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Estimation of the degree of surgically induced astigmatism after small incision cataract surgery (SICS) using u shaped incision – A prospective study

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Abstract

Introduction: The phrase "cataract" It originates from the Greek term "katarraktes," which meaning "waterfall," and was first used in the Middle Ages. The term "cataract" today describes any opacity that develops in the lens or its capsule.

Aim: To evaluates the degree of surgically induced astigmatism (SIA) in manual small incision cataract surgery (SICS) using U-shaped scleral incision. **Methodology**-A Study was conducted after getting approval from the institutional Ethical Committee. The patient who are fulfilling inclusion criteria and giving consent were included in the study. Detailed pre operative examination which include Anterior segment evaluation using slit lamp, Fundus examination using direct ophthalmoscop, K1 and K2 values were noted, Auto Refractokera to meter (URK - 700 Unicos) value were noted . All the surgeries were performed by a single experienced ophthalmic surgeon. In surgery scleral tunnels can be carried out in a variety of ways. Here U-shaped scleral incision is used. Patients were thoroughly examined immediate post op day 1 and postoperative findings of UCVA, refraction, and keratometry were noted at the end of 1 st day, 1st week, and 6th week. SIA was calculated for all the follow-ups using the SIA calculator version 2.1, a free software program (Dr. Saurabh Sawhney and Dr. Aashima Aggarwal.

Result: Statistical analysis was done by SPSS latest version. 21.0. Postoperatively, the average SIA was 0.65 ± 0.25 D at postoperative day 1, 0.61 ± 0.26 D at the end of the 1th week, 0.55 ± 0.20 D at the end of 6th week.

Conclusion: From being a procedure that restores vision loss due to the lenticularopacity, manual SICS is changing into a procedure that aims for postoperative emmetropia in developing countries. Reducing SIA is an

important factor in achieving this. In a developing country like ours where manual SICS is still being practiced regularly, the incision technique described in our study is ideal for a better postoperative surgical out come.

Keywords: Cataract, Astigmatism, SICS, U Shape Incision, Keratometer.

Introduction- The phrase "cataract" It originates from the Greek term "katarraktes," which meaning "waterfall," and was first used in the Middle Ages. This phrase was employed under the presumption that a "abnormal humor" formed and flowed in front of the lens, causing the vision to deteriorate. The term "cataract" today describes any opacity that develops in the lens or its capsule. Thus, cataracts may arise as a result of[1]

1. the creation of opaque lens fibers (congenital and developmental cataracts);

2. a degenerative process that causes the opacification of the regularly generated clear lens fibers (acquired cataract). According to medical terminology, a cataract is an opacification that is severe enough to impair vision.

Types of surgical techniques in management of cataract[1]

I. Removal of the intracapsular cataract (ICCE)

II. Extra capsular cataract extraction include Phacoemulsification, Manual small incision cataract surgery (SICS), and Conventional extra capsular cataract extraction (ECCE)

The type, length, and position of the incision, as well as the suture closure technique that is employed[2] , all affect how much SIA develops. An incision funnel that indicates the astigmatic neutral zone. Modern cataract surgery currently aims at rapid visual rehabilitation and achieving the best-uncorrected visual acuity (UCVA) with minimal postoperative astigmatism. Although the current surgical techniques allow for rapid visual recovery, surgically induced astigmatism (SIA) remains a common obstacle to achieving an excellent UCVA. This idea hinges on the following significant equations in mathematics:

A. Long scleral incision α SIA (3)

B. SIA α 1/Distance from the corneal center of the incision (3)

Above equations shows that corneal astigmatism is inversely related to how far away the scleral incision is from the limbus and directly proportional to how long the incision is. The incisional funnel, according to Koch[5] , is a fictitious pair of curving lines with its base at the limbus and a base that grows as it goes away from the limbus. The link between astigmatism and incision lengths is shown by a funnel. The described funnel has an incision that is a stigmatically neutral. As the distance from the limbus grows, the lines separate as they depart from it [5]

