PHACOEMULSIFICATION IN DIFFICULT SITUATIONS

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ABSTRACT:

Purpose:

To evaluate the outcome of Phacoemulsification in cataracts with pseudo exfoliation and subluxated lenses of varying etiology between the period November 2008 and March 2009.

Materials and Methods:

25 cases of cataract with pseudo exfoliation and 10 cases of cataract with subluxated lenses were chosen for this retrospective study. Detailed preoperative assessment included slit lamp examination, visual acuity, presence of phacodonesis, zonulolysis or vitreous in the anterior chamber if the lens was subluxated, extent of subluxation, corneal status, Intraocular pressure with applanation tonometry, detailed fundus evaluation after dilatation, +78D biomicroscopic evaluation of Macula and optic disc, intraoperative and postoperative complications, postoperative observations including lens centration were noted.

All cases had foldable intraocular lenses and those cases which did not have capsular support had rigid PMMA IOLs by scleral fixation method. CTR was used whenever bag stability was found to be inadequate in both types of cataract. Student t test was used for statistical analysis.

Results:

Out of 25 cases with PEX cataract, 13 females and 12 males were enrolled in this retrospective study. Age range was from 60 to 80 years. Phacoemulsification was done for the right eye in 16 patients and left eye in 9 patients. Mean Best corrected visual acuity was 6/9:N6.
patient had 6/24P:N10 where fundus showed evidence of persistent CME. Two patients had 6/12P:N8, where vitreous loss occurred, and anterior vitrectomy were done in 2 cases and rigid lenses were placed in the sulcus. Postoperatively, increase in the IOP and inflammation during early period were controlled with medications.

The etiology of subluxated cataracts was due to blunt trauma in 3 out of the 10 cases. One case had subluxated lens associated with high myopia and Ehler danlos syndrome. Most of them were in the age ranging from 60 to 80 years. 2-port anterior vitrectomy was done in 3 cases. Retinal detachment of the other eye occurred in one myopic patient. Postoperative Visual acuity ranged from 6/6:N6 to 6/18P:N6. Drop in visual acuity was due to Cystoid macular edema and Age related macular degeneration. Six eyes had endocapsular phacoemulsification. One patient had anterior vitrectomy prior to capsulorhexis and the other patient had it during phacoemulsification. CTR was implanted (Morcher ring 10/12mm) in all cases. Two were aborted due to tear in the anterior capsule and rigid single piece PMMA lenses were placed in the sulcus by scleral fixation method.

**Conclusion:**

For safe and predictable outcome appropriate parameters have to be used in subluxated cataracts. IOP and inflammation control during early postoperative period will give good results cataracts with pseudo exfoliation.
Scope of the study:

Phacoemulsification is one of the finest procedures where rehabilitation of the patient is very fast associated with good visual outcomes if done properly. There are certain conditions like posterior polar cataract, High myopia, vitrectomised eyes, pseudo exfoliation cataracts, subluxated lenses, cataracts with rigid pupil pediatric cataracts and brown cataracts which can pose challenge to even experienced phaco surgeons.

I would like to discuss two most important situations where phacoemulsification has to be handled with utmost skill to get the desired postoperative results.

Pseudo exfoliation is characterized by abnormal production of a fibrillar extra cellular matrix material that deposits in the intraocular and systemic tissues. It is well known that eyes with pseudo exfoliation are at high risk of developing open and closed angle glaucomas along with cataract. In my studies, cataract surgery in the presence of this material has been associated with increased risk of intraoperative and postoperative complications like zonular dialysis, vitreous loss, prolonged corneal edema and inflammatory reaction. Lens decentration has also been reported. Zonular weakness, rigid pupils, corneal endothelial changes, breakdown of bloodaqueous barrier is some of the leading causes increasing the risk of intraoperative and postoperative complications, in eyes with pseudo exfoliation cataracts. We would like to share our experiences in series of 25 cases.

