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COMPARATIVE EVALUATION OF SURGICALLY INDUCED ASTIGMATISM FOLLOWING BLUMENTHAL VERSUS FROWN CORNEOSCLERAL TUNNEL INCISION IN MSICS (MANUAL SMALL INCISION CATARACT SURGERY)

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ABSTRACT

Background: The goal of cataract surgery is to provide clear eyesight and early visual recovery. In addition to being safe, less reliant on technology, sutureless, short-duration, cost-effective, stable, consistent, and successful in restoring vision, MSICS has the benefit of being able to treat all types of cataracts.

Aim: The purpose of this study was to compare the astigmatism that was surgically inflicted after Frown versus Blumenthal corneoscleral tunnel incisions in MSICS.

Methods: 88 participants of both sexes were included in the study and were split into two groups of 44 participants each using odd and even numbers. Group A participants underwent MSICS with a Frown Corneoscleral incision, while Group B participants underwent an MSICS with a Blumenthal Corneoscleral incision. Every participant underwent follow-up at one day, one, four, and six weeks following surgery, at which time they underwent fundoscopy, keratometry, and other assessments.

Results: With mean best-corrected values of 0.630±0.210 and 0.691±0.229, respectively, Group B (Frown incision) had greater visual acuity than Group A (Blumenthal incision). Nevertheless, at p=0.199, this difference was statistically not significant. Preoperative mean visual acuity for Group A and B was 0.123±0.136 and 0.191±0.408, respectively, and was statistically not significant between the two groups (p=0.297). The difference in visual acuity between the two groups on postoperative day 1, first week, third week, and sixth week was statistically non-significant, with corresponding p-values of 0.402, 0.387, 0.227, and 0.087.

The current study reveals that postoperatively, both Frown and Blumenthal corneoscleral incisions in MSICS result in the best-corrected visual acuity and the least amount of astigmatism. There is no statistically significant difference in surgically produced astigmatism between the two research groups. Therefore, both incisions can be utilised to treat cataracts; however, the Blumenthal incision works better than the Frown incision for large nuclei and hard cataracts.

Keywords: medically induced astigmatism, manual tiny incision cataract surgery, Frown incision, Blumenthal incision

INTRODUCTION

According to the World Health Organisation (WHO), cataracts are the most prevalent cause of treatable blindness worldwide, with an incidence of over 48%. Only 5 million cataract procedures are performed in India annually, despite the fact that about 51% of blindness in the country is caused by cataracts, which cause 4 million blind people annually and 10 million operable cases. Mass cataract surgery can significantly lower the incidence of blindness. Extracapsular surgery was once used to treat cataracts, however the procedure increased astigmatism. Due to its high

cost, phacoemulsification is another technique for cataract surgery that is not used in impoverished nations. Due to the high incidence of cataracts, camps are typically used as a form of treatment.

The preferred therapy for cataracts is MSICS (manual small incision cataract surgery), as phacoemulsification is neither feasible or affordable for campers.1

The goal of cataract surgery is to provide clear eyesight and early visual recovery. In addition to being safe, less reliant on technology, sutureless, short-duration, cost-effective, stable, consistent, and successful in restoring vision, MSICS has the benefit of being able to treat all types of cataracts. However, compared to phacoemulsification, MSICS has a few drawbacks, including a wider incision and higher medically produced astigmatism. Wound construction, age, pre-existing astigmatism, incision design, place, and size are the characteristics that influence medically caused astigmatism.2. Wound design depending on endothelium state, astigmatism, nucleus hardness, and method type plays a major role in MSICS. A different incision location helps balance out pre-existing astigmatism. Due to the fact that incisions placed temporally, which are parallel to the force vector, balance the force created by superiorly placed incisions resulting from drag from gravity and eyelid blinking.3

Various incisions related to cataract surgery are being explained. Reduction of medically produced astigmatism can be accomplished by temporally neutralising astigmatism or by making an incision on the steep meridian axis, which balances pre-existing astigmatism.4 According to Singer's frown incision technique, a 6-7 mm incision made around 1.5 mm away from the corneal limbus helps reduce wound sliding against its drift in astigmatism. This increases surface area, reduces postoperative astigmatism, and improves wound stability.

Another Blumenthal incision increases tunnel space for the nucleus to be delivered more easily by using a straight incision with cuts at both ends.5 In order to compare astigmatism caused surgically after Frown versus Blumenthal corneoscleral tunnel incisions in MSICS, the current investigation was carried out.

MATERIALS AND METHODS

After receiving approval from the relevant ethical council, the current prospective, randomised comparative study was carried out at the People's Hospital, Department of Ophthalmology, Peoples College of Medical Science, and research centre Bhanpur, and Bhopal (M.P.). In the study, 88 participants of both sexes were split into two groups of 44 participants each using odd and even numbers. Group A participants had MSICS with a Frown Corneoscleral incision, while Group B participants had a Blumenthal Corneoscleral incision.

