Original article

Comparison of endothelial cell loss and complications between phacoemulsification and manual small incision cataract surgery (SICS) in uveitic cataract

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Abstract

Introduction: Endothelial cell loss and complications after cataract surgery may be higher when cataract is complicated by uveitis. **Objective**: To compare endothelial cell damage and complication rates after phacoemulsification and manual small incision cataract surgery (SICS) in patients with uveitis. **Materials and methods:** Patients with uveitic cataract were randomly allocated for phacoemulsification (n=75) or manual SICS (n=80) in a double blind prospective study. In the bag implantation of a hydrophobic acrylic intraocular lens was aimed in all cases. Patients with follow up of less than six months were excluded. Main outcome measures were alteration in endothelial cell counts (ECC) and morphology, improvement in vision and complication rates. ECC was measured preoperatively and at 1 week, 3 months and six months, postoperatively. **Results**: Six patients were lost to follow up and another three due inability to implant IOL. There were no significant difference in endothelial cell counts (P= 0.032), the variance of endothelial cell size (CV) and percentage of hexagonal cells between both the groups at six months (Mann-Whitney test, P=0.283). Endothelial cell density was significantly less in the group in which vitrectomy and/or pupil dilatation procedures were performed (2290±31.5 cells/mm^2) versus (2385±50.3 cells/mm^2), respectively (t test, P<0.001). Incidence of postoperative complications that were observed like persistent uveitis (P=0.591), macular edema (P=0.671) and PCO (P=0.678) and visual outcome (P=0.974) were comparable between the two groups. **Conclusions**: Manual SICS and phacoemulsification do not differ significantly in endothelial cell loss and complication rates in uveitic eyes. However, increased anterior chamber manoeuvring due to additional procedures may lead to significantly higher endothelial cell loss.

Keywords: Small Incision cataract surgery (SICS); Phacoemulsification; Uveitis; endothelial cells;

Received on: 15/07/14 Accepted on: 30/06/15
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Introduction

Intraocular inflammation of long standing duration and corticosteroids often leads to cataract formation (Ganesh et al, 2004). In uveitic cataracts, presence of synechia or pupillary membranes, new vessels in the angle, compromised zonular integrity or poor pupillary dilatation may pose additional surgical challenges. Therefore, procedures like using pupil expanding devices or iris retractors, synechiolysis and peeling of fibrous membranes are often required; thereby increasing anterior chamber manoeuvres. Moreover, preoperative inflammatory control prior to surgery is of utmost importance (Kosker et al, 2013).

Some degree of endothelial cell loss is inevitable after any type of cataract surgery (Liesegang et al, 1984). However, endothelial cell loss may be much higher when surgery is complicated (Kraff et al, 1980). In manual small incision cataract surgery (SICS), most manoeuvres are performed in the anterior chamber, close to the endothelium. In earlier days, phacoemulsification was done in anterior chamber and was associated with 20 to 30% loss of endothelial cells; with introduction of capsulorrhexis and hydrodissection phacoemulsification is now performed within the capsular bag. Moreover, with advent of torsional ultrasound and ophthalmic viscosurgical devices (OVDs) with higher retention, phacoemulsification is now more endothelial friendly. Rosado-Adames et al (2012).

Although in most settings, phacoemulsification is now the preferred surgical technique for cataract surgery; however, its effect on corneal endothelium has not been studied extensively in patients with uveitis. On the contrary, safety and efficacy of manual SISC in uveitic eyes has not been established. A review of literature showed that no randomized study has been performed to determine the appropriate technique (Medline search). A prospective, randomized, study was done to compare endothelial cell loss over time, visual outcome, and complication rates of phacoemulsification and manual SICS in patients with uveitis.

Materials and methods

This study was performed between February 2009 and June 2012 at Laser Eye Clinic, Noida, Santosh Medical College, Ghaziabad and Rotary Eye Hospital, Palampur India, are all three a regional referral facility. A written informed consent was obtained from all subjects (or their guardians) based on Helsinki protocol; the information sheet was translated into patient's preferred language. The research protocol was approved by institutional review boards and the local Ethics committee.

Inclusion and exclusion criteria

Patients with visually significant cataract (defined as reduction of best corrected visual acuity by two or more Snellen lines) and that impairing adequate visualization of posterior segment participated in the study. All patients had cataract surgery only when they had a quiet eye defined as 5 or less than five cells per high power field in anterior chamber for a minimum period of three months; however, in cases with vitritis, cells may persist even in inactive stage and cannot be completely eliminated (Murthy et al, 2013). Patients with less than 6 months follow-up, retinal pathologies like cystoid macular edema (CME), traumatic and subluxated cataracts, diabetes mellitus and preoperative endothelial cell counts (ECC) less than 2000cells/mm^2 were excluded from the study.

