High Order Aberrations after Femtosecond Laser-assisted In Situ Keratomileusis Using Contoura Topographic-guided Ablation in Mild to Moderate Myopia.

Ayat Mohamed El Alfy*[1], Dina Fouad Ghoneim[2], Ahmed Medhat Abdelsalam[3], Ibrahim Mohieldin Taher[3], Aziza Ahmed Hassan[2]

1. Assistant researcher at National Research Centre, Cairo, Egypt
2. Assistant Professor of Ophthalmology, National Institute of Laser Enhanced Science, Cairo University, Cairo, Egypt
3. Professor of Ophthalmology, National Institute of Laser Enhanced Science, Cairo University, Cairo, Egypt

*** Corresponding author:** Ayat Mohamed El Alfy, 1 Mohamed Farid St., Heliopolis, Cairo, EGYPT, E-mail: Dr.ayat.m.elalfy@gmail.com

ABSTRACT

Purpose: This study aimed to compare the efficacy and safety of femtosecond laser-assisted in situ keratomileusis (FS-LASIK) and the incidence of HOAs in mild and moderate myopia.

Methods: This comparative prospective controlled study was conducted in Cairo, Egypt, upon 50 individuals with 100 eyes, from Jan-2020 to Jan-2021. They are grouped into mild myopia group (myopia ≥-1 to -3 & astigmatism up to -1.5) (n=50), and moderate myopia group (myopia >-3 to -6 & astigmatism >-1.5 to -3) (n=50). The primary outcome measure was the proportion of HOAs. The study used Allegro topolyzer Contoura.

Results: Both groups were comparable regarding age and gender. At the baseline, there was a significant ($p < 0.001$) difference between the two groups in central corneal thickness, with the mean in each of mild myopia and moderate myopia groups, was 528.86±22.54 and 555.48±22.12, respectively. There were comparable in K1 (p=0.357); however, they differed in K2 (p=0.030).

Vision at preoperative was statistically different in both groups (p=0.040). However, there is no statistically significant difference between groups according to vision second day postoperative (p=0.517), after one month (p=0.671), and after three months (p=0.665).

High order aberrations were comparable between groups at the preoperative period and three months postoperative. However, the HOAs were significantly lower in the moderate myopia group than in mild myopia after one week ($p < 0.001$) and one month (p=0.016). One important note was that 4th order astigmatism was developed in the moderate myopia group, but not in the mild myopia group, after the procedure in 16%, 20%, 20% of eyes at week 1, month 1 and month 3.

Conclusions: In conclusion, topography-guided FS-LASIK using Contoura demonstrated to have good safety, efficacy, and predictability in the treatment of myopia and myopic astigmatism in both mild and moderate cases.

Keywords: Myopia, Myopic astigmatism, Topography-guided femtosecond LASIK, Contoura, High order aberrations.

DOI Number: 10.14704/nq.2022.20.9.NQ44559 **Neuro Quantology 2022; 20(9):4810-4818**

INTRODUCTION

Refractive errors are an important cause of vision impairment and blindness [1]. Myopia (nearsightedness) is a type of refractive error that causes blurry vision at a distance because abnormal structural conditions of the cornea, lens, or length of the eye prevent the images from focusing correctly on the retina [2]. Myopia affected 1.95 billion people worldwide in 2010, with a higher prevalence in urban areas [1, 3]. The global economic burden generated by myopia has been estimated at 202 billion United States dollars (USD) per annum and approximately 139 billion USD in the USA alone [4, 5].

Laser-assisted in-situ keratomileusis (LASIK) is a keratorefractive surgery that modifies the cornea's refractive power by changing its curvature [6]. It has a safety and efficacy profile that made it more popular compared with other surgeries. It creates a flap of the outermost parts of the cornea to expose the stromal bed and reshape it using photoablation with excimer laser [7]. The corneal flap can be achieved by a mechanical microkeratome (conventional) or a femtosecond laser [8]. The main differences between femtosecond and microkeratome flaps are the thickness and architecture (structural design) [9].

