Original Research Article

# Clinical comparison of visual outcomes following manual small incision cataract surgery and phacoemulsification

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## Abstract

The WHO projects that between 2000 and 2020, the number of cataract surgeries performed worldwide must be tripled. In India out of the 9 - 12 million who are blind, 80% are due to cataract. Our annual incidence of cataract blindness is 3.8 million, which is added to a backlog of 10 million operable cataract in India, whereas only 5 million cataract surgeries are performed annually in the country. Out of 200 patients, 100 were operated by MSICS with PCIOL implantation under LA. Peribulbar block with 5 ml of anesthetic solution, i. e., mixture of 2%lignocaine with 1:1000 adrenaline with 50 units of hyalase and 0.25 % bupivacaine was given. Digital ocular compression is given every 30 seconds, pressure would be released for 5 second. Visual acuity improved in both the groups by the 6th week. Uncorrected visual acuity of better than 6/18 was seen in 60 cases in Group A and 72 cases in Group B. Best Corrected visual acuity of more than 6/18 was seen in 94 cases in Group A and 96 cases in Group B.

**Keywords:** Visual Outcome, Manual Small Incision Cataract Surgery, Phacoemulsification.

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## INTRODUCTION

Cataract is a major cause of curable blindness in the world. Cataract forms the second most prevalent treatable blindness in world today. Cataract extraction is the most frequently performed surgical procedure in patients above 60 years of age. The incidence of cataract has also increased drastically over the past decade. An estimated 16 - 20 million are blind bilaterally from cataract. The number is increasing because of backlog of untreated cataract and underutilisation of existing facilities, more in the developing countries. Cataract left untreated could lead to severe complications, ultimately resulting in irreversible slight loss.

It is estimated that in Africa and Asia atleast 1 in 1000 population go blind from cataract every year i.e. 600,000 per year in Africa and 1,000,000 per year in Asia. The WHO projects that between 2000 and 2020, the number of cataract surgeries performed worldwide must be tripled. In India out of the 9 - 12 million who are blind, 80% are due to cataract. Our annual incidence of cataract blindness is 3.8 million, which is added to a backlog of 10 million operable cataract in India, whereas only 5 million cataract surgeries are performed annually in the country.[1]

There are two ways in which cataract is removed

- Intra Capsular Cataract Extraction
- Extra Capsular Cataract Extraction

Outcome studies are necessary to evaluate safety and efficacy of various cataract extraction procedures, because ultimately the primary indicator of accomplishment is not the number of surgeries performed, but the number of cases in which patients reported improvement in vision.

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Our study was designed to be such an outcome study with the primary objective of evaluating the :

- Efficacy by visual acuity and post operative induced astigmatism.
- Safety by incidence of post - operative complications.

Currently four principal surgical techniques are used in our country to treat cataract blindness :[2]

- Intra Capsular Cataract Extraction with aphakic glasses
- Conventional Extra Capsular Cataract Extraction with PCIOL implantation
- Manual Small Incision Sutureless Cataract Surgery with PCIOL implantation
- Phacoemulsification with PCIOL implantation.

Phacoemulsfication with PCIOL implantation is becoming popular among the affluent society of developing countries; although in developed countries it is the gold standard procedure. In developed countries like USA, 86% of cataract surgeries are done by Phacoemulsification and 14% by ECCE. Its advantage being greater wound stability and hence earlier rehabilitation in the changing socioeconomic scenario. It's operative and maintenance costs, availability of trained surgeons and prohibitive factors limit it's use in mass programmes. The more recent Manual Small Incision Sutureless Cataract Surgery (MSICS) with PCIOL implantation offers the advantages of standard Phacoemulsification without the cost factor. It also has another added advantage of being a quicker procedure than ECCE with PCIOL implantation increasingly used in mass programmes.[3,4]

## METHODOLOGY

**Group A :** 100 who underwent Manual Small Incision Cataract Surgery with rigid PMMA IOL implantation.

**Group B :** 100 who underwent Phacoemulsification with foldable IOL implantation.

**INCLUSION CRITERIA**

All cataract patients in age group of 45 – 80 years with normal fundus and intraocular pressure.

