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ORIGINAL PAPER

Corneal Astigmatism After Micro-incision Cataract Operation

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Goals: To evaluate the effect of micro-incision (2.2 mm) and small-incision (3.0 mm) coaxial phaco-emulsification on surgically induced astigmatism (SIA). **Methods:** Cataract patients (n = 60, 60 eyes) were randomized into two groups: 30 eyes in the 2.2-mm incision group, 30 eyes in the 3,0-mm group. Phaco-emulsification was followed by intraocular lens implantation via the Monarch II injector with the C cartridge (Alcon Laboratories Inc., Fort Worth, TX, USA). Uncorrected distance visual acuity, corneal keratometry and corneal astigmatism and SIA were assessed 1, 7 and 30 days after cataract surgery. **Results:** At 1, 7 and 30 days postoperative, SIA of the 3.0-mm group was greater than SIA of the 2.2-mm ($p < or = 0.05$) only at first postoperative day, but SIA was similar between the 2.2-mm group and the 3,0-mm group at other follow-ups. Time wise, mean SIA at 30 days was greater than SIA at 90 days in the 3.0-mm group ($p = 0.04$), while SIA did less change with time for the 2.2-mm group. Postoperative uncorrected distance visual acuity tended to be better with the smaller incisions, but this trend did not reach statistical significance ($p > or = 0.07$) especially at letter follow-ups. **Conclusion:** Incision size contributed to postoperative corneal astigmatism especially at earlier postoperative period. When incision size was reduced from 3.0 mm to 2.2 mm, SIA was reduced and refractive stabilization was faster. In longer period of time difference between 3,0 mm and 2,2 mm incision size groups decreases. **Key words: cataract, microincision phaco, surgically induced astigmatism.**

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1. INTRODUCTION

Operations that create preconditions for IOL(intraocular lens) implantation in the capsular bag, such as extracapsular cataract extraction (ECCE) and phacoemulsification (PE) develop in second half of 20th century. Phacoemulsification as surgical method with small incision described American ophthalmologist Charles Kelman 1960. This method, due to its low invasiveness (operative corneal incision about 3 mm) allows quick postoperative recovery, with minimal induced astigmatism which proved to be particularly important in refractive eye surgery. Recently developed new techniques that allows you to reduce surgically induced astigmatism named MICS micro incision coaxial surgery, Incision is smaller than 3 mm, and has its two variants: coaxial and biaxial, depending on whether there are one or two incisions on cornea. In 2001. Jorge Alio introduced new concept of microincision phaco cataract surgery through corneal incision of 1.8 mm. In modern ophthalmology and modern cataract surgery standard surgery is with corneal incision of 3.0 mm. Cataract surgery under 3.00 mm was given name microincision cataract surgery. Recent studies shows that this method is safe and reliable for ophthalmologists throughout the world, but the same studies suggest that cataract surgery with an incision of 3.0 mm postoperatively induced somewhere around 0.5D of astigmatism. Present lower limit of cornealincision, which allows a successful cataract surgery with IOL implantation is 1.0 mm with expansion to 1.6 mm for implantation of the IOL's. (1, 2, 3, 4,)

The aim of this study was to compare two modifications of a cornea incision in the cataract surgery using phacoemulsification with implantation of intraocular lenses. The study was conducted at the Clinic for eye diseases, University Clinical Centre Tuzla, in the period from July 2009 to April 2010. Subjects were divided into two groups of 30 patients (eyes), 60 in total. One group consisted patients that undergone phacoemulsification cataract surgery with implantation of an intraocular lens throw cornea incision with a 3.0 mm incision, and the other patients with the same surgery with an incision on the cornea of 2.2 mm.

In all patients undergone ophthalmologic examination, preoperative preparation, surgery and postoperative follow-up to the already anticipated protocol, which was the same for both examined groups.

Documenting the value of measuring astigmatism and topographic projection of the strongest and weakest meridian on the cornea worked on the day of the surgery, the day after surgery, after 7 days and 30 days after surgery.

2. GOALS

Aim of this study was to determine the value of postoperative astigmatism in cataract surgery with different corneal incision. The study compared two subtypes of the operation, where one group has corneal incision of 3.0 mm in the second group corneal incision was 2.2 mm, and whether size of incision induced significant difference in corneal, surgical and postoperative astigmatism in short postoperative period after cataract surgery. Beside this aim of study was to determine visual acuity after phacoemulsification of cataract with different corneal incision sizes, so as keratometric values after cataract operation.

