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RESEARCH ARTICLE

COMPARISON OF SURGICALLY INDUCEDASTIGMATISM BETWEEN PHACOEMULSIFICATION AND SMALL INCISION CATARACT SURGERY

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Abstract

Background: Surgically induced astigmatism is that the reason for poor postoperative vision even after uneventful cataract surgery. Aim: The aim of study was to check the incidence, amount, type, and course of surgically induced astigmatism and visual sense in temporal 3.5-mm clear corneal phacoemulsification and 6-mm superior scleral incision in Small incision cataract surgery (SICS). Materials and Methods: A total of 200 eyes of 200 patients with a mean age of 62 years were included within the study. Cases were randomly divided into two groups. group A had undergone 3.5-mm temporal clear corneal phacoemulsification and blood type had undergone 6-mm superior scleral SICS. Surgically induced astigmatism was analyzed by SIA software. Results: Mean age in A was 61 (±8) years and in group B was 63 (±10) years. Mean surgically induced astigmatism in blood group was 1.05 (±0.58) D, 1.13 (±0.52) D, 1.13 (±0.56) D, and 1.08 (±0.52) D on 1st , 7 th ,21 th , and 45 th postoperative days, respectively. The change from 1st to 45th day wasn't significant. the identical in blood group was 0.75 (±0.58) D, 0.81 (±0.54) D, 0.88 (±0.49) D, and 0.91 (±0.47) D 1st , 7 th ,21 th , and 45 th postoperative days, respectively. Surgically induced astigmatism was comparable on all days between the groups. We found significant with the rule and against the rule form of astigmatism post-operatively within the temporal clear corneal incision in phacoemulsification group and in superior scleral incision in small incision cataract surgery group respectively. Conclusion: Surgically induced astigmatism was higher within the the superior scleral group than in 3.5-mm temporal clear corneal group. Clinical outcome of both surgeries was same, as there was no significant difference within the uncorrected postoperative acuity in between the groups.

Key Words: SIA (surgically induced astigmatism) , SICS (small incision cataract surgery), superior scleral incision, WRA (with the role astigmatism) ,ARA (against role astigmatism).

Introduction

Cataract surgery has undergone various advances since it absolutely was evolved. It started from ancient couching then transformed to intracapsular cataract surgery and at last evolved to the so called manual phaco technique that's small incision cataract surgery (SICS) finally to modern phacoemulsification cataract surgery. The primary aim may be a good postoperative visual rehabilitation without correction with immediate mobilization, but the most obstacle is surgically induced astigmatism (SIA). Over time, various surgeons have strived hard and invented different incisions to scale back the SIA. the end result of a cataract surgery depends on various factors like incision, approach, variety of surgery, mode of lense (IOL) insertion, and sort of IOL[1] The introduction of self-sealing clear corneal incision has gained popularity worldwide because it offers several benefits over the normal sutured limbal incisions and scleral tunnel. [2] Clear corneal incision has advantages of, decreased inflammation and pain,and increased safety similarly as reduced SIA. [1] Clear corneal wounds have revolutionized cataract surgeries by reducing the surgical time and resulting in faster postoperative recovery as compared to the scleral tunnel approach. Cataract remains the foremost important and significant reason for bilateral blindness in senile people, both in Libya further as worldwide. Modern cataract surgeries with lens (IOL) became one among the safest, simple, and consistent, frequently performed surgeries. Small incision cataract surgery (SICS) is gaining popularity in developing countries as a reasonable alternative to phacoemulsification. [1] SICS and phacoemulsification have advantages like less induced astigmatismand early visual rehabilitation, , and no suture-related complications. With advances in technology and predictability of surgery, expectations of both surgeons and patients have increased. Surgeons aim to fulfill the individual patient's refractive goal and patients expect good vision without the spectacles immediately. Postoperative SIA depends on location, size, and architecture of the wound, and also the surgeon's position and luxury during the procedure. [3] the tiny size incision gives a rapid and a stable optical recovery, and thus a lesser SIA. [4] Many studies were done to check the astigmatism with differing kinds of small incisions in several locations like superior, super-nasal, supero-temporal, and temporal. Regarding the architecture of the cornea, giving phacoemulsification incision on the steepest corneal axis at the time of cataract surgery can correct alittle amount of astigmatism. Other options like peripheral corneal relaxing incisions and toric IOLs were also safe and effective for treating quite 1 diopter of preexisting astigmatism Surprises in refractive errors after cataract surgery became unacceptable in recent few years. As a result, cataract surgery has become refractive surgery offering improvements both in "best corrected" and "uncorrected" visual sense.