Surgical management of subluxated cataracts presents a real challenge to anterior segment surgeons. With recent advances in equipment and instrumentation, better surgical techniques with perfect understanding of fluidics, a surgeon should be able to perform relatively safe cataract surgery in the presence of compromised zonules. I would
like to describe my experience regarding phaco in these cases. The sole aim of this study with short series is to assess the intraoperative risks and postoperative outcomes.

Those cases with pseudoexfoliation present major challenge to phaco surgeons especially during intraoperative and postoperative period.

**Materials and Methods:**

**Cataracts with pseudo exfoliation:**

In our retrospective study conducted during November 2008 to March 2009, we selected 25 eyes having cataract with pseudo exfoliation. There were 13 females and 12 males in the age ranging from 60 to 80 years. Patients included in the study had no associated ocular disease, previous surgery or trauma. All eyes were assessed under slit lamp after dilatation, which showed presence of fibrilllin deposits on the pupillary margin, anterior lens capsule or both, presence of phacodonesis, type and grade of cataract were noted. Visual acuity, intraocular pressure with applanation tonometry and A-Scan biometry was done. Grade of Nuclear opacity was rated on a four-item scale:

a. +1=white yellow  
b. +2= dark yellow  
c. +3=orange  
d. +4=Brown / red  

On the day of surgery, patients were dilated with 1 drop of Cyclopentolate. All surgeries were performed by a single surgeon. 1%, Phenylephrine 10 % and diclofenac sodium 0.1% every fifteen minutes was used for dilatation one hour before surgery. Tab .Diamox (250 mg) and Tab. Valium was also given one hour prior to surgery. After peribulbar anesthesia, a 2.75 mm superotemporal clear corneal incision
was done using a steel disposable keratome. Aqueous in the anterior chamber was replaced with air and 0.5cc trypan blue dye was used to stain the anterior capsule. Anterior chamber was filled with high molecular weight cohesive viscoelastic. Side port was then created using 1mm 15 degree knife. An anterior continuous curvilinear capsulorhexis was made with bent 26 gauge needle. Pupil dilatation was around 6 mm. Iris hooks or pupil expanders were not used. Vernier calipers were used to measure the pupil size. Lens extraction was performed with Allergen compact machine with OCE technology. Step-by-step chop, direct chop, chop and stuff technique was used for nucleus division and fragment consumption. After ensuring complete cortical removal with bimanual irrigation and aspiration, in uneventful cases, the capsular bag was reformed with dispersive viscoelastic and foldable intraocular lenses were implanted in the bag. In cases, where posterior capsule rupture or vitreous loss occurred intraoperatively a PMMA single piece IOL was implanted. Anterior vitrectomy was done in two cases. Endocapsular ring was used in all cases where zonules appeared fragile after capsulorrhexis was done.

**Cataracts with subluxated lens:**

During the same period, a retrospective study was done in ten eyes with subluxated cataract. Patients had subluxation either due to trauma or nontrauma. One case had subluxated cataract congenitally due to Ehler Dahnlos syndrome. Data included age, sex, refractive error, preoperative visual acuity and cause for subluxation.

Slit lamp examination included anterior chamber depth, pupil abnormality due to trauma, presence or absence of zonules and vitreous, types and grades of cataract. Extent of subluxation was documented in terms of quadrant involvement in clock hours. IOP was measured with Applanation tonometry and none of the cases had corneal abnormality. Dilated fundus examination was done along with slit lamp biomicroscopic examination with +78D lens. Keratometry, A scan biometry was done to get proper DBR values. B scan was not done as
all cases could be seen clearly with indirect ophthalmoscopy. Scleral Indentation was done only if necessary.

All patients were given peribulbar anesthesia. No digital massage or super pinky was used. Single surgeon performed all surgeries. Maximum dilatation was achieved using cyclopentolate 1% eye drops and phenylephrine 10% every 15 minutes one hour prior to surgery. Topical flurbiprofen eye drops were used 30 mins and 15 mins before surgery to maintain intraoperative mydriasis.