**EXCLUSION CRITERIA**

1) Complicated cataract.
2) Traumatic cataract.
3) Congenital and developmental cataract.
4) Uveitis with corneal oedema.
5) Any macular or optic nerve disease.
6) Any preceding eye disease other than cataract

**SURGICAL PROCEDURE UNDERTAKEN IN**

**Manual Small Incision Cataract Group**

Out of 200 patients, 100 were operated by MSICS with PCIOL implantation under LA.

Peribulbar block with 5 ml of anesthetic solution, i. e., mixture of 2%lignocaine with 1:1000 adrenaline with 50 units of hyalase and 0.25 % bupivacaine was given. Digital ocular compression is given every 30 seconds, pressure would be released for 5 second.

Eyelids and surrounding areas were thoroughly cleaned with diluted betadine. Exposure of the operative field was achieved by application of eye speculum. All the surgeries were done by a single surgeon.

In the manual small incision cataract group, conjunctival irrigation done with diluted betadine and balanced salt solution. A superior rectus bridle suture was put for fixation and the eyeball was rotated downwards. A fornix based conjunctival flap was made just sufficient to accommodate the incision. Hemostasis was then achieved with bipolar wet field cautery to blanch the exposed episcleral and scleral vessels.

A frown shaped 6mm long external scleral incision was made 2mm posterior to the anterior limbal border at superior limbus with a sharp guarded knife to create ½ depth scleral groove.

Then the bevel of rounded crescent blade engaged into the scleral groove and its lamellae split along the entire length by gentle wiggled side to side movements with forward pressure. The tunnel was extended upto 1 mm into the clear cornea, just anterior to the vascular arcade careful attention was paid to assure that dissection remains at the desired depth along its entire length.

While entering into the cornea, tip of the blade was kept up to follow its curvature . Then 3.2 mm keratome was passed through the tunnel and at the anterior border of the tunnel in the clear cornea, the tip was angled down to create dimpling in the cornea and anterior chamber was entered.

Thus the scleral tunnel incision had 3 components

1. External Frown / Chevron / Straight scleral incision.
2. Sclero corneal tunnel.
3. Internal corneal incision into Anterior Chamber

**CAPSULOTOMY**

After entering the anterior chamber with keratome, viscoelastic (2% hydroxyl propyl methyl cellulose) was injected and a side port incision was made in the cornea using a side port knife about 120 degree away from the main incision. Continuous Curvilinear Capsulorrhexis was made in all cases. Tunnel incision was enlarged with blunt tip extension knife cutting on the inward stroke, to the full extent of external incision.

Hydrodissection was done. Nucleus was brought into the anterior chamber and viscoelastic was injected both above and below the nucleus.

**NUCLEUS DELIVERY**

Irrigating wire vectis was passed under the nucleus and the nucleus was delivered out by hydro extraction.

CORTICAL WASH

The residual cortical material was removed using a two way Simcoe cannule.

IOL IMPLANTATION

Single piece PMMA intraocular lens of appropriate power, with optic diameter of 6mm was then inserted into the capsular bag.

CLOSING THE SCLERAL TUNNEL

The anterior chamber was inflated with fluid from side port. The inferior limbus and the dome of the cornea was pressed to check the integrity of the wound.

Subconjunctival injection of 0.5 ml of Gentamycin and 0.5 ml of Dexamethasone was instilled in the subconjunctival sac. Pad and bandage were applied.

Post – operatively analgesics, sedatives and antibiotics were prescribed. Dressing was changed and the dark glasses were given the next day.

Topical antibiotic steroid combination was applied. Wound approximation, depth of the anterior chamber clarity of anterior chamber and status of the fundus were examined. Any complications like striate keratitis were treated.

Post – operative vision with pinhole was tested.

The patients are instructed to continue antibiotic steroid drops hourly and advised to come for the first follow up after 1 week, 4th week, then for refractive correction after six weeks.

**Phacoemulsification Group**

100 cases underwent phacoemulsification with foldable IOL implantation under LA.