astigmatism by various methods introduced by Alpins and Goggin, [3] Holladay *et al.*, [4] and many others. Postoperative astigmatism is affected by various factors such as preoperative astigmatism,

location, type, size, closure, and healing of the surgical incision, amount of scleral cauterization performed, type of suturing material used and its placement, position of IOL, and postoperative use of steroids, and all these have effects on corneal curvature. [5] In 1975, Jaffe and Clayman were first to report surgically induced astigmatism after cataract surgery. In 1975, Jaffe and Clayman first reported the exact measure of change induced by surgery, the SIA. [6] Now MS Excel sheet-based programs are available that calculate SIA. One such program was used in our study to determine SIA. It used the vector analysis with trigonometry formulas to calculate the SIA. They are also used to predict and modify the surgical skills to reduce SIA according to individuals. [7]

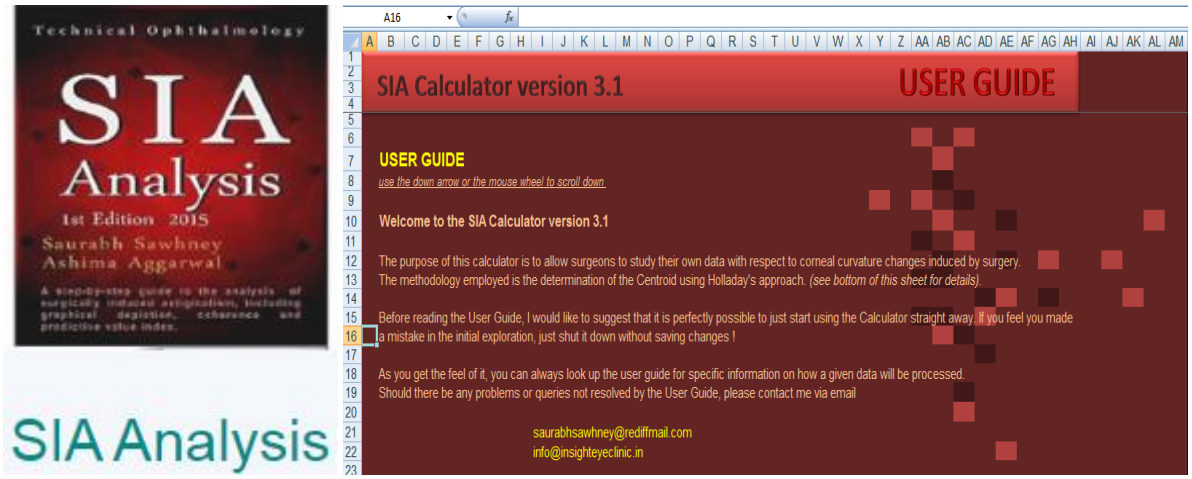
The aim of our study was to document the changes in corneal curvature occurring after cataract extraction over a period of 45 days postoperatively. We planned to compare SIA produced by 3.5-mm temporal clear corneal phacoemulsification and by 6-mm superior scleral incision in SICS..

