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Phacoemulsification versus Small Incision Cataract Surgery for Treatment of Cataract

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ABSTRACT

Objectives: The study aimed to evaluate the effect of suture-less small incision cataract surgery (SICS) on the postoperative astigmatism refractive error compared to the effect of phacoemulsification.**Background:** Non-Phacoemulsificationsuture-lesscataractextractionretainsmostoftheadvantagesofphacoemulsification with the comparable visual outcome and isaffordable.**Materials and methods:** Phacoemulsification and SICS were performed in 200 eyes of 200 patients. Both techniques wereperformedattheDepartmentofOphthalmology,EraUniversity,Lucknow,Uttar Pradesh.Thestudywasconductedbetween1January2020and28March 2021.The outcome was evaluated in both techniques in early visual rehabilitation, surgically induced astigmatism, and final best-corrected visualacuity.**Results:** Ofthe200patientswhounderwentphacoemulsification,60%weremalepatients,and40%were femalepatients.Ofthe200patientswhounderwentSICS,45%weremalepatients,and55% were female patients. Both surgical techniques achieved excellent visual outcomes with low complication rates. The initial visual recovery on the first postoperative day was better in the patientswhounderwentphacoemulsification,withtheuncorrectedvisualacuitybetterthanor equal to 6/18 in 75% of the patients. In contrast, the percentage was 60% in the SICS group. The initial difference was nearly equalized within four weeks. In the sixth month, 85% of the patientsintheMSICSgrouphaduncorrectedvisualacuitybetterthanorequalto6/18versus 90% of the patients in the phacoemulsification group. The surgically induced astigmatism at the sixth month was comparable in both techniques, 1.18 ± 0.2 D in the phacoemulsification group versus 1.2 ±0.23 D in the SICSgroup.**Conclusion:** BothphacoemulsificationandSICSachievedexcellentvisualoutcomeswithlowcomplication rates.SICSislesstechnology-dependent;hence,itislessexpensiveandmoreappropriate for treating advanced cataracts prevalent in the developingworld.

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INTRODUCTION

Cataract has been documented to be the most significant cause of bilateral blindness in Indiawhere vision < 20/200 in the better eye on presentationis defined as blindness.[1-6]In Indiacataract has been reported to be responsible for 60-80% ofthe bilaterally blind in the country.[1-6] Global agencies for eliminating avoidable blindness have pledged support to operationalize strategies to reduce the burden of cataract blindness by the "Vision 2020:The right to sight" initiative.[7]Coordinated national efforts were supplemented by a world Health Organization-assisted cataract blindness control project launched in seven states of India in 1994.[8] From around 1.2 million cataract surgeries per year in the 1980s,[9] the cataractsurgical output increased to 3.9 million per year by 2003.[10] Recent data from the World Health Organization (WHO) shows a 35% decrease in blindness prevalence in India.[11] This could be due to the increased cataract surgeries in the country. At the same time, the proportion of the aged has also increased significantly in the country. The 60+ population, which stood at 56 million in 1991, will double by 2016.[12]This increase in population means that the number of people' at-risk of blinding cataracts will also increase tremendously. India is committed to eliminating avoidable blindness by 2020 in line with the Global Vision 2020: the right to sight initiative. We used existing surveys, cataract surgical output, and population data to determine whether India can meet the Vision 2020: the right to sight cataract blindness goals.

To deliver an effective cataract service, wherever it is based, it must be affordable. In more affluent areasof the world, phacoemulsification has become the primary method of performing cataract surgery in developedcountries. There are,however,manyareaswherephacoemulsificationis not appropriate. This possibly involves most of thecataractblindnesstodaybecauseofthe density of cataracts involved besides the cost andmaintenance demands of the equipment. To effectively address this increasing backlog, significant efforts are being undertaken to increase the output of cataract surgical services in many developing countries and make cataractsurgeryaffordabletoallpeopleirrespectiveof their economic status.[3]

