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Original Research Article

Comparative Study of Preoperative and Post Operative Astigmatism in Small Incision Non phaco Cataract Surgery from Superior and Temporal Incision and Phacosurgery

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Abstract

Aim: The aim of the present study was to evaluate the preoperative and post-operative astigmatism in small incision non-phaco cataract surgery from superior and temporal incision and phacosurgery.

Methods: The present study was conducted in the Department of Ophthalmology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for the period of one year. 150 patients were selected in the study. All the patients underwent manual small incision cataract surgery (MSICS), 50 with superior scleral incision, 50 with superotemporal incision and rest of the 50 with phacosurgery. All were evaluated and managed in the same hospital and they underwent post-operative follow up as outpatient in the same.

Results: A randomized comparative study of astigmatism at postoperative follow ups following superior (SI), superotemporal scleral incision (STI) and Phacosurgery in manual small incision cataract surgery in total 150 patients with 50 each with each incision. In the present study, it was found that 74% of the patients of both groups who underwent MSICS had visual acuity less than 6/60, whereas rest 26% had visual acuity more than 6/60. In this study, it is seen that 18(36%) patients who had WTR astigmatism underwent SI, 17 (34%) underwent STI and Phacosurgery 16 (32%), whereas 22 (44%) patients of those who had ATR astigmatism underwent SI, 46% underwent STI and 24 (48%) underwent Phacosurgery.

Conclusion: This study suggests that sutureless superotemporal scleral incision produces less post-operative astigmatism than superior scleral incision and phacosurgery. It was seen, that superotemporal incision causes with-the-rule astigmatism in most of the cases postoperatively along with a capability of neutralizing against-the-rule astigmatism which will be present in majority of elderly patients with cataract, whereas superior scleral incision causes against-the-rule astigmatism in the most.

Keywords: MSICS, Surgically Induced Astigmatism (SIA), Superior scleral incision, phacosurgery

Introduction

Modern cataract surgery currently aims at rapid visual rehabilitation and achieving the best- uncorrected visual acuity (UCVA) with minimal postoperative astigmatism. [1] Although the current surgical techniques allow for rapid visual

recovery, surgically induced astigmatism (SIA) remains a common obstacle to achieving an excellent UCVA. On average, the SIA following conventional manual small incision cataract surgery (SICS) ranges from 1.00 to 3.00 diopters (D) depending on the size of the incision. [2]

Miller [3] defined astigmatism as a condition of refraction in which a point of light cannot be made to produce a punctate image upon the retina by a correcting spherical lens. Surgically induced astigmatism (SIA) is an entity which is studied in detail in recent times. It is a vector quantity having magnitude as well as direction. [4] It is a type of astigmatism which is induced after surgery because of size, site, type of incision, and also placement of the lens.

Pre-existing astigmatism is present in over 60% of all patients scheduled for cataract surgery. [5] Girard and Hoffman were the first to call the posterior incision "scleral tunnel incision" and were the first to practice entry from a slightly corneal location. [6] Recent sutureless unlike ECCE, which required number of sclero-corneal stitches and self-sealing scleral tunnel small incisions have imparted not only self-sealability but also astigmatic neutrality. [7,8] Though, for any leaking incision, 10-0 nylon or vicryl suture can be used to give horizontal single suture. [9] In recent times, surgeons prefer to start the incision from the vascular region preferably on the sclera due to its stability and rapid healing. Choice of the incision site is made taking into consideration about the rapid healing of the wound and its potential to correct astigmatism. Along with the site, healing also varies on whether the conjunctival flap is fornix based or limbal based and presence of sutures. [10]