Phacoemulsification was done so that closed chamber could be maintained in all cases. 3-Plane valvular clear corneal incision was done with 2.75mm keratome. Temporal incision was done irrespective of the zone of subluxation site. Anterior chamber was maintained with adequate viscoelastics. Bimanual irrigation and aspiration and 2 port anterior chamber vitrectomy was done when necessary. Anterior chamber was filled with cohesive viscoelastic and a side port entry was made about 3 clock hours from the main site with 15 degree paracentesis knife. Anterior curvilinear capsulorhexis was done from the site where zonules appeared firm with a bent 26 gauge needle. Utrata forceps were used at times to complete the small rhexis which was enlarged as required later. Flexile iris retractors were used in some cases with large inadequate zonular support to hold the capsular bag. The stop on the hook was adjusted to hold the rhexis edge to the scleral wall. Multiquadrant gentle hydro dissection was performed in all cases.

Phacoemulsification was done using Allergan Compact machine with ICE technology using appropriate low power, low vacuum and aspiration with low bottle height. Slow motion phaco inside the capsular bag was performed. Constant anterior chamber depth was maintained using 2% HPMC during phaco and before removing any instrument from the eye. The tip of phaco probe was directed to 6 0 clock position. Lens was fragmented with chop and stop or stop chop-chop technique before fragment removal. A step down principle was used to remove fragments.
In young patients in whom soft cataract was present, only phacoaspiration was done using low parameters. Vitreous presence in the anterior chamber when detected was cleared by 2 port anterior vitrectomy. Probable entry of vitreous was checked using iris spatula at the points of entry to make sure that it was cleared with vitrectomy. Cortical removal was done by gentle irrigation aspiration. Low aspiration flow rate, minimum bottle height and appropriate vacuum. Natural bag support for IOL placement was the main aim. CTR (Morcher 10/12mm diameter ring) was inserted with forceps after injecting sodium hyaluronate. CTR was inserted where the zonular support was weak or deficient even more than 3 clock hours. Cortical aspiration was done before inserting CTR through the main port.

Acrysof SA 60 AT single piece lenses were implanted in all patients where the bag could be maintained with good capsular support. In 2 cases, where there was total displacement of the capsular bag, scleral fixation IOL was done using Hanita lenses with hooklets. Anterior chamber was cleared of vitreous. In such cases, conjunctival peritomy was done at 2 sites viz., 10 o clock and 4 o clock. 26 Gauge bent needle was introduced 1 mm behind the limbus at one site and at the opposite site, a side cutting straight needle with 10-0 polypropylene suture was threaded and guided into the 26 gauge needle tip to guide the suture outside from the opposite side. The procedure was repeated with straight needle 1 mm from the pulled out side so that 2 threads, a superior and an inferior thread were seen in the pupillary axis. Both inferior and superior sutures were pulled through the main site. The mid portions of the sutures were cut after pulling adequate length. The inferior suture was threaded through the hooklet of the haptic from inferiorly and tied to the superior loop of a single piece Hanita IOL on one side. Similarly the superior loop was threaded superiorly in the opposite hooklet and then the knot tied to the inferior loop of the lens in the opposite side. Both the loops were pulled through 10 and 4 o clock positions with careful insertion of the optic through the main incision and under the iris. The straight arm needle and the adjacent loop were
pulled to anchor the lenses in the sulcus on either side. The sutures were then fastened to sclera on either side. Conjunctival peritomy was closed with 10-0 nylon. Residual viscoelastic was then thoroughly removed. Main incision and paracentesis were sutured with 10-0 nylon sutures. Subconjunctival decadron and garamycin 0.5 cc were given.

Postoperative assessment was done for all cases on day 1, day 4, day 7 and four weeks later. Intraocular inflammation was graded +1 to +4 depending on the number of cells in the anterior chamber visualized with slit beam 1 mm width and 3 mm height. Standard postoperative drug regime included a combination of prednisolone acetate 1% and antibiotic drops for 4 to 6 weeks in a tapering fashion weekly. In cases of raised IOP, antiglaucoma medication was added. X2 and students test were used for statistical analysis.

