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Comparative study of use of pharmacological agents vs mechanical stretching techniques in management of small pupil in manual small incision cataract surgery

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Abstract

Purpose: Manual SICS requires a well-dilated pupil for nuclear management. Cataract with small pupil causes problems during nuclear management and Capsolorrhexis. In this study we share our own experience of using pharmacological agents vs mechanical stretching methods in management of small pupil in manual small incision cataract surgery.

Aim: To compare the use of Pharmacological agents vs Mechanical Stretching methods in Management of Small Pupil in Manual Small Incision Cataract Surgery**.**

Methods: 50 cataract patients whose pupil failed to dilate beyond 4 mm were selected and randomized into two groups. 25 patients underwent cataract surgery by using 0.1 ml of intracameral inj.Adrenaline(preservative free) and other 25 patients underwent cataract surgery by mechanical stretching of pupil(Sphincterotomy/ iris hooks). All the surgeries were performed by the same surgeon and the outcome was assessed on the basis of intraoperative mydriasis, intraoperative complications during capsulorrhexis, hydro dissection, Nucleus delivery and IOL implantation and the post-operative visual acuity, IOP and complications.

Results: Of the 25 patients, who used Intra cameral Inj.Adrenaline(Group A) intraoperative mydriasis of 8mm was achieved in 20 patients. Pupil remained small in other 5 patients of which 2 had severe Pseudo exfoliation and 2 had Posterior synechiae and 1 had Floppy Iris syndrome. There was difficulty in Capsulorrhexis and nucleus delivery in these 5 patients.

Of the 25 patients who underwent cataract surgery by mechanical stretching(Group B), pupil was expanded upto 9mm in all patients but had intraoperative complications like bleeding(40%), permanent loss of iris sphincter function(44%) and abnormal pupil shape postoperatively(28%).

Conclusions: Successful surgical outcomes may be achieved with both pharmacological agents and mechanical devices. Intra operative use of Adrenaline is easier and cost effective to maintain mydriasis in cataract cases with non-dilating pupil(4mm). Mechanical stretching though expands pupil effectively, it causes trauma to the iris and also possibly to corneal endothelium and causes permanent distortion and loss of sphincter function and also increases the duration of surgery.

Keywords: Small pupil, Intracameral adrenaline, Iris hooks, Sphincterotomy.

Introduction

During cataract surgery, the pupil must be sufficiently dilated to provide adequate surgical access to cataract. A small pupil(less than 4mm) presents a considerable challenge for cataract surgeons. Such cases carry a fairly high risk of complications such as increased risk of iris damage, iris bleeding, iris prolapse from one or more wounds, failed capsulorhexis, posterior capsule rupture, vitreous loss, dropped nucleus, endothelial cell loss and assymetrical IOL fixation. A well-dilated pupil with a sharp red reflex enhances the ease of cataract extraction and decreases the likelihood of complications. The postoperative result of these encounters can be an irregular and atonic pupil, photophobia and discomfort for the patient decreased Visual Acuity.

Small pupil are commonly caused by a lot of reasons such as synechiaes related to anterior uveitis(Fig. 1), previous trauma or surgery, advance age leading to iris sphincter sclerosis, iridoschisis, chronic miotic therapy, diabetes and pseudo exfoliation syndrome(Fig. 2).

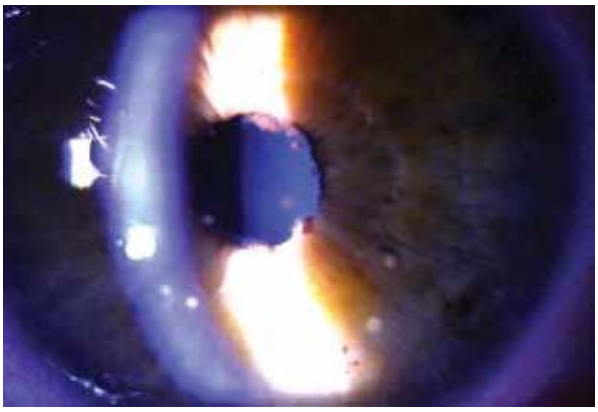


Fig. 1: Uveitic eye with peripheral anterior synechiae on the pupillary border in the setting of mutton fat keratoprecipitates and iris nodules