Sample size and randomization

To estimate the sample size and to compare mean difference in endothelial cell density/loss between the two groups, a pilot study was first done on 20 subjects. The mean decrease of endothelial cell density in SICS group was 580 cells/mm^2. The mean decrease of endothelial cell density in phacoemulsification group was 560 cells/mm^2. The common standard deviation was 43. Assuming 1:1 randomization, alpha was set at 0.05 and power 80%. The sample size in each group was estimated to be 71. To account for 20% loss in follow up, the idea was to randomly assign 155 patients to either of the two surgical procedures. Figure I shows the patient flow chart, randomization schedule and follow-up protocol.

Bias and confounding

The procedures were performed by either of the two surgeons, both of them well versed with the necessary skill and expertise to perform the surgical procedure. Both surgeons used standardized and similar surgical techniques. The allocation codes were generated by a DOS based computer software in the department of Community ophthalmology. The allocation was concealed in sequentially numbered blue coloured envelopes that were opened ten minutes prior to surgery in operating room, by health care staff not involved in patient care. Patients were not informed about the type of surgical procedure performed for their cataract surgery. There were two independent investigators (M.K. & A.A.), an ophthalmologist (not a study surgeon) and an optometrist who assessed vision, respectively. They were also masked to the identity of the operating surgeons and the type of procedure.

Preoperative examination

Routine preoperative investigations included total and differential leucocyte counts, erythrocyte sedimentation rate and blood sugar levels, Mantoux test, chest X-ray, X-rays of the cervical spine and sacroiliac joints. Special investigations were done as and when needed that included rheumatoid factor, angiotensin converting enzyme essay, anti-nuclear factor, human leucocyte antigen typing and enzyme linked immunosorbant assay for TORCH infections, human immunodeficiency virus and tuberculosis. B-scan ultrasonography was performed in cases where funduscopy was not possible due to dense cataract. Intraocular pressure was measured with applanation tonometry. Endothelial cell counts (cells/mm^2), variation in size of endothelial cells (CV) and cells coefficient of variation and central corneal thickness (CCT) measurements were done by EM-3000 specular microscope (Tomey, Japan). Aqueous flare and cells were graded with a modified Hogan's technique (Hogan et al, 1959). Vitreous cells were graded with the classification proposed by (Bloch-Michel and Nussenblatt, 1987).

A thorough work up was done and the data was collected, which included sex, age at surgery, aetiology of uveitis, pre-operative findings such as uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), corticosteroid intake, frequency and duration of quiescence of inflammation before surgery, endothelial cell counts, surgical time and duration of follow-up and presence of complications.

Preoperative corticosteroids

Oral prednisolone, 1 mg/kg body weight was given 7 days prior to surgery, continued post-operatively and tapered according to the inflammatory response over 4-6 weeks in patients with previously documented macular edema, recurrent uveitis, chronic anterior uveitis and intermediate uveitis.

Surgical techniques

Peribulbar anaesthesia was delivered. The surgical area was painted and draped and the lids separated using a wire speculum. A bridal suture was then passed beneath the superior rectus. A fornix based conjunctival flap was made superiorly and bleeders cauterized with wet field cautery. For SICS, a side port entry was made at the 10 O' clock position with a 20 G micro vitreo-retinal surgery (MVR) or a 15° angled knife. A 5.5- 6 mm superior incision was made on the sclera, 1.5 mm posterior to the limbus. A self-sealing (tri-planar) sclero-corneal tunnel was made with a 2.2 mm bevel up crescent knife with adequate side pockets. The AC was formed with 2% hydroxypropyl methylcellulose. AC entry was made and enlarged with a 2.8 mm keratome. In non-dilating pupils, synechiolysis, membrane peeling or iris hooks were used as and when required. Adjunctive Trypan blue-assisted continuous curvilinear capsulorrhexis (CCC) was created followed by hydrodissection with a 2 cc syringe attached to a 25 G cannula. The nucleus was rotated in the bag with a bent capsulotomy needle and prolapsed into the AC. The ophthalmic viscosurgical device (OVD) was again injected above and below the nucleus to protect the endothelium. The nucleus was then delivered by the sandwich technique. Lens matter aspiration was performed with a Simcoe cannula. Implantation of a hydrophobic acrylic lens (Alcon, AcrySof IQ) in the capsular bag was aimed in all cases. The self-sealing wound was left unsutured.