A 2.8 mm scleral tunnel 1 mm to 2 mm away from the limbus was made after peritomy. Side port incisions were made in the cornea at the required quadrants. Continuous curvilinear capsulorrhexis was made followed by hydrodissection in all cases. A deep central groove was sculpted in the nucleus with the tip of the phaco probe and the nucleus bisected into two. The nucleus was emulsified using Divide and Conquer technique. The remaining cortex was aspirated using a simcoe's cannula. After filling the bag with viscoelasti, an acrylic single piece foldable IOL was inserted. The eyes were reinflated with fluid. The tunnel integrity was checked and paracentesis incisions were hydrated stromally. Surgery was completed with subconjunctival injection of dexamethasone and gentamycin.

## RESULTS

**Table 1:** Table showing preoperative visual acuity of patients in the study

| VISUAL ACUITY | NO OF CASES | PERCENTAGE |
|---|---|---|
| PL +VE – CF-CF | 54 | 27% |
| CF 1m – 3m | 92 | 46% |
| CF 4m – 6m | 30 | 15% |
| >6/60 | 24 | 12% |

**Table 2: Table showing visual acuity in the first post operative day**

| VISUAL ACUITY | Group A (MSICS) | Group B (Phaco) |
|---|---|---|
| 6/6 – 6/12 | 28 | 36 |
| 6/18 – 6/24 | 48 | 54 |
| 6/36 – 6/60 | 20 | 6 |
| < 6/60 | 4 | 4 |

Uncorrected Visual Acuity better than 6/12 was seen in 44 cases in Group A compared to 52 cases in Group B. Visual acuity better than 6/18 was seen in 84 cases in Group A and 94 cases in Group B after best correction.

**Table 3 :** UCVA and BCVA after 1 week post operative

| VISUAL ACUITY | UCVA | | BCVA | |
|---|---|---|---|---|
| | Group A | Group B | Group A | Group B |
| 6/6 – 6/12 | 44 | 52 | 84 | 94 |
| 6/18 – 6/24 | 34 | 36 | 10 | 4 |
| 6/36 – 6/60 | 20 | 12 | 4 | 2 |
| < 6/60 | 2 | 0 | 2 | 0 |

Visual acuity improved in both the groups by the 6th week. Uncorrected visual acuity of better than 6/18 was seen in 60 cases in Group A and 72 cases in Group B. Best Corrected visual acuity of more than 6/18 was seen in 94 cases in Group A and 96 cases in Group B.

**Table 4:** UCVA and BCVA after 6th post operative week

| VISUAL ACUITY | UCVA | | BCVA | |
|---|---|---|---|---|
| | Group A | Group B | Group A | Group B |
| 6/6 – 6/12 | 60 | 72 | 94 | 96 |
| 6/18 – 6/24 | 26 | 22 | 4 | 2 |
| 6/36 – 6/60 | 12 | 6 | 2 | 2 |
| < 6/60 | 2 | 0 | 0 | 0 |