Each individual gave their verbal and written informed permission after being fully told about the study's design. Subjects with bilateral or unilateral simple senile cataracts who were willing to participate in the study and who were at least 50 years old were the study's inclusion criteria. Subjects having a history of prior ocular surgery, such as pterygium excision, squint, glaucoma surgery, or scleral tear repair, were excluded. Astigmatism, pterygium, corneal disease, and complex, traumatic, or glaucomatous cataract were excluded preoperatively. Following the research subjects' final inclusion, demographic information such as age, gender, employment, and history of cataracts was collected along with a thorough history.

The purpose of the preoperative ocular examination was to evaluate conditions that might impact the result of vision. Best-corrected visual activity using Snellen's chart6, IOP (intraocular pressure), lacrimal patency, fundus examination, slit-lamp examination, lenticular opacity grading using LOCS III, corneal curvature, and IOL (intraocular) length power were the tests that were performed.

Following standard blood and biochemical testing, patients were evaluated for cataract type, corneoscleral incision type, incision length, and pre-existing astigmatism before being scheduled for MSICS and IOL installation. To lower preoperative IOP, all individuals received two stat doses of 250 mg Diamox in addition to a topical antibiotic eye drop every three days before to surgery. In order to prevent intraoperative miosis, appropriate mydriasis was established prior to surgery using tropicamide 0.5% ± phynilephrine 5% and flurbiprofen 0.03% eye drops every 15 minutes for an hour.

A single, very skilled surgeon carried out every operation in the group. Under peribulbar anaesthesia (5-8 cm), the procedure was carried out according to conventional surgical procedures using lignocaine 2%, bupivacain 0.5%, and hyaluronidase 5 IU/ml. Following eye preparation, a superior rectus bridle suture was inserted, speculum was used, and a fornix-based conjunctival flap was created. For cataract, a superior tunnel corneal incision was made. This involved filling the cavity with a balanced salt solution, managing the nucleus, managing hydro dissection and hydro delineation, filling the external scleral incision with either the Blumenthal7/frown8 corneoscleral incision or the sclero-corneal tunnel, side-port entry, anterior capsulotomy, and non-foldable PMMA IOL. After that, the superior

rectus suture was taken out. Dexamethasone and Gentamycin were injected subconjunctivally, and the eye was patched following the application of antibiotic ointment.

Following surgery, each individual in both groups received 200 mg of ofloxacin for five days and 3 days of diclofenac. For 72 hours, 1% topical Prednisolone acetate was applied every two hours. The dose was then tapered over the course of six weeks. 0.5% moxifloxacin was administered for 15 days throughout the first 15 days.

Additionally administered for six weeks were homatropine 0.5%, flurbiprofen TDS, and eye ointment chlorocol-H HS. All individuals were followed up with at least one day, one, four, and six weeks following surgery, and assessments using keratometry, fundoscopy, slit-lamp biomicroscopy, and vision were performed. Complications during and after surgery were also recorded. On the forty-fifth day, the refraction was assessed, and glasses were recommended. By deducting the strength of astigmatism prior to Apreop from that following surgery, Bpostop, the amount of surgically induced astigmatism (SIA) was determined.

After straight and frown sclera incision cataract surgery, the postoperative change in corneal curvature was used to calculate the perioperative grade of astigmatism (SIAsubtraction = Bpostop _ Apreop).9 Chicago Inc., USA's SPSS version 20 was used to statistically evaluate the gathered data. The data were presented as a mean, standard deviation, percentage, and number. At $p<0.05$, the significance threshold was maintained. Chi-square, student t-test, ANOVA, Spearman's correlation, and Turkey post-hoc analysis were the tests that were employed.

RESULTS

The study sample consisted primarily of individuals aged 50-90, with a mean age of 64.49±9.98 years. In this study, 42 females and 46 males participated. When comparing groups A and B's mean visual acuity before and after surgery at various time intervals, the results showed that there was no statistically significant difference in the two groups' preoperative values, which were 0.191±0.408 and 0.123±0.136 for Group A and B, respectively (p=0.297). Table 1 displays the statistical non-significant differences in visual acuity between the two groups on postoperative day 1, first week, third week, and sixth week, with corresponding p-values of 0.402, 0.387, 0.227, and 0.087 at various time intervals.

With values of 0.630±0.210 and 0.691±0.229, respectively, the mean best-corrected visual acuity was greater in Group B (Frown incision) than in Group A (Blumenthal incision). Nevertheless, Table 2 indicates that this difference was statistically non-significant at p=0.199.

