and forecasts nearing 49.7 percent by 2050.[5,6] Evidence from a recent systematic review and meta-analysis among Middle Eastern children likewise points to a high burden of myopia, particularly in older ages within childhood.[7,8] Consistent with these trends, refractive surgery, most often LASIK, is commonly used in the region and in Saudi Arabia.[9]

The Pentacam, a Scheimpflug-based platform, provides detailed anterior segment assessment, including corneal topography, pachymetry, and anterior chamber metrics.[10] With advanced diagnostics like the Pentacam, interest has grown in how corneal and anterior chamber parameters differ between untreated myopic eyes and post-LASIK eyes. The device offers analysis of curvature, volume, and thickness of cornea and anterior chamber depth and angle, helping to clarify the biomechanical impact of LASIK.[11] Prior work shows that LASIK primarily changes the anterior corneal surface and can influence anterior chamber depth and volume. It consistently reduces corneal thickness and alters corneal curvature, while the posterior surface often remains stable.[12] One study reported a postoperative drop in anterior chamber parameters in both low and high myopia, whereas hyperopic eyes showed increases in depth and angle, a pattern that may relate to corneal magnification effects.[13]

Comparative studies of LASIK and SMILE suggest that both procedures are effective for myopia, while their effects on corneal and anterior chamber metrics differ slightly. LASIK has been linked to more pronounced changes in corneal asphericity and larger decreases in corneal volume.[12] Taken together, these observations argue for routine Pentacam-based follow-up of corneal and anterior chamber parameters after LASIK to inform aftercare and reduce the risk of ectasia. On this basis, we aimed to quantify these parameters in untreated myopic eyes and in post-LASIK myopic eyes with the Pentacam.

METHODS

In 2024, a prospective cross-sectional study was conducted to measure corneal and anterior chamber parameters in myopic individuals and in patients who had LASIK at least 6 months back. Participants were recruited from College of Applied Medical Sciences, Qassim University from January 2024 to May 2024. Two groups were enrolled. Group 1 included individuals with low to moderate myopia. Group 2 comprised post-LASIK myopic patients who had completed at least six months of follow-up. All participants were seen at an optometric clinic between January and May 2024.

The Biomedical Ethics Committee approved the study (24-80-04). Procedures followed the Declaration of Helsinki. All participants gave written informed consent and were reminded that participation was voluntary and that they could withdraw at any time without providing a reason.

Myopic group included young individuals aged 20–26 years with low to moderate myopia who had not undergone any refractive surgery. Post-LASIK group included individuals between 20 and 29 years of age and who underwent LASIK surgery to correct myopia at least six months prior to joining the study. Patients with corneal pathologies (e.g., keratoconus, corneal dystrophy), history of any other ocular surgeries or trauma, ocular comorbidities such as glaucoma, uveitis, or retinal diseases, subjects diagnosed with systemic diseases or syndromes affecting ocular status or had high myopia and incomplete or poor-quality Pentacam measurements were excluded.

All participants underwent a comprehensive ophthalmic examination. Visual acuity (VA) was measured using a Snellen chart at 6 meters. Refractive error in both groups was measured using a NIDEK autorefractor. A slit-lamp examination and intraocular pressure measurement confirmed eligibility.

The Pentacam® HR, Oculus, USA, recorded central corneal thickness, anterior and posterior corneal surface power, anterior chamber depth, angle, and volume. Primary outcomes were between-group differences in central corneal thickness, anterior chamber depth, angle, and volume, along with keratometric values, comparing untreated myopic eyes with post-LASIK eyes. Analyses focused on the magnitude of postoperative change attributable to LASIK.

Data were compiled in Microsoft Excel and analysed in SPSS version 25.0, IBM Corp., Armonk, NY, USA. For each variable in both groups, we calculated means and standard deviations. Independent t-tests compared untreated myopic eyes with post-LASIK eyes. A two-sided P value below 0.05 was regarded as statistically significant.

RESULTS

A total of 173 subjects, aged 20 to 29 years, participated in the study, with 120 (69.4%) being females. The one-sample Kolmogorov-Smirnov test indicated that the measurements of corneal and anterior chamber parameters for both myopic and post-

LASIK myopic eyes were normally distributed, with p-values greater than 0.05. An independent sample t-test revealed that the mean age difference between the myopic and post-LASIK myopic subjects was not statistically significant (P = 0.544).The demographic characteristics of both groups are shown in Table 1.

Corneal parameters of post-LASIK patients and myopic patients.