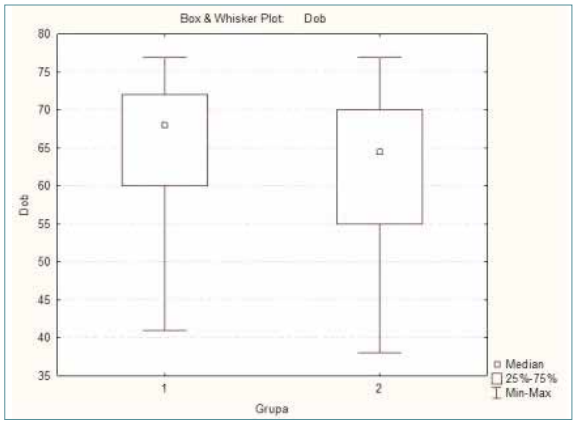

Figure 1. Mean age of participians by groups

3. METHODS

This study was a prospective, randomized, parallel study of the effectiveness of operational methods and it included patients planned for cataract surgery and those who meet the criteria for inclusion in the study. Subjects were divided into two groups of 30 patients (eyes), 60th in total.

One group consisted of subjects involving phacoemulsification cataract surgery with implantation of intraocular lens with the corneal incision 3.0 mm, and the other patients with the same surgery with corneal incision 2.2 mm. All subjects were operated on the technique of Phaco cataract surgery by an experienced surgeon, on Infinity phaco-unit pharmaceutical company Alcon.

Operations were done with Zeiss surgery microscope OPMI 150. All subjects were operated on under local, peribulbar anesthesia. Testing was done according to pre-planned program, with the history of the disease using a questionnaire containing: general information about participants, data relevant to cataracts identification, the choice of surgical method, the method of preoperative preparation, the values of corneal curvature, ie the numerical values of strength in diopters of astigmatism, topographic projection astigmatic meridian on the cornea, and the answers to the subjective perceptions of participants, and the satisfaction obtained by the quality of vision after surgery.

Documenting the value of measured astigmatism and topographic projection of the strongest and weakest meridian on the cornea was on day of the surgery, day after surgery, after 7 days and 30 days after surgery.

Statistical analysis

To analyze the results was used standard SPSS version 10.0, as well as standard methods of parametric statistics. To test statistically significant differences between groups in the test sample were applied parametric and nonparametric tests (standard error, standard deviation, coefficient of linear correlation), c 2 test and t-test.

The statistical hypotheses were tested at the level of a = 0.05, ie the difference between groups in the sample was considered significant if P <0.05.

4. RESULTS

This study included patients from every-day operational program cataract surgery at the Eye clinic of University Clinical Center Tuzla in the period from October 2009 to December 2009. The group I of participants which underwent cataract phacoemulsification surgery with 3.0 mm ("Clear cornea incision" "CCI"), and a group II , in whom was performed the same surgery with a 2.2 mm incision, consisted thirty (30) patients.

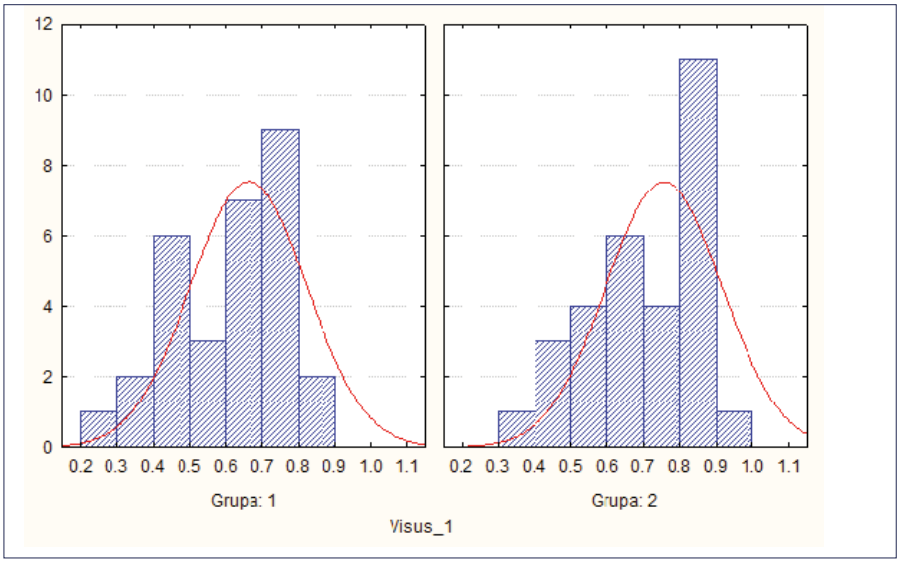

Figure 2. Astigmatism value before operation

Average age (± SD) in group I was 65.13 ± 9.59 years, while in group II was 62.06 ± 10.04 years. This difference between the two groups was not statistically significant (p = 0.240). Graphical representation of these differences is given in Figure 1.