Superotemporal scleral incision (STI) in comparison to superior incision, gives greater access to the incisions, better visibility of intraocular structures, lesser endothelial damage due to location of the incision farthest from the visual axis, advantageous in terms of astigmatism since it induces with-the-rule astigmatism in most cases and it is very helpful for elderly patients developing cataract since they generally have against-the-rule (ATR) astigmatism pre-operatively and absence of postoperative ptosis by avoiding superior rectus bridle suture. [11] Intraoperatively, superotemporal incision gives greater access to the incision than working over the brow and natural drainage of the fluid due to the presence of lateral central angle just beneath the incision. Superotemporal incision also neutralizes the forces of gravity and eyelid drag on the incision unlike superior incision. Whereas superior scleral incision (SI) is advantageous in patients with with-the-rule (WTR) astigmatism present preoperatively. Wherever the incision is, scleral, corneal or anterior or posterior limbal, incision creates a tissue gape which causes flattening along the meridian of incision and steepening in the meridian 90 degree away. [12]

The aim of the present study was to evaluate the preoperative and post-operative astigmatism in small incision non-phaco cataract surgery from superior and temporal incision and phacosurgery.

Methods

The present study was conducted in the Department of Ophthalmology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for the period of one year. 150 patients were selected in the study. All the patients underwent manual small incision cataract surgery (MSICS), 50 with superior scleral incision, 50 with superotemporal incision and rest of the 50 with phacosurgery. All were evaluated and managed in the same hospital and they underwent post-operative follow up as outpatient in the same.

Inclusion criteria

1. Age related senile cataract.

2. No associated ocular disorders like previous ocular surgeries, history of trauma, glaucoma etc.
3. No associated systemic disorders.
4. Patients who were posted for manual small incision cataract surgery.

Exclusion criteria

1. Age below 40 and above 90 years.
2. Corneal surface irregularities.
3. Associated ocular disorders.
4. Combined surgical procedures at the time of surgery like trabeculectomy, pterygium excision.
5. Previous ocular surgeries.
6. With systemic connective tissue disorders.
7. Inability to give informed consent.
8. Congenital and developmental cataract.

Pre-operatively detailed history regarding ocular and systemic complains if any along with drug and family history were taken followed by general physical and systemic examination. Visual acuity was recorded for both distance and near, both unaided and aided (if applicable) along with detailed anterior segment examination under slit lamp biomicroscopy. Posterior segment was examined with both direct and indirect ophthalmoscopy along with intraocular pressure with Schiotz tonometer and lacrimal syringing before posting for surgery. Necessary investigations were done, physician fitness obtained and the patients were started on oral and topical antibiotics one day prior to surgery. Xylocaine test dose was given one day before surgery too.

All 100 cases underwent manual small incision cataract surgery with PCIOL implantation. Among them, 50 underwent MSICS with superior scleral incision whereas rest 50 with superotemporal scleral incision. Pre-operative mydriasis was achieved using tropicamide 0.5% and phenylephrine 5% eyedrops along with flurbiprofen 0.03% eyedrop. After preparing the eye for surgery, peribulbar anaesthesia was given. In half of the patients, a straight scleral incision of about 6.5 mm was placed 2 mm behind the limbus using 11 no. B.P. blade. Dissection of sclerocorneal tunnel was done by crescent blade upto 1 mm inside the cornea. Whereas, in remaining 50 patients, fornix based conjunctival lap was taken from 12 o'clock to 3 o'clock, following which 6.5 mm scleral straight incision was placed in the same region around 1-1.5 mm posterior to limbus and sideport was made 3 o'clock hours away from the main port. Remaining steps are done similarly in all 100 cases according to conventional MSICS procedure. Intraoperative complications if any were managed accordingly.

A detailed post-operative examination was done on 1st day, 7th day, 2nd week and 4th week. Cases with 70-110 degree axes are considered as WTR astigmatism, cases with 160-20 degree were considered ATR astigmatism and other than these axes were excluded from study.

Results

Table 1: Sex distribution

Sex	SI	STI	Phacosurgery
Male	26	26	28
Female	24	24	22
Total	50	50	50

A randomized comparative study of astigmatism at postoperative follow ups following superior (SI), superotemporal scleral incision (STI) and Phacosurgery in manual small incision cataract surgery in total 150 patients with 50 each with each incision at Darbhanga Medical College and Hospital, Darbhanga, Bihar, India was done at a period of one year.