In post-LASIK group, central corneal thickness ranged from 396 to 550µm, with a mean of 489.25 ± 33.10µm. This was significantly lower than in myopic subjects, who had a mean central corneal thickness of 554.55 ± 33.22µm (P = 0.000). Comparison of the changes in corneal and anterior chamber parameters of myopic and post-LASIK myopic eyes are depicted in Table 2.

In post-LASIK individuals, the anterior chamber angle ranged from 25.90° to 52.30°, with a mean of 39.91° ± 5.04°. This was not significantly different from the myopic subjects, who had an average anterior chamber angle of 41.26° ± 5.36° (P = 0.092). The anterior chamber volume in post-LASIK group was 175.31 ± 24.71 mm³ which was lesser than the myopic individuals (P = 0.014), as shown in Figure 2. Similarly, anterior chamber depth was lesser in post-LASIK group, with a mean of 3.08 ± 0.29 mm, compared to 3.18 ± 0.34 mm in myopic cases (P = 0.034), as presented in Figure 3.

Table 1: *Demographic characteristics of myopic and post-LASIK myopic eyes.*

Variables	Myopic(83)		Post-LASIK myopic (89)		P-Value[a]
	Mean ± SD	Range	Mean ± SD	Range	
Age(years)	22.37±1.47	20 to 26	22.57±2.63	20 to 29	0.544
BCVA (decimal)	0.98± 0.26	0.6 to 1.2	1.03±0.15	0.7 to 1.5	0.098
Refraction (D)	-2.01±-1.02	-0.5 to -4.25	-0.51 ± -0.41	-0.25 to -1.00	0.000

a:Independent sample t-test; BCVA: best corrected visual acuity; D: dioptre.

Table 2: *Comparison of the changes in corneal and anterior chamber parameters of myopic and post-LASIK myopic eyes.*

Variables	Myopic (83)		Post-LASIK myopic(90)		P-Value [a]
	Mean ± SD	Range	Mean ± SD	Range	
CCT (µm)	554.55±33.22	479 to 640	489.25±33.10	396 to550	0.000
Thinnest CT(µm)	549.43±34.82	461 to 640	487.03±32.62	396 to 549	0.000
Anterior Cm(D)	42.90±1.43	39.7 to 45.60	40.41±175	35.80 to 45.35	0.000
Posterior Cm(D)	-6.21±0.28	-6.85 to -5.55	-6.26±0.26	-6.95 to-5.75	0.277
ACA (degree)	41.26±5.36	22.60 to 51.60	39.91±5.04	25.90 to 52.30	0.092
ACV (mm^3)	185.80±30.72	107.0 to 261.0	175.31±24.71	113.0 to 238.0	0.014
ACD (mm)	3.18±0.34	2.33 to 3.87	3.08±0.29	2.48 to 3.84	0.034

a: Independent sample t-test; CCT: Central corneal thickness; Cm: mean corneal power; ACA: Anterior chamber angle; ACV: Anterior chamber volume; ACD: Anterior chamber depth.

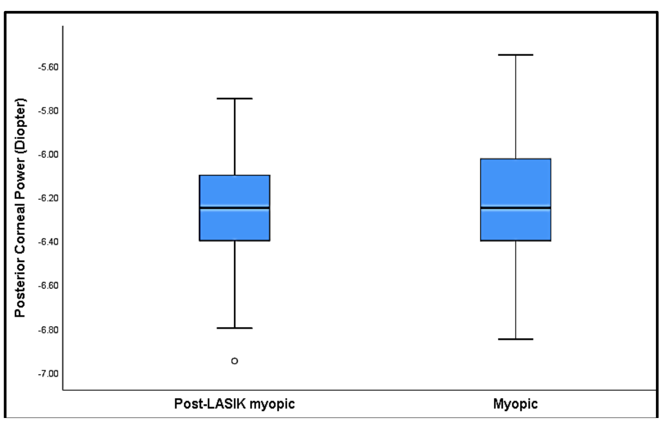

Figure 1: Comparison of posterior corneal power between post-LASIK and myopic individuals.

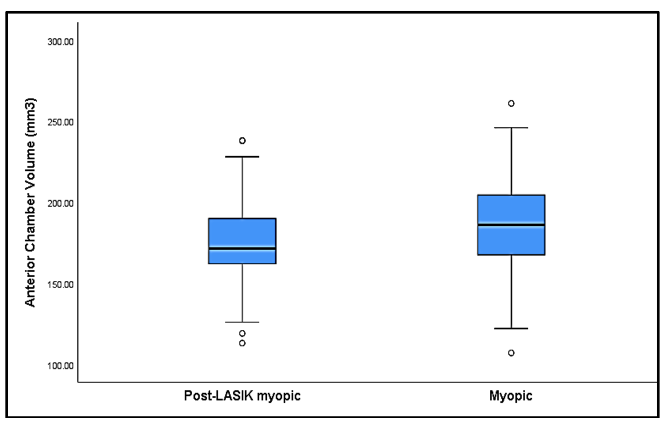

Figure 2: Anterior chamber volume of post-LASIK and myopic individuals.