The essential advantage of Topo-guided LASIK is that its calculations are independent of the size or shape of the pupil. In addition, it covers the peripheral cornea and the central part of the cornea, as peripheral corneal irregularities are responsible for most high order aberrations (HOAs) [10]. Topography-guided LASIK uses data from refraction and corneal topography to create a smooth and regular cornea and alleviate some of Wavefront-guided LASIK's limitations [11]. Topographic-guided ablation (brand name Contoura on the WaveLight laser; WaveLight GmBH, Erlangen, Bavaria) utilizing the topography-measured refraction has previously demonstrated vision better than 20/20 with no significant night glare or halos [12]. The Contoura measures astigmatism magnitude and axis. Then, the system determines the corneal HOAs removed first and then removes manifest refraction [13].

This study aims to compare the efficacy and safety and the incidence of HOAs after Femtosecond LASIK (FS-LASIK) using Contoura topographic-guided ablation in mild and moderate Myopia.

MATERIALS AND METHODS

This comparative interventional study was conducted at one institution in Cairo, Egypt, upon 50 individuals with 100 eyes who are coming to the hospital for corrective refractive surgery using FS-LASIK from Jan-2020 to Jan-2021. The research followed the tenets of the Declaration of Helsinki. Additionally, the research was approved by the institutional review board (IRB) and the ethical review committee of the National Institute of Laser Enhanced Science, Cairo University. The purpose, the nature and possible consequences of the study were clearly explained to all patients before their enrollment. Before participating in this study, each patient gave written informed consent.

Patients between 19-40 years of age, having myopia of ≥ -1.00 to -6.00 D, with astigmatism between (-1.00 D to -3.00 D), with stable refraction error throughout one year, central corneal thickness 480-620 µm, residual stromal bed more than 300 µm were included. Those with diabetes mellitus, connective tissue disorders, pregnancy, breastfeeding or keratoconus were excluded.

Before the procedure, all cases had a complete ophthalmology examination, including measurement of uncorrected visual acuity (UCVA) and best-corrected visual acuity (BCVA) and refraction using an auto-refractometer (KR-800; Topcon Medical Systems, Inc., Fukuoka, Japan). Also, dilated fundus exam, anterior segment slit-lamp biomicroscopy, corneal pentacam (Wavelight pentacam oculyzer, WaveLight Inc, ErLangen, Germany). Patients were asked to discontinue wearing soft contact lenses one week before the screening.

We used the topography-guided custom ablation treatment (T-CAT), including topography, keratometry, and pupilometry; this was done using the Allegro topolyzer Contoura (Alcon Laboratories, Inc., TX, USA). Patients were scheduled for a topography-guided simultaneous bilateral FS-LASIK procedure. The same surgeon operated on each eye under topical anesthesia. The LASIK platform used was Allegretto Wave Eye-Q Laser System (Alcon

Surgical, Inc., TX, USA) with Contoura Allegro topolyzer topography system and T-CAT treatment-planning software. Five scans of T-Cat in each eye were included for the contoura planning. The central corneal thickness (CCT) was measured on the apex of the cornea before surgery and after creating the flap to assess the underlying stromal thickness. Corneal flaps were placed with a superior hinge at a 70 degree side-cut angle. The flap thickness was 120 m, and the diameter was estimated depending on the preoperative astigmatism; 9.1 mm for group of moderate myopia and astigmatism more than -1.5 (topographiv astigmatism) and 8.8 mm for group of mild myopia and astigmatism less than -1.5 astigmatism (topographiv astigmatism). An optic zone of 6.5 mm was employed, with a total ablation zone ranging from 7.1 to 9.0 mm. The total ablation zone was calculated based on mesopic pupil size. The flap was raised using a tissue separator, and a balanced solution was used to irrigate the eyes once the procedure was completed and the flap was repositioned.

After the procedure, all subjects were treated with levofloxacin ophthalmic solution (4 times a day for a week and tobramycin dexamethasone ophthalmic solution (Alcon, USA) 4 times a day for a week. polyethylene glycol ophthalmic solution (Alcon, USA) 6 times a day for one month, then decrease to 4 times for two months. The patients were evaluated as regard vision and spherical equivalent on the second day and after one month and after 3months and evaluated after one week and after one month and three months by pentacam as regard corneal astigmatism and type and value of HOAs. Astigmatism was measured by pentacam. HOA is measured by zernike polynominals.

