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Comparative study between LASIK procedures using ultra-thin Moria sub-Bowman keratomileusis (SBK) 90, Moria M2 90 microkeratomes, and femto-LASIK regarding dryness of the eyes

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Abstract

Introduction: The most popular form of refractive surgery for the treatment of myopia is laser-assisted in situ keratomileusis (LASIK), excessive nearsightedness and/or irregularly shaped pupils. The visual outcome of the entire LASIK process depends on the initial step of the procedure, the formation of a corneal flap. After the flap has been produced, the underlying stroma is ablated using an excimer laser, and the flap is relocated. When it comes to creating a tiny flap, there are three options: either the ultra-thin Moria SBK 90, the classic thin Moria M2 90 microkeratome, or femto-LASIK.

Aim of the study: To examine how the eye-dryness levels might change over time in the three groups.

Subjects and Methods: The study represents a comparative study." "Patients are separated into three groups." In group A, the mechanical microkeratome ultra-thin Moria SBK 90 was used to create the flap with superior hinge, the suction ring chosen based on the corneal curvature nomogram, the used blade was intended to produce 90 m flap, the same blade for both eyes starting with the right eye, the flap was lifted, excimer laser ablation was done by ALLEGRETTO Wavelight EX500.

Results: There was no statistically significant difference between the three groups in the ocular dryness of the eyes.

Conclusion: Different LASIK procedures didn't have direct impact on the ocular dryness of eyes.

Keywords: LASIK procedures; Sub-Bowman keratomileusis; Dryness of the eyes.

1. Introduction

The most popular method of refractive surgery for the correction of myopia, hyperopia, and astigmatism is laser-assisted in situ keratomileusis (LASIK) [1]. The visual outcome of the entire LASIK surgery is dependent on the initial step of the procedure, the formation of a corneal flap. Initially, a flap is created, then the exposed stroma is ablated using an excimer laser, and finally, the flap is repositioned [2]. There are three techniques for creating a narrow flap. The traditional one is using a Moria M2 microkeratome with a 90-mm head; the second method is using a Moria Plus. microkeratome with sub-bowman keratomileusis. Most recently, femtosecond lasers have been developed, which utilize ultrafast pulses of energy to induce photodisruption of tissue at a predetermined depth with minimal collateral tissue damage and inflammation [3]. The M2 microkeratome is a mechanical, automated, rotative, and 360° hinge-position microkeratome with disposable heads [4]. A corneal flap of approximately 8.5–9.0 mm in diameter is created using a 90-mm head to establish a superior hinge [5]. With a variant of LASIK known as Sub-Bowman Keratomileusis (SBK), the corneal flap is made even smaller than in standard LASIK. The corneal flap created by the Moria-Plus SBK microkeratome has a diameter of 8.5-9 mm and a nasal hinge. Using this tool, one can try to achieve a central flap thickness of 110 m while using a 90 m-head calibration [6].

The current study aimed to compare the impact of the above-mentioned techniques on ocular dryness.

2. Subjects and methods

2.1. Subjects

The study included 30 patients, who were recruited between July, 2016 and July, 2019. All procedures were done at ELOYON ELDAWLY hospital, Cairo, Egypt. They were divided into three groups according to the LASIK procedures to be applied:

Group A (10 eyes): patients who would get ultra-thin Moria SBK 90.

Group B (10 eyes): patients who would receive a classic thin Moria M2 90 microkeratome.

Group C (10 eyes): patients who would obtain femto-LASIK.

Inclusion criteria

All patients were adults (ages >18 years), had refraction stability, suffered from myopia with spherical equivalent (more than 2 D and less than 10 D), and myopic astigmatism (less than 4 D). All recruited patients didn't experience any previous refractive surgery and had a manifest and best corrected distance acuity of 20/25 distant vision with optimal correction in both eyes.

Exclusion criteria

Patients with a thin cornea (less than 500 microns by Pentacam), an ecstatic cornea (e.g., keratconus and related disorders), glaucoma, pregnancy, autoimmune and systemic collagen disease (e.g., rheumatoid arthritis and SLE), signs of previous viral keratitis, or post-segment gross pathology were excluded from the study.

2.2. Methods

All eyes were targeted for emmetropia and topical anesthesia. Benoxinate hydrochloride 0.4% was instilled before surgery. In group A, the mechanical mirokeratome ultra-thin Moria SBK 90 was used to create the flap with superior hinge, the suction ring was selected in accordance with the nomogram dependent on the corneal curvature, the used blade was intended to produce a 90-m flap, starting with the right eye, use the same blade for both eyes, and the flap was lifted; and excimer laser ablation was done by Allegretto Wavelight ® EX500 (Alcon Laboratories Inc., TX, USA). In group B, the mechanical mirokeratome Moria M2 (Moria Inc., Antony, France) was utilized to generate a flap with a superior hinge; the suction ring was chosen using a nomogram relying on corneal curvature; and the blade employed was designed to produce a 110-m flap with an identical blade for both eyes. Beginning with the right eye, the flap was lifted, and the Allegretto Wave Light EX500 excimer laser (Alcon Laboratories Inc., Fort Worth, TX, USA) was used for the ablation. In group C, the Intralase femtosecond laser (IntraLase TM FS200) (Abott Medical Optics Inc., CA, United States) was used for flap creation.

