Research Article

A comparative study of the efficacy and safety of Phacoemulsifacation in white mature and other types of senile cataracts

Meena RK[1], Chouhan JK[2], Sharma P[3], Meena A[4], Sharma D[5]

[1]Dr Ravindra kumar Meena, Assistant Professor, Department of Ophthalmology, Jhalawar Medical College, Jhalawar, [2]Dr J K Chouhan, Professor and Head, Department of Ophthalmology, SMS Medical college, Jaipur, [3]Dr Pankaj Sharma, Professor, Department of Ophthalmology, SMS Medical college, Jaipur, [4]Dr Ashok Meena, Associate professor, Department of Ophthalmology,Government medical college, Kota, [5]Dr Devesh Sharma, Department of Ophthalmology, Government medical college, Kota, Rajsthan, India

Address for correspondence: Dr Ravindra kumar Meena, Email: drravindrameena@gmail.com

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Abstract

Introduction: Phacoemulsification in white mature cataract is one of the most difficult anterior segment procedure. Our purpose to conduct this study was to compare the outcome of Phacoemulsification in white mature and other type (immature cortical, nuclear, posterior subcapsular and mixed cataract) of senile cataract. **Methods:** This is a hospital based observational Study conducted on 100 patients of cataract (49 male and 51 female) in the upgraded department of Ophthalmology, SMS Medical college Jaipur subjected to clear corneal temporal phacoemulsification with foldable IOL. Postoperative outcome, intraoperative difficulties were analyzed between two groups. Postoperative examination were done at 1st, 3rd, 7th, 30th & 45thday. **Results:** Intraoperative difficulties, postoperative corneal oedema, mean IOP changes & postoperative BCVA were not significantly different between two groups ($p>0.05$). Mean effective phaco time between two groups was found to be significantly higher in white mature cataract group ($p<0.01$).**Conclusion:** The Phacoemulsification is equally safe and efficacious in white mature senile cataracts as in other senile cataracts.

Key words : Mature White Cataract, Phaco Time, Phacoemulsification**,**

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Introduction

Cataract is the most common curable blindness in the world. Mature and hypermature cataracts constitute a significant volume of the cataract surgical load in ophthalmic practice in developing countries. A cataract is termed mature if the cortex and nucleus become so opaque that the red fundus reflex is absent, the cortex becomes extensively hydrated; this is the stage where the lens looks white. In developing countries white mature cataracts are seen very frequently [1, 2].

White, mature, senile cataract is an advanced form of cataract disease. According to differences in biomicroscopic appearance, A-scan findings and intraoperative particularities, white cataracts may be divided into three types: 1) cortically mature cataract, which has diffusely flocculent cortex and may be associated with increased intralenticular pressure (intumescent, swollen cataract); 2) cortically mature cataract with flocculent cortex and a hard, brown nucleus; and 3) uniformly soft cataract with gelatinous cortex and soft nucleus [3].

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Phacoemulsification is the ideal technique for the management of cataract because of the rapid wound healing, minimal post-operative induced astigmatism and early visual rehabilitation [4].

In the last decade, phacoemulsification has become the standard management of cataract in developed countries. However, phacoemulsification of white cataract poses particular challenge to the cataract surgeon as the continuous curvilinear capsulorrhexis (CCC) is more difficult to complete due to loss of red reflex, increase in intracapsular pressure, and occasional leakage of lens matter from the anterior capsule puncture site. An intact complete CCC is critical to minimize the risk of capsular tear and to ensure stable in-the-bag intraocular lens (IOL) implantation [5].

Despite the many innovations in cataract surgery, there are still some technical difficulties in white mature cataract surgery. The technical difficulties depend on poor visualization of the anterior capsule during continuous circular capsulorrhexis (CCC), fragile lens capsule, swelling or liquefaction of the lens cortex which facilitates radial tear formation during CCC. Among these

difficulties, the most difficult is poor visualization of the anterior capsule during CCC which can be minimized by staining of the anterior capsule with 0.1% trypan blue dye [2].

The use of trypan blue to stain the anterior capsule under air was initiated by Melles etal [6] This allowed the formation of a 'dye lake' and prevented the dye dilution by aqueous. Phacoemulsification using trypan blue was safe and effective in managing white cataract [7, 8].

A modified surgical technique of anterior capsulotomy and phacoemulsification for use in hypermature cataratcs was described by RB Vajpayee and SK Angra Surgical steps included inferior linear capsulotomy with aspiration of milky cortex, inflation of the capsular sac with viscoelastic [9]. Vijay K. Dada et al studied that trypan blue, ICG,and gentian violet were more effective in staining the anterior capsule[10]. Performing phacoemulsification in white cataracts is a challenge for the cataract surgeon that requires skillful technique and experience [11].

