ORIGINAL ARTICLES

Changes in Corneal Wavefront Aberrations and Asphericity Following Optimized LASIK Ablation in Moderate to Highly Myopic Eyes

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ABSTRACT

Objective: to evaluate changes in corneal higher order aberrations; namely spherical, coma, trefoil, aberration coefficients, total aberration coefficient as well as corneal asphericity (Q-value) following optimized LASIK ablation for moderate to highly myopic eyes. Design: Retrospective, consecutive case series. Participants: One hundred and fourteen eyes (of 74 myopic patients) whom had undergone LASIK procedure using optimized excimer laser ablation by Allegretto Wave Light Eye-Q 1010 (400 Hertz) with active eyetracker (frequency 400 Hertz). Methods: all eyes were evaluated for corneal higher order aberrations; namely spherical, coma, trefoil, aberration coefficients, total aberration coefficient as well as corneal asphericity (Q-value) for the corneal front surface after one to three months following the LASIK procedure. All patients were examined preoperatively as well as one to three months postoperatively for uncorrected visual acuity (UCVA), best spectacle corrected visual acuity (BSCVA), spherical equivalent (Sph.Eq.), Scheimpflug imaging (i.e. Pentacam, ALLEGRO Oculyzer Version 1074; Allergo, Germany) to detect Keratometric reading, central pachymetry, higher order spherical, Coma, trefoil aberration coefficients, total aberration coefficient for the corneal front surface (from Zernike values at 6.0 mm optical zone) and corneal asphericity (Q-value) from (refractive map at 30 degrees) were also obtained. The collected data were tabulated and analysed with the suitable statistical methods. The mean values and standard deviation were calculated for quantitative data. Comparison tests (t-test) and correlation tests (Pearson) are also performed. The effect of age and sex on the studied criteria was evaluated by Mann-Whitney test (non parametric test of significance) to test the difference between different patients groups. Main outcome measures: corneal higher order aberrations; namely spherical, Coma, trefoil aberration coefficients, total aberration coefficient, asphericity (Q-value), spherical equivalent. Results: In our study, which included One hundred and fourteen eyes (of 74 myopic patients); 87 eyes (of 57 female patients) and 27 eyes (of 17 male patients) the age ranged from 12-48 years (mean age 28.22±7.16 years), and preoperative spherical equivalent (Sph.EQ) ranged from -2.38 to -12 diopters (D) (mean value -6.34±2.44D), The spherical aberration coefficient for the corneal front surface, increased from a mean value of 0.11±0.10µ preoperatively to a mean value of 0.23±0.20 µ postoperatively denoting a statistically significant increase (P-value =0.00). A statistically significant correlation (P<0.05) existed between postoperative change in spherical aberration coefficient of front corneal surface and the postoperative change in the spherical equivalent, and mean keratometric readings. The coma aberration coefficient for the corneal front surface, increased from a mean value of 0.16±0.15µ preoperatively to a mean value of 0.32±0.24 µ postoperatively denoting a statistically significant increase (P-value =0.00). The trefoil aberration coefficient for the corneal front surface, increased from a mean value of 0.16±0.20µ preoperatively to a mean value of 0.21±0.16 µ postoperatively denoting a statistically significant increase (P-value =0.02). The total aberration coefficient (ABR) for the corneal front surface, increased from a mean value of 1.16±0.66µ preoperatively to a mean value of 1.84±0.47 postoperatively denoting a statistically significant increase (P-value =0.00). A non significant correlation (P>0.05) existed between postoperative change in coma, trefoil and total aberration coefficients of front corneal surface and the postoperative change in the spherical equivalent, and mean keratometric readings. The corneal asphericity (Q value) for the corneal front surface, increased from a mean value of -0.27±0.15 preoperatively to a mean value of 0.96±0.59 postoperatively denoting a statistically significant difference (P-value =0.00). A highly significant correlation (P<0.01) existed between postoperative change in corneal asphericity (Q value) of front corneal surface and the postoperative change in the spherical equivalent. And a statistically significant correlation (P<0.05) existed between postoperative change in corneal asphericity (Q value) of front corneal surface and the postoperative change in the mean keratometry. The studied items were not affected by age or sex of patients. Conclusions: A statistically significant increase occurred in the spherical, coma, trefoil, total aberration coefficients as well as in the corneal asphericity (Q-value) following optimized LASIK ablation for moderate to high myopia. The postoperative change in the spherical aberration coefficient and corneal asphericity was statistically correlated with the the postoperative change in the spherical...
equivalent (amount of refractive correction), and mean keratometric readings. Age and sex had no effect on the studied criteria.