Materials and Methods

This was a prospective, interventional, hospital based, observational, follow-up study allotted from July 2013 to September 2017 at university hospital that's Tripoli center at eye department. a complete of 200 eyes of 200 patients with a mean age of 63 years were included within the study. concent was obtained before starting the study. The cases were randomly divided into two groups. One group (group A) had undergone phacoemulsification and therefore the other group (group B) had undergone SICS. Written approval was obtained from all the patients undergoing study. The inclusion criteria were uncomplicated senile cataract, patients with preoperative astigmatism less then 3 D, good fixation, and cataracts up to grade 4 nuclear scleroses. Higher grade of nuclear scleroses was excluded to stay uniformity within the two groups and to stay the incisional architecture uniform and every one posterior chamber lense PCIOLs were placed within the bag. Exclusion criteria were complicated cataracts, traumatic cataract, cataract with glaucoma, uveitis and tumor, cataract related to pterygium, corneal opacity, the eyes which had undergone C3R or LASIK, presenile cataract, zonular dehiscence, and therefore the eyes which had undergone previous ocular surgery like scleral tear repair, visual disorder buckling surgery, glaucoma surgery, squint, corneal suturing also eyes which were high myopic and hypermetropic. Preoperative assessment included sight, pressure, sac syringing, and examination of anterior and posterior segments. an intensive posterior segment evaluation was finished 90 D. The grading of nucleus was performed in line with Lens Opacification organisation III (LOCS III). Keratometry was performed preoperatively and postoperatively by using Auto- Keratometer. SRK II formula was accustomed calculate the IOL power. Surgical Technique All cases were operated under local peribulbar anesthesia or topical anaesthesia. Under all aseptic precautions, 5% povidone iodine was instilled within the conjunctival cul-de-sac before surgery. Group A patients underwent phacoemulsification. A 3.5-mm straight Corneal tunnel was made ahead of the vascular arcade.. Anterior chamber was entered with 3.5 keratome. Corneal tunnel was bi-

planar and had self-sealing property. Corneal tunnel width was 3 mm. A side port was made. The nucleus was emulsified by stop &chopping technique. A 5.25-mm optic sized foldable IOL of appropriate power was implanted within the bag all told cases. Stromal hydration of the most incision and site port was done. Wound was water tight by pressing over cornea with a blunt spatula . Group B patients underwent SICS. A 6-mm scleral straight incision was made superiorly, 2 mm faraway from limbus, with 15 no. Bard Parker blade. Sclero-corneal tunnel was dissected employing a crescent knife, and also the tunnel width was 1 mm in clear cornea. Internal incisions were 7 mm and hydrodissection was performed. Nucleus was brought in anterior chamber (AC) and delivered by visco-expression; PMMA PCIOL was implanted within the bag altogether the cases. Both groups had self-sealing incisions, which thereby prevented the necessity for any suture. There was no attempt made in any case to switch the pre-existing astigmatism. Assessment Postoperatively was done on the 1 st , 7 th , 21 st , and 45 th days. At each visit, measurement of visual sense, anterior segment examination, fundoscopy, and keratometry were done. The course of postoperative astigmatic changes determined by keratometry performed with a typical calibrated Topcon auto-keratometer. Corneal clarity, wound integrity, and PCIOL placement were carefully examined on postoperative follow-ups. SIA was calculated by using SIA version 3.1. softwear calculater [7] SIA was interpreted in magnitude [diopter (D)] and axis (degree).