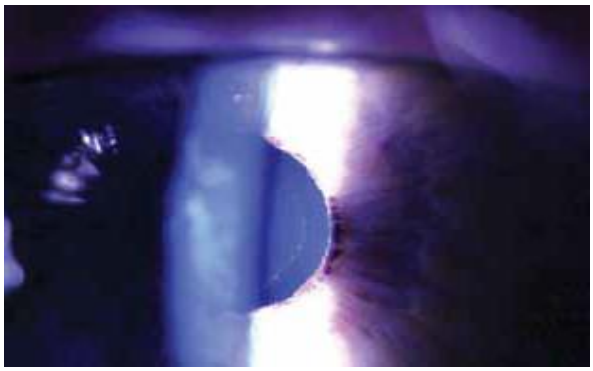


Fig. 2: Pseudo exfoliative material on anterior capsule

The surgeon's plan to eyes with a small pupil, requires flexibility and resourcefulness. The underlying pathophysiology should be taken into consideration when strategizing the surgical plan. This study is undertaken to compare the protective effect and dilating potential of intracameral Inj. Adrenaline 1:100000 concentration vs mechanical stretching methods like sphincterotomy and iris hooks.

Materials and Methods

Source of Data: Total of 50 cataract patients whose pupil failed to dilate beyond 4mm even after 40 minutes of instillation of dilating drops (Tropicamide 0.8% with phenylephrine 5%) posted for surgery were studied. All the cases are the patients attending Department of Ophthalmology, K.R. Hospital, Mysore, Karnataka. The cases were randomized into two groups of 25 each.
Duration: The study was done for the period of three months.
Study Type: Prospective Interventional
Sampling Method: Convenience Sampling method.

Institutional Ethics committee clearance was obtained and an informed consent was obtained from the patients.

Pre-operative workup: All the patients were admitted a day prior to surgery for preoperative workup and underwent a complete pre-operative evaluation was done viz Visual Acuity testing using Snellens chart, Slit Lamp examination, IOP measurement by I Care, Pupillary Reaction to light, pupil size after dilatation, Fundus examination, B-Scan & A Scan Biometry, Keratomety and proper management of systemic diseases like Diabetes, Hypertension, and Asthma by the concerned specialists**.**

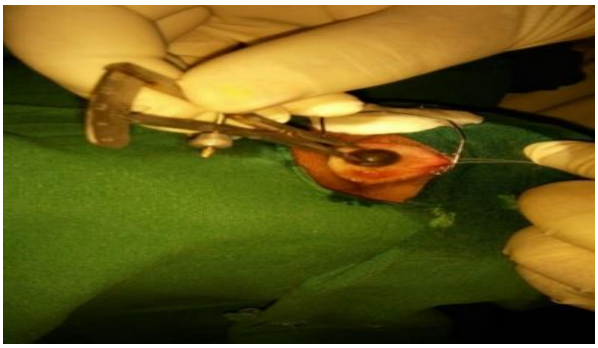
Slit Lamp examination revealed Cornea & Anterior Chamber Depth are Normal, except for Arcus Senilis in most of the cases.
Iris Pattern: Thick & Hyperpigmented in all the cases.

Cataract grading of nuclear sclerosis	No of cases
Grade 1 to 2	28
Grade 3 to 4	22

Pupil: Preoperatively pupillary diameter was measured using calipers. Pseudoexfoliation of Pupillary Margin is seen in 19 patients with Normal Direct and Consensual Reflex action. Fundus is within normal limits except for Tessellation observed in 2/3 cases. B-Scan is performed in all the cases.

Pre-Operative Preparation: The eye is prepared with Topical Antibiotic Drops. IOP kept under teens with Oral Acetazolamide 250 Mg at night & 2 hours before surgery. Local analgesia required for surgery, is achieved by Peribulbar Block with the infiltration of Lignocaine 2% combined with Bupivacaine 0.5% Adrenalin 1 in 2,00,000 and hyaluronidase.

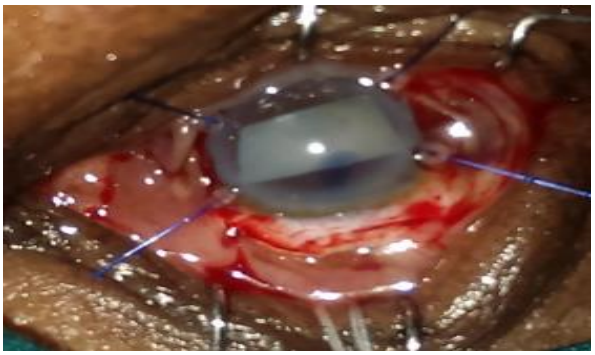
25 patients underwent cataract surgery by using intracameral inj. Adrenaline (preservative free). 0.1 ml Adrenaline 0.01% in 0.9ml of Balanced Salt Solution, giving a concentration of 1:100000 is prepared at the start of the surgery by the surgeon and is given intracamerally just after the entry into AC, and stayed at the anterior chamber for 1 minute. Approximately 3 minutes is needed to complete the whole procedure mentioned above. The intra operative pupil diameter is again measured using calipers.