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The authors have no proprietary or commercial interest in any of the materials discussed in this article.

Introduction

LASIK had become the technique of choice for treatment of wide range of myopia, offering quicker visual recovery and relatively pain-free experience (Schmack, et al 2010, Yoon, et al., 2009 and Stephen and Slade, 2008). The incidence of visual complaints by patients even after a successful refractive surgery, ranges from 3 to 40% (Mrochen, et al 2001). Theses complains were related to reduced image quality with patient dissatisfaction due to an increase in corneal higher order aberrations (HOA) (Chalita, et al 2004). In a attempt to reduce increase in post-LASIK corneal higher order aberrations, some studies was done using wavefront optimized LASIK for myopia and other refractive errors (Alió, et al 2013 and Padmanabhan, et al 2010) while others used wavefront guided LASIK treatment (Bottos, et al 2011). Among the high order aberrations, only spherical, coma and trefoil aberrations are of clinical interest. The spherical aberration is the cause of night myopia and it increases after LASIK and surface ablation. It results in haloes around point images. It excacerbates myopia in low light (night myopia) (Lombardo, et al., 2010). Coma aberration is common in patients with Keratoconus and decentered ablations. The trefoil aberration causes less degradation of image quality than coma of the same RMS magnitude. (American accedemy of ophthalmology 2011-2012). The Q value is a coefficient that describes the rate of change in the curvature of the cornea from its center to the periphery using corneal radii values. It shows whether the eye is more oblate or more prolate (Calossi, 2007).

Objective:
The aim of this study is to evaluate changes in corneal higher order aberrations; namely spherical, coma, trefoil, aberration coefficients, total aberration coefficient as well as corneal asphericity (Q-value) following optimized LASIK ablation for moderate to high myopic eyes and to find out if these changes could be affected by the age or sex of patients aiming to achieve reasonable patient satisfaction following refractive surgery.

Design:
Retrospective, consecutive case series.

Participants:
One hundred and fourteen eyes (of 74 myopic patients) whom had undergone LASIK procedure using optimized excimer laser ablation by Allegretto Wave Light Eye-Q 1010 (400 Hertz) with active eyetracker (frequency 400 Hertz) at the Research Institute of Ophthalmology Giza, Egypt in the interval b tween January 2011- march 2013 who were free from flap and other LASIK related complications that could affect visual quality and affect wavefront aberrations and whom attended for regular follow up post-LASIK. Exclusion criteria included previous intraocular or corneal surgery, a history of ocular trauma, irregular astigmatism on corneal topography, active ocular or systemic disease that could affect corneal wound healing, and pregnancy.

Methods:
One hundred and fourteen eyes of 74 patients seeking for excimer laser ablation, were included in the study; 87 eyes (of 57 female patients ) and 27 eyes (of 17 male patients) .the age ranged from 12-48 years (mean age 28.22±7.16 years) , and preoperative spherical equivalent (Sph.EQ) ranged from -2.38 to -12 diopters (D) (mean value -6.34±2.44D).

The LASIK Procedure:

1) Topical anesthesia with proparacaine hydrochloride 0.4 % (Benox eye drops) 5 minutes just before the operation.
2) Sterilizing the eyelids with Povidone-Iodine10% (Betadine) .
3) Speculum application.
4) Corneal marking using surgical marker with marks created at (lower quadrants for [Moria M2) and at (temporal quadrants for Moria SBK 90) .
6) The microkeratome handle was applied over the cornea creating a superior hinged corneal flap for Moria M2 and a nasal hinged corneal flap for Moria SBK 90 microkeratomes.

7) Ablation was performed by the Allegretto Wave Light Eye-Q 1010 (400 Hertz) with active eyetracker (frequency 400 Hertz) using 6.5 mm ablation zone.

8) The stromal bed was irrigated with balanced salt solution (BSS).

9) The flap was repositioned painted by jet of air.

10) The flap alignment was checked by preoperative corneal marks alignment.

11) Postoperatively, patient received antibiotics, corticosteroid eye drops and preservatives free artificial tears eye drops.