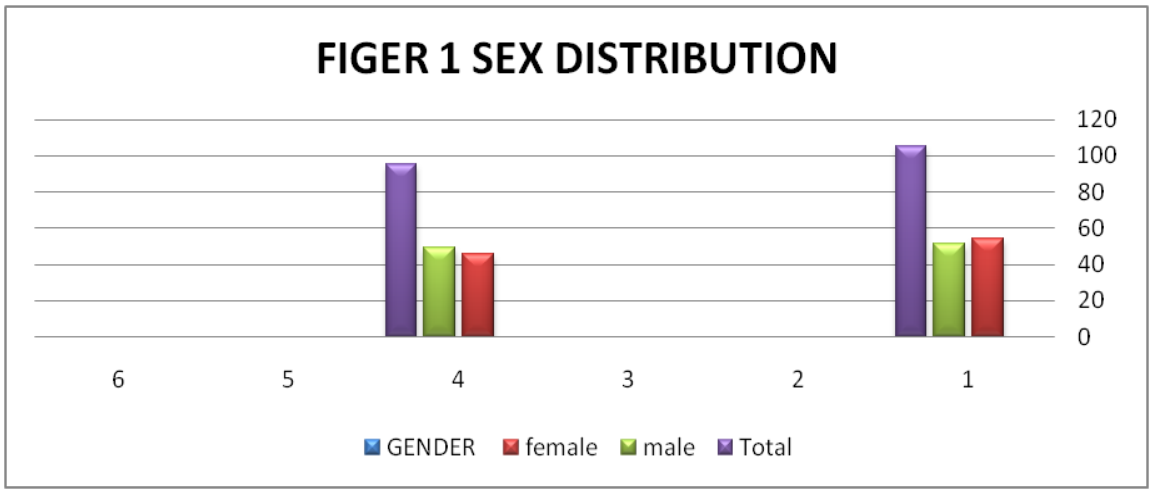
{ https://www.insighteyeclinic.in/SIA_calculator.php}



Data analysis was done using the Statistical Package for the Social Science (SPSS) Version 15 for Windows. Z test was used to find significant differences in age, gender, SIA and astigmatism in the study group. Paired t-test was performed for SIA. Chi-square test was used to find the significance among postoperative visual acuity in the study groups. A probability value of 0.05 was accepted as the level of statistical significance. P value of <0.05 was considered statistically significant.

Results

In this study, 200 eyes of 200 patients were included and underwent cataract surgery. They were categorized as group A : phacoemulsification with temporal clear corneal incision in 100 eyes and group B : 100 eyes underwent SICS with superior straight scleral incision. The results were analyzed and the following observations were made.



GENDER	Group A	Group B	Total
Female	54	46	100
Male	51	49	100
Total	105	95	200

The mean age of the participants was 60.98 ± 7.83 years in group A and 62.88 ± 9.63 years in group B . There was no significant difference in the incidence of age between group A and group B . Group A had 54 female patients and 46 male patients. Group B had 49 male and 51 female patients. Both groups were comparable. There was no significant difference between the groups with respect to the laterality of the eye.

Uncorrected postoperative visual acuity was analyzed on the 45 th postoperative day. Three sub-groups were made to analyze the post-operative visual acuity.

There was no statistically significant difference in the uncorrected postoperative visual acuity between the two groups. The two groups were comparable [Table 1].

Table 2a shows comparison of 1st postoperative day SIA to those of 7th, 21st, and 45th days. SIA postoperatively showed no statistically significant differences in group A .

Table 2b shows comparison of 1st postoperative day SIA in group B with 7th, 21st, and 45th day SIA postoperatively. It shows no statistical significant difference on 7th postoperative day, but there was significant difference on 21st and 45th postoperative days.

There was statistical increase in SIA from 1st to 45th postoperative day. A comparison of SIA between the two groups on 1st, 7th, 21st, and 45th days showed a statistically significant difference

on all postoperative days [Table 2c]. On comparing the two groups, there was a statistically significant difference between the preoperative and postoperative astigmatism [Table 3] .

Table 1: Comparison of uncorrected postoperative visual acuity on 45th postoperative day in the study groups

Visual acuity	Group A	Group B	Total
6/60 to 6/24	**17**	**15**	**42**
6/ 18 to 6/ 12	**61**	**59**	**96**
6/9 to 6/6	**22**	**26**	**62**
Total	**100**	**100**	**200**
Chi-square = 0.49, *P* > 0.05			

Table 2a and diagram: Comparison of postoperative SIA in diopter (D) in group A .