Statistical analysis

For sample size calculation, MedCalc® version 12.3.0.0 program "Ostend, Belgium" was used, statistical calculator based on 95% confidence interval and power of the study 80% with α error 5%**.** According to a previous study (Wang et al., 2018)**,** showed that the corneal aberrations on the posterior surface were less affected by FS-LASIK compared with those on the whole cornea in HOAs, it was mean 0.175±0.050 versus 0.703±0.329 respectively, with p-value (p<0.001) [14]. So it can be relied upon in this study, based on this assumption, sample size was calculated according to these values produced a minimal samples size of 50 patients were enough to find such a difference, subdivided into two groups; Mild myopia (n=25 patients bilateral eye) and Moderate myopia (n=25 patients bilateral eye).

A convenient sample of 50 cases with 100 eyes was used as a sampling technique in this study. They are grouped into mild myopia group (myopia ≥-1 to -3 & astigmatism up to -1.5) (n=50), and moderate myopia group (myopia >-3 to -6 & astigmatism >-1.5 to -3) (n=50). A p-value of < 0.05 is considered statistically significant. SPSS software (Statistical Package for the Social Sciences, version 24.0, SSPS Inc., Chicago, IL, USA) was used. Comparisons between groups were made using the Chi-square test or Fisher exact test for categorical variables and the independent t-test or Mann-Whitney test for the continuous variables. Independent-samples t-test of significance was used when comparing between two means. Repeated measures Analysis of variance (ANOVA) test for whether there are any differences between related means was conducted.

RESULTS

Fifty patients (with 100 eyes) who met the inclusion criteria were included in the study with an average age of 26.94±5.43 years. Females constituted 26 (52%) of them.

Both groups were comparable regarding age and gender. The mean age ±SD in the mild myopia and moderate myopia groups was 26.68±4.46 years and 27.20±6.29, respectively (p=0.635). Females constituted 52% and 48% of mild myopia and moderate myopia group, respectively (p=0.842). At the baseline, there was a significant (p <0.001) difference between the two groups in central corneal thickness, with the mean in each of mild myopia and moderate myopia groups was 528.86±22.54 and 555.48±22.12, respectively. They were comparable as regard K1 (p=0.357) 44.10±1.76 and 43.74±2.12; however, and differed in K2 (p=0.030) 43.91±6.01 and 45.87±1.89 in the mild myopia and moderate myopia group, respectively. The mesopic pupil size in mm was 2.91±0.35 in mild myopia and 2.84±0.42 in moderate myopia, no statistically significant difference between the two groups (p-value = 0.07).

Vision at preoperative was statistically different in both groups (p=0.040). In the mild myopia group, 42 eyes (84%) and eight eyes (16%) were 20/20 and 20/25, respectively, compared to 32 eyes (64%) and 36 eyes (36%) were 20/20 and 20/25 in the moderate myopia group. However, there is no statistically significant difference between groups according to vision second day postoperative (p=0.517), after one month (p=0.671), and after three months (p=0.665) (Fig. 1).

The value of astigmatism was significantly better in the mild myopia than the moderate myopia group preoperatively (1.24±0.17 vs 2.12±0.49; p < 0.001), after one month (0.26±0.16 vs 0.36±0.22; p=0.011), and after three months (0.21±0.19 vs 0.29±0.19; p=0.038), but not after one week (0.37±0.16 vs 0.43±0.28, p=0.191). However, comparing between preoperative with after one week, one month, and three months, revealed a significant (p-values <0.05) improvement in both groups with time with more improvement in the mild myopia group.

The refraction regarding sphere and cylinder were significantly lower in the mild myopia group than in moderate myopia with a p-value (p <0.001 significant) in preoperative. However, it was comparable between groups after one day, one month, and three months. Comparing between preoperative with after one day, one month and three months revealed that each group showed statistically (p-value < 0.05) significant improvement in the refraction (sphere and cylinder) after one month and after 3months, compared to the preoperative values in each group, as shown in Table 1. In addition, the spherical equivalent was significantly lower in the mild myopia group than in moderate myopia with a p-value (p <0.001 significant) in preoperative. However, it was comparable between groups after one day, one month, and three months. Comparing between preoperative with after one day, one month and three months revealed that each group showed statistically (p-value < 0.05) significant improvement in the spherical equivalent after one month and after three months, compared to the preoperative values in each group, as shown in Table 1.

The aberration value did not significantly differ between groups preoperatively (0.42±0.25 vs 0.43±0.26; p=0.845), after one week (0.48±0.23 vs 0.46±0.28; p=0.697), after one month (0.36±0.17 vs 0.30±0.20; p=0.192), and after three months (0.26±0.44 vs 0.25±0.16; p=0.880). However, comparing preoperative with after one week, one month, and three months values in each group showed statistically (p-value < 0.05) significant reduction in the mean value of aberration after one month and after 3months, compared to the preoperative values in each group. That indicates improvement in the two groups.

