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

Meena RK¹, Chouhan JK², Sharma P³, Meena A⁴, Sharma D⁵

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

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

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. Post operative outcome, intraoperative difficulties were analyzed between two groups. Postoperative examination were done at 1st, 3rd, 7th, 30th & 45th day.

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,
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 et al [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 cataracts 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 preparations 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 conjunctival 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 1st, 3rd, 7th, 30th and 45th 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 ($\chi^2$). 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

<table>
<thead>
<tr>
<th>Age group (In Yrs)</th>
<th>Study</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>40-60</td>
<td>11 (22%)</td>
<td>19 (38%)</td>
</tr>
<tr>
<td>61+</td>
<td>12 (24%)</td>
<td>8 (16%)</td>
</tr>
<tr>
<td>Total</td>
<td>23 (46%)</td>
<td>27 (54%)</td>
</tr>
</tbody>
</table>

† Mean 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

<table>
<thead>
<tr>
<th>Age group (In Yrs)</th>
<th>Study group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White MSC</td>
<td>Total</td>
</tr>
<tr>
<td>40-60</td>
<td>25 (50%)</td>
<td>25 (50%)</td>
</tr>
<tr>
<td>61+</td>
<td>25 (50%)</td>
<td>25 (50%)</td>
</tr>
<tr>
<td>Total</td>
<td>50 (100%)</td>
<td>50 (100%)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Intraoperative complications</th>
<th>Study group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Detachment of descemet’s</td>
<td>0 (0%)</td>
<td>50 (100%)</td>
</tr>
<tr>
<td>Wound site thermal injury</td>
<td>0 (0%)</td>
<td>50 (100%)</td>
</tr>
<tr>
<td>Zonulodialysis</td>
<td>1 (2%)</td>
<td>49 (98%)</td>
</tr>
<tr>
<td>Capsulorrhexis ext.</td>
<td>2 (4%)</td>
<td>48 (96%)</td>
</tr>
<tr>
<td>Posterior capsule rent</td>
<td>1 (2%)</td>
<td>49 (98%)</td>
</tr>
</tbody>
</table>

† 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

<table>
<thead>
<tr>
<th>Cornea</th>
<th>Study</th>
<th>Control</th>
<th>Study</th>
<th>Control</th>
<th>Study</th>
<th>Control</th>
<th>Study</th>
<th>Control</th>
<th>Study</th>
<th>Control</th>
<th>Study</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bright</td>
<td>46    (92%)</td>
<td>49     (98%)</td>
<td>46    (92%)</td>
<td>50     (100%)</td>
<td>48    (96%)</td>
<td>50     (100%)</td>
<td>50    (100%)</td>
<td>50     (100%)</td>
<td>50    (100%)</td>
<td>50    (100%)</td>
<td>50    (100%)</td>
<td></td>
</tr>
<tr>
<td>Stromal edema</td>
<td>4     (8%)</td>
<td>1      (2%)</td>
<td>4     (8%)</td>
<td>0      (0%)</td>
<td>2     (4%)</td>
<td>0      (0%)</td>
<td>0      (0%)</td>
<td>0      (0%)</td>
<td>0      (0%)</td>
<td>0      (0%)</td>
<td>0      (0%)</td>
<td></td>
</tr>
</tbody>
</table>

$\chi^2$ = 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)

<table>
<thead>
<tr>
<th>Group</th>
<th>Study</th>
<th>Control</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± Sd</td>
<td>32 ± 9.97</td>
<td>18.24 ± 13.36</td>
<td>&lt; .001</td>
<td>Highly significant</td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>BCVA</th>
<th>1</th>
<th>3</th>
<th>7</th>
<th>30</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Study</td>
<td>Control</td>
<td>Study</td>
<td>Control</td>
<td>Study</td>
</tr>
<tr>
<td>6/18</td>
<td>11 (22%)</td>
<td>8 (16%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6/12</td>
<td>12 (24%)</td>
<td>10 (20%)</td>
<td>15 (30%)</td>
<td>10 (20%)</td>
<td>6 (12%)</td>
</tr>
<tr>
<td>6/9</td>
<td>16 (32%)</td>
<td>20 (40%)</td>
<td>15 (30%)</td>
<td>13 (26%)</td>
<td>15 (30%)</td>
</tr>
<tr>
<td>6/6</td>
<td>11 (22%)</td>
<td>12 (24%)</td>
<td>20 (40%)</td>
<td>27 (54%)</td>
<td>29 (58%)</td>
</tr>
<tr>
<td>Total</td>
<td>50 (100%)</td>
<td>50 (100%)</td>
<td>50 (100%)</td>
<td>50 (100%)</td>
<td>50 (100%)</td>
</tr>
</tbody>
</table>

P-value > 0.05 > 0.05 > 0.05 > 0.05 > 0.05

Sig. NS NS NS NS NS
Capsulorrhexis was difficult in white mature cataract due to duration of visual symptoms increased. In our study there was also a tendency for hardening of the lens as the nuclear cataract usually seen beyond 60 years which 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.

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.

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. Zonulolysis 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, x² = .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.

Funding: Nil
Conflict of interest: None initiated.
Permission from IRB: Yes

References


How to cite this article?