In group I there was 15/30 (50%) of patients with surgery on his right eye and 15/30 (50%) of patients with surgery on his left eye. In group II there was 14/30 (46.7%) patients who were operating right eye and 16/30 (53.3%) patients who were operating left eye. In comparing this difference between the two groups using c 2-test, there is not a significant difference ((c 2 = 0.066741, p = 0.7961).

Mean preoperative visual acuity (BCVA) for group I was 0.1200 ± 0.0414. In group II mean preoperative visual acuity was 0.1123 ± 0.0374. There was no statistically significant difference in preoperative values acuity compar-

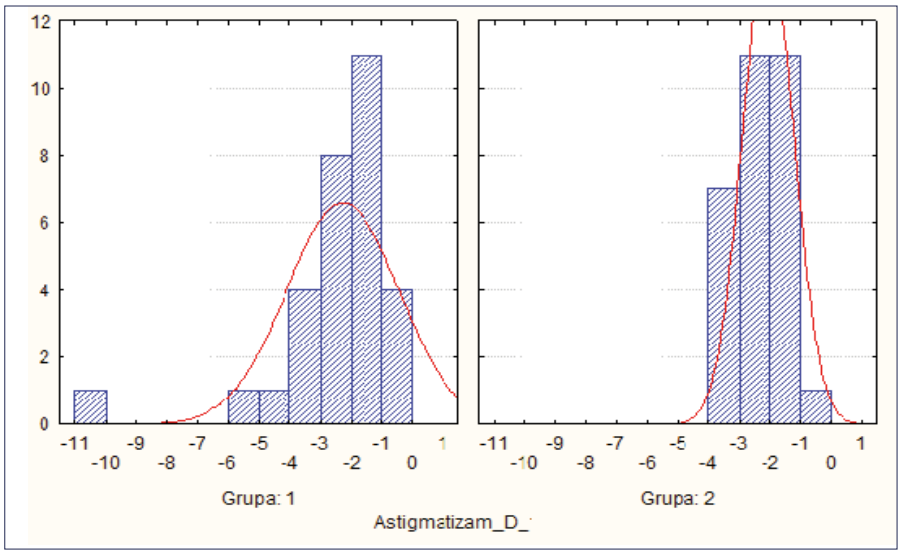

Figure 3. Postoperative astigmatism value one day after surgery

ing two groups.

On the first postoperative day after surgery mean uncorrected visual acuity in group I was 0.66 ± 0.0593 in group II was 0.75 ± 0.0594. Comparing the mean uncorrected visual acuity in both groups, day after surgery it is observed statistically significant difference p = 0.026737 (P> 0.05).

There was no significant statistical difference between the average values of visual acuity between these two groups on seventh and thirtieth day after the operation.

Analyzing mean values of astigmatism in both groups we calculated average value of preoperative astigmatism in group I, so it was M = 0.5667 and standard deviation SD ± 0.581 D, while in group II average value of preoperative astigmatism was M = 0.65 and standard deviation ± SD 0.1581 D. With parametric analytical analysis values of preoperative astigmatism in both groups of patients we found no statistically significant differences between groups (t = 0.86543, P> 0.05 = 0.114501) and that the groups are homogeneous regarding preoperative astigmatism values.

Analysis mean values of astigmatism at first postoperative follow-up in both groups we came to average of postoperative astigmatism one day after surgery, in group I it was M = 2.3167 with standard deviation of 1.81461 ± SD D, while in group II it was M = 2.1083 with standard deviation SD ± 0.82180 D. Using analytical parametric analysis values of postoperative astigmatism day after surgery in both groups of patients we founded a statistically significant difference between groups (t = 0.86543, P> 12:05 = 0.000054).

Seven and thirty days after surgery there was no statistically significant difference between groups comparing mean astigmatism values.

	Grupa 1	Grupa 2
SIA 1 day after the surgery		
M-mean	1.87	2.18
SD-standard deviation	1.055	0.908
Max value	4.65	3.80
Min value	0.00	0.45
SIA 7 days after the surgery		
M-mean	1.36	1.36
SD-standard deviation	0.895	0.778
Max value	3.81	3.47
Min value	0.00	0.00
SIA 30 ays after the surgery		
M-mean	0.85	0.85
SD-standard deviation	0.722	0.63
Max value	2.90	2.30
Min value	0.00	0.00

Table1. Surgical induced astigmatism

5. DISCUSION

Ophthalmic surgeries are in the first place by number in the United States compared with other surgical procedures. In the whole range ophthalmic cataract surgery is the most represented among persons older than 65 years. (5, 6, 7).