For phacoemulsification, a superior, 3.0 mm scleral tunnel incision was made under peribulbar anaesthesia. Two side-port clear corneal incisions were created 180 degrees apart with 20G MVR knife for the second instrument. AC was maintained with 2% hydroxypropyl methylcellulose. Iris hooks were used and/or synechiotomy was done in case of non-dilating pupils. Trypan blue-assisted CCC was done as described previously. Anterior chamber (AC) entry was fashioned with a 2.8 mm keratome. Cortical cleavage hydrodissection was done just below the anterior capsule rim and nucleus rotated in the bag. Phacoemulsification was done using an Infinity vision system (Alcon, Inc.). Sculpting of the nucleus was done up to 90% depth with the phaco tip. The nucleus was thus fragmented and removed by stop-and-chop method. Cortical material was removed by bimanual irrigation/aspiration. The aim was to implant a hydrophobic acrylic lens (Alcon, AcrySof IQ) in the capsular bag. Paracentesis was hydrated. A subconjunctival injection of gentamicin 20 mg and dexamethasone 4 mg was given at end of both the procedures.

Postoperative care and follow up

Routine post-operative care included topical Moxifloxacin 0.5 % 6 times a day, 1.0% atropine 3 times a day and 0.1% topical betamethasone hourly that was tapered over 10-12 weeks. Topical Ketorolac tromethamine 0.4% was used selectively, 3 times a day in patients who developed cystoid macular edema; these patients also received topical corticosteroids. Patients were followed-up on first, third and seventh postoperative days, then weekly for two weeks, monthly for two months and every three months thereafter. At each visit, stereoscopic fundus examination with a +90D lens and recording of UDVA/CDVA, aqueous cells and flare was done. Endothelial cell counts were measured at one week, and thereafter at 3 and 6 months. Posterior segment OCT was done in all patients at 1month and repeated at three months. Dose of patients taking preoperative systemic corticosteroids were tapered over 4-6 weeks, depending on response and they underwent monitoring of blood sugar, blood pressure and urine analysis.

Outcome measures

Extent of endothelial cell damage was the primary outcome measure (decrease in ECC over time and alteration of endothelial cell morphology). ECC were measured preoperatively, 1 week, 3months and 6-months postoperatively. During each visit, 2 photographs of the cornea were taken and analyzed by the two independent investigators (masked to identity of surgeon and type of procedure). The mean of 4 readings was taken as the final reading for the visit. Secondary outcome measures were improvement in vision, postoperative astigmatism and rate of complications.

Statistics

Statistical analysis was performed on intent to treat basis using SPSS software for windows (version 18, SPSS Inc.). One-way analysis of variance (ANOVA) was used when there were more than two groups. Means of groups were compared using t tests. The 95% confidence interval (CI) values were calculated for each mean. Chi-square tests were used for proportions. P value was calculated at 1% and 5 % levels. A P value <0.05 was considered statistically significant.

Results

A total of 155 patients were enrolled in the study. 75(48.7%) were randomized to the phacoemulsification group and (80/51.6%) to SICS group. Six patients were lost to follow up and another three were excluded due to inability to implant IOL due to loss of capsular support. One hundred and forty six of 155 patients (94.2%) completed the six month follow-up. The mean age (P=0.114), sex (P=0.978) and follow up duration (P=0.701) was comparable in both the groups. Table I shows baseline characteristics of patients.

Endothelial cell counts (ECC)

There was a significant decrease in endothelial cell density in both groups postoperatively (P<0.001), however, ECC at six months was comparable between phacoemulsification and SICS groups (t test, P=0.032). Table II shows mean ECC and endothelial cell loss over time. There was no significant difference in the variance of endothelial cell size (CV) and percentage of hexagonal cells between both the groups at six months (Mann-Whitney test, P=0.283). Table III shows change in corneal endothelial cell morphology postoperatively. Final ECC was significantly less in the group in which pupil dilatation procedures were performed or cases with posterior capsular rent with vitreous loss (n=6). The mean final ECC at 6 months in group with pupil dilation procedures/and or vitrectomy (n=30 & 6 respectively) was (2290±31.5 cells/mm^2) as compared to (2385±50.3 cells/mm^2) in the group without additional procedures (n=114) (P<0.001). Table IV shows endothelial cell loss in reported series of patients following cataract surgery.