## DISCUSSION

Phacoemulsification is the preferred technique for cataract surgery in developed countries, and also to some extent in the developing countries. An alternative surgical technique, manual sutureless small incision extracapsular cataract surgery, has been gaining popularity, as the technique has been shown to yield comparable surgical outcomes as phacoemulsification. Both phacoemulsification and manual small incision cataract surgery (MSICS) achieve excellent visual outcomes with low complication rates, but MSICS is less expensive and requires less technology; hence, preferred by many surgeons in the developing countries. With this backdrop the results of the study are analysed and discussed below. This study compares the visual outcomes, surgically induced astigmatism and Postoperative complications of phacoemulsification and small incision cataract surgery. The values of uncorrected and best corrected visual acuity in both the groups were comparable to most reported studies. Visual acuity on the first post operative day was better in the phacoemulsification group with 36 % of the patients showing visual acuity > 6/12 compared to 28 % in the manual small incision cataract group, owing to less surgical manipulation in the anterior chamber and less inflammatory material induced by the foldable IOL material. The post operative uncorrected visual acuity at 1st post operative week was > 6/12 in 44 % of the patients in Group A and 52 % in Group B, but not statistically significant (p=0.157). The best corrected visual acuity at 1st post operative week was >6/12 in 84 % in group A and 94 % in group B (p=0.024). At 6 weeks both the groups achieved good visual outcome with best possible correction after 6 weeks. However a difference is seen in the uncorrected visual acuity between the two groups with the phacoemulsification group showing better results of uncorrected visual acuity at the end of 6 weeks. A visual acuity of better than 6/18 was seen in 60 % of the patients in Group A compared to 72% in Group B. However this difference of uncorrected visual acuity at the end of 6 weeks between the two groups was not statistically significant (p=0.073). 94 eyes of Group A and 96 eyes of Group B had best corrected visual acuity of better than 6/18 at the end of 6 week. Two case each in Group A and Group B reported best corrected visual acuity of < 6/36. There are several possible reasons for the better visual outcomes in phacoemulsification group. The less surgical manipulation required along with the small size of the incision and better clarity of Foldable IOL which induced less inflammation were probably the cause. The mean surgically induced astigmatism in Group A (manual SICS) is 0.99 D and Group B (phacoemulsification) is 0.67 D and the difference betweeen the mean SIA in the two techniques was 0.32D. The less surgically induced astigmatism in the phacoemulsification group was probably due to the smaller incision used. The uncorrected visual acuity of a patient and his / her needs for spectacles depends on the total astigmatism (post operative astigmatism) and not on the shift in astigmatism as seen in surgically induced astigmatism. 60% in Group A and 84% in Group B had surgically induced astigmatism of less than or equal to 1 D. Careful technique and audit of personal outcomes is advisable as the incision size is not the sole factor causing surgically induced astigmatism. Other factors such as wound architecture, instrument handling, stretching of the incision and thermal damage also influence astigmatism. The validity of our study was good; there was no deviation from the protocol. All the cases which did not fit into the baseline criteria and those lost in the follow up were removed from the study. All the cases were done by a single surgeon. The participating surgeon was trained and very experienced. The major limitation of our study was the short follow up period i.e., 6 weeks postoperative period. Endothelial cell counts were not recorded. The cost effectiveness and time taken for the surgical technique were also not taken into consideration in the study. Calculation of astigmatism was done by subtraction method using keratometry readings and not by vector analysis. MSICS can be performed under retrobulbar, peribulbar, sub-tenon and topical anesthesia. A study by Parker *et al* compared the use of sub-tenon anaesthesia and peribulbar anaesthesia in MSICS and found no difference in results. About 64.8% patients of the peribulbar group had absolute akinesia during surgery as compared to none (0%) in sub-tenon group. There was no difference in the final visual acuity and intraoperative and postoperative complications except that the sub-tenon group had slightly greater incidence of sub-conjunctival hemorrhage.[5] All of our surgeries were performed under peribulbar anesthesia. A study by Bellucci *et al* described the use of topical anesthesia for small incision cataract surgery (SICS ).A study by Kaderli *et al* successfully performed MSICS