Table 2: Pre-operative visual activity

Visual Activity	SI	STI	Phacosurgery	Total
PL + - CF	10	5	10	25
CF ½ m – CF 3 m	10	15	15	40
CF 3.5 m – CF 5.5 m	15	16	15	46
> 6/60	15	14	10	39
Total	50	50	50	150

In the present study, it was found that 74% of the patients of both groups who underwent MSICS had visual acuity less than 6/60, whereas rest 26% had visual acuity more than 6/60.

Table 3: Pre-operative astigmatism

Type of astigmatism	SI	STI	Phacosurgery	%
WTR	18 (36%)	17 (34%)	16 (32%)	51 (34%)
ATR	22 (44%)	23 (46%)	24 (48%)	69 (46%)
NA	10 (20%)	10 (20%)	10 (20%)	30 (20%)

In this study, it is seen that 18(36%) patients who had WTR astigmatism underwent SI, 17 (34%) underwent STI and Phacosurgery 16 (32%), whereas 22 (44%) patients of those who had ATR astigmatism underwent SI, 46% underwent STI and 24 (48%) underwent Phacosurgery.

Table 4: Pre and Post-operative astigmatism in superior and superotemporal scleral incision

Type of incision	Pre-operative astigmatism	Post-operative change in stigmatism	PODay 1	PODay 7	PO-2nd week	PO-4th week
SI	**WTR (18)**	Increased	12	7	7	8
		Decreased	2	9	10	9
		Same	4	2	1	1
	ATR (21)	Increased	18	13	12	14
		Decreased	2	4	5	4
		Same	1	4	4	3
	NA (11)	WTR	2	2	2	4
		ATR	9	9	9	7
		Same	0	0	0	0
STI	**WTR (18)**	Increased	10	12	14	14
		Decreased	6	5	3	3
		Same	2	1	1	1
	ATR (21)	Increased	10	3	5	4
		Decreased	10	18	15	15
		Same	1	0	1	2
	NA (11)	WTR	6	8	9	9
		ATR	5	3	2	2
		Same	0	0	0	0
Phacosurgery	**WTR (19)**	Increased	10	12	14	14
		Decreased	6	5	4	4
		Same	3	2	1	1
	ATR (20)	Increased	10	2	4	3
		Decreased	10	18	14	15

		Same	0	0	2	2
	NA (11)	WTR	6	8	8	9
		ATR	5	3	3	2
		Same	0	0	0	0

In this study, it is seen that out of 18 patients with preoperative WTR astigmatism who underwent SI, 12(66.66%) had increased while 2 (11.11%) had decreased and only 4 (22.23%) had same amount of WTR astigmatism 1st postoperative day. On 7th day, only 7 (55.56%) patients had increased while 8 (50%) had decresased WTR astigmatism. By 2nd and 4th week postoperatively, number of patients with increased WTR astigmatism remained almost same whereas, number of patients with decreased astigmatism increased drastically in comparison to the 1st from 2 (11.11%) to 9 (50%).

STI group shows that on 1st post-operative day, out of 18 patients who had WTR astigmatism pre-operatively, 10 (52.63%) had increased but 6 (31.58%) had decreased amount of astigmatism while for only 2 patients no variation was there. On 7th post-operative day, it is seen that the number of patients with increased astigmatism increased slightly from 10 to 12, with a gradual decrease in the number of patients with reduced astigmatism from 6 to 5. Thus it is seen that in SI group the number of patients with postoperative decreased pre-existing WTR astigmatism was more than that of the STI group.