Intraoperative procedures and complications

Pupil dilation procedures as synechiolysis, membrane peeling or iris hooks were required in 29(41.4%) eyes in Phaco group and 33(43.4%) eyes in SICS group (Chi Square test, P=0.283). The mean surgical time in SICS group was 11.2±2.4 minutes and phaco group 14.2±3.1 minutes) (P< 0.001). Intraoperatively, 2 eyes (2.7%) randomized to receive phacoemulsification and 4 eyes (5%) randomized to receive SICS had posterior capsular rent. One eye (1.3%) in phaco group was converted to manual SICS and multi-piece Polymethyl methacrylate (PMMA) IOL placed in sulcus. IOL could not be implanted in three eyes due to insufficient capsular support. However, sulcus fixation of multi-piece PMMA IOL was successfully done in four eyes in the SICS group.

Visual acuity and astigmatism

There was significant improvement in vision after both the procedures (paired t test; P<0.001). On first postoperative day, UDVA was 20/63 or better in 36(51.4 %) patients in phacoemulsification group and 41 (53.9 %) patients in manual SICS group; the difference was not statistically significant (P=0.323). There was no significant difference between the 2 groups in CDVA at 6 months, with 63 (90%) patients in the phacoemulsification group and 67 (88.1%) in the manual SICS group had a CDVA of 20/63 or better (P=0.974). The cause for final CDVA to worse than 20/200 in the phaco group were persistent uveitis, age related macular degeneration and macular edema, 2 cases each. In SICS group, final CDVA was worse than 20/200 due to persistent uveitis in 3 cases and macular edema in 2 cases.

In phaco group 24 (34.3%) patients and 25 (32.9%) patients in SICS group received systemic corticosteroids Chi square test, P=0.859). Patients on systemic corticosteroids had significantly better vision than patients who did not used pre-operative corticosteroids in both the groups (P<0.003 & P<0.001, respectively). However, final CDVA was comparable in both the groups.

Surgically induced astigmatism was calculated using the rectangular coordinate method (Holladay et al, 2001). The mean surgically induced astigmatism (SIA) was 0.95±0.24

dioptres (D) in the phacoemulsification group and 1.12±0.23 D in SICS group. The difference between the groups was significant (t test, P=0.005).

Postoperative complications

There were postoperative complications in both the groups (Table VI). On first post-operative day, 8 eyes in phaco group and 6 eyes in SICS group had mild to moderate anterior chamber reaction. At the end of first post-operative month, 4 eyes in phaco group and 2 eyes in SICS group had 2+ anterior chamber cells and 4 eyes had 1+ anterior chamber cells. Topical steroids were continued for 8 weeks and resulted in resolution of inflammation in most of these cases. However, 2 eyes in both the groups had recurrent episodes of uveitis. Aetiology of uveitis (Table V) did not significantly influence postoperative inflammation (ANOVA, P=0.347). On first postoperative day, there were more cases of corneal edema 12 (17.1%) in the phacoemulsification group than in the SICS group 8 (11.4%) (P=0.046). The mean endothelial cell loss in these patients was 26.8% at 1 week and 31.4% at 6 months in phacoemulsification group and 22.7% and 26.4% in SICS group, respectively. The incidence of late complications like persistent uveitis (Chi square, P=0.591), macular edema (P=0.671) and PCO (P=0.678) did not differ significantly between the two groups. Other complications included superior iridodialysis (1 clock hour) in 2 eyes in SICS group and retained sub-incisional cortical lens matter in 3 eyes in phacoemulsification group and 4 eyes in SICS group. Persistent uveitis had a significant effect on final CDVA in both the groups (t test, P=0.005 and 0.001, respectively).

Secondary procedures: Nd: YAG laser capsulotomy was done in 10(14.2%) eyes in phacoemulsification group and 13(17.1%) eyes in SICS group after a quiet postoperative period of 3 months. 4(5.7%) patients in phaco group and 3(3.9%) patients in SICS group were referred to retina clinic for epiretinal membrane (ERM) peeling. Glaucoma filtering surgery was done in 5(7.1%) and 4(5.2%) eyes in Phaco and SICS groups, respectively.

Table I: Baseline parameters of patients

Parameter	Phaco group	SICS Group
Age	53.5±8.6	55.6±7.2
Sex (N)		
Male	33	36
Female	37	40
Follow up (months)	11.8±4.4	12.0±3.7
Surgical Time (minutes)	13.8±2.1	11.2±1.9
ECC (preoperative)	2962±38.8	2939±62.8

[a] ECC (Endothelial cell counts), SICS (Small Incision Cataract surgery), Phaco (phacoemulsification).