Other 25 patients underwent cataract surgery by mechanical stretching of the pupil(Sphincterotomy/ iris hooks).

Sphincterotomy was done for 5 cases whose pupil was <3mm. It was performed with long vannas scissors through main port. The iris sphincter was cut at 6 o' clock hour.

Iris hooks were placed at 60 degree apart near the incision and 90 degree apart distal to the wound to minimize inadvertent iris trauma.



All the surgeries were performed by the same surgeon. Continuous curvilinear capsulorrhexis was done in all patients. The lens was removed by viscoexpression and the IOL was implanted into capsular bag. Incision was closed by hydration without sutures.

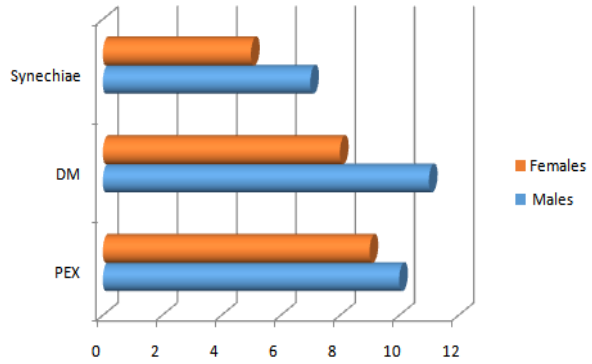
The outcome was assessed on the basis of intraoperative mydriasis, intraoperative complications during capsulorrhexis, hydrodissection, nucleus delivery and IOL implantation. The refraction and the best corrected visual acuity was measured preoperatively and day 1, 1 week, and 1 month postoperatively. The IOP was measured preoperatively and 1week and 1 month postoperatively.

Results

Of the 50 patients, 28 were males and 22 were females ranging from the age group of 40 to 80 years. Most of the patients were in the group of 65-70 years.

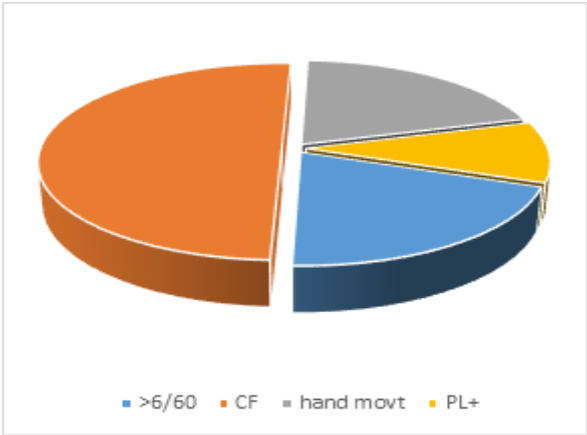
Age(yrs)	Males	Females
40-50	3	1
51-60	10	9
61-70	13	11
71-80	2	1
Total	28	22

The causes of small pupil in our study were Pseudo exfoliation(19), synechiae formation(12) and Diabetes(19). Depicted in the graph below:



Preoperative visual acuity: 50% had counting fingers 1 to 2 metres, 20% better than 6/60, 20% hand movements, 10% only perception of light.

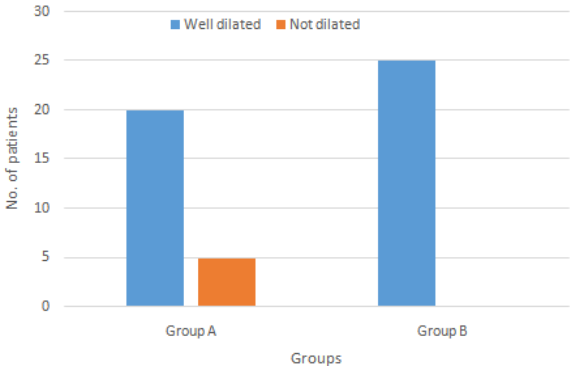
Better than 6/60	10
Counting fingers	25
Hand movements	10
Perception of light	5