Every follow up included a thorough slit lamp exam, IOP recording, Best corrected visual acuity, centration of IOL and dilated fundus exam. Systemic anti-inflammatory drugs along with oral steroids 1 mg/kg body weight in tapering doses were given if indicted after postoperative assessment. Decentred IOL was defined by the difference in distance from the optic edge to the limbus on both sides of the IOL.

Results:

25 eyes were taken for this study with pseudo exfoliation. Out of these 3 were females and 12 were males. Mean age was 70 (60 – 80 years). Differences in the ages between the two groups were not statistically significant. Phacoemulsification was done for the right eye in 16 patients and left eye in 9 patients. Mean Best corrected visual acuity was 6/9:N6. One patient had 6/24P:N10 where fundus showed evidence of persistent CME. Two patients had 6/12P:N8. Where vitreous loss occurred, anterior vitrectomy was done in 2 cases and the lenses were placed in the sulcus. With medications over 4 weeks there vision improved to 6/9:N6. Two patients had zonular dehiscence during the
procedure and CTR was inserted with forceps. 56% of the eyes had associated posterior sub capsular cataract and 10% had brown cataract. Pupil diameter was only 6mm postoperatively also. Lens decentration, Nucleus drop, iris prolapse or wound leak was not observed in any patients. Corneal edema was seen in 3 patients with brown cataract which resolved in a weeks time with medications. Iritis was noted in 10 patients which was resolved with topical anti-inflammatory medications. Mean IOP was increased during the 1st week after surgery in 18 patients. (Range 12-24 mm.Hg).

Out of the 10 eyes with subluxated cataract during the study period, 3 patients had subluxation due to blunt trauma. One patient who was highly myopic had subluxation secondary to Ehler-Danlos syndrome. 2 patients had subluxated lenses secondary to hyper mature cataract. Traumatic mydriasis was noted in two patients and one had angle recession glaucoma. Age group ranged from 18 years to 80 years. There 3 females and 7 males in the study. One case secondary to trauma had broken anterior vitreous face. Vitreous was present in the anterior chamber. Two eyes had more than 180 degree subluxation. Zonules were absent in them. Fundus examination showed lattice degeneration with hole in two patients. They were advised to under laser barrage before surgery. One young patient with high myopia and Ehler danlos syndrome had retinal detachment in the other eye one month after surgery. Postoperative Visual acuity ranged from 6/6:N6 to 6/18P:N6. Drop in visual acuity was due to Cystoid macular edema and Age related macular degeneration. Six eyes had endocapsular phacoemulsification. One patient had anterior vitrectomy prior to capsulorhexis and the other patient had it during phacoemulsification. CTR was implanted (Morcher ring 10/12mm) in all cases. Two were aborted due to tear in the anterior capsule and rigid single piece PMMA lenses were placed in the sulcus. No serious intraoperative complications like vitreous loss, dropped nucleus or further zonular dialysis were noted. IOP was elevated in 3 patients who were treated with Timolol 0.5% eye drops bd.
Nine eyes had geometrically and clinically well centered IOL but one lens was not in the capsular bag. It was found to be in the sulcus. All patients were being followed for long term complications.

**Discussions:**

Pseudo exfoliation prevalence varies widely throughout the world. It has been noted that PEX increases with increasing age. It has been reported to be more in females than males because of longer life expectancy. In this study, males were found to have Grade 3 nucleus. Posterior sub capsular cataract was also seen in more than 50% of the cases in this study which corroborates with the Ackinci turkey study.

There were no cases of gross phacodonesis, type or zonulolysis as reported in journals. Moreno et al found higher incidence of iridophacodonesis in eyes with PEX having light colored iris. Even in Indian studies, no phacodonesis, type or zonulolysis was reported. Dark irides have less damage which is prevalent among Indian eyes. Poor Mydriasis is one of the main features in patients with PEX. We were able to achieve 6 mm diameter only through viscoelastics or stretches. There was no difficulty in performing anterior curvilinear capsulorhexis. Trypan blue stain was used to stain the capsule in all the cases.

In many case cataract surgery with pseudo exfoliation has been found to be associated with increases risk of complications. One reason could be the volume in those studies. In our study, we had only 25 cases with no phacodonesis, zonulolysis. Most important reason for good vision could be the surgical experience and use of latest equipments for decreased rate of complication.