All patients were examined preoperatively as well as one to three months postoperatively for uncorrected visual acuity (UCVA), best spectacle corrected visual acuity (BSCVA), spherical equivalent (Sph.Eq.). Scheimpflug imaging to detect Keratometric readings and central pachymetry. Higher order spherical (Coma, trefoil aberration coefficients, total aberration coefficient for the corneal front surface (from Zernike values at 6.0 mm optical zone) and corneal asphericity (Q-value) from refractive map at 30 degrees were also obtained. The collected data were tabulated and analysed with the suitable statistical methods. The mean values and standard deviation were calculated for quantitative data. Comparison tests (t-test) and correlation tests (Pearson) were also performed. The effect of age and sex on the postoperative changes was also studied by Mann-Whitney test (non parametric test of significance) to test the difference between different patients groups.

Results:

Preoperatively, the uncorrected visual acuity (UCVA) in Snellen lines ranged from 0.02 to 0.5 (mean value 0.11 ±0.11) and best corrected visual acuity (BSCVA) in Snellen lines ranged from 0.4 to 1.0 (mean value 0.84±1.6). The preoperative spherical equivalent (Sph.EQ.) ranged from -2.38 to -12 diopters (D) (mean value -6.34±2.44D). The mean keratometric readings (Km) ranged from 39.9 to 46.7 diopters (D) (mean value 43.61±1.40D) and the central pachymetry ranged from 487 to 596µ (mean value 540.60±25.37 µ).

Postoperatively, the uncorrected visual acuity (UCVA) in Snellen lines ranged from 0.3 to 1.0 (mean value 0.77 ±0.19) and best corrected visual acuity (BSCVA) in Snellen lines ranged from 0.4 to 1.0 (mean value 0.84±0.14). The postoperative spherical equivalent (Sph.EQ.) ranged from 0.87 to -2.75 diopters (D) (mean value -0.71±0.87D). The mean keratometric readings (Km) ranged from 31.4 to 43 diopters (D) (mean value 37.88±2.67D) and the central pachymetry ranged from 361 to 521µ (mean value 440.58±35.91 µ).

For studied cases:

The spherical aberration coefficient for the corneal front surface, increased from a mean value of 0.11±0.10µ (range 0-0.6µ) preoperatively to a mean value of 0.23±0.20 µ (range 0.00-1.02µ) postoperatively with t-test showing a value of -5.89 (P-value =0.00) denoting a statistically significant increase. The coma aberration coefficient for the corneal front surface, increased from a mean value of 0.16±0.15µ (range 0.01-0.78) preoperatively to a mean value of 0.32±0.24 µ (range 0.02-1.213µ) postoperatively with t-test showing a value of -6.73 (P-value =0.00) denoting a statistically significant increase. The trefoil aberration coefficient for the corneal front surface, increased from a mean value of 0.16±0.20µ (range 0.01-1.36µ) preoperatively to a mean value of 0.21±0.16 µ (range 0.016-1.03µ) postoperatively with t-test showing a value of -2.41 (P-value =0.02) denoting a statistically significant increase. The total aberration coefficient (ABR) for the corneal front surface, increased from a mean value of 1.16±0.66µ (range 0-2.3) preoperatively to a mean value of 1.84±0.47 (range 1.1-4.1) postoperatively with t-test showing a value of -22.92 (P-value =0.00) denoting a statistically significant increase. (table 1 and chart 1). The corneal asphericity (Q value) for the corneal front surface, increased from a mean value of -0.27±0.15 (range -0.63-0.38) preoperatively to a mean value of 0.96±0.59 (range -0.01-1-3.13) postoperatively with t-test showing a value of -10.01 (P-value =0.00) denoting a statistically significant difference. (table 1 and chart 2).

Pearson correlations were studied between Spherical, coma, trefoil, total aberration coefficients and Q value post LASIK changes and post-LASIK change in refraction, and mean keratometry among cases under study.

A statistically significant correlation "r"=0.21(P<0.05) existed between postoperative change in spherical aberration coefficient of front corneal surface and the postoperative change in the spherical equivalent. A statistically significant correlation "r"=0.22(P<0.05) existed between postoperative change in spherical aberration of front corneal surface and the postoperative change in the mean keratometry readings. A non significant correlation "r"=0.05 (P>0.05) existed between postoperative change in coma aberration coefficient of front corneal surface and the postoperative change in the spherical equivalent. A non significant correlation "r"=0.05 (P>0.05) existed between postoperative change in coma aberration coefficient of front corneal surface and the postoperative change in the mean keratometry. A non significant correlation "r"=0.02
A non significant correlation \( r=0.03 \) (\( P=>0.05 \)) existed between postoperative change in trefoil aberration coefficient of front corneal surface and the postoperative change in the spherical equivalent. A non significant correlation \( r=0.07 \) (\( P=>0.05 \)) existed between postoperative change in total aberration coefficient of front corneal surface and the postoperative change in the mean keratometry. A highly significant correlation \( r=0.65 \) (\( P=<0.01 \)) existed between postoperative change in corneal asphericity (Q value) of front corneal surface and the postoperative change in the spherical equivalent. A statistically significant correlation \( r=0.38 \) (\( P=<0.05 \)) existed between postoperative change in corneal asphericity (Q value) of front corneal surface and the postoperative change in the mean keratometry. (Table 2).