The proportions of the types of HOAs were comparable between groups at the preoperative period, one month, and after three months postoperative. However, they were significantly different after one week (p-value = 0.003). The proportion of coma HOAs were increased dramatically after one week (from 8% to 64% in mild myopia and 6% to 50% in moderate myopia) and decreased gradually at one month (20% & 22%) and 3-months (20% & 20%) evaluations; however, still significantly higher than in the preoperative values. The proportion of spherical HOAs were increased dramatically after one week (from 6% to 64% in mild myopia and 14% to 56% in moderate myopia) and decreased gradually at one month (30% & 30%) and 3-months (18% & 22%) evaluations; however, still significantly higher than in the preoperative values. On the other hand, the proportions of trefoil aberration were decreased by a good percent after the procedure from 40% to 18% in mild myopia and from 46% to 8% in moderate myopia. Also, the proportions of 6th foil aberrations were decreased by a good percent after the procedure from 34% to 8% in mild myopia and from 26% to 4% in moderate myopia (Table 2). One important note was that 4th order astigmatism was developed in the moderate myopia group, but not in the mild myopia group, after the procedure in 16%, 20%, 20% of eyes at week 1, month 1 and month 3.

Discussion

The current interventional study demonstrated that FS-LASIK using Contoura topographic-guided ablation was efficient and safe in treating myopia and myopic astigmatism over three months. There is no significant difference in UCVA between mild and moderate myopia groups second day postoperative, after one month, and after three months. Between groups, the analysis showed that astigmatism by

Pentacam was significantly better in the mild myopia group than in the moderate myopia group after one month and after three months. However, the study showed a significant improvement in both groups with time, with more improvement in the mild myopia group. The aberration value did not significantly differ between both groups all over the three months of the study. However, the mean value of aberration after one month and after three months was improved in both groups. Also, the refraction regarding sphere and cylinder were significantly improved after one month and after 3months, compared to the preoperative values in each group. The spherical equivalent was comparable between groups after one day, one month, and three months. The within-group analysis showed that each group showed statistically significant improvement in the spherical equivalent after one month and after 3months, compared to the preoperative values in each group. High order aberrations were comparable between groups at the preoperative period and three months postoperative. However, the HOAs were significantly lower in the moderate myopia group than in mild myopia after one week and one month. We wait one month until healing occur. The within-group analysis showed statistically significant change in the proportion of HOAs after one week, one month and after 3months, compared to the preoperative values in each group.

At the moment, wavefront aberration-guided or topographic-guided LASIK is the most common personalized surgical procedure, and it focuses on whole-eye optical aberration but ignores the impact of the pupils, tears film, and the corneal aberration [15].

The automatic iris tracking method is devised in this study based on the texture of the iris. The three-dimensional tracking mode reduces the eye rotation induced by the subject's position shift. In addition, the technology precisely changes the kappa angle to limit the occurrence of HOAs [16]. Contoura is a novel approach that uses corneal topography to guide personalized ablation in primary eyes (normal cornea) and is used to reduce coma difference caused by inaccurate adjustment of kappa angle and off-center ablation [16, 17]. The automatic iris tracking system in the Contoura surgery estimates the corneal apex position by detecting the position of the center of the cornea, and it estimates the positions of the pupil center and corneal apex by detecting the center of the pupil and improves the accuracy of the tracking [18].

Optimal postoperative visual acuity and quality of vision and stability, and safety are the critical factors to success in refractive surgery [18, 19]. The results of the current work showed a mean spherical equivalent myopic after three months in the mild myopia group (-0.00±0.36D) and in the moderate myopia group (-0.02±0.32D), the mean myopic regression was (-0.12) and (-0.8) D in both mild myopia and the moderate myopia groups, respectively. Other studies by Stulting RD et al. (2016) and Hashmani S et al. (2018) reported a myopic mean myopic regression of approximately 0.39 D over six months and 0.06 D over 12 months [11, 20].

UCVA directly affects patient's satisfaction after the surgery and is thus one of the essential parameters in postoperative assessments. The outcomes of our study showed that UCVA at one day postoperatively was better in both. That is in line with other research studies Chiche A et al. (2018) and Liu ML et al. (2016) about FS-LASIK [21, 22].