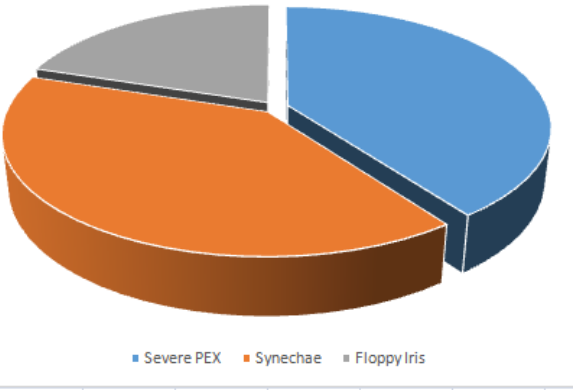


The pre operative IOP of all the patients was within normal limits(12- 20 mmHg)

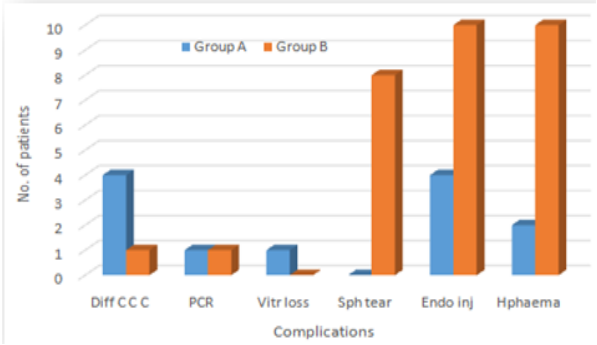
mmHg	No
12-14	7
14-16	15
16-18	18
18-20	10

Intraoperative mydriasis was again measured in all cases using calipers. In Group A, intraoperative mydriasis was achieved in 20 of the patients. Pupil remained small(<5mm) in 5 of them of which 2 had severe PEX, 2 had Posterior synechiae and 1 had floppy iris syndrome. Pupil was well dilated in all patients in Group B.





Intra operative Complications-A small capsulorrhexis was made in 4 cases in Group A due to inadequate pupil dilatation following intracameral adrenaline. There was a PCR in one case in each group. Sphincter tear was seen in 8 cases in Group B. 10 cases had injury to endothelium n hyphaema intraoperatively in Group B.

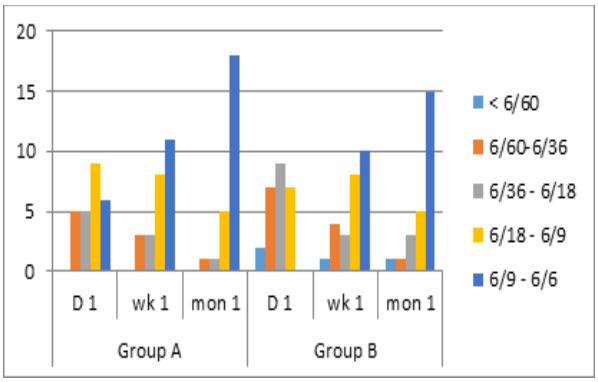


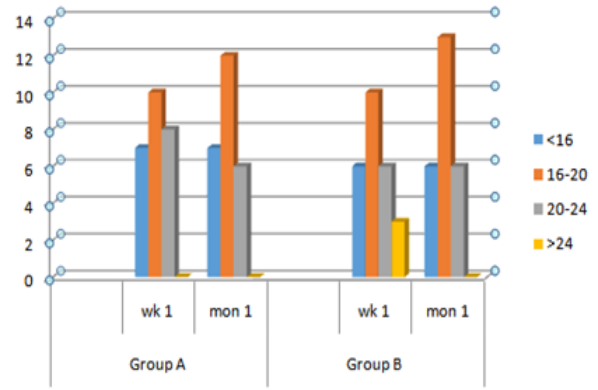
Intra op complications

	Group A	Group B
PCR	1	1
Vitreous Loss	1	0
Sphincter Tear	0	8
Endothelial Injury	4	10
Hyphaema	2	10

The duration of surgery for Group A- 15 minutes and Group B – 25 minutes.

Post-operative Visual Acuity and IOP: All the patients in Group A had vision >6/60 on POD1 while two of them had <6/60 in Group B. Visual Acuity gradually improved in all patients in subsequent follow-ups. 92% of the patients in Group A and 80% of them in Group B had vision 6/9 to 6/6 at the end of one month. IOP was raised due to postop uveitis(Group B> Group A). At the end of 1 week, three patients in Group B had 24 mmHg and the rest were within normal limits. At one month, both the groups had IOP within normal limits i.e. ranging between 16- 20 mm Hg.





