A Comparative Study Between Manual Small Incision Cataract Surgery, Planned Extracapsular Cataract Extraction and Phacoemulsification In Mature Cataract Cases

Gamal Mostafa Abo El Maaty, Mohamed Elmoddather, Ashraf Mohamed Gad Elkareem, Hassan Shamselden Yousef

Ophthalmology department, Faculty of Medicine, Al-Azhar university, Assuit, Egypt.
moddatheryym1@yahoo.com

Abstract: Aim of the work: To compare the surgically induced astigmatism, financial cost, intraoperative difficulties and complications and postoperative complications and visual outcome of manual sutureless small-incision cataract surgery (SICS), planned extracapsular cataract extraction and phacoemulsification. **Design:** Prospective, randomized comparison of 60 consecutive patients with mature cataracts. **Methods:** Sixty consecutive patients with mature cataracts were assigned randomly to receive either MSSICS, planned extracapsular cataract extraction (ECCE) and phacoemulsification. **Intervention** Cataract surgery with implantation of intraocular lens. **Measures:** Operative time and coast, surgical complications, uncorrected and best-corrected visual acuity (BCVA), surgically induced astigmatism. **Results:** these surgical techniques achieved excellent surgical outcomes with low complication rates. On postoperative day 1, the groups had comparable uncorrected visual acuity (UCVA) (*P* _ 0.185) and the MSSICS group had least corneal edema (*P* _ 0.0038). At six months, 92% of the MSSICS patients had UCVA of 20/60 or better and 98% had a best-corrected visual acuity (BCVA) of20/60 or better vs 85% of patients with UCVA of 20/60or 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* <.0001). **Conclusion:** MSSICS, planned ECCE and phacoemulsification achieved excellent visual outcomes with low complication rates ECCE is significantly faster, less expensive, and less technology dependent than MSSICS and phacoemulsification but with higher surgically induced astigmatism than MSSICS and phaco.MSSICS may be the more appropriate surgical procedure for the treatment of mature cataracts in the 3rd world countries.
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Key Words: MSICS, Planned Extracapsular Cataract Extraction, Phacoemulsification, Mature Cataract.

1. Introduction

ECCE is a refractive procedure aiming to remove the lenticular opacity with preservation of the posterior capsule and apart from the equatorial anterior capsule (bag) to allow implantation of a posterior intraocular lens implantation to correct refractive error[(1)]. The major drawback of ECCE is the large wound and sudden hypotony increasing the risk of expulsive hemorrhage, infection and high postoperative surgically induced astigmatism[(2)]. Phacoemulsification developed to ensure closed chamber surgery decreasing the risk of expulsive hemorrhage and rapid rehabilitation of the patient after surgery and good postoperative UCVA due to less amount of surgically induced astigmatism and also decrease the incidence of infections[(3)]. The main drawback of phacoemulsification is the financial cost and heat production affecting corneal endothelium and it needs a special skills otherwise disasters occurs in the form of corneal decompansation and posterior segment complications as dropped particles or dropped whole nucleus[(4)]. MSSICS appeared as an alternative tool (to somewhat) to phacoemulsification as it needs no expensive equipment, less surgical skills, better results than ECCE but lower to phacoemulsification and less side effects than ECCE[(5)]. In our study we compare the three procedures in mature cataract cases as regards intraoperative and postoperative complications and visual outcome[(6)].

Aim Of The Work

In march 2011, till January 2013 60 consecutive patients with operable mature cataracts and no other ocular disease were assigned randomly to receive either phacoemulsification or manual MSSICS or ECCE in Al-Azhar University hospitals with detailed informed consent was obtained.

Preoperative assessment:

uncorrected visual acuity(UCVA), pinhole visual acuity, pupil and slit-lamp examination and intraocular pressure measurement. Patients with decreased visual acuity because of cataracts and no other apparent ocular disease received further testing that consisted of manual keratometry, A-scan and B-scan, biometry

blood glucose measurement, and blood pressure measurement.