Our aim to conduct this study was to compare the intraoperative difficulties and postoperative outcome in white mature and other types of senile cataracts.

Materials and Methods

This is a hospital based observational study conducted on 100 (49 male and 51 female) patients of cataract in the upgraded Department of Ophthalmology, SMS Medical College Jaipur.

A detailed clinical examination of both eyes included visual acuity, detailed biomicroscopic examination, IOP measurement by Non-contact Tonometer (TOPCON CT-80), keratometry by manual Bausch and Lomb keratometer, axial length measurement by A-scan (Echoscan US-800) with IOL power calculation using SRK-II formula, B-scan (Ultrascan) in cases of white mature cataract to rule out posterior segment pathology.

Inclusion criteria: All cases of cataract.

Written informed consent was obtained from every patient. All selected patients were divided into two groups of 50 each and all underwent standard surgical technique of phacoemulsification with PCIOL.

1. Study Group - Mature cortical cataract subjected to phacoemulsification with PCIOL.
2. Control Group - Included cortical, nuclear, posterior subcapsular and mixed cataract subjected to phacoemulsification with PCIOL.

Routine preoperative preprations of cases have been done.

Operative Procedure

All surgeries were done by same surgeon so as to avoid any surgical bias. Eyelids and adjoining areas were painted with 5% betadine solution and draped and speculum was applied. Surgeon took his position on the temporal side of the patient. The anterior chamber was entered through the clear cornea with MVR blade to make a side port at 12 O'clock position in right eye and 5 O'clock position in left eye. In cases of white mature cataract air was injected, and Trypan blue dye 0.1%, 0.2 cc was injected drop by drop under the air bubble through a 26 G needle introduced through the same entry
Sodium hyaluronate 1.4% was injected in the anterior chamber to remove the dye. Clear corneal temporal incision was made with 2.5 mm keratome and sodium hyaluronate 1.4% was injected in the anterior chamber to deepen it. A continuous curvilinear capsulorrhexis was achieved by microcapsulorrhexis forceps. Hydrodissection was performed with 27 G hydrodissection canula using BSS but usually it is avoided in most of the cases of white mature cataract.

Viscoelastic material was injected in the anterior chamber and nucleus was emulsified by direct vertical chop technique using alcon universal II phaco machine. Remnants of the cortical matter were removed with coaxial irrigation and aspiration method. After inflating the capsular bag with viscoelastic material foldable hydrophilic acrylic intraocular lens was implanted in the bag. Anterior chamber washed with BSS to remove the viscoelastic material. The corneal stroma at the incision site was hydrated with BSS and sealed. Injectable dexamethasone and gentamycin was instilled in the conjuctival sac. Pad and patch was applied till coming morning.

Postoperative Management

All patients were given topical prednisolone 1% steroid antibiotic eye drops every 2 hourly for 4 days, then gradually tapered it to four times, three times, two times and lastly once a day till 6 week.

A detailed postoperative assessment was carried out at the 1^{st}, 3^{rd}, 7^{th}, 30^{th} and 45^{th} days with regards to the

- Best corrected visual acuity
- Slit lamp examination to examine the cornea, anterior chamber reaction, iris, pupil and lens centration.
- Intraocular pressure measurement
- Fundus examination

All data were then collected and analyzed using t-test, z-test, and Chi square test (x^2). P <0.01 was considered significant.

Results

According to age there were two groups first between 40-60 years and second more than 61+ years age group.

Table No 1: Distribution of cases according to age & sex

Age group (In Yrs)	Study			Control		
	Male	Female	Total	Male	Female	Total
40-60	11 (22%)	19 (38%)	30 (60%)	10 (20%)	12 (24%)	22 (44%)
61+	12 (24%)	8 (16%)	20 (40%)	16 (32%)	12 (24%)	28 (56%)
Total	23 (46%)	27 (54%)	50 (100%)	26 (52%)	24 (48%)	25 (100%)

† Me an age of Study group = 59.38 ± 9.66 years, ‡ Mean age of Control group = 62.56 ± 12.77 years

In study group female ratio was more in 40-60 year age group (38%) whereas male were only 22%

Table No 2: Distribution of the type of cataract according to age group

Age group (In Yrs)	Study group		Control group				Total
	White MSC	Total	Nuclear	PSC	Cortical	Mixed	
40-60	25 (50%)	25 (50%)	0 (0%)	7 (14%)	13 (26%)	2 (4%)	22 (44%)
61+	25 (50%)	25 (50%)	9 (18%)	2 (4%)	8 (16%)	9 (18%)	28 (56%)
Total	50 (100%)	50 (100%)	9 (18%)	9 (18%)	21 (42%)	11 (22%)	50 (100%)

White mature cataract was equal in both age group (40-60 & more than 60 years) where as in control group cortical cataract were present most commonly.