The main objective in modern cataract surgery is to achieve a better unaided visual acuity with rapid post-surgical recovery and minimal surgery-related complications.[4]Earlyvisualrehabilitationandbetter-unaidedvisioncan beachievedmainlybyreducingtheincisionsize.[5]Over the past several decades, the evolution of cataract surgical techniques has been associated with a progressivedecreaseinthesizeofthecataract surgicalincision. Woundsizehasprogressivelydecreasedfrom12.0mm in intracapsular cataract surgery to about 10.5 mm in earlyextracapsularsurgery,and5.5–7.0mmwithin phacoemulsification, the duration of surgery, Phacoemulsificationpower used, and even the incidence of intraocular complications varies with the nucleus density. In SICS, the time spent on nucleus delivery does not differ from patient to patient. Hence, manual small incision techniques are gaining popularity, as they are quick,relativelyinexpensivetechniquesforlarge-scale cataract management in developing countries.[11]

SICS is an up-and-coming technique, even in the developed countries. SICS is more and more looked upon, not as a 'poor man's phacoemulsification' but rathera viabletechnique. Insomesocieties,itisapreferable alternative to phacoemulsification. In addition, a background in MSICS will ease the learning curve for phacoemulsification, as many steps are familiar. Mastering SICS will also help save a phacoemulsificationsurgery if one is forced to bail out and still come out with arespectable sutureless outcome to the surgery[12]the advent of phacoemulsification. Thewidespreaduse of foldable intraocular lens (IOL) has implanted the incision wound to decrease to 3.0 mm or smaller.[6]

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In intraoperative management, reduced wound size has several advantages. The smaller the incision, the more stable the anterior chamber with improved control during capsulorhexis and hydrodissection[7].More minor wounds heal more rapidly during the postoperative period with less risk for haptic, iris prolapse,and a theoretically reduced risk for the infection as it Panophthalimitis andendophthalmitis.[8]

Manual small incision cataract surgery (SICS), liketheextracapsularcataractextraction(ECCE) technique but with its sutureless, relatively smaller incision,hassimilaradvantagestophacoemulsification affordable. It has evolved as an effective alternative to phacoemulsification in the present times because it combines both sutures less benefits of phacoemulsification with minimum investment.[9]SICS has the advantages of small suture-less incisions regarding early wound stability, less postoperative inflammation, and no suture-related complications such as those in conventional ECCE. MSICS also has the advantage of being manual where no posterior segment (vitreous, choroid, retina) complications such as those in phacoemulsification are present[10]Moreover;SICS can be performed in almost all types of cataract in contrast to phacoemulsification where case selection is significant for an averagesurgeon;hence,itisamoreappropriatesurgical procedureforthetreatmentofadvancedcataractinthe Developing Countries.[5]

MATERIALS AND METHODS

Both phacoemulsification and SICS wereperformed at the Department of Ophthalmology, Era University, Lucknow, Uttar Pradesh. Thestudywasconductedbetween1January2020and28March 2021.The outcome was evaluated in both techniques in early visual rehabilitation, surgically induced astigmatism, and final best-corrected visualacuity. Two hundredeyes were assigned to phacoemulsification with a foldable IOLimplantation, andtheother200eyeswereassignedtoSICS. Ophthalmic history was taken regarding the onset, course, and duration of diminution of vision, history of drug intake for eye diseases, and history of previous eye surgery. Medical history was also taken regarding diabetes mellitus, hypertension,autoimmunedisease(suchasrheumatoid arthritis), cardiac diseases, and other relevant medical conditions. The preoperative examination included uncorrected visual acuity (UCVA), refraction, best-corrected visual acuity (BCVA), color vision testing, pupillary light reflex testing, slit-lamp assessment of the anteriorsegment,intraocularpressuremeasurementby the schiotz tonometer, and posterior segment examination done by Ophthalmoscope and OCT. A Keratometer was used to detect the steepest and flattest corneal meridian. The difference between them was the amount of corneal astigmatism, and its axis was the axis of the steepest meridian. The information reviewed and documented in this study included patients' sex, age, preoperative and postoperative UCVA,BCVA, preoperative clinical diagnosis, preoperative and postoperative corneal astigmatism, and astigmatic axis using keratometric readings, calculating surgically induced astigmatism (SIA), and intraoperative and postoperative complications. Each patient inboth groups in this study was followed up on the first postoperative day and one week, 15 days, one month,and 1.5monthsafterthe operation.BCVAdatawerecategorized as better than, equal, or less than6/18.