<table>
<thead>
<tr>
<th>Item</th>
<th>Preoperative mean value and standard deviation</th>
<th>Post-operative mean value and standard deviation</th>
<th>t-test</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spherical aberration</td>
<td>0.11±0.10 ( \mu )</td>
<td>0.23±0.20 ( \mu )</td>
<td>-5.89</td>
<td>0.00</td>
<td>Statistically significant</td>
</tr>
<tr>
<td>Coma aberration</td>
<td>0.16±0.15 ( \mu )</td>
<td>0.32±0.24 ( \mu )</td>
<td>-6.73</td>
<td>0.00</td>
<td>Statistically significant</td>
</tr>
<tr>
<td>Trefoil aberration</td>
<td>0.16±0.20 ( \mu )</td>
<td>0.21±0.16 ( \mu )</td>
<td>-2.41</td>
<td>0.02</td>
<td>Statistically significant</td>
</tr>
<tr>
<td>Total aberration coefficient (ABR)</td>
<td>1.16±0.66 ( \mu )</td>
<td>1.84±0.47 ( \mu )</td>
<td>-22.92</td>
<td>0.00</td>
<td>Statistically significant</td>
</tr>
<tr>
<td>Corneal asphericity (Q value)</td>
<td>-0.27±0.15</td>
<td>0.96±0.59</td>
<td>-10.01</td>
<td>0.00</td>
<td>Statistically significant</td>
</tr>
</tbody>
</table>

**Chart 1:** Showing the mean values of Spherical, coma and trefoil aberration coefficients as well as total aberration coefficient and corneal asphericity (Q-value) both preoperatively and 1-3 months postoperatively for cases under the study.

**Chart 2:** Showing the mean values of corneal asphericity (Q-value) both preoperatively and 1-3 months postoperatively for cases under the study.

The effect of age and sex on the studied criteria was evaluated by Mann -Whitney test (non parametric test of significance) to test the difference between different patients groups. In studying the effect of the age on the changes in wavefront aberration coefficients and asphericity post-LASIK, patients were divided into two groups: Age group A (74 eyes of 47 patients≤30y) and age group B (40 eyes of 27 patients>30y);
The spherical aberration coefficient for the corneal front surface showed an average increase of 0.12±0.21 μ for group A and 0.11±0.24 μ for group B with Mann–Whitney test showing a Z-test value of -0.82 (P value =0.41) denoting a non significant difference. The coma aberration coefficient for the corneal front surface showed an average change of 0.16±0.20 μ for group A and 0.14±0.32 μ for group B with Mann – Whitney test showing a Z-test value of -1.53 (P value =0.13) denoting a non significant difference. The trefoil aberration coefficient coefficient for the corneal front surface showed an average increase of 0.05±0.26 μ for group A and 0.05±0.13 μ for group B with Mann – Whitney test showing a Z-test value of -0.24 (P value =0.82) denoting a non significant difference. The total aberration coefficient (ABR) for the corneal front surface, showed an average increase of 0.74±0.72 μ for group A and 0.61±0.77 μ for group B with with Mann – Whitney test showing a Z-test value of -1.40 (P value =0.16) denoting a non significant difference. The corneal asphericity (Q value) for the corneal front surface, showed an average change of 1.31±0.66 μ for group A and 1.10±0.45 μ for group B with with Mann – Whitney test showing a Z-test value of -1.54 (P value =0.12) denoting a non significant difference. Table 3.