Phacoemulsification as new cataract surgery method allows earlier operation in earlier stage of lens opacification, what leads to selection of younger patients for surgery (8, 9, 10). Last few years cataract surgery has evolved from a relatively complicated procedure that requires several days of hospitalization, up to today's so-called one-day surgery when patients are operated by phacoemulsification (8). In our study average age in group 1 was 65.13 ± 9.59 years in group 2 was 62.06 ± 10.40 years.

Looking at changes in average values of postoperative visual acuity day after surgery it is observed statistically significant differences between groups of patients, the mean uncorrected visual acuity in group I was 0.66 ± 0.15, while in group II it was 0.75 ± 0.15 Comparing these two values we come to the conclusion that visual acuity in the group II (a corneal incision of 2.2 mm) was faster established one day after surgery. Changes in the mean uncorrected visual acuity 7 and 30 days following surgery show that mean visual acuity were very similar and there were not statistically significant differences between groups.

Analyzing mean preoperative astigmatism it was found that by this criterion there is no statistically significant difference, ie that groups are homogeneous according to preoperative astigmatism. In the group with a 3.0 mm incision mean preoperative astigmatism was 0.56 D ± 0.31 D in the group with a corneal incision of 2.2 mm mean preoperative astigmatism was 0.65 D ± 0.42 D. Statistical analysis of these parameters led to that there was no significant statistical difference, ie (t = 0.865, P> 0.05 P = 0.1145). Comparing this data with the study of Hoffmann and colleagues shows that preoperative astigmatism is slightly lower in our study, which can be explained with number participants in our study, incomparably fewer participants than in study of Hoffmann and colleagues (11) .

Comparing mean value of postoperative astigmatism day after surgery there was significant differences between the two groups. In addition to this it was found a large value of standard deviation in the group with a 3.0

mm incision (± 1.81 D), which explains that the size of the incision in the cornea leads to great instability in all parameters of corneal curvature and thus the astigmatism in the early postoperative period. Mean astigmatism day after surgery in group I was 2.31 D, while in group II 2.10 D, with plenty of lesser values the standard deviation of (± 0.82 D). All this shows that the values of postoperative astigmatism in patients with an incision of 2.2 mm are less distinct and that are grouped around a mean value, ie that same value in patients with an incision of 3.0 mm and has an irregular schedule of astigmatism (12). Through the next period of time there is a convergence value of postoperative astigmatism in both groups of participants, so there is no statistically significant difference. The values of astigmatism 30 days after cataract surgery have become almost identical, ie, the mean astigmatism in patients in group I was M = 1.01 D ± 0.49 D 30 days after the operation, while in Group II M = 1.05 D ± 0.57 D. There is an obvious tendency that values of astigmatism in the course of time returned to initial values, ie, preoperative. In studies by other authors their period of study is much longer and their data show that astigmatism values closest to the initial return in the period from 3 months to one year after surgery. Study Holloday and associates stated that the smallest change in refraction after cataract surgery occur 60-365 days after surgery (13).

Study of Kocabera and associates from 2010 compared values of surgically induced astigmatism (SIA) in cataract surgery with 2.4 mm and 3.0 mm incision. (14, 15, 16). Their study founds differences only in value of SIA day after surgery. Barraquer and associates compared in his study standard "conventional" phaco microincision with coaxial phaco, and their results do not speak in favor microincision Phaco, but only that it is a good and safe alternative to conventional phaco.(17) Ernest and associates 1994 show a series of studies that have provided answers to the most important factors affecting the healing cornea incision: Geometry-cut, regular cut provides better stability, regardless of location -Tissue properties; elastin provides tissue retraction to original position

Histology, fibroblasts accelerate the wound healing (18, 19, 20).

6. CONCLUSION

Our results do not differ greatly from the results of similar studies in the world, and shows good introduction of this surgical technique in everyday practice.

Postoperative visual acuity day after surgery, established faster among patients undergoing cataract surgery with a small corneal incision, in the course of further check-ups there is no difference in uncorrected visual acuity.

In terms of postoperative astigmatism, difference appears only in the control examination day after surgery and to the benefit smaller corneal incision.

Microincision "Phaco" is a safe surgical technique, which can be applied in non-complicated cataracts, in those patients where not expected intraoperative complications. This method provides excellent results in those patients in which the general state and local status of the eye allow this surgical technique.

Conflict of interest: none declared.

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