It has been found that there was a definite increase in postoperative irits and glaucoma which could be treated with medicines in these eyes. The cause of rise in IOP could be partly due to inflammation though the exact cause could not be ascertained. There
could be breakdown of blood aqueous barrier leading to leakage of inflammatory materials and proteins. In two recent studies by various authors there has been no significant increase in IOP.

The management of subluxated lenses has remained controversial for many years. Jarrett has analyzed retrospectively surgical indications for subluxated lenses. Techniques included discussion, ICCE, ECCE, and cryoextraction. Recently, several authors have reported pars plana lensexctomy with anterior vitrectomy. Scleral fixated IOls have become a good alternative to anterior chamber IOLs in eyes lacking capsular support. Our surgical paradigm of closed chamber technique was invaluable. Temporal clear corneal incision was preferred basically for surgeons comfort and convenience. Most surgeons would prefer to operate from the site where there is good zonular support. Care was taken to stay away from the site of subluxation to prevent decentration of the IOL with the capsular bag. Rhexis was small to restrict the turbulence in the bag and vitreous aspiration. Iris retractors were used to support the capsular bag and cause less stress on the remaining zonules. Multiquadrant hydro dissection in small squirts helped us to reduce stress on zonules and aid thorough cortical clean up, thereby less chances for posterior capsule opacification. Nucleus rotation was not attempted in all cases for fear of zonular stress and rupture.0 degree phaco tip was used to bury the needle in the nucleus and not to cause stress or shear on the capsular bag. Low flow parameters help to reduce the turbulence in the chamber and bag. Repeated HPMC injection had to be done to push the posterior capsule from coming forward. Endocapsular technique helped us to fragment the nucleus and remove the pieces from the central space without stress on the zonules. Using the stop-chop-chop and stuff technique and step down technique with smaller fragments helps us to keep the flow and vacuum at low levels. Vitrectomy was performed to prevent traction on the vitreous base which may lead to retinal detachment. Bimanual I/A was performed with low bottle height to reduce turbulence within the capsular bag. Use of CTR helps to stabilize and expand the capsular bag. The bag equator was pushed to the periphery and IOL decentration was also
prevented. Less incidence of capsule contraction has also been reported. Scleral fixation of IOL was done in cases where natural bag support could not be retained. Inadvertent placement of one foldable lens could be the reason for one of the lenses being placed in the sulcus rather than haptic pop out.

In summary, we could achieve in the bag implantation in most eyes due to closed chamber technique. IOLs could be implanted with good CTR support and stretched bag. Decentration was not noted probably because of less number of cases in this study. Cionni ring was not used.

CONCLUSION:

Patients with cataracts associated with either pseudo exfoliation or subluxated lenses can achieve good visual acuity following phacoemulsification with intraocular implantation. Surgeon should exercise cautious approach after careful preoperative evaluation. Strict IOP and iritis control along with regular follow-ups can help patients to have good visual acuity in the long run. Using appropriate phaco power depending on the grades of cataract is essential. Cornea should be sufficiently protected with good viscoelastics when one deals with hard cataracts. In subluxated cataracts, low aspiration flow rate, low vacuum and low bottle height will cause very minimal turbulence in the anterior chamber. CTR and anterior vitrectomy has to be done whenever necessary. Understanding the fluidics and the machine helps the surgeon do the surgery with utmost confidence and ease. Keeping the inflammation under control ensures that the chances of getting CME are grossly reduced. Finally a safe and predictable outcome is what the surgeon expects after a skillful surgery.
**Patients with Pseudoexfoliation Cataract**

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<th>Eye R/L</th>
<th>Axial length</th>
<th>IOL Emmetrop</th>
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### Patients with SUBLUXATED CATARACT