Grade I astigmatism was found in both groups (A and B) for the assessment of astigmatism grades pre and post-operatively at different time intervals, whereas grade V astigmatism was found in the fewest number of patients. There was no statistically significant difference between group A and B at any time period following the procedure; only a preoperatively statistically significant difference existed (P=0.001). In Reference to Astigmatism Grade [i.r.t] (Table 3).

The group's mean astigmatism increased steadily until the third week, at which point it started to decline. However, no statistically significant changes (P=0.453) were discovered between the various time spans. In group B, it increased progressively until the third week, at which point it somewhat decreased. Table 4 indicates that there was a statistically significant difference (P=0.026) between the time periods.

The mean difference in astigmatism on Pre vs. Post 1st day, Pre vs. Post 1st week, Pre vs. Post 3rd day, Pre vs. Post 6th week, Post 1st day vs. Post 1st week, Post 1st week vs. Post 6th week, Post 1st week vs. Post 6th week, and Post 3rd week vs. Post 6th week, respectively, was 0.051, 0.040, 0.068, 0.119, 0.011, 0.017, 0.170, 0.028, 0.159, and 0.188 on Turkey's post hoc analysis. Table 5 displays the corresponding p-values as follows: 1.000, 1.000, 1.000, 1.000, 0.981, 1.000, 1.000, and 2.00.

DISCUSSION

It has been known for more than a century that astigmatism is impacted by the incision made during cataract surgery. Tejedor J et al. (2005) claimed that MSICS is less costly, less reliant on technology, safe, and successful in visual rehabilitation when compared to phacoemulsification. The earlier research by Haldipurkar SS et al.10 in 2009 compared the visual results and astigmatism from the Frown and Blumenthal incisions. In the current study, 88 patients with senile cataracts were evaluated. Frown and Blumenthal incisions both produced acceptable visual results and very little astigmatism. The current study shows that SIA increased over the first week before gradually decreasing.

In group A, the preoperative mean SIA was 0.789±0.488. It climbed to 0.840±0.788 in the first week and decreased to 0.670±0.580 in the sixth week. Comparably, the preoperative mean SIA in group B was 0.608 ± 0.506; it rose to

0.835 ± 0.690 in the first week and subsequently decreased to 0.840 ± 0.522 in the sixth week. However, there was no statistically significant difference between groups A and B in the all-time interval (p=0.151). These outcomes were in line with those of Fukuda S et al. (2011), who found that SIA is not a constant value but rather rises during the first postoperative period before falling over time.

The quantity of SIA may rise with stromal hydration, and this effect may last for one week following surgery. In the current study, at the sixth week, SIA was 0.840±0.522D in patients in group B and 0.670±0.580D in patients in group A; nevertheless, there was a statistically non-significant difference between the two groups (P=0.151).

These results were consistent with research by Jauhari et al. (2012), who found that after four weeks after surgery, the superior scleral frown incision group had a mean SIA of -0.96±0.71D. In MSICS with superior frown incision, Gokhale et al. (2005) reported mean astigmatism of 1.28 D at 29 degrees. Furthermore, after three months, the mean medically induced astigmatism was 1.09D in the group that had a straight scleral incision and 0.90D in the group that had a frown scleral incision, which was significantly smaller than in the straight group, according to Raimagiya et al.'s 2015 study.

The study findings also revealed that at the conclusion of the sixth week, the study magnitude of postoperative astigmatism was almost comparable in both groups, measuring 0.0-0.5D in 54.5% and 38.6% in the Frown and Blumenthal groups, respectively. This difference was statistically not significant (p= 0.258). In 2014, Jauhari et al. (12) discovered that the majority of patients (57.9%) in the group with frown incisions had induced astigmatism of less than 1 D.

These findings were from research conducted in 2008 by Randeri et al., who discovered that only 28.57% of patients had astigmatism caused by a central frown incision of less than 1 D, and that the majority of patients (42.55%) had SIA between 1.25-2 D.At the conclusion of three months, the largest number of patients in the straight group (raimagiya et al., 2015) exhibited 1.1-2.0 D of SIA, whereas the Frown group showed 0.6-1.0 D of SIA. By employing a superior incision, the high SIA in this study may aid to minimise substantial WTR astigmatism of > 2 D and neutralise any pre-existing 2D WTR astigmatism. Furthermore, preoperative corneal with the rule (WTR) astigmatism (around 2 D) can be decreased by superior incision, according to research published in 2011 by Radwan et al.

CONCLUSION

Within its limitations, the present study concludes that in MSICS, both Frown and Blumenthal corneoscleral incisions have minimal astigmatism and best-corrected visual acuity postoperatively. However, surgically induced astigmatism has a non-significant difference in the two study groups. Hence, both the incisions can be used for cataract management; however, the Blumenthal incision is better for big nuclei and hard cataracts compared to the Frown incision. The present study had a few limitations including a smaller sample size and short monitoring period. Universal acceptance is not associated with Blumenthal incision owing to its large incision. Also, ease of performing and learning frown incision is low, however, SIA has made its choice among ophthalmic surgeons.