Table II: Comparison of mean endothelial cell loss over time

Group	Mean ECC (cells/mm²)			Mean cell loss (N, %)	
Pre-op	3 months	6 months	3months	6 months	
Phaco	2962	2369	2324	583(19.7)	607(20.5)
SICS	2939	2398	2375	540(18.4)	564(19.2)

[b] ECC (Endothelial cell counts).

Table III: Endothelial cell morphology

	Coefficient of variance			Hexagonality (%)		
	Phaco	SICS	P value	Phaco	SICS	P value
Preop	32.8± 4.6	32.1± 5.1	0.467	57.4±5.6	56.8±6.4	0.634
3 months	34.6± 3.9	35.2± 4.7	0.564	59.8±7.2	59.2±8.1	0.862
6 months	35.1± 4.4	35.7± 4.2	0.634	58.6±6.9	58.1±7.2	0.973

[c] SICS (Small Incision Cataract Surgery).

Table IV: Endothelial cell loss in reported series of patients after cataract surgery.

Author	Year	Type of Cataract	Procedure	Endothelial cell Loss (%)
Bourne et al	2004	Age-related	Phaco & ECCE	10 & 10
George et al	2005	Age-related	ECCE, SICS & Phaco	4.72, 4.21 & 5.41
Silva et al	2008	Age-related	Phaco & ECCE	11.8 & 12.8
Gogate et al	2010	Age-related	Phaco & SICS	15.5 & 15.3
Storr-Paulsen et al	2008	Age-related	Phaco (2 techniques)	6.3 & 5.7
Present study	2014	Uveitic	Phaco + SICS	20.5 & 19.2

[d] ECCE (Extra capsular cataract extraction), Phaco (Phacoemulsification), SICS (Small incision cataract surgery).

Table V: Etiology of uveitis.

Parameter	Phaco group	SICS Group
Aetiology	N %	N %
Idiopathic	58(82.8)	65(85.5)
FHC	4(5.7)	3(3.9)
AS	2(2.8)	4(5.3)
VKH	1(1.3)	2(2.6)
Toxoplasmosis	3(4.3)	1(1.3)
Sarcoidosis	2(2.6)	1(1.3)
Total	70 (100)	76(100)

[e] FHC (Fuchs heterochromic cyclitis), AS (Ankylosing spondylitis), VKH (Vogt's Koyanagi Harada Syndrome), RA (Rheumatoid Arthritis).

Table VI: Complications

Complication	Phaco Group	SICS Group	Chi Square test
	N (%)	N (%)	P value
Corneal Edema	12(17.1)	8(11.4)	0.046
Persistent Uveitis	9(12.8)	12(16)	0.591
Macular Edema	6(8.6)	9(12)	0.564
PCO	13(18.6)	16(21)	0.678
Glaucoma	4(5.7)	2(2.7)	0.357
Iridodialysis	0(0)	2(2.7)	0.214
Retained cortex	3(4.2)	4(5.2)	0.764

d PCO (posterior capsule opacification), SICS (Small Incision Cataract surgery), Phaco (phacoemulsification).

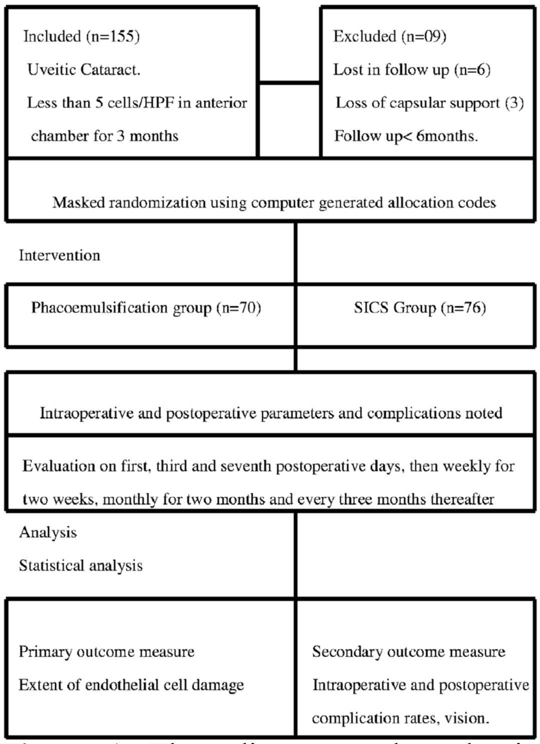

Figure 1: Flow diagram and randomization schedule

Figure 2: Small Incision Cataract Surgery in a patient with uveitis.