Modern fast repetition rate excimer laser equipped with precise eye tracker system might have contributed to better UCVA in FS-LASIK procedure. Moreover, topography-guided customized ablation not only precisely defines the centration of the ablation and compensates for ocular cyclotorsional movement, but also regularizes the irregular astigmatism at the anterior corneal surface, leading to better postoperative UCVA [23-25].

The changes in corneal morphology could induce the changes of corneal aberrations. The increases in corneal HOAs could be affected by the healing process of the corneal incisions, the stability of the tear film, and the amount of stromal ablation [26]. Therefore, a long-term follow-up to observe the changes in corneal HOAs is warranted. The increase in total HOAs was lower in FS-LASIK using the Contoura than other techniques. The amount of residual astigmatism decreased with time. Thus, the topography-guided FS-LASIK with iris recognition and cyclo-torsional compensation (Contoura) gives better results in the treatment of preoperative anterior corneal HOA and astigmatism.

Taskov G and Taskov T (2020) examined the changes in HOAs before and after FS-LASIK for simple myopia or compound myopic astigmatism following topography-guided (TG) and wavefront-guided (WG) ablation. In this study, 42 eyes had TG FS-LASIK and 31 eyes had WG FS-LASIK. Without a significant difference between the two groups, total HOAs increased from 0.410.16 m pre-operatively to 0.660.30 m post-operatively in the TG group and from 0.420.13 m pre-operatively to 0.590.27 m post-operatively in the WG group. However, there was a significant difference in the postoperative change of secondary astigmatism between the two groups [0.20 (0.0-0.53) vs. 0.0 (0.0-0.20) for the TG and WG groups, respectively; p=0.009]. In both the TG and WG ablation profile groups, the total HOAs rose compared to pre-operative data, according to the researchers. The degree of secondary astigmatism rise was substantially reduced in the WG group, possibly favoring postoperative vision quality [27]. However, in the current research, the proportion of coma and spherical HOAs were increased dramatically after one week and decreased gradually at one month and 3-months evaluations; however, still significantly higher than in the preoperative values. On the other hand, the proportions of trefoil and sixth foil aberrations were decreased by a good percent after the procedure.

One limitation of the current study is that it lacks data in patient's subjective evaluation of the quality of vision, as well as the objective quality of vision assessments such as objective scattering index and modulation transfer function. Another limitation is that the follow-up time was only three months. Therefore, studies with long-term follow-up and contralateral eye comparisons are warranted.

In conclusion, topography-guided FS-LASIK using Contoura demonstrated to have good safety, efficacy, and predictability in the treatment of myopia and myopic astigmatism in both mild and moderate cases.

References

1. Holden BA, Fricke TR, Wilson DA, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. Ophthalmology 2016;123(5):1036-42.
2. Riordan-Eva P. Chapter 21. Optics & refraction. In: Riordan-Eva P, Emmett CT, editors(s). Vaughan & Asbury's General Ophthalmology. 18th edition. New York, NY: McGraw-Hill. 2011:396-411.
3. Morgan IG, Ohno-Matsui K, Saw SM. Myopia. Lancet 2012;379(9827):1739-48.
4. Smith TS, Frick KD, Holden BA, et al. Potential lost productivity resulting from the global burden of uncorrected refractive error. Bulletin of the World Health Organization 2009;**87**(6):431-7.
5. National Academies of Sciences, Engineering, Medicine, Teutsch SM, McCoy MA, Woodbury RB, Welp A, editor(s).Making Eye Health a Population Health Imperative: Vision for Tomorrow. Washington (DC): National Academies Press, 2016.
6. Bower KS, Weichel ED, Kim TJ. Overview of refractive surgery. American Family Physician 2001;64(7):1183-90.
7. Ang EK, Couper T, Dirani M, et al. Outcomes of laser refractive surgery for myopia. Journal of Cataract and Refractive Surgery 2009;35(5):921-33.
8. Farjo AA, Sugar A, Schallhorn SC, et al. Femtosecond lasers for LASIK flap creation: a report by the American Academy of Ophthalmology.Ophthalmology 2013;120(3):e5-20.
9. Kahuam-López N, Navas A, Castillo-Salgado C, et al. Laser-assisted in-situ keratomileusis (LASIK) with a mechanical microkeratome compared to LASIK with a femtosecond laser for LASIK in adults with myopia or myopic astigmatism. Cochrane Database of Systematic Reviews 2020, Issue 4. Art. No.: CD012946. DOI: 10.1002/14651858.CD012946.pub2.
10. Chen X, Stojanovic A, Zhou W, et al. Transepithelial, topography-guided ablation in the treatment of visual disturbances in LASIK flap or interface complications. J Refract Surg. 2012;29:120-126.
11. Stulting RD, Fant BS, Group T-CS. Results of topography guided laser in situ keratomileusis custom ablation treatment with a - refractive excimer laser. J Catarct Refract Surg. 2016;42:11-18