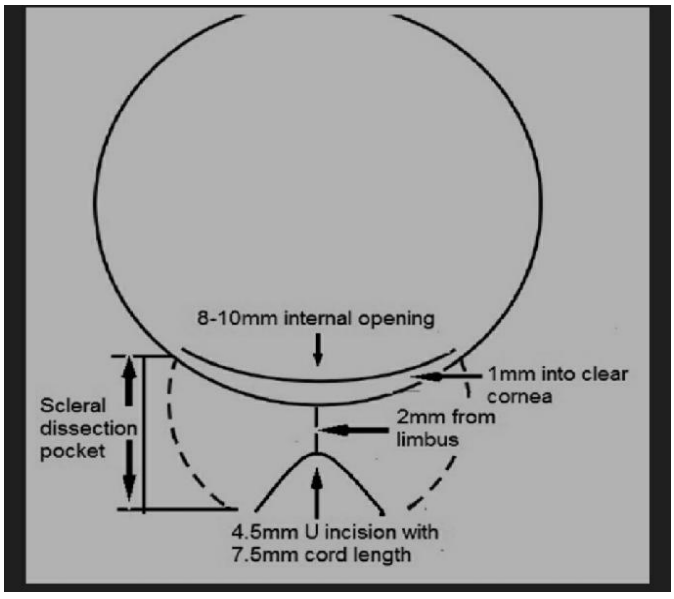

Figure 1: Incision funnel

Various forms of scleral incisions, including as straight, frown, V-shaped, and U- shaped, can be utilized in SICS to remove senile cataracts from patients who are 40

years or older in this study. A U-shaped scleral incision will be used for this investigation. Following cataract surgery, an auto refractometer (AR) will be used on days one, one week, and six weeks to measure the amount of SIA. Following analysis of the data gathered during the study's duration to determine the level of SIA

Methodology

Study Design: prospective study

Study Setting: tertiary rural health care centre

Study Population: patient aged above 18 years having cataract

Sample Size: all the patient aged above 18 years having cataract undergoing sics with u shaped scleral incision during 1 JAN 2021 to 30 JUNE 2022

Study Duration: 1 Nov 2020 to 30 Nov 2022

Inclusion Criteria: 1. Age above 18 years having various grades of senile cataract.

Exclusion Criteria: 1. Age less than 40 years 2. Any pre-existing ocular conditions like - complicated cataracts, pterygium, corneal opacity, cataract with glaucoma,if present

Data Collection: A Study was conducted after getting approval from the institutional Ethical Committee. The patient who are fulfilling inclusion criteria and giving consent were included in the study. Detailed pre operative examination which include Anterior segment evaluation using slit lamp, Fundus examination using direct ophthalmoscop, K1 and K2 values were noted, Auto Refractokeratometer (URK - 700 Unicos) value were noted . All the surgeries were performed by a single experienced ophthalmic surgeon. In surgery scleral tunnels can be carried out in a variety of ways. Here U-shaped scleral incision is used. In all the cases, the incision was placed superiorly. After making a fornix-based conjunctival flap, a 4.5 mm U- shaped partial-thickness scleral incision was made 2 mm away from the superior limbus at 12 o' clock position in the astigmatic neutral zone with a number 15 blade. Here, the 4.5 mm implies the distance between the two arms of the 'U'. A sterile disposable, 2.8 mm crescent blade was used to create a self-sealing scleral corneal tunnel, extending into the clear cornea for 1 mm. When compared to a regular SICS, additional scleral dissection was done maintaining the inner lip parallel to the limbus with precaution taken to avoid peripheral extension of the inner lip of tunnel near the limbus. This helps in easy manipulation and delivery of a larger nucleus. The total cord length of the incision ranged between 6 and 7.5 mm. A side port incision was made at 9 o'clock position with a 15° side port lancet. Continuous curvilinear capsulorrhexis was done using a 26 G cystotome through the side port under a viscoelastic cover. A 3.2 mm keratome was used to enter the anterior chamber through the tunnel incision. The internal wound was then enlarged to 8-10 mm length approximately, which is sufficient to accommodate a larger nucleus as well. None of the scleral incisions were enlarged intra operatively. Hydro dissection is performed. The prolapsed nucleus was engaged in the sclera tunnel and was delivered out. A single piece PMMA lens with a 6 mm optic diameter was implanted in the capsular bag and dialed using diller. The self-sealing wound was left sutureless after checking for any wound leakage. Postoperatively, topical eye drops Moxifloxacin (0.5%) given 2 hourly. Eye drops prednisolone (1%) given hourly in the first week and gradually tapered every week over the next six to eight weeks. Patients were thoroughly examined immediate postop day 1 and postoperative findings of UCVA, refraction, and keratometry were noted at the end of 1 st day, 1st week, and 6th week. SIA was