Postoperative day	SIA in group A (n = 100)		*t* Value	*P* value
	Mean	**SD**		
1..day	**1.05**	**0.58**	**ZERO**	**ZERO**
7th day	**1.13**	**0.52**	**1.84**	**>0.05**
21thday	**1.13**	**0.56**	**1.6**	**>0.05**
45th day	**1.08**	**0.52**	**0.58**	**>0.05**

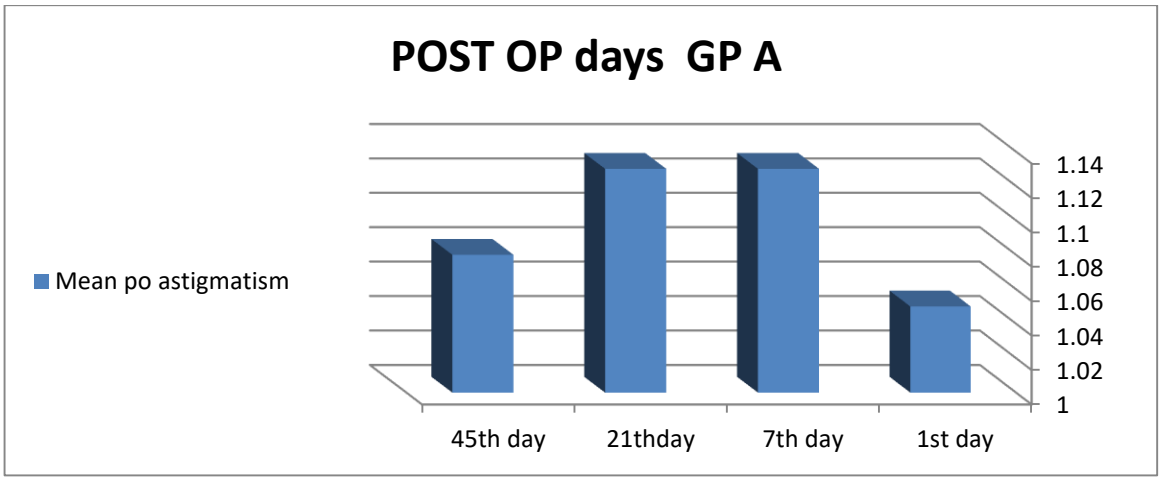


Table 2: Table 2band diagram : Comparison of postoperative SIA in diopter (D) in group B

Postoperative day	SIA in group B (n = 100)		*t* Value	*P* value
	Mean	**SD**		
1..day	**0.75**	**0.58**	**ZERO**	**ZERO**
7th day	**0.81**	**0.54**	**1.25**	**> 0.05**
21thday	**0.88**	**0.49**	**2.71**	**< 0.01**
45th day	**0.91**	**0.47**	**2.71**	**<0.01**

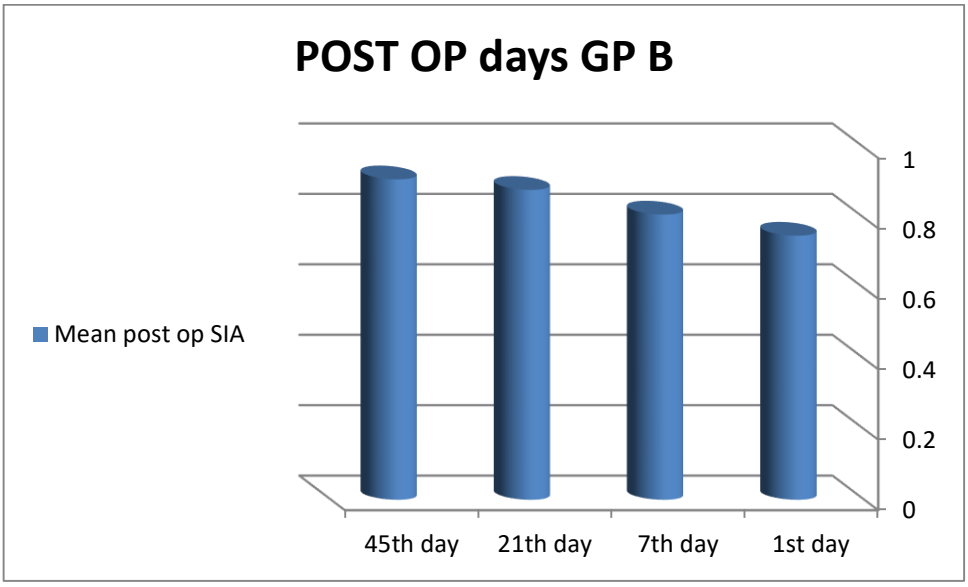


Table 2c: Comparison of SIA on postoperative 1st, 7th, 21st, and 45th days in the study groups