Table No 3: Distribution of Intraoperative complications

Intraoperative complications	Study group			Control group			χ^2	P-value	Significance
	Present	Absent	Total	Present	Absent	Total			
Detachment of descemet's	0 (0%)	50 (100%)	50 (100%)	0 (0%)	50 (100%)	50 (100%)	-	-	-
Wound site thermal injury	0 (0%)	50 (100%)	50 (100%)	0 (0%)	50 (100%)	50 (100%)	-	-	-
Zonulodialysis	1 (2%)	49 (98%)	50 (100%)	1 (2%)	49 (98%)	50 (100%)	0.00	> .05	NS
Capsulorrhexis ext.	2 (4%)	48 (96%)	50 (100%)	1 (2%)	49 (98%)	50 (100%)	0.033	> .05	NS
Posterior capsule rent	1 (2%)	49 (98%)	50 (100%)	1 (2%)	49 (98%)	50 (100%)	0.00	> .05	NS

‡ NS – not significant

Capsulorrhexis extension was seen in 4% cases in study group and 2% cases in control group. Other complications are equally present in both groups.

Table No 4: Day wise distribution of corneal edema

Cornea	Days									
	1		3		7		30		45	
	Study	Control	Study	Control	Study	Control	Study	Control	Study	Control
Bright	46 (92%)	49 (98%)	46 (92%)	50 (100%)	48 (96%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)
Stromal edema	4 (8%)	1 (2%)	4 (8%)	0 (0%)	2 (4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
χ^2	0.842		-		-		-		-	
P-value	> .05		-		-		-		-	
Significance	NS		-		-		-		-	

On first postoperative day corneal edema was more common in study group (8%).

Table No 5: Effective Phaco time (Mean ± Sd in seconds)

	Group		P-value	Significance
	Study	Control		
Mean ± Sd	32 ± 9.97	18.24 ± 13.36	< .001	Highly significant

Mean effective phaco time of study group was 32±9.97 seconds and in control group was 18.24±13.36 seconds time was more in study group.

Table 6: Mean value of intraocular pressure on follow up

Group	Mean ± Sd Postoperative day					
	Pre-OP	1	3	7	30	45
Study	15.19 ± 1.59	17.50 ± 1.99	16.72 ± 1.82	15.54 ± 1.49	15.01 ± 1.58	14.76 ± 1.64
Control	14.01 ± 1.38	15.89 ± 1.57	15.77 ± 1.44	14.75 ± 1.32	14.38 ± 1.29	13.63 ± 1.15

Study group also has increased value of IOP (15.19±1.59) preoperatively. There was rise in IOP postoperatively (17.50±1.99).

Table No 7: Distribution of BCVA at various intervals

BCVA	Day									
	1		3		7		30		45	
	Study	Control	Study	Control	Study	Control	Study	Control	Study	Control
6/18	11 (22%)	8 (16%)	-	-	-	-	-	-	-	-
6/12	12 (24%)	10 (20%)	15 (30%)	10 (20%)	6 (12%)	4 (8%)	6 (12%)	4 (8%)	5 (10%)	4 (8%)
6/9	16 (32%)	20 (40%)	15 (30%)	13 (26%)	15 (30%)	13 (26%)	11 (22%)	9 (18%)	10 (20%)	8 (16%)
6/6	11 (22%)	12 (24%)	20 (40%)	27 (54%)	29 (58%)	33 (66%)	33 (66%)	37 (74%)	35 (70%)	38 (76%)
Total	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)	50 (100%)
P-value	> 0.05		> 0.05		> 0.05		> 0.05		> 0.05	
Sig.	NS		NS		NS		NS		NS	

‡ At the day 45 BCVA (6/9-6/6) was achieved in 90% cases in study group and 92% cases in control group. On first postoperative day 54% patients in study group and 64% patients in control group had visual acuity 6/9-6/6.