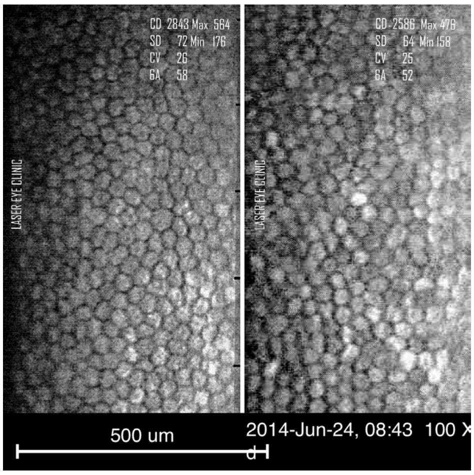

Figure 3: Pre and post-operative endothelial photograph in the same patient

Figure 4: Phacoemulsification in a patient with uveitic cataract

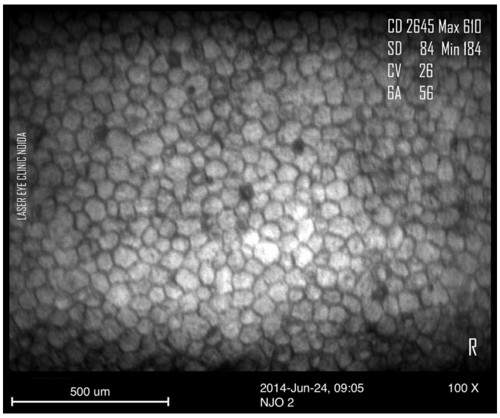

Figure 5: Preoperative endothelial cell counts in the same patient

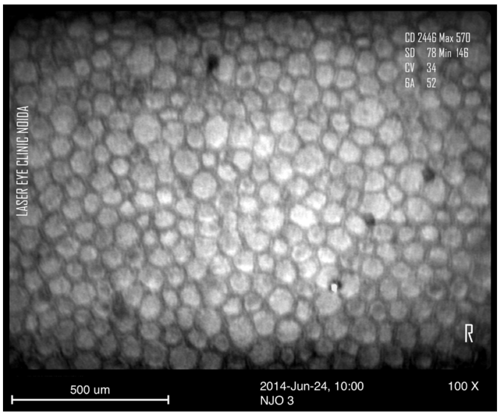

Figure 6: Postoperative endothelial cell counts

Discussion

In the present study, we compared endothelial cell loss and complication rates between phacoemulsification and manual SICS in patients with uveitic cataract. In this study, baseline data and endothelial cell parameters were comparable preoperatively, and patients were randomized between the two groups, virtually, there were no sampling bias.

In most countries and settings, phacoemulsification is now the preferred technique of management of age related cataract and is generally considered endothelial friendly (George et al, 2005). Manual SICS has emerged a cost-effective alternative to phacoemulsification in the developing world (Bhargava et al, 2012). However, review of literature (Medline search) did not reveal any study evaluating the effect of phacoemulsification on the corneal endothelium in patients with uveitis.

Corneal endothelial cell loss remains a well-known, undesirable side-effect of cataract surgery that may, in severe cases, negatively impact patients' postoperative visual outcomes. The extent of endothelial cell damage (reflected by decrease in cell density and alteration of cell morphology) during cataract surgery depends on incision type, OVD used, composition of irrigation solution, total phaco energy and location of active nucleus manipulation

(Gogate et al, 2005). In a randomized study comparing endothelial cell loss following conventional extracapsular cataract surgery (ECCE), SICS and phacoemulsification with non-foldable intraocular lens implantation, the mean endothelial cell loss was 4.72%, 4.21% and 5.41% respectively, with no significant difference in between the three groups Holzer et al (2001). In another prospective randomized comparison, Gogate et al (2010) did not find any significant difference at 6 weeks in endothelial cell loss and ECC between phacoemulsification and manual SICS for age related cataracts.

In our study, the mean endothelial cell loss 6 months postoperatively was 20.5% in the phacoemulsification group and 19.2% in the SICS group; there was no significant difference between the two groups. The higher endothelial cell loss (3.98% more) in comparison to age related cataract was probably the result of increased manoeuvring time in anterior chamber due to additional procedures often required in uveitic cataract like use of iris hooks, synechiolysis and pupillary membrane peeling and/or vitrectomy. Having said this, an OVD with higher retention (e.g. Healon G.V.) could have resulted in less endothelial cell loss but cost factors forbade us from doing so.