Postoperative day	SIA in group A (n = 100)		SIA in group B (n = 100)		*Z* value	*P* value
	Mean	**SD**	**Mean**	**SD**		
1..day	**1.05**	**0.58**	**0.75**	**0.58**	**3.66**	**< 0.005**
7th day	**1.13**	**0.52**	**0.81**	**0.54**	**4.27**	**<0.0001**
21thday	**1.13**	**0.56**	**0.88**	**0.49**	**3.36**	**< 0.005**
45th day	**1.08**	**0.52**	**0.91**	**0.47**	**2.43**	**< 0.05**

Table 3: Comparison of type of astigmatism in the study groups

Type of astigmatism	Group A (N=100)	Group B (N=100)	Chi-square	P value
Preoperative				
ATR	**55**	**73**	**8.85**	**<0.0001**
WTR	**26**	**20**		
NA	**19**	**7**		
Postoperative on 45th day				
ATR	**24**	**91**	**92.19**	**> 0.0001**
WTR	**73**	**8**		
NA	**3**	**1**		

Discussion

Patients undergoing cataract surgery expect clear vision and fewer dependence on spectacles. to realize this goal, SIA should be reduced. Modern cataract surgery aims at this modification. The rationale behind the current study was little information available on SIA after 3.5-mm temporal clear corneal phacoemulsification surgery. SIA was the most aim of this study, Astigmatism was assessed by using keratometry readings and SIA was calculated with SIA Soft Microsoft Excel sheet calculator. On comparing the sort of astigmatism postoperatively, we found a big change to with the rule (WTR) astigmatism after temporal clear corneal incision and to against the rule (ATR) astigmatism within the superior scleral SICS. In our study, no oblique astigmatism was encountered. The difference was accused to the traction force of eyelid blinking on superior wound. The change within the corneal curvature is accountable for SIA and also the astigmatic refractive error. Uncorrected astigmatism can cause blurred images and glare that leads patient discomfort and dissatisfaction with otherwise uneventful cataract surgery. [7] Length of incision and site are the 2 major factors affecting the induced astigmatism. We compared two sizes and sites, one for SICS 6-mm scleral incision and therefore the other for phacoemulsification group 3.5-mm clear corneal incision. Many studies document temporal clear corneal incision of 2.75 , 3.25, and 4.1 mm, which are astigmatically neutral eyes and people with low preoperative WTR astigmatism. So, horizontal meridian incisions have a plus of less SIA as they're far from the visual axis. [9],[10],[11],[12],[13] Postoperative visual sense was monitored on all postoperative day follow-ups in both groups, and also the results were analyzed on the 45 th postoperative day. Both the groups had similar sharp-sightedness. There was no significant difference between the 2 groups. This was supported by the difference of SIA within the two groups on the 45 th postoperative day. Difference in SIA was statistically significant, but there was a negligible difference between the 2 groups. SIA in

type A was 1.08 (±0.52) and in blood type was 0.91 (±0.47) on the 45 th postoperative day. Further studies are required to search out its efficacy and advantages over other kinds of incisions, both in SICS and phacoemulsification. Follow-up time was too short (45 days) and a extended follow-up is required for the observation of changes in astigmatism and decay within the induced astigmatism over time because the wound heals. Videokerotography wasn't performed. Temporal clear corneal incision caused a minimal change within the kind of astigmatism and superior scleral incision induced a big ATR astigmatism postoperatively. SIA in phacoemulsification group was slightly more than SICS group. But the clinical evaluation proved that postoperative uncorrected visual outcome was same in both the groups. Clinically it's proved that the results of both 3.5-mm temporal clear corneal incision and 6-mm scleral incision are comparable and either of the incisions are often used while performing successful cataract surgery.

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