Discussion

In our study both group had more female patients. The mean age of study group was 59.38±9.66 year and in control group 62.56±12.77 year. That data was supported by Framingham eye study [12], Punjab study [13] and Saudi Arabia study [14]. Poor nutritional status of female in India is also a reason for cataract formation according to beaver dam study [15]. This study was also supported by the Ermiss et al study [1] in which females (52%) exceeds male (47%) and it is in agreement with our study. However the difference was not so much as to statistically prove that female patients are more prone to get cataract than male patients.

In different types of cataracts cortical cataract is very common which was also seen in our study. Results were consistent with Ermiss et al study [1] Katoh et al, [16] Congdon Nathan et al [17] in which cortical cataract was more common. However Klein et al [15] showed that nuclear cataract was more common in white population. In our research we saw that prevalence of cortical cataract was more in 40-60 year age group where as nuclear cataract was mostly seen beyond 60 years. Mac Carty et al [18] showed that above 50 years of age the incidence of nuclear cataract was 11.6%, cortical cataract was 11.3% and PSC was 4.1% which is also similar to our study.

There was also a tendency for hardening of the lens as the duration of visual symptoms increased. In our study nuclear cataract usually seen beyond 60 years which was supported by Tan AG etal [19], Mac Carty etal[18], Vashisth P etal [20]. The reason is that as age increases the incidence of nuclear cataract also increases.

During phacoemulsification in both group Capsulorrhexis extension was seen in two cases in study group and one case in control group which was not significant (p>.05). Capsulorrhexis was difficult in white mature cataract due to absence of red reflex and leakage of fluid immediately after puncture the capsule. Fragile capsule and increase in intracapsular pressure are responsible for tear extension.

In 2001 Kothari Kulin et al [2] studied that trypan blue dye staining of the anterior capsule appears to be a very useful and safe technique that simplifies capsulorrhexis in mature and hypermature cataracts. Zonulodialysis was seen in one case in study group and one case in control group due to zonular dehiscence. It was also not significant (p>.05)

Posterior capsular rent occur equally in both the groups (one in each) which was also not significant (p>.05). Posterior capsule rupture is an intraoperative complication with a higher incidence during white cataract phacoemulsification. The common causes include the extension of an anterior capsular radial tear toward the equator; more prolonged phacoemulsification time and manipulation with a large and hard nucleus; stretched and thinned posterior capsule by the expanded intumescent lens, so the posterior capsule is weak and flaccid. Posterior capsule rupture brings an additional risk of posterior luxation of the solid nucleus that sinks more easily, and vitreous loss.

In Ermiss et al study [1] posterior capsular rent was equal in both group, which also supports our study. Raminder Singh et al [21] studied that the step-by-step, chop in situ, lateral separation technique was effective and did not produce serious complications such as zonulolysis or posterior capsule rupture.

In both groups on first postoperative day corneal oedema was present in 4 cases in mature cataract group and in one case in control group, however the difference was not significant (p>.05, x^2 = .842) whereas on 3rd day corneal edema was still present in study group but disappeared in control group. Corneal edema resolved in mature cataract group within a week. The reason for significant corneal oedema in study group was using more phaco power to chop the nucleus because in some cases hard nucleus lying behind the cortically mature cataract. In Ermiss et al study [1] postoperative corneal edema was seen in 34 eyes (34%) in mature cataract group and in 3 eyes (3%) in control group which was significant, but does not support our study, which is not in favour of our study.

The mean effective phaco time was more in the study group than control group (P <0.001) which was highly significant. Our this study supported by Ermiss et al study[1] in which mean phaco time is more in mature cataract group. The mean preoperative and postoperative intraocular pressure values in both group and the difference between the two groups were not significant at preoperative and all postoperative visit. Ermiss et al study [1] also didn't show any significant difference of intraocular pressure in both the groups at preoperative and postoperative visit.

In Comparison of best corrected visual acuity the difference of postoperative visual acuity levels between

two groups was not significant (p>0.05). Ermiss et al [1] also showed similar results which is in agreement with our study. Vasavada A et al [22] describe a technique that combines the principles of chop in situ and cracking for division of leathery, hard cataracts. After a space (trench or crater) is created in the center, the phaco probe is buried at 6 o'clock to produce a vacuum seal, resulting in an effective hold on the nucleus. In 2000 Chakrabarti A, Singh S et al [23] studied that phacoemulsification was a safe and effective technique to remove white mature cataract in the developing countries.

Conclusion

We can conclude that phacoemulsification is equally safe and efficacious in white mature cataracts as in other senile cataracts. Intraoperative difficulties and postoperative outcome of clear corneal temporal phacoemulsification surgery and foldable intraocular lens implantation is similar in white mature and other types of senile cataracts.

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