In patients with uveitis, different uveitic syndromes may respond differently to surgery, therefore, the optimal surgical technique in these cases is not known. Hazari et al (2002) reported a series of 106 eyes with uveitic cataract which had conventional ECCE (93/106, 87.7%) and phacoemulsification (11/106, 10.3%) with or without IOL implantation. The authors found both techniques comparable in terms of visual outcome but postoperative inflammation was less severe in the phacoemulsification group. In another retrospective case series of 22 uveitic eyes of patients with Behcet's disease, there was no significant difference in postoperative inflammation between phacoemulsification (4, 15.4%) and conventional ECCE (22, 84.6%) at a mean postoperative follow up of 22.9 months (Kadayifcilar et al, 2002). However, in the present study, postoperative inflammation was comparable between the two techniques. The key to success lies in adequate preoperative control of inflammation for minimum three months and judicious use of systemic corticosteroids in selected cases as described previously, irrespective of the aetiology of uveitis (ANOVA, P=0.347).

A prospective non randomized study by Venkatesh et al (2005) found manual SICS to be safe and effective for white cataracts with adjunctive use of Trypan blue dye. The mean surgical time was 8.8±3.4 and 12.2±4.6 minutes for SICS and phaco groups respectively. Increased anterior chamber manoeuvres during pupillary dilatation, which are often required in uveitic eyes, accounted for the relatively higher surgical time (11.2 and 14% more) in this study. In our experience, phacoemulsification is not always successful in fragmenting and emulsifying extremely dense nuclei with extensive posterior synechia, making it prudent to convert to large incision ECCE in some circumstances. A scleral tunnel phacoemulsification can always be enlarged to allow manual nuclear extraction; therefore we routinely use scleral tunnel incisions for phacoemulsification of uveitic cataracts. A study comparing endothelial cell damage between scleral tunnel and clear corneal incisions found scleral tunnels to be more endothelial friendly for age related cataract due to their posterior placement (Beltrame et al, 2002). In the present study, endothelial cell loss was significantly higher with both techniques despite scleral tunnel incisions being used. This reinforces our hypothesis that increased anterior chamber manoeuvring time due to additional procedures in uveitic cataract is associated with higher loss of endothelial cells with no significant difference in safety between phacoemulsification and SICS.

The CDVA at six months was excellent with both the techniques; however, slightly higher number of patients in the phacoemulsification group achieved a UDVA of 20/63 or better. This could be explained by the higher SIA in the SICS group due to larger incision.

There was no significant difference in the rate of postoperative complications between phacoemulsification and manual SICS. In a retrospective study on 53 eyes in patients with uveitis Bhargava et al (2014) found manual SICS to be a safe procedure with predictably good visual outcome. Persistent uveitis, macular edema and PCO were the main factors affecting visual outcome. A similar observation was also made by Ram et al (2010) in a series of 108 eyes in patients with coexisting cataract and uveitis. Other reported series in patients with uveitis also reinforce these observations (Lin et al, 2013 and Kawaguchi et al, 2007).

In a meta-analysis of 6 published randomized controlled trials comparing phacoemulsification and manual SICS for visual outcomes, ECCs and surgically induced astigmatism, the authors found that phacoemulsification was superior to manual SICS in UCVA and causes less SIA in age related cataracts. However, there was no significant difference in visual rehabilitation, ECC loss and complication rates between the two techniques (Zhang et al, 2013).

A major shortcoming of this study was that only one technique of phacoemulsification and one technique of SICS were compared; results may slightly differ with other techniques. Secondly, an OVD with higher retention may have resulted in less endothelial cell loss although the loss would have been the same for both the techniques.

Conclusion

We found SICS to be as safe for the corneal endothelium as phacoemulsification in patients with uveitis, with no significant difference in complication rates and visual outcomes.

Financial disclosure
No author has a financial or proprietary interest in any material or method mentioned.

Acknowledgements
We thank Dr Puneet Gupta, Shodh, Indore, India, for statistical analysis.

Appendix

Independent Investigators; MK (Manoj Kumar), AK (Avinash Kaur), Ayub Ali (AA).

References

Beltrame G, Salvetat ML, Driussi G, Chizzolini M (2002). Effect of incision size and site on corneal endothelial changes in cataract surgery. J Cataract Refract Surg; 28(1):118-25.