12. Motwani M. The use of WaveLight(R) Contoura to create a uniform cornea: the LYRA Protocol. Part 3: the results of 50 treated eyes. Clin Ophthalmol. 2017;11:915-921.

13- Peri R, Motwani M. The use of WaveLight Contoura to create a uniform cornea: 6-month results with subjective patient surveys Clin Ophthalmol. 2018; 12: 1559–1566.

14. Wang J, Ren Y, Liang K, Jiang Z, Tao L. Changes of corneal high-order aberrations after femtosecond laser-assisted in situ keratomileusis. Medicine (Baltimore). 2018 May;97(18):e0618.

15. Motwani M. The use of WaveLight(R) Contoura to create a uniform cornea: the LYRA Protocol. Part 2: the consequences of treating astigmatism on an incorrect axis via excimer laser. Clin Ophthalmol. 2017;11:907–913.524–533.

16. Moreno-Barriuso E, Lloves JM, Marcos S,et al. Ocular aberrations before and after myopic corneal refractive surgery: LASIK-induced changes measured with laser ray tracing. Invest Ophthalmol Vis Sci. 2001 May;42(6):1396-403. PMID: 11328757.

17. Xiong ning, Liu yi, Wang ping. Theraperutic effect of wavefront-guided laser in situ keratomileusis for myopic astigmatism. Rec Adv Ophthalmol, 2007:276452-454.

18. Zhang Y, Shen Q, Jia Y, Zhou D, Zhou J. Clinical outcomes of SMILE and FS-LASIK used to treat myopia: a meta-analysis. J Refract Surg. 2016;32(4):256–265.

19. Lü F, Wang QM, Qu J. Focus on safety and efficiency of refractive surgery. Zhonghua Yan Ke Za Zhi. 2005;41(6):482–485.

20. Hashmani S, Hashmani N, Haroon H, Hashmi Y. Visual and Refractive Outcomes of Topography-guided Laser-assisted In Situ Keratomileusis in Virgin Eyes. Cureus, 2018 Jan; 10(1): e2131

21. Chiche A, Trinh L, Saada O, et al. Early recovery of quality of vision and optical performance after refractive surgery: small-incision lenticule extraction versus laser *in situ* keratomileusis. J Cataract Refract Surg. 2018;44(9):1073–1079.

22. Liu ML, Chen YL, Wang DY, et al. Clinical outcomes after SMILE and femtosecond laser-assisted LASIK for myopia and myopic astigmatism: a prospective randomized comparative study. Cornea. 2016;35(2):210–216.

23. Moshirfar M, Murri MS, Shah TJ, et al. Initial single-site surgical experience with SMILE: a comparison of results to FDA SMILE, and the earliest and latest generation of LASIK. Ophthalmol Ther. 2018;7(2):347–360.

24. Lau YT, Shih KC, Tse RH, et al. Comparison of visual, refractive and ocular surface outcomes between small incision lenticule extraction and laser-assisted *in situ* keratomileusis for myopia and myopic astigmatism. Ophthalmol Ther. 2019;8(3):373–386.

25. Stojanovic A, Chen S, Chen X, et al. One-step transepithelial topography-guided ablation in the treatment of myopic astigmatism. PLoS One. 2013;8(6):e66618.

26. Smadja D, Santhiago MR, Mello GR, et al. Corneal higher order aberrations after myopic wavefront-optimized ablation. J Refract Surg. 2013;29(1):42–48.

27. Taskov G, Taskov T. Higher order aberrations (HOA) changes after femto-LASIK in topography and wavefront-guided treatments. Folia Med (Plovdiv) 2020;62(2):331-7.