Phacosurgery group shows that on 1st post-operative day, out of 19 patients who had WTR astigmatism pre-operatively, 10 (52.63%) had increased but 6 (31.58%) had decreased amount of astigmatism while for only 3 patients no variation was there. On 7th post-operative day, it is seen that the number of patients with increased astigmatism increased slightly from 10 to 18, with a gradual decrease in the number of patients with reduced astigmatism from 6 to 4. By 2nd and 4th week, the number of patients with increased and reduced WTR astigmatism became constant to 14 (73.68%) and 4 (21.05%) respectively.

Discussion

While phacoemulsification remains the more advanced and technically superior method of cataract surgery, it is not always appropriate either from a cost perspective or the density of the cataracts involved. [13] MSICS is the first choice alternative to phacoemulsification- retains most of the advantages of "phacoemulsification" giving visual results equivalent to phacoemulsification at a lower cost and it is the surgery for the masses and appropriate for a developing country. The surgery is cheap, fast, safe and easy to learn and needs fewer resources. However, the larger incision used induces greater astigmatism than phacoemulsification. [14] High astigmatism is an important cause of poor uncorrected visual acuity after cataract surgery. [15]

The curvilinear incision parallel to limbus being out of this funnel is unstable whereas straight incisions are less out of this funnel and thus they are more stable than curvilinear incision which creates a potential for wound slide and ATR drift in astigmatism in case of curvilinear incision. Frown incision falls totally within this funnel with its margin moving away from the cornea thus making it a stable incision and stabilizes the astigmatism to a greater range. [16] But in both frown and Chevron inverted V incision, it is difficult to convert the incision to ECCE in case of emergency. [17]

Superotemporal incision also provide other advatages like better wound strength due to minimal separational force of lid pressure and gravity, preservation of functioning filter bleb in previous glaucoma surgery. It is preferred in deeply

seated eyes and eyes with coloboma iris. This incision site also causes less central corneal endothelial loss. [18] Thus an obvious approach is to reduce the change of astigmatic shift by an incision which is small, away from the cornea, either straight or frown shaped to stay within astigmatically neutral zone, multiplanar and one that can be left unsutured. Also wounds with a square configuration are considered desirable. [19]

The result of this study is consistent with previous reports [20,21] that, temporal incision induces small amount of WTR astigmatism and gives early visual rehabilitation to the patients within 6 weeks. This could be due to the fact that temporal location is farther from the visual axis than superior location and any flattening due to wound is less likely to affect the corneal curvature at the visual axis. When the incision is located superiorly, both gravity and eyelid blink tend to create a drag on the incision. These factors are neutralized well with temporally placed incision because the incision is parallel to the vector of forces. [22]

Visual acuity didn't improve significantly on 1st day in both groups whereas by 1 week, visual acuity improved in more number of cases in superotemporal incision than the other group which by 4th week the difference increased drastically with more satisfactory improvement with superotemporal incision. In superotemporal incision group, minimal WTR astigmatism and early rehabilitation of visual recovery could be due to location of the incision away from the visual axis and steepening of the vertical meridian unlike superior incision. [23]

Superotemporal incision causes minimal WTR astigmatism whereas SI group had majority of ATR astigmatism. Besides, superotemporal incision can neutralize ATR astigmatism which is advantageous since most elderly cataract patients had preoperative ATR astigmatism. Besides, the average astigmatism in SI group is higher and majority of them being ATR type than that of STI group in which majority of them are having WTR astigmatism.

Conclusion

Post-operative astigmatism, being a common complication to cataract surgery, can be reduced or avoided with modification of location, sutureless, self-healing incision. Placement of incision temporally, superotemporally or phacosurgery is one modification to minimise the high pre-existing ATR astigmatism, thereby improving the visual outcome. This study suggests that sutureless superotemporal scleral incision produces less post-operative astigmatism than superior scleral incision and phacosurgery. It is seen, that superotemporal incision causes with-the-rule astigmatism in most of the cases postoperatively along with a capability of neutralizing against-the-rule astigmatism which will be present in majority of elderly patients with cataract, whereas superior scleral incision causes against-the-rule astigmatism in the most.

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