Bhargava R, Kumar P, Prakash A, Chaudhary KP (2012). Estimation of mean ND: YAG laser capsulotomy energy levels for membranous and fibrous posterior capsular opacification. Nepal J Ophthalmol; 4:108-13.

Bhargava R, Kumar P, Bashir H, Sharma SK, Mishra A (2014). Manual suture less Small Incision cataract surgery (SICS) in patients with uveitic cataract. Middle East Afr J Ophthalmol; 21:77-82.

Bhargava R, Kumar P, Sharma SK, Kumar M, Kaur A. Phacoemulsification versus

small incision cataract surgery in patients with uveitis. Int J Ophthalmol. 2015 18;8(5):965-70.

George R, Rupauliha P, Sripriya AV, Rajesh PS, Vahan PV, Praveen S (2005). Comparison of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small-incision surgery and phacoemulsification. Ophthalmic Epidemiol; 12(5):293-7.

Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, et al (2005).

Safety and efficacy of phacoemulsification compared with manual small-incision cataract surgery by a randomized controlled clinical trial: six-week results. Ophthalmology; 112:869-74.

Gogate P, Ambardekar P, Kulkarni S, Deshpande R, Joshi S, Deshpande M (2010). Comparison of endothelial cell loss after cataract surgery: phacoemulsification versus manual small-incision cataract surgery: six-week results of a randomized control trial. J Cataract Refract Surg; 36:247-253.

Ganesh SK, Babu K, Biswas J (2004). Phacoemulsification with intraocular lens implantation in cases of pars planitis. J Cataract Refract Surg; 30:2072-6.

Holzer MP, Tetz MR, Auffarth GU, Welt R, Völcker HE (2001). Effect of Healon5 and 4other viscoelastic substances on intraocular pressure and endothelium after cataract surgery. J Cataract Refract Surg; 27:213-8.

Hogan MJ, Kimura SJ, Thygeson P. Signs and symptoms of uveitis 1959). I. Anterior uveitis. Am J Ophthalmol; 47:155-70.

Hazari A, Sangwan VS @002_). Cataract surgery in uveitis. Indian J Ophthalmol; 50:103-7.

Holladay JT, Moran JR, Kezirian GM (2001). Analysis of aggregate surgically induced refractive change, prediction error, and intraocular astigmatism. J Cataract Refract Surg; 27:61-79.

Kadayifçilar S, Gedik S, Eldem B, Irkeç M (2002). Cataract surgery in patients with Behcet's disease. J Cataract Refract Surg; 28(2):316-20.

Kawaguchi T, Mochizuki M, Miyata K, Miyata N (2007). Phacoemulsification cataract extraction and intraocular lens implantation in patients with uveitis. J Cataract Refract Surg; 33:305-9.

Kosker M, Sungur G, Celik T, Unlu N, Simsek S (2013). Phacoemulsification with intraocular lens implantation in patients with anterior uveitis. J Cataract Refract Surg; 39:1002-7.

Kraff MC, Sanders DR, Lieberman HL (1980). Specular microscopy in cataract and intraocular lens patients. A report of 564 cases. Arch Ophthalmol; 98:1782-4.

Lin CP, Yeh PT, Chen PF, Yang CM, Hu FR (2013). Cataract extraction surgery in patients with uveitis in Taiwan: Risk factors and outcomes. J Formos Med Assoc; S0929-6646:00360-4.

Liesegang TJ, Bourne WM, Ilstrup DM (1984). Short- and long-term endothelial cell loss associated with cataract extraction and intraocular lens implantation. Am J Ophthalmol; 97:32-9.

Murthy SI, Pappuru RR, Latha KM, Kamat S, Sangwan VS (2013). Surgical management in patients with uveitis. Indian J Ophthalmol; 61:284-90.

Rosado-Adames N, Afshari NA (2012). The changing fate of the corneal endothelium in cataract surgery. Curr Opin Ophthalmol; 23:3-6.

Ram J, Gupta A, Kumar S, Kaushik S, Gupta N, Severia S (2010). Phacoemulsification with intraocular lens implantation in patients with uveitis. J Cataract Refract Surg; 36:1283-8.

Venkatesh R, Das M, Prashanth S, Muralikrishnan R (2005). Manual small incision cataract surgery in eyes with white cataracts. Indian J Ophthalmol; 53:173-6.

Zhang JY, Feng YF, Cai JQ (2013). Phacoemulsification versus manual small-incision cataract surgery for age-related cataract: meta-analysis of randomized controlled trials. Clin Experiment Ophthalmol; 41:379-86.

Source of support: nil. Conflict of interest: none