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TABLES

Time interval	Group A (Blumenthal) (Mean ± S. D)	Group B (Frown) (Mean ± S. D)	Student 't' Test Value	p-value
Preoperatively	0.191±0.408	0.123±0.136	1.0488	0.297
Post Operatively 1st Day	0.250±0.135	0.270±0.130	0.843	0.402
Post-Operatively 1st week	0.372±0.152	0.400±0.151	0.869	0.387
Post Operatively 3rd Week	0.540±0.208	0.500±0.146	1.218	0.227
Post Operatively 6th Week	0.660±0.240	0.580±0.128	1.729	0.087

Table 1: Mean visual acuity pre and postoperatively at different time-interval among groups A and B

Mean BCVA	Best-corrected visual acuity (Mean ± S. D)	Student 't' Test Value	p-value
Group A (Blumenthal)	0.691±0.229	1.293	0.199
Group B (Frown)	0.630±0.210		

Table 2: Mean best-corrected visual acuity among groups A and B

Astigmatism	Preoperatively				
	Astigmatism and Grade				
	0.0-0.5 D	0.6-1.0 D	1.1=1.5 D	1.6-2.0 D	2.1-2.5 D
Group A (Blumenthal)	2(4.5%)	32(72.7%)	7(15.9%)	2(4.5%)	1(2.3%)
Group B (Frown)	29(65.9%)	10(22.7%)	2(4.5%)	3(6.8%)	0(0.0%)
Chi-square value	**39.018**				
	Postoperative Day 1				
Group A (Blumenthal)	20(45.5%)	11(25.0%)	5(11.4%)	6(13.6%)	2(4.5%)
Group B (Frown)	21(47.7%)	11(25.0%)	6(13.6%)	4(9.1%)	2(4.5%)
Chi-square value	**0.515**				
p-value	**0.972**				
	Postoperative 1st week				
Group A (Blumenthal)	25(56.8%)	7(15.9%)	4(9.1%)	5(11.4%)	3(6.8%)
Group B (Frown)	24(54.5%)	10(22.7%)	7(15.9%)	2(4.5%)	1(2.3%)
Chi-square value	**3.654**				
p-value	**0.455**				

	Postoperative 3rd week				
Group A (Blumenthal)	19(43.2%)	13(29.5%)	6(13.6%)	5(11.4%)	1(2.3%)
Group B (Frown)	14(31.8%)	16(36.4%)	8(18.2%)	4(9.1%)	2(4.5%)
Chi-square value	**1.798**				
p-value	**0.773**				
	Postoperative 6th week				
Group A (Blumenthal)	24(54.5%)	12(27.3%)	6(13.6%)	1(2.3%)	1(2.3%)
Group B (Frown)	17(38.6%)	14(31.8%)	8(18.2%)	5(11.4%)	0(0.0%)
Chi-square value	**5.301**				
p-value	**0.258**				

Table 3: Astigmatism grade pre and postoperatively at different time-interval among groups A and B

Astigmatism	**Group A (Blumenthal) (Mean ± S. D)**	**Group B (Frown) (Mean ± S. D)**
Preoperatively	0.789±0.488	0.608±0.506
Post Operatively 1st Day	0.840±0.788	0.835±0.690
Post-Operatively 1st week	0.829±0.865	0.681±0.613
Post Operatively 3rdWeek	0.858±0.647	0.960±0.662
Post Operatively 6thWeek	0.670±0.580	0.840±0.522
ANOVA F-value	0.850	3.249
p-value	0.453	**0.026**

Table 4: Mean Astigmatism pre and postoperatively at different time-interval among groups A and B

S. No	**Time Interval**	**Mean difference in Astigmatism**	**p-value**
1.	**Pre vs Post 1st day**	0.051	1.000
2.	**Pre vs Post 1st week**	0.040	1.000
3.	**Pre vs Post 3rd day**	0.068	1.000
4.	**Pre vs Post 6th week**	0.119	1.000
5.	**Post 1st day vs Post 1st week**	0.011	1.000
6.	**Post 1st day vs Post 3rd week**	0.017	1.000
7.	**Post 1st day vs Post 6th week**	0.170	0.981
8.	**Post 1st week vs Post 3rd week**	0.028	1.000
9.	**Post 1st week vs Post 6th week**	0.159	1.000
10	**Post 3rd week vs Post 6th week**	0.188	0.200

Table 5: Turkey's post hoc analysis for intergroup comparison among the group a subjects in relation to [I.R.T.] astigmatism