using deep topical anesthesia with 4% lidocaine in 326 eyes. They found that the cauterization of the scleral vessels and conjunctiva, and the subconjunctival injection were the stages causing severe pain. George *et al* compared Surgically Induced Astigmatism (SIA) following Manual Small incision cataract surgery (MSICS) and phacoemulsification (PE) in 186 eyes with nuclear sclerosis of grade 3 or less. Mean SIA was 0.95 D in the SICS group and 0.65 D in the PE group (P= 0.001). PE induced less astigmatism than SICS.[6] In our study Mean SIA was 0.99 D in the Small incision cataract surgery group (MSICS) and 0.67 D in the Phacoemulsification(PE) group. Phacoemulsification induced less astigmatism than SICS. Gogate *et al*. Compared the efficacy, safety, and astigmatic change after cataract surgery by phacoemulsification and MSICS. The intraoperative and post operative complications, UCVA, BCVA, and astigmatism were recorded at 1 and 6 weeks post operatively. They found that 68.2% patients in the phacoemulsification group and 61.25% patients in the SICS group had UCVA better than or equal to 6/18 at 1week. At 6 weeks follow up, 81.08% patients in the phacoemulsification group and 71.1% patients in the SICS group had UCVA of better than or equal to 6/18. The mode of astigmatism was 0.5 D for the phacoemulsification group and 1.5 D for the small incision cataract surgery group, and the average astigmatism was 1.1 D and 1.2 D respectively. There was an intrasurgeon variation in the astigmatism. The Phaco group had 7 posterior capsule rents compared with 12 in small incision group, but the phaco group had more corneal oedema on the first post operative day. They concluded that both phacoemulsification and SICS are safe and effective for visual rehabilitation of cataract patients, although phacoemulsification gives better UCVA in a larger proportion of patients at 6 weeks.[7] Our study in comparison with the above study showed that 52% patients in the phacoemulsification group and 44% patients in the SICS group had UCVA better than or equal to 6/12 at 1 week. At 6 weeks follow up, 72% patients in the phacoemulsification group and 60 % patients in the SICS group had UCVA of better than equal to 6/12. The mean surgically induced astigmatism in our study was correlating with the above study. The mean SIA in group A was 0.67 D in the phacoemulsification group and 0.99 D in the Manual small incision cataract group. Ruit *et al*. Compared the efficacy and visual results of phacoemulsification vs MSICS for the treatment of cataracts. They compared cases on parameters like operative time, surgical complications, uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), astigmatism, and central corneal thickness (CCT). They found that both the surgical techniques achieved excellent surgical outcomes with low complication rates. At six months, 89% of the SICS patients had UCVA of 20/60 or better and 98% had a BCVA of 20/60 or better vs 85% of patients with UCVA of 20/60 or better and 98% of patients with BCVA of 20/60 or better at six months in the phaco group (P=0.30). Surgical time for SICS was much shorter than that for phacoemulsification (P < 0.0001). They concluded that both the techniques achieved excellent visual outcomes in the groups with less complications. SICS is significantly faster, less expensive and less technology dependent than phacoemulsification and hence may be more appropriate surgical procedure for the treatment of advanced cataracts in the developing world.[8] Our study showed BCVA of 6/6 - 6/12 in 94% at the end of 6$^{th}$ week for SICS vs. 96% in phacoemulsification. Surgical time for SICS was shorter than phacoemulsification. Venkatesh R *et al* conducted a randomised prospective study to compare the safety and efficacy of phacoemulsification and small incision cataract surgery for treatment of white cataract. On the first post operative day, the UCVA was comparable in the two groups (p= 0.805) and the MSICS group had less corneal oedema (10.2%) than the phacoemulsification group (18.7%). At 6 weeks, the UCVA was 20/60 or better in 87.6% in phacoemulsification group and 82% in MSICS group(p= 0.10) and the BCVA was 20/60 or better in 99% and 98.2% respectively (p=0.59). The mean surgical time was significantly shorter in the MSICS group than the phaco group. Posterior capsular tear was seen in 3 eyes (2.2%) in the phacoemulsification group and 2 eyes (1.4%) in the MSICS group (p= 0.618).[9,10] This study concluded that both the techniques achieved excellent visual outcomes with low complication rates. Because MSICS is significantly faster, less expensive and less technology dependent than phaco it may be more appropriate technique in eyes with mature cataract especially with the adjunctive use of trypan blue dye. A study by Venkatesh R *et al* reported good results of MSICS in brunescent and black cataracts. Our study in comparison with the above studies showed UCVA of 6/12 or more in 72 % in the phaco group compared to 60 % in the MSICS group. A visual acuity of 6/18 – 6/24 was noted in 22% in the phaco group and 26 % in MSICS group. The BCVA in our study was better than 6/9 in 96 % in the phaco group and 94 % in the MSICS group. A visual acuity of 6/18 – 6/24 was seen in 4 % in the both the groups. Our study also showed similar results in terms of SIA with the phaco group showing a post operative SIA of 0.67D and the MSICS group 0.99D which was statistically significant.

## CONCLUSION

This study concludes by stating that at 6 weeks, manual small incision cataract surgery is comparable to

phacoemulsification technique gives better uncorrected visual acuity in a slightly larger proportion of patients at 6 weeks. Manual small incision cataract surgery is safe and nearly as effective. Manual Small incision cataract surgery does not need the capital investment and recurring expenditure of a phacoemulsification machine and is thus an alternative to phacoemulsification whenever the requisite equipment and expertise are not available.

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