calculated for all the follow-ups using the SIA calculator version 2.1, a free software program (Dr. Saurabh Sawhney and Dr.Aashima Aggarwal

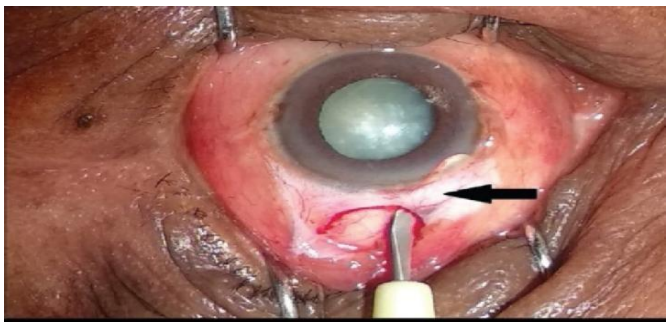

Fig 2: Intra operative picture of the modified U-shaped sclera incision used in this study.

Result: Data obtained during study duration was analysed at the end to get idea about SIA after SICS done using U shaped sclera incision. Statistical analysis was done by SPSS latest version.21.0

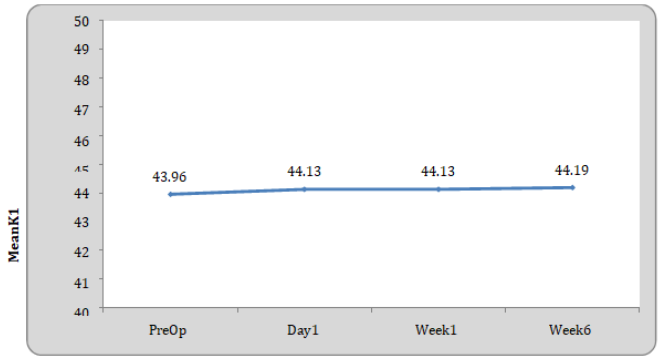

Figure 3: Comparison of K1 at postoperative day 1, week 1 andweek6incomparisonwithbaseline

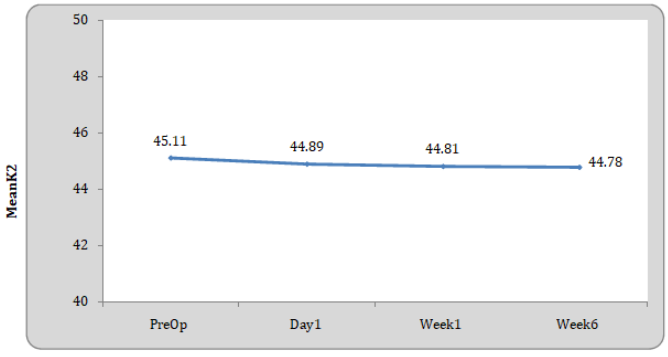

Figure 4: Comparison of K2 at postoperative day 1, week 1 andweek6incomparison with baseline