The patients divided into three groups

Group I: twenty cases subjected to ECCE

Group II: twenty cases subjected to MSSICS

Group III: twenty cases subjected to phacoemulsification

Inclusion Criteria:

Prospective subjects should be diagnosed with senile cataract. Subject must require extraction of cataract in one eye followed by implantation of foldable acrylic IOL (eyecryl) or PMMA (biovision) posterior chamber intraocular lens.

Pupil dilation equal or greater to 7 mm after mydriasis.

Patients undergoing cataract surgery for the first eye.

Visual prognosis equal or greater to 6/12.

Exclusion Criteria:

Patients with history of ocular pathology, glaucoma, uveitis, high myopia, PEX, or corneal pathology.

Patients with traumatic, subluxated and posterior polar cataract.

Patients who had previously ocular surgery in the past 6 months prior to the screening visit.

Patients with diabetic retinopathy.

Patients who are not suitable for follow-up visits.

Patients with Fuchs' Dystrophy, Macular Degeneration, Ocular Surface Disease that will interfere with normal recovery.

Any patients with significant intra-operative complications will be removed from the overall analysis of the results. All patient data should still be recorded, even if from the "excluded" patient group.

2. Surgical technique:

Mydriasis with topical tropicamide and phenylephrine and were prepped with Betadine solution. A retrobulbar block was administered, and a Honan ballon was applied to soften the eye. The patients were brought to the operating room for cataract surgery. In the phacoemulsification group, all surgery was performed by stop and chop technique surgeries were performed through a temporal clear corneal incision that was fashioned with a keratome 3.2 mm. A Zeiss lumera operating microscope (Carl Zeiss Meditec, Jena, Germany) was used. A capsulorrhexis was performed in every eye, and trypan blue dye was used to visualize the capsule.dispersive viscoelastic, was used for each case. The pulsar II phacoemulsification machine with minimal stress technology was used to perform a phacoemulsification chop technique in every eye. After cortical clean-up, each eye received a foldable IOL that was injected through the un-enlarged phacoemulsification incision. Eyecryl one piece foldable IOL was used.Manual sutureless small incision extracapsular cataract extraction was performed by upper approach. Peritomy and light wetfield cautery, a 6 to 7 mm scleral tunnel incision was created with a crescent blade, starting 1.5 to 2.0 mm behind the limbus. This incision was widened to approximately 9 mm as it was carried forward 1.0 to 1.5 mm into clear cornea. A side port was done by MVR and trypan blue was injected under air, viscoelastic injection and very wide capsulorhexis was done to allow eaisy nuclear delivery outside the bag and then to AC. A3.2 mm metal keratome blade was used to open the entire internal lip of the tunnel incision.hydrodissection, loosening, and floating the nucleus into the mouth of the tunneled incision, through which it was then expressed using irrigating vectis. All cortical material was removed with the double way cannula. A single-piece PMMA IOL was inserted into the capsular bag. A watertight wound was confirmed by reinflating the eye with balanced salt solution. No sutures were placed, and the conjunctiva was apposed with cautery. The group of ECCE done by posterior limbal incision by 15 blade opening the AC by MVR and injection of viscoelastic. Kanobbner anterior capsulotomy was done. Hydrodissection and widening of the limbal wound. Delivery of the nucleus and I/A by double way cannula. Injection of vicoelastic and implantation of 6.5 mm hard PMMA PC IOL. Closure of the wound by shoe laze 10/0 stitches. All patients received the same postoperative medication regimen, beginning with topical ciprofloxacin and dexamethasone and a sterile dressing at the conclusion of surgery. After operation, all patients received a combination ciprofloxacin and dexamethasone eye drop every two hours, beginning on the first postoperative day and then five times per day for the next week. The drop usage was then tapered and continued three times per day for a total of five weeks.