FIGURES

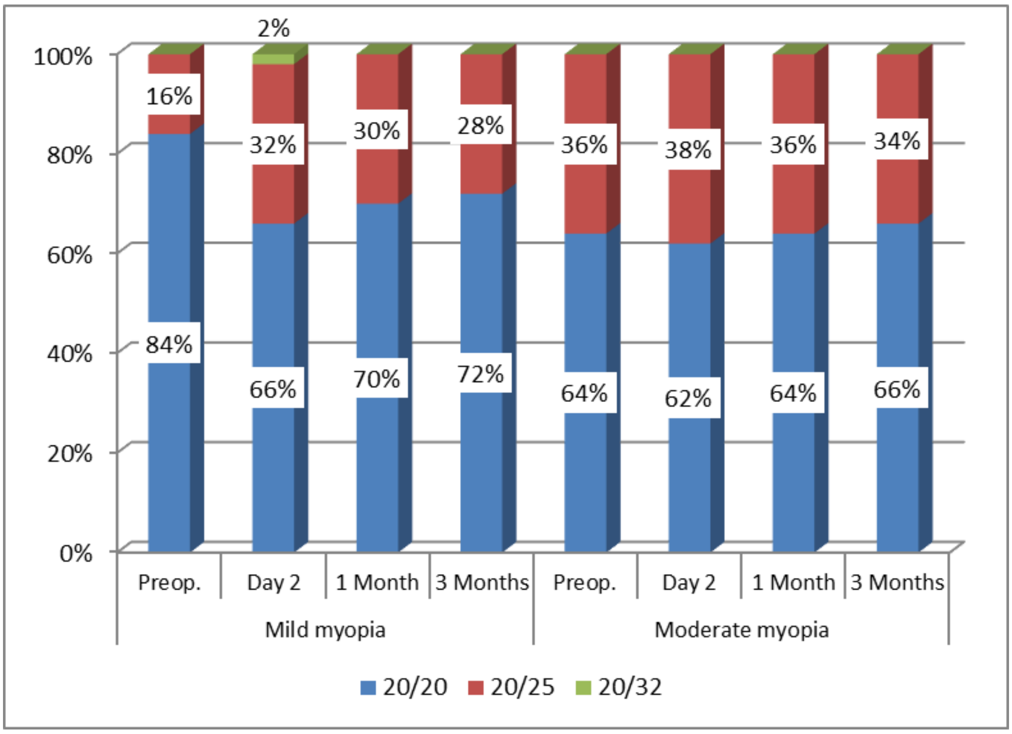

Figure 1: Vision in both groups

TABLES

Table 1: Refraction and spherical equivalent during the study period

	Preoperative	Day 2	1 Month	3 Months
Refraction: spherical				
Mild myopia	-1.98±0.73	0.22±0.48#	0.01±0.39#	0.03±0.34#
Moderate myopia	-4.68±0.88	0.07±0.49#	0.07±0.35#	-0.03±0.29#
p-value	**<0.001**	0.125	0.421	0.345
Refraction: cylindrical				
Mild myopia	-1.19±0.23	-0.20±0.40#	-0.10±0.36#	-0.05±0.31#
Moderate myopia	-2.18±0.43	-0.23±0.50#	-0.03±0.25#	0.03±0.25#
p-value	**<0.001**	0.741	0.262	0.159
Spherical equivalent				
Mild myopia	-2.57±0.76	0.12±0.48#	-0.04±0.42#	0.00±0.36#
Moderate myopia	-5.77±0.99	-0.05±0.50#	0.06±0.35#	-0.02±0.32#
p-value	**<0.001**	0.086	0.199	0.77

Table 2: Types of High Order Aberrations during the study period

	Preop	Week 1	Month 1	Month 3
Mild myopia				
Coma	8%	42%	20%	20%
Spherical	6%	64%	30%	18%
Trefoil	40%	18%	32%	22%
6th foil	34%	8%	12%	10%
4th order astigmatism	0%	0%	0%	0%
No HOAs*	12%	2%	12%	36%
Moderate myopia				
Coma	6%	50%	22%	20%
Spherical	14%	56%	30%	22%
Trefoil	46%	8%	20%	16%
6th foil	26%	4%	8%	12%
4th order astigmatism	0%	16%	20%	20%
No HOAs*	8%	14%	12%	18%
p-value	0.304	0.003	0.069	0.059

* HOAs: High order aberrations