In phacoemulsification, after sterilization and topical anesthetic drug and application of a wire or universal speculum, a corneal tunnel using disposable ophthalmic 3.0-mm keratome was made in the upper temporal quadrant of about 2 mm length and 3 mm width. After that, side ports were made using a 20-G disposable ophthalmic microvitreoretinal blade. An adequate amount of ophthalmic viscoelastic was then injected to fill the anterior chamber and flatten the anterior capsule of thelensfora propersubsequentcapsulorhexisprocedure. Continuous curvilinear capsulorhexis was performed with a self-fashioned cystotome using a bent 24-G needle; if needed, a capsulorhexis forceps was used to complete the process, ending with 6 mm wide capsulorhexis. Hydro dissectionwas then performed using a 27-G flat tip hydro dissection cannula.Standard tips with 15° bevel fitted on phacoemulsification handpiece were used in all patients in phacoemulsification systems. The divide and conquer technique was applied to performnucleusdisassemblyunderspecificparameters.

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In SICS, after sterilization and draping and applyingawirespeculum,peritomywasperformed superiorly with scissors where the conjunctiva and the Tenon'scapsuleweredissectedseparately,andbleedingwas cleared with a wet-field cautery. For wound construction, a frown incision was made with the tip of a crescent blade at about 1.5–2 mm distance from the limbus. The external width of the incisionwas about 6–6.5 mm, according to the expected size of the nucleus. The incision was dissected forward for 1–1.5 mm into a clear cornea with a bevel-up crescent blade.

RESULTS

There was a mean age of 60 years with 1.84 SD in the phacoemulsification group versus a mean age of 61 years with 1.25 SD in the SICS group concerning the age. Concerning the sex, there were more male patients 120 (60%) as compared with female patients 80 (40%) in the phacoemulsification group, but there were more female patients 110(55%)] as compared with male patients 90 (45%) in the SICS group.

Table 1 Age distribution among the study groups

	Group A	Group B	p-Value
Mean Age	60±1.84	61±1.25	0.42

Table 2 Sex distribution among the study groups

	Male (%)	Female (%)
Group A	120 (60)	80 (40)
Group B	90 (45)	110 (55)

Both surgical techniquesachieved excellent surgical and visual outcomes with low complication rates. The initial visual recovery on the first postoperative day was better in the patients who underwent phacoemulsification, with UCVA better than or equal to 6/18 in 75% of the patients. In contrast, the percentage was 60% in the SICS group. The initial difference was nearly equalized within fourweeks. In the sixth month, 85% of the patients in the SICS group had better than or equal to 6/18 UCVA versus 90% of the patients in the phacoemulsification group. The mean SIA was comparable in the two groups at 3 and 6 months postoperatively.

Table 3 Postoperative uncorrected visual acuity on the first dayand at six months

	Day 1 (%)	6 months (%)
Group A (UCVA≥6/18)	75	90
Group B (UCVA≥6/18)	60	85

UCVA- uncorrected visual acuity

Table 4 Comparison between the mean preoperative and postoperative corneal cylinder at 6 months in each group

	Mean preoperative cylinder	Mean postoperative cylinder at 6 months	*P* value
Group A	0.9 ± 0.44	1.1 ± 0.36	>0.05
Group B	0.73 ± 0.48	0.94 ± 0.34	>0.05

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The mean SIA in the phacoemulsification group was1.23 ± 0.32 D at three months and 1.18 ± 0.2 D at six months. In the SICS group, the mean SIAwas1.27 ± 0.22 D at three months and 1.2 ± 0.23 D at six months. There was no significant statistical difference between both groups regarding the mean SIA. The mean age of the patients was about 60 years in groupAandalmost61yearsingroupB;hence,themean ageisnearlysimilarinbothgroups.Thiswasimportant when comparing the astigmatic effect between thetwo groups,astherelaxingeffectofanincisionvarieswith the patient's age.

Table 5 Comparison between the mean preoperative and postoperative axis at six months within each group

	Mean preoperative axis (deg.)	**Mean postoperative axis (deg.)**	***P* value**
Group A	90 ± 48.96	92.5 ± 49.6	>0.05
Group B	93 ± 52.38	90.25 ± 50.33	>0.05

Table 6 Mean surgically induced astigmatism at 3 and 6 months postoperatively in both groups

	SIA at three months	**SIA at six months**
Group A	1.23 ± 0.32	1.18 ± 0.2
Group B	1.27 ± 0.22	1.2 ± 0.23
***P* value**	>0.05	>0.05

SIA- Surgically Induced Astigmatism.