The flap diameter, according to the nomogram, was 120 side cut angle, 45 hinge angle, superior hinge position, laser raster pattern, spot/line separation of 12/10, stromal energy of 1.8 microjoules, and side cut energy of 2.4 microjoules. Medical Optics Inc., Santa Ana, CA) was applied to the cornea, which is cleaved in a circular pattern by the laser, beginning at one end and moving to the other. When the first horizontal cleavage plane has been established, the pattern switches to a vertical orientation, traveling through the basement membrane and the epithelium, and finally generating a flap edge at a user-defined angle via a radial pattern of shorter pulses. While the software decides on the flap's final dimensions (diameter, thickness, angle of side cut, hinge size, position, and energy parameters), the bed must be at least 300 microns thick before the process can begin. All groups had their corneal flaps adjusted with a balanced saline solution rinse.

2.3. Statistical Analysis

The information was analyzed using SPSS for the Social Sciences, version 20.0. The statistical distribution was characterized by means and standard deviations (SD). Quantitative information was shown as percentages and frequencies. ANOVA was used to compare more than two means; the paired sample t-test of significance was used to compare samples that were related; and the Chi-square (x2) significance test was used to evaluate proportions among qualitative components. The confidence interval was set to 95%, while the allowable margin of error was set at 5%. Hence, the *P-value* <0.05 was considered significant.

3. Results

The tear film breakup time test (TBUTT) didn't reveal any statistically significant differences among groups (*P > 0.05*). Two minutes after touching the inferior temporal bulbar conjunctiva with a sodium fluorescein strip, tear breakup time was determined by examining the pre-corneal tear film under a slit lamp with a cobalt-blue light after all subjects were asked to blink. In addition, the number of seconds between the previous blink and the appearance of the first breakup area was recorded. Three independent measurements were collected for each eye (+8.0 sec., ++6.8 sec., +++4.6 sec.), and the results were averaged.

Preoperatively, TBUTT was (+) (80.0% within the femto-LASIK group, 80.0% within the MORIA group, and 100.0% within the SBK group), and TBUTT was normal >10 sec (20.0% within the femto-LASIK group, 20.0% in the Morea group, and 0.0% within the SBK group) (*P = 0.315*). At one-month post-operatively, TBUTT was + (20.0% within the femto-LASIK group, 20.0% within the MORIA group, and 0.0% within the SBK group), ++ (50.0% within the femto-LASIK group, 60.0% within the MORIA group, and 90.0% within the SBK group), and +++ (30.0% within the femto-LASIK group, 20.0% within the MORIA group, and 10.0% within the SBK group) (*P = 0.367*).

At three months postoperatively, TBUTT was + (20.0% within the femto-LASIK group, 30.0% within the MORIA group, and 30.0% within the SBK group), ++ (60.0% within the femto-LASIK group, 50.0% within the MORIA group, and 50.0% within the SBK group), and +++ (20.0% within the femto-LASIK group, 20.0% within the MORIA group, and 20.0% within the SBK group) (*P =0.984*) (Table 1).

Table 1: The tear film break uptime test (TBUTT) used to compare the groups.

Variables	Femto-Lasik *(n=10)*	MOREA *(n=10)*	SBK *(n=10)*	ANOVA	*P-value*
Preoperative					
+	8 (80.0%)	8 (80.0%)	10 (100.0%)	2.308	0.315
0	2 (20.0%)	2 (20.0%)	0 (0%)		
After one month					
+	2 (20.0%)	2 (20.0%)	0 (0.0%)	4.300	0.367
++	5 (50.0%)	6 (60.0%)	9 (90.0%)		
+++	3 (30.0%)	2 (20.0%)	1 (10.0%)		
After three months					
+	2 (20.0%)	3 (30.0%)	3 (30.0%)	0.375	0.984
++	6 (60.0%)	5 (50.0%)	5 (50.0%)		
+++	2 (20.0%)	2 (20.0%)	2 (20.0%)		

4. Discussion

In our investigation, TBUTT was used to determine dryness two minutes after a sodium fluorescein strip was applied to the inferotemporal bulbar conjunctiva. Patients were asked to blink while a cobalt blue slit lamp light was focused on their eyes to assess the precorneal tear film. In addition, the number of seconds between the previous blink and the appearance of the first breakup area was recorded. A preoperative tear film break-up time test showed clearly noticeable differences between groups when three separate values were recorded for each eye (+8.0 sec., ++6.8 sec., +++4.6 sec.) and averaged. Statistics showed that the SBK group improved their tear film breakup time over the Morea and femto-LASIK groups over time.

Ocular surface discoloration and reduced CS were two of the dry eye symptoms all three groups experienced after LASIK surgery. In our research, we observed that using the femto-LASIK group during surgery led to a greater TBUTT in the postoperative period. Further controlled trials are needed to determine if femto-LASIK group reduces post-LASIK dry eye and to learn the underlying causes [7]. That agreed with the findings of Salomão et al., 2010, who showed that the conjunctival staining scores six months after surgery were significantly lower in the femto-LASIK group than they had been before surgery, suggesting that the length of suction time played a role in the degree of damage to goblet cells [8]. In order to confirm the impact of additional elements, such as suction ring materials, on the damage to conjunctiva goblet cells and dry eye parameters, more research is needed [9].

Flap thickness is another potential cause of post-LASIK dry eye, but the evidence is inconclusive. More residual stromal bed thickness, decreased tissue volume for nerve regeneration, and quicker recovery from CS and dry eye symptoms after LASIK are all possible outcomes of thinner corneal flaps. Several studies also confirmed that TUBTT in femtosecond-treated eyes was higher than in microkeratome treated eyes [10–13].

In conclusion, the study showed no difference in degree of dryness.

Ethical Approval Statement: Institutional Ethics Committee approval was granted for the project from Kasralainy Faculty of Medicine, Cairo University, Giza, Egypt.

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