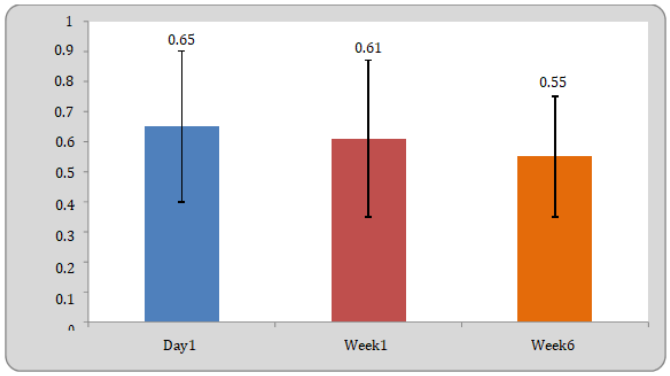

Figure 5: Descriptive Statistics for of SIA at postoperative day1,week1 andweek6

In our study postoperatively, the average SIA was 0.65±0.25D at postoperative day 1, 0.61 ± 0.26D at the end of the1thweek, 0.55 ± 0.20D at the end of 6thweek.

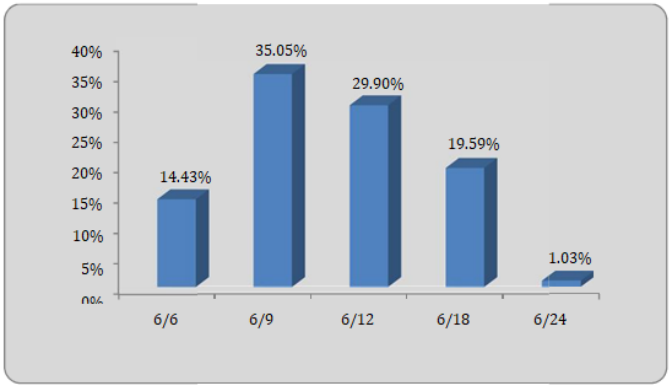

Figure 6: Distribution of patients according to UCVA at 6th post operative week

In our study 97.94% cases were observed with 6/6 and 1.03% each case was observed with 6/12 and 6/9 BCV A respectively.

Discussion

Cataract is the main cause of blindness worldwide and a major contributor to visual impairment over the whole continent of Africa, making it a huge financial burden and public health concern. The most common surgical care option for cataracts today is cataract surgery with SICS, which is especially common in developing nations due to its afford ability, rapid recovery time, little reliance on technology.

AGE: In the present study most of the cases were observed having age in 6th decade of their age. 38.40% cases were observed having age from 61 to 70 years of age,21.65% cases were observed having age from 51 to 60 years of age, 19.59% cases were seen having age from 41 to 50 years of age, 13.40% cases had age more than70 years, where 7.22% cases were observed having age less than or equal to 40yearsofage. 58.64 ±1 1.36 years mean age was observed. In a study conducted by Suresha Anepla Rajappa (2020)[4], Hima Bhatt did a study at Bapuji Eye Hospital Davangere, Karnataka, India, 69.59 ± 11.251 years mean age was observed In study conducted by Ahmed MS (2021)[35], 62.3 years mean age was observed. In study conducted by Jauhari N et al (2014)[36] they observed, 56.57years mean age was observed.

Gender: In the present study 54.64% were male cases and 45.36% were female cases. In a study conducted by Suresha Anepla Rajappa (2020)[4] ,Hima Bhatt did a study at BapujiEye Hospital Davangere, Karnataka , India ,they observed out of 61 patient 36men and 25 women. In study conducted by Ahmed MS (2021)[35] they observed, 42.4% were male cases and 57.6% were female cases. In study conducted by Jauhari N et al (2014)[36] they observed, 49.33% were male cases and 50.67% were female cases.