Measurement of surgical time:

The average time of surgery was calculated by summing the total group time of surgeries divided by twenty.

Follow-up and end points:

Patients were monitored on postoperative days 1 and one weeks, and postoperative months 1 and 2. Parameters that were measured were UCVA and, keratometry. All postoperative visual acuities and refractions were obtained by ophthalmic assistants who were masked to the treatment group and had not been involved in the preoperative portion of the study. Patients were then examined at the slit-lamp by a physician.

Financial element:

At the conclusion of the trial, data on cost of equipment and consumables for each technique were collected and analyzed.

3. Results

The patients were divided into three groups

Group I: twenty patients subjected to ECCE mean age was 55 years

Group II: twenty patients subjected to MSSIC mean age was 58 years

Group III: twenty patients subjected to phacoemulsification mean age was 52 years (tab., 1)

Table (1):mean age.

Group	Mean age	Standard deviation
I (ECCE)	55	9.1
II (MSSIC)	58	10
III (phaco)	52	8.9

The preoperative UCVA and BCVA in all groups was hand motion.

The first day postoperative the UCVA was

Group I: 5 eyes (25%) with UVA 0.7 up to 0.4, 10 eyes (50%) with UVA 0.5 up to 0.1 and 5 eyes (25%) less than 0.1

Group II: 8 eyes (40%) with UCVA 0.7 up to 0.4, 11 eyes (55%) with UCVA 0.5 up to o.1 and one eye (5%) less than 0.1

Group III: 10 eyes (50%) with UVA 0.7 up to 0.4, 10 eyes (50%) with UVA 0.5 up to 0.1 and zero eyes (0%) less than 0.1 (tab.,2)

Table (2): UCVA at first day postoperative.

Group/UCVA	0.7 – 0.4	0.5 – 0.1	Less than 0.1
I	5 (25%)	10 (50%)	5 (25%)
II	8 (40%)	11(55%)	1 (5%)
III	10 (50%)	10 (50%)	0 (0%)

At 2 month visit:

Group I: 13 eyes (65%) with UVA 0.7 up to 0.4, 6 eyes (30%) with UVA 0.5 up to 0.1 and one eye (5%) less than 0.1

Group II: 14 eyes (70%) with UCVA 0.7 up to 0.4, 5 eyes (25%) with UCVA 0.5 up to o.1 and one eye (5%) less than 0.1

Group III: 16 eyes (80%) with UVA 0.7 up to 0.4, 4 eyes (20%) with UVA 0.5 up to 0.1 and zero eyes (0%) less than 0.1 (tab., 3)

Table (3): UCVA at 2 months postoperative.

Group/UCVA	0.7 – 0.4	0.5 – 0.1	Less than 0.1
I	13 (65%)	6 (30%)	1 (5%)
II	14 (70%)	5(25%)	1 (5%)
III	16 (80%)	4 (20%)	0 (0%)

As regards keratometric readings and surgically induced astigmatism (SIA)one week post-operatively, in group I the surgically induced astigmatism mean value was 2.50 D, group II was 0.99 D and in group III was 0.80 D. after 2 months the SIA was 1.50 D in group I, 0.90 D in group II and 0.80 D in group III (tab., 3). (NB.: the SIA and UCVA in group one improved 2 months after surgery as the patient suffering from tight stitchs were subjected to stitch removal).

Table (4): SIA at one week and 2 months postoperative.

Group/SIA	1st week	2nd month
I	2.50 D	1.50 D
II	0.99 D	0.90 D
III	0.80 D	0.80 D

As regards postoperative complications the group I and II show least incidence {one case for each group presenting (5%) incidence} of corneal edema than group III {two cases representing 10% incidence, all cases resolved after two weeks. no cases of expulsive hemorrhage or endophthalmitis were recorded. no cases with ruptured posterior capsule.

Time factor: for the ECCE was 11 minutes, the MSSICS of 15.0 minutes and 18.5minutes for phacoemulsification.