Concerning the preoperative visual acuity in this study, it was almost similar in both groups. The visual outcome achieved on the first postoperative day was better in group A. The patients underwent phacoemulsification, where the percentage of patients who achieved UCVA of 6/18 or better was 75%. In contrast, it was 60% in group B. Both groups achieved good visual results after six months, and the difference in UCVA and BCVA between both groups was statistically insignificant.Concerningthe SIA in this study, the mean SIA in group A was 1.23 ± 0.32 D at threemonths after the operation and 1.18 ± 0.2 D at sixmonths, whereas,in group B,it was1.27±0.22Datthreemonthsafterthe operationand1.2±0.23Datsix months.Therewasnosignificant statistical difference between both groups regarding the meanSIA.

DISCUSSION

Phacoemulsification is now the preferred technique among most eye surgeons all over the world. Another alternative to phacoemulsification – SICS – was shown to get popularity because of itscomparable surgical and postoperative outcomes similar to phacoemulsification. Furthermore, SICS has added benefit of being a cheap and affordable technique; hence,itcanbeusedinovercrowdedpoorcommunities. Manycataractsurgeriesareneeded to be performed to overcome the increasing incidence of blindness in those communities. In this study, the twotechniquesofcataractsurgerywerecomparedfrom their effect on the SIA and subsequently the postoperative visualacuity.Thismeansthatbothmethodshavechangedthecorneal cylinder, but the effect was minimal in bothgroups.Gogate*et al.*[14] compared phacoemulsification and SICS concerning postoperative astigmatism. Averageastigmatismforthephacoemulsificationgroup was 1.1 D (0.9 SD), and for the small incision group, it was 1.2 D (0.8 SD). 49.2%of patients in the phacoemulsification group and 73 of the 39.0% patients in the small incision group hadastigmatismupto0.75D.Thus,asignificantlysmaller number of patients in the phacoemulsification

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group had astigmatism of less than 1D.Khan *et al*.[15] studied the visual outcome and complications of sutureless MSICS. The aim was to determine the SIA and difficulties of sutureless SICS. In all, 150 eyes of 134 patients were includedin this study. Cataract surgery was performed in allpatients as a manual sutureless small incision technique.Final BCVA 6 months postoperatively was 6/18 orgreater in 86.8% of patients. Astigmatism was notedto be significant or high in 50% of patients, which is alarge percentage. Still, the study proved that the courseof time has no significant effect on the final amountof postoperative astigmatism in eyes operated bySICS. Other complications included hyphemanoted in 17 (11.3%) patients, posterior capsule rupturein five (3.3%) patients, endophthalmitis in two (1.3%)patients on the firstpostoperative day. They concludedthat SICS is a safe and effective procedure withrapid visual rehabilitation; the amount of postoperativeastigmatism was high in significant patients, and the final best-corrected visual outcome was good in most patients.Imtiyaz*et al*.[16] conducted a study on 115 patientsconcerned with visual rehabilitation after MSICS. Theyfound that 70 (60.8%) patients improved to a UCVAof 6/12 or better in the third week only, and 88 (76.52%)patients had a UCVA of 6/12 or better by the end ofthe 12th week. They found that the most typical cause of anuncorrected vision of less than 6/12 was astigmatism.Of the 27 patients with a visual acuity of less than 6/12at 12th week, 20 (74%) patients had postoperativeagainst-the-rule astigmatism, and seven (26%) patientshad postoperative with-the-rule astigmatism. Fromthe above observation, they concluded that patientsundergoing MSICS have an early visual rehabilitation.This quick visual restoration is attributed to minorinflammation and less SIA.

CONCLUSION

The phacoemulsification technique has the advantage of early visual rehabilitation after cataract surgery, and this is mainly attributed to the small incision size used. However, phacoemulsification is an expensive technique; hence, it is not an affordable technique in developing countries with a meager income. With its sutureless and relatively more minor incision, SICS has similar advantages tophacoemulsification and is affordable; hence, it is an excellent alternative to phacoemulsification.In this study using both techniques, it was found that both methods can give excellent visual results. However, it was found that there is an increased incidence of posterior capsule opacification in the SICS group.The occurrence of endophthalmitis confirmed that no technique is immune until now, and all available prophylactic measures possible must beused.