Diagnosis: In the present study 49.48% cases were diagnosed with mature cataract followed by22.68% cases with NS2PSC, 27.84% cases with NS3PSC. In a study conducted by Suresha Anepla Rajappa (2020)[4], Hima Bhatt did a study at Bapuji Eye Hospital Davangere, Karnataka India, they observed, Out of the operated 61 cases, 34 (68.8%) cases were soft cataracts, i.e., nuclear sclerosis grade one to two. Three (4.9%) cases were hard cataracts, i.e., nuclear sclerosis grade three to four. Sixteen (26.2%) cases were mature white cataracts

BCVA Preoperative

In the present study most of the cases were observed with PL + PR + best corrected visual acuity (BCVA). 48.48% cases were observed with PL + PR + followed by 18.56% cases with 6/60 BCVA, 11.34% cases with F Cat 3m,1 0.31% cases with F Cat 2m, 2.06% cases with FC at 1m, 4.21% cases with HM, 3.09%cases with 6/36, 1.03% cases with 6/241.03%

Atpostop6thweek–97.94% cases were observed with 6/6 and 1.03% each case were observed with 6/12and6/9BCVArespectively**.**In a study conducted by Suresha Anepla Rajappa (2020)[4], Hima Bhatt did a study at Bapuji Eye Hospital Davangere, KarnatakaIndia, they observed, The final postoperative visual outcome in our study was BCVA of 6/9 or better [Snellen's chart]in 95% of cases by week 6.This finding is well supported by Zawar and Gogate who observed in their study on 2000 eyes undergoing manual SICS that 93.4% of eye sachieveda final BCVA betterthan6/12 at week 6 postoperatively. In study conducted by Jauhari Netal (2014)[36] they observed, the raisin increase in BCVA in all the incision groups but no significant inter group difference was observed for any of the follow-up visits. 89.50% of patients in straight incision group, 94.7% in frown incision group and 95.20% in inverted V group respectively have BCVA of at least 6/18 or better at 4wk postoperatively. Only 6.86 %(4) patients had BCVA less than 6/18 which was attributed to macular oedema in one patient, drusenat macula in 1 patient, vitreous in anterior chamber in one patient and thick fibrin us membrane over the IOL in one patient.

SIA: Postoperatively, the average SIA was 0.65± 0.25D at postoperative day 1, 0.61 ± 0.26D at the end of the 1th

week, 0.55 ± 0.20 D at the end of 6thweek. In a study conducted by Suresha Anepla Rajappa (2020)[4], Hima Bhatt did a study at Bapuji Eye Hospital Davangere, Karnataka India, they observed, Postoperatively, the average SIA was 0.43 ± 0.13 D at the end of 1stweek, 0.29 ± 0.20 D at the end of the 4thweek, andremainedthesame0.29±0.21D at the end of6thweek.

Keratometry: In the present study preoperatively 43.96 mean K1 was observed, at Day 1 44.13 mean K1 was observed, at 1 week 44.13 mean K1 was observed and at 6th week 44.19 mean K1wasobserved. Statistically significant difference wasobservedinK1.45.11 mean K2 was observed preoperatively, 44.89 mean K2 was observed at Day1,at 1 week 44.81mean K2 was observed and at 6th week 44.78 mean K2 was observed. Statistically significant difference was observed in K2 mean preoperatively and at6thweek.(p=<0.0001***)

Co morbidities: In the present study 14.43% cases were having diabetes mellitus, 12.37% cases were having Hypertension. 73.20% cases were without any co morbidities like diabetes mellitus, hyper tension or any other systemic illness

Conclusion

Postoperatively, the average SIA was 0.65± 0.25 D at postoperative day 1, 0.61 ± 0.26D at the end of the 1th week, 0.55 ± 0.20 D at the end of 6th week. From being a procedure that restores vision loss due to the lenticularopacity, manual SICS is changing into a procedure that aims for postoperative emmetropia in developing countries. Reducing SIA is an important factor in achieving this. The importance of the size as well as the location of the scleral incision as one of the major determinants of SIA in non phaco manual SICS has been successfully concluded in this study The results in this study were encouraging and provide further scope to compare the difference in SIA between superior and temporal incisions with the same type of incision. In a developing country like ours where manual SICS is still being practiced regularly, the incision technique described in our study is ideal for a better postoperative surgical outcome.

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