**Table 3:** showing the mean values for the post-operative change of Spherical, coma and trefoil aberration coefficients and total aberration coefficient and corneal asphericity (Q-value) for both age group A (≤30y) and age group B >30y for cases under the study compared by Mann –Whitney test.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean value and standard deviation for post-operative change for age group A ≤30y (74 eyes)</th>
<th>Mean value and standard deviation for post-operative change for age group B &gt;30y (40 eyes)</th>
<th>Mann-Whitney U</th>
<th>Z-test</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spherical aberration</td>
<td>0.12±0.21 μ</td>
<td>0.11±0.24 μ</td>
<td>1342.000</td>
<td>-0.82</td>
<td>0.41</td>
<td>Non significant</td>
</tr>
<tr>
<td>Coma aberration</td>
<td>0.16±0.20 μ</td>
<td>0.14±0.32 μ</td>
<td>123.000</td>
<td>-1.53</td>
<td>0.13</td>
<td>Non significant</td>
</tr>
<tr>
<td>Trefoil aberration</td>
<td>0.05±0.26 μ</td>
<td>0.05±0.13 μ</td>
<td>1440.000</td>
<td>-0.24</td>
<td>0.82</td>
<td>Non significant</td>
</tr>
<tr>
<td>Total aberration coefficient (ABR)</td>
<td>0.74±0.72 μ</td>
<td>0.61±0.77 μ</td>
<td>1240.000</td>
<td>-1.40</td>
<td>0.16</td>
<td>Non significant</td>
</tr>
<tr>
<td>Corneal asphericity (Q value)</td>
<td>1.31±0.66 μ</td>
<td>1.10±0.45 μ</td>
<td>1220.000</td>
<td>-1.54</td>
<td>0.12</td>
<td>Non significant</td>
</tr>
</tbody>
</table>

In studying the effect of sex on the changes in wavefront aberration coefficients and asphericity post-LASIK, patients were divided into two groups: Group A: (27 eyes of 17 male patients); and Group B: (87 eyes of 57 female patients).

The spherical aberration coefficient for the corneal front surface showed an average increase of 0.08±0.22 μ for group A and 0.13±0.22 μ for group B with Mann –Whitney test showing a Z-test value of -1.49 (P value =0.14) denoting a non significant difference. The coma aberration coefficient for the corneal front surface showed an average increase of 0.15±0.28 μ for group A and 0.16±0.24 μ for group B with Mann – Whitney test showing a Z-test value of -0.48 (P value =0.63) denoting a non significant difference. The trefoil aberration coefficient for the corneal front surface showed an average increase of 0.05±0.24 μ for group A and 0.05±0.22 μ for group B with Mann –Whitney test showing a Z-test value of -0.62 (P value =0.53) denoting a non significant difference. The total aberration coefficient (ABR) for the corneal front surface, showed an average increase of 0.53±0.85 μ for group A and 0.74±0.70 μ for group B with with Mann –Whitney test showing a Z-test value of -1.61(P value =0.11) denoting a non significant difference. **The corneal asphericity**
(Q value) for the corneal front surface, showed an average change of 1.16±0.47 μ for group A and 1.26±0.63μ for group B with with Mann–Whitney test showing a Z-test value of -0.10 (P value =0.92) denoting a non significant difference. (table 4).

Table 4: showing the mean values for the post-operative change of Spherical, coma and trefoil aberration coefficients as well as total aberration coefficient and corneal asphericity (Q-value) for both male group A and female group B for cases under the study compared by Mann–Whitney test.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean value and standard deviation for post-operative change for male group A(27 eyes)</th>
<th>Mean value and standard deviation for post-operative change for female group B(87 eyes)</th>
<th>Mann-Whitney U</th>
<th>Z-test</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spherical aberration</td>
<td>0.08±0.22 μ</td>
<td>0.13±0.22 μ</td>
<td>950.500</td>
<td>-1.49</td>
<td>0.14</td>
<td>Non significant</td>
</tr>
<tr>
<td>Coma aberration</td>
<td>0.15±0.28 μ</td>
<td>0.16±0.24 μ</td>
<td>1102.000</td>
<td>-0.48</td>
<td>0.63</td>
<td>Non significant</td>
</tr>
<tr>
<td>Trefoil aberration</td>
<td>0.05±0.24μ</td>
<td>0.05±0.221 μ</td>
<td>1081.000</td>
<td>-0.62</td>
<td>0.53</td>
<td>Non significant</td>
</tr>
<tr>
<td>Total aberration</td>
<td>0.53±0.85μ</td>
<td>0.74±0.70 μ</td>
<td>933.000</td>
<td>-1.61</td>
<td>0.11</td>
<td>Non significant</td>
</tr>
<tr>
<td>coefficient (ABR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corneal asphericity</td>
<td>1.16±0.47 μ</td>
<td>1.26±0.63μ</td>
<td>1159.500</td>
<td>-0.10</td>
<td>0.92</td>
<td>Non significant</td>
</tr>
</tbody>
</table>

Discussion:

Although LASIK is increasingly popular for correction of wide range of myopia, offering quicker visual recovery and relatively pain-free experience (Schmack, *et al* 2010; Yoon, *et al* 2009), yet a significant number of patients complained of reduced image quality with patient dissatisfaction due to an increase in higher order aberrations (HOA) (Oshika, *et al* 2002; Chalita, *et al* 2003; Yamane, *et al*, 2004). In an attempt to reduce increase in post-LASIK corneal higher order aberrations, some studies was done using wavefront optimized lasik for myopia and other refractive errors (Alió, *et al* 2013 and Padmanabhan, *et al* 2010) while others used wavefront guided LASIK treatment (Bottos, *et al* 2011 and Mrochen, *et al*, 2004).

Bottos, *et al* (2011), in a study that involved 177 myopic eyes (with spheroequivalent reached up to -9.87 diopters), that undergone wavefront guided LASIK treatment (Visx S4 IR, Abbott Medical optics, Inc) and were evaluated by Scheimflug tomography assessment (Pentacam HR system,version 1-17r60, Oculus Optikgerate GmbH) where the mean Q-value was -0.28±0.11 preoperatively and +0.35±0.44 postoperatively. The asphericity change was highly correlated with preoperative spherical equivalent (r²=0.81;P≤0.001). The mean corneal spherical aberration was +0.21±0.08 μ preoperatively and +0.36±0.17μμm postoperatively. The corneal spherical aberration changes were correlated with the amount of preoperative refractive error (r²=0.34,P≤0.001). There was a tendency for Q values and spherical aberrations to become more positive after myopic ablation.

Padmanabhan, *et al*, (2010) in a study that involved 117 eyes that underwent Optimized LASIK by Allegretto laser (WaveLight Technologi) to perform the ablation. The Allegretto wave analyser (Tscherning type) measured the ocular aberrations prior to LASIK, one month and six months postoperatively. The spherical equivalent was 5.33±1.22 preoperatively and –0.21±0.38 postoperatively. There was a 1.96-fold increase in total root-mean-square of corneal higher order aberrations. Induced changes in seven of the 22 higher order Zernike terms showed a significant linear correlation with the refractive correction attempted. Larger ablation zones induced less spherical aberration.

The spherical aberration coefficient for the corneal front surface, increased from a mean value of 0.11±0.10μ μ preoperatively to a mean value of 0.23±0.20 μ postoperatively denoting a statistically significant increase (P-value =0.00). A statistically significant correlation (P=0.05) existed between postoperative change in spherical aberration coefficient of front corneal surface and the postoperative change in the spherical equivalent, and mean keratometric readings. We studied the coma, trefoil and total aberration coefficients which were not studied in previous studies. The coma aberration coefficient for the corneal front surface, increased from a mean value of 0.16±0.15μ μ preoperatively to a mean value of 0.32±0.24 μ postoperatively denoting a statistically significant increase (P-value =0.00). The trefoil aberration coefficient for the corneal front surface, increased from a mean value of 0.16±0.20μ μ preoperatively to a mean value of 0.21±0.16 μ postoperatively denoting a statistically significant increase (P-value =0.02). The total aberration coefficient (ABR) for the corneal front surface, increased from a mean value of 1.16±0.66μ μ preoperatively to a mean value of 1.84±0.47 postoperatively denoting a statistically significant increase (P-value =0.00). A non significant correlation (P=0.05) existed between postoperative change in the coma, trefoil and total aberration coefficients of front corneal surface and the postoperative change in the spherical equivalent, and mean
The corneal asphericity (Q value) for the corneal front surface, increased from a mean value of -0.27±0.15 preoperatively to a mean value of 0.96±0.59 (range -0.01 to 3.13) postoperatively denoting a statistically significant difference (P-value = 0.00). A highly significant correlation (P≤0.01) existed between postoperative change in corneal asphericity (Q value) of front corneal surface and the postoperative change in the spherical equivalent. And a statistically significant correlation (P<0.05) existed between postoperative change in corneal asphericity (Q value) of front corneal surface and the postoperative change in the mean keratometry. The studied items were not affected by age sex of patients.

Conclusions:

A statistically significant increase occurred in the spherical, coma, trefoil, total aberration coefficients as well as in the corneal asphericity (Q-value) following optimized LASIK ablation for moderate to high myopia. The postoperative change in the spherical aberration coefficient and corneal asphericity was statistically correlated with the the postoperative change in the spherical equivalent (i.e amount of refractive correction), and mean keratometric readings. Age and sex had no effect on the studied criteria.

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