Financial cost per Case: was much greater for phacoemulsification at 500EGP(Egyptians pounds) vs 100EGP for manual SICS and 60 EGP for ECCE. As a

result of use of foldable acrylic IOL compared with the one-piece PMMA lens for manual SICS and ECCE. tips, sleeves, test chambers, large volumes of infusion fluid, and trypan blue dye were also used for the phacoemulsification technique.

4. Discussion

Both phacoemulsification and MSICS achieved Excellentn visual outcomes than ECCE. All groups had a low complication rate, the group I and II show least incidence {one case for each group presenting (5%) incidence} of corneal edema than group III {two cases representing 10% incidence, all cases resolved after two weeks. no cases of expulsive hemorrhage or endophthalmitis were recorded. no cases with ruptured posterior capsule. Vision on postoperative day 1 was better in groupII and III but less in group I. This correlated with the greater increase in corneal thickness in the phacoemulsification group. The increased corneal edema that was seen in the phacoemulsification group is understandable, given the advanced hard cataracts in this patient population[7]. All of the corneas in all groups were clear by three weeks after surgery and had returned to their preoperative clarity. The World Health Organization defines visual impairment as vision worse than 20/60[8]. With the use of this standard of better than or equal to 20/60, phacoemulsification and MSICS were extremely successful at restoring useful vision. Most importantly, both surgical methods were equally successful at achieving unaided visual acuity of better than or equal to 20/60. In remote developing world settings, it is often difficult for poor patients to obtain refractions or corrective spectacles after cataract surgery. The same is true for obtaining replacement lenses if their spectacles break or become scratched. Therefore, good uncorrected vision is particularly important in this population**. Ruit et al., Hennig et al., Kapoor et al., and Venkatesh et al.,** [9,10,11,12] reported that better initial UCVAs after phacoemulsification. However, the cataracts in this study were more advanced than those reported in these studies. In this study manual SICS results for both corrected and uncorrected vision are slightly better than previously reported series[13,14]. We have found that induced astigmatism has been reduced by adopting a temporal approach for manual SICS surgery. At six months, vision outcomes were better in the phacoemulsification group, with more patients having better than or equal to 20/30 vision both with and without correction. The most likely explanation maybe the greater rate of posterior capsule opacification in the manual SICS group. A foldable IOL with a truncated edge that is placed in the capsular bag with an overlapping capsulorrhexis would be expected to have a lower incidence of PCO compared with a one-piece PMMA IOL with a rounded edge and a discontinuous anterior capsulotomy. Although the difference in average keratometric astigmatism between group II and III was low with slight increase in MSICS than phaco the induced astigmatism was higher in group I (ECCE) Finally, the iris manipulation that is required with manual SICS and ECCE to prolapse these large nuclei into the anterior chamber may have resulted in greater inflammation and cystoid macular edema, compared with the phacoemulsification group. Future studies are needed to investigate these possibilities. Time length of surgery and efficiency are important in the developing countries, manual SICS proved tobe a much faster surgical technique[15]. **Venkatesh et al.[12].** reported outcomes from a high-volume manual SICS study at the A ravind Eye Hospital system in which three surgeons performed 600 surgeries, with an average time of4 minutes per case, including turnover time. Manual SICS is far less expensive to perform than phacoemulsification both are more expensive than ECCE but with more good results. the only expensive equipment that is necessary to perform manual SICS is an operating microscope. Finally, high-quality PMMA lenses that are manufactured in India are roughly one-tenth the cost of foldable IOLs that are imported from the United States. The use of Indian produced IOLs, viscoelastics, and pharmaceuticals has lowered the cost of manual SICS surgery[15].

Conclusion:

In the hands of experienced surgeons, both phacoemulsification and manual SICS achieved excellent visual outcomes, with low complication rates inpatients with mature cataracts than ECCE although financial cost enhance the superiority of MSICS.

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