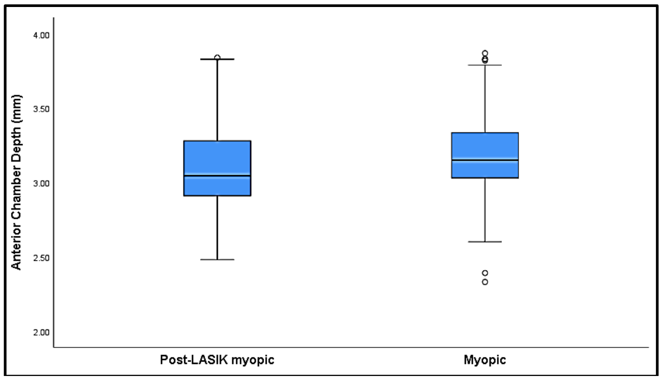

Figure 3: Anterior chamber depth of post-LASIK and myopic patients.

DISCUSSION

This work compared the corneal and anterior chamber parameters of myopic and post-LASIK eyes, providing valuable insights into the structural changes occurring after LASIK surgery. The findings showed statistically significant difference of anterior corneal surface power, central corneal thickness (CCT), anterior chamber volume (ACV), and anterior chamber depth (ACD) between myopic and post-LASIK eyes. In contrast, no statistically significant differences were noted in the anterior chamber angle (ACA) or posterior corneal surface power.

The marked difference in mean spherical equivalent of post-LASIK eyes versus myopic eyes (P = 0.000) matches the intended effect of LASIK, which flattens the anterior cornea to correct refractive error, consistent with prior reports that showed a shift towards emmetropia.[14] Central corneal thickness decreases significantly after LASIK (P = 0.000) which is a direct result of stromal ablation.[15,16] Because corneal thickness reflects structural integrity, follow-up is important, particularly with respect to possible longer-term complications such as ectasia.[17] Literature shows that ectasia is 4.5 times more frequent after LASIK than after photorefractive keratectomy.[18]

As for corneal power, anterior surface power was significantly less in post-LASIK eyes (P = 0.001) while posterior surface power was not different (P = 0.277). This pattern fits the mechanism of LASIK, which reshapes the anterior stroma and usually leaves posterior curvature stable.[19]

The anterior chamber angle was smaller in post-LASIK eyes than the myopic eyes. However, it was not statistically significant (P = 0.092). Published findings vary, with some studies noting significant decreases and others describing only small or negligible shifts.[13,20] Baseline myopia, individual anatomy, and measurement methods may all contribute to these differences.[21,22] In contrast, anterior chamber volume and depth were significantly lesser in post-LASIK eyes (P = 0.014 and P = 0.034). Postoperative corneal remodelling can influence anterior segment metrics. Wang et al, observed a significant increase in lens thickness after LASIK, which may contribute to the drop in anterior chamber depth.[20] Such changes can influence intraocular pressure measurements, because tonometry responds to anterior segment configuration. Regular postoperative checks of anterior chamber parameters are advisable. Longer follow-up will help clarify durability and clinical relevance.

The limitations of the study include shorter follow-up of post-LASIK eyes. The sample covered low to moderate myopia only; therefore, the conclusions may not apply to high myopia. The data on common postoperative issues, such as dry eye or ectasia, has not been documented, which would have broadened the clinical assessment.

CONCLUSION

LASIK was associated with significant changes in corneal and anterior chamber parameters. At six months, central corneal thickness and anterior corneal surface power were reduced, posterior surface power was unchanged, the anterior chamber angle decreased without statistical significance, and both anterior chamber volume and depth were significantly lower than in myopic eyes. These results reflect how LASIK reshapes the cornea and alters anterior segment anatomy, with practical implications for postoperative care.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(24-80-04)**.

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Author's Designation and Contribution

Majid A. Moafa; Associate Professor: *Concepts, Design, Literature Search, Data Acquisition, Data Analysis, Statistical Analysis, Manuscript Preparation, Manuscript Editing, Manuscript Review.*