There are many surgeons nowadays, especially in the developing countries, who prefer SICS, whereas others perceive phacoemulsification as the only way, and if failed, they convert to the unplanned ECCE.If phacoemulsification is not planned, conversion to SICS instead of conventional ECCE utilizes the same wound as the phacoemulsificationone and provides better outcomes than the traditionalECCE.Transition to phacoemulsification is easier if one has mastered SICS, as he is familiar with thestepssuch as sclera pocket incision, capsulorhexis, and hydroprocedures. Familiarity with these steps helps to reduce the incidence of complications while learning phacoemulsification.

REFERENCES

1. Thylefors B, *et al.* Global data on blindness: an update. Bull World Health Organ 1995;73:115–121.
2. Foster A. Elimination of cataract blindness. Survey 2000;45:532–543.
3. Limburg H, Vasavada A, Muzumdar G, *et al.* Rapid assessment of cataract blindness in urban district of Gujarat. Indian J Ophthalmol 1999; 47:135–141.
4. Mitchell PW. Update on bimanual microincisional cataract surgery. CurrOpinOphthalmol 2006;17:62–67.
5. Ravindran RD, Haripriya A, Minu M. In: Ashok G, Luther L, Geoffery T,*et al.* editors. Relevance and clinical significance of SICS (manual phaco) in modern cataract surgery. *Clinical practice in small incision cataract surgery (phacoemulisificationmanual).* 1st ed. Jaypee Brothers; 2005.238–240.

6. SosciaW,HowardJG,OlsonRJ.Micro-phacoemulsificationwithWhiteStar: a wound-temperature study. J Cataract Refract Surg 2002;28:1044–1046.
7. Tsuneoka H, Shiba T, Takahashi Y. Feasibility of ultrasound cataract surgerywitha1.4mmincision.JCataractRefractSurg2001;27:934–940.
8. Naus NC, Luyten GPM, Stijnen T, *et al.* astigmatism and visual recovery afterphacoemulsificationandconventionalextracapsularcataract extraction. Doc Ophthalmol 1995; 90:53–59.
9. GogatePM,DeshpandeM,WormaldRP.Ismanualsmallincisioncataract surgery affordable in the developing countries? A cost comparison with extracapsular cataract extraction. Br J Ophthalmol 2003;87:843–846.
10. Steinert RF, Brint SF, White SM, *et al.* astigmatism after small incision cataract surgery: a prospective, randomized, multicenter comparison of 4- and 6.5-mm incisions. Ophthalmology 1991;98:417–424.
11. Ronnie G, PankajR, SripriyaAV, Rajesh PS, SmitaP. Comparison of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small-incision surgery and phacoemulsification. Ophthalmic Epidemiol 2005; 12:293–297.
12. NikhileshT. In: Ashok G, Luther L, GeofferyT, *etal.*editors. Blumenthal's technique in MSICS: a 100% approach. *Clinical practice in small incision cataractsurgery(phacoemulisificationmanual).*1sted?:JaypeeBrothers;2005.344–352.
13. Ruit S, Tabin G, Chang D, Bajracharya L, Kline DC, Richheimer W, *et al.* A prospective randomized clinical trial of phacoemulsification vs. manual sutureless small-incision extracapsular cataract surgery in Nepal. Am J Ophthalmol 2007;143:32–38.
14. Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, *et al.* Safety and efficacy of phacoemulsification compared with manual small-incision cataract surgery by a randomized controlled clinical trial: six- week results. Ophthalmology 2005;112:869–874.
15. MT Khan, S Jan, Z Hussain, S Karim, MK Khalid. Visual outcome and complications of manual sutureless small incision cataract surgery. Pak J Ophthalmol 2010;26.
16. Ahmed I, A Wahab, S Sajjad, RA Untoo. Visual rehabilitation following manual small incision cataract surgery. JK Sci 2005;7:146–148.
17. Gogate, Deshpande M, PK Nirmalan. Is manual small incision cataract surgeryassafeforthecorneaasphacoemulsification2008;114:965–968.