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<th>S.No</th>
<th>Name</th>
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<td>2.</td>
<td>Mr. Sethuraman</td>
<td>69/M</td>
<td>3/60</td>
<td>R</td>
<td>23.5</td>
<td>+18.5</td>
<td>6/6:N6</td>
<td>Nil</td>
<td>ints</td>
</tr>
<tr>
<td>3.</td>
<td>Mr. Selvaraj</td>
<td>64/M</td>
<td>2/60</td>
<td>L</td>
<td>23.5</td>
<td>+21.5</td>
<td>6/6p:N6</td>
<td>Nil</td>
<td>HMC</td>
</tr>
<tr>
<td>4.</td>
<td>Mrs. Sandhya</td>
<td>74/F</td>
<td>6/36</td>
<td>L</td>
<td>23.96</td>
<td>+18.5</td>
<td>6/18p:N8</td>
<td>CTR used+art.vit</td>
<td>Trauma</td>
</tr>
<tr>
<td>5.</td>
<td>Mr. Subhash</td>
<td>18/M</td>
<td>3/60</td>
<td>R</td>
<td>26.02</td>
<td>+12</td>
<td>6/9p:N6</td>
<td>RD (L) later</td>
<td>E.D.Syndrome</td>
</tr>
<tr>
<td>6.</td>
<td>Mr. Ramaswamy</td>
<td>75/M</td>
<td>3/60</td>
<td>R</td>
<td>23.5</td>
<td>+22</td>
<td>6/12p:N6</td>
<td>CTR used</td>
<td>AMD+HMC</td>
</tr>
<tr>
<td>7.</td>
<td>Mrs. Radha</td>
<td>61/F</td>
<td>6/36</td>
<td>R</td>
<td>24.6</td>
<td>+19.0</td>
<td>6/6p:N6</td>
<td>CTR used</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Mr. Chendrasekar</td>
<td>60/M</td>
<td>3/60</td>
<td>R</td>
<td>23.05</td>
<td>+21.5</td>
<td>6/6:N6</td>
<td>CTR used</td>
<td>HMC</td>
</tr>
<tr>
<td>10.</td>
<td>Mr. Devaraj</td>
<td>63/M</td>
<td>6/24</td>
<td>R</td>
<td>24.05</td>
<td>+17.5</td>
<td>6/12p:N6</td>
<td>Vitreous loss</td>
<td>ScI.Fxated IOL</td>
</tr>
</tbody>
</table>
PSEUDOEXFOLIATION STATISTICS

Gender Distribution

- Male: 11
- Female: 14

Post Operative Visual Acuity

- Vision: 6/6, 6/9, 6/12, 6/18
- Numbers: 15, 1, 4, 1

Age Distribution

- Age Groups: 60-65, 65-70, 70-75
- Numbers: 8, 11, 3, 3

SUBLUXATED LENS STATISTICS

Age Distribution

- Age Groups: 60-65, 65-70, 70-75
- Numbers: 4, 1, 2

Gender Distribution

- Male: 7
- Female: 3

Post Operative Visual Acuity

- Vision: 6/6, 6/9, 6/12, 6/18
- Numbers: 5, 2, 2, 1
Surgical Steps: In Subluxated Cataract

Subluxated cataract

Corneal entry

Capsulorrhexis

Rhesis completed

Phacoaspiration

Cortex aspiration

Cortex cleaned up

A.C reformed

I.O.L. in A.C.

I.O.L. dialed into the bag.
PSEUDOEXFOLIATION CATARACT:

Pseudoexfoliation cataract

Gonioscopic view – Sampo laesi Line

Crack and Chop

CTR

Chop and Stuff
References:

ACKNOWLEDGEMENTS

I would like to thank God and my wife for giving me the strength to complete the work in time. My heartfelt thanks to my staff, Dr.Uma, and my assistants for their support in selecting the patients for this study.

I am grateful to all the patients who visited Jaya Eye Care Centre, 12, Norton 3rd Lane, Mandavelipakkam, Chennai – 600 028 and graciously consented to be a part of this study. I would also like to extend my sincere thanks to the nursing staff and theatre staff for their kind cooperation to carry out the surgeries successfully.

I would like to mention at this juncture that this work is original and no copyright has been infringed upon.

Dr.Ganesh Balasubramaniam