Group A

	Day 1	1wk	1 mon
Corneal edema	5	2	0
Hyphaema	2	0	0

Group B

	Day 1	1wk	1 mon
Corneal edema	17	6	0
Hyphaema	4	1	0

Cystoid macular edema was found in one case in each group.

	A	B
Pupil shape distorted	0	11 (44%)
Loss of sphincter function	0	7 (28%)

Statistically significant

Discussion

The prevalence and demographic data of Small pupil in cataract surgery is not well documented. We

operated around four cases with small pupil per week. Present methods of dealing with a small pupil at the time of cataract surgery have all had limitations.

Pharmacological therapy with the use of non-steroidal eye drops, or strong mydriatics such as 10% phenylephrine, are often associated with untoward ocular and systemic side effects and may be ineffective in dilating bound-down and scarred pupils. The surgeon can simply ignore pupil size and perform the maneuvers of small incision surgery through an unenlarged incision, but this may result in the inadvertent complications described.

Fortunately, many eyes with small pupils respond to pharmacologic technique. Intracameral lidocaine,[4,5] epinephrine in balanced salt solution (BSS; Alcon Laboratories, Inc.), and intracameral solutions such as Surgicaine (4% unpreserved lidocaine diluted 1:3 with BSS Plus [Alcon Laboratories, Inc.]) are all tools at the cataract surgeon's disposal. (To make epinephrine for intracameral use, we use 1:1000 epinephrine and mix 0.1 ml epinephrine with 9.9ml BSS, then use 0.1 ml of that mixture intracamerally for a total of 1:100000).[6]

A study was conducted by Satyavathi et al., at GMC, Vijayawada during 2011-12. 50% of the total cases with small pupil were operated using Inj.adrenaline in BSS intraoperatively and the others without it (controls). Those cases where intraoperative Adrenaline was used, Pupil was well dilated in 60% of the cases and the rest of them needed mechanical stretching. There was difficulty in nuclear delivery in 4% and PCT in 2% of the cases. Round Pupil was achieved in 94%. 6/9 to 6/6 of Visual acuity was achieved in all cases.

Group A in our study, 80% of the cases were well dilated after administration of Intracameral adrenaline and there was difficulty in capsulorrhexis and nuclear delivery and injury to endothelium in those with not well dilated pupil. PCR and vitreous loss was seen in one case with severe pseudo exfoliation. All the cases had round pupil and 92% of the cases had 6/9 to 6/6 vision at the end of one month.

Laden Espander et al has discussed the use of intracameral adrenaline for Intaroperative floppy iris syndrome. It proved useful for a case with IFIS in our study.

When a more aggressive approach is required to open an obstinate pupil, incisional or stretching strategies may be helpful. Multiple tiny, equally spaced sphincterectomies created with small-caliber intraocular scissors can be helpful in a variety of scenarios, especially in cases of sphincter hypertrophy. With this technique, care should be taken to avoid extending the sphincter incisions into the iris stroma to reduce the risk of permanent mydriasis.

Bimanually stretching the pupil to 8 mm in two to three axes opposed 180º from each other with two iris hooks or two notched instruments such as Kuglen hooks can break synechiae, enhance moderate diabetic dilation, or open a pharmacologically small pupil.[4] With all of these techniques, less is more. It is important to minimize the trauma to the iris to reduce the risk of inflammation, bleeding, and chronic mydriasis.[3]

Jie Li, Fei Li etal have studied the use of self made Iris retractors for small pupil in Phacoemulsification in their study. Pupil was expanded upto 5.5 mm. 88% of the pupil- oval. BCVA stabilized in 74% on POD1, 86% at 1 week, 88% at 1 month.

Group B in our study, all cases were well dilated(>8mm) with iris hooks. Few cases with Grade 4 nuclear sclerosis needed sphincterotomy. 66% of them had oval pupil and pupil shape was distorted in 44%. BCVA was stabilized in 80% at 1 month. There was loss of sphincter function in 28% of cases.

Cystoid macular edema was noted in one case in each group at the end of one month due to PCR and vitreous loss.

Conclusion

Successful surgical outcomes may be achieved with both pharmacological agents and mechanical stretching methods.

Intra operative use of Adrenaline in BSS is easier and cost effective to maintain mydriasis in cataract cases with non-dilating pupil(4mm). Mechanical stretching though expands pupil effectively, possibly causes increased intra operative complications, permanent distortion and loss of sphincter function.

References

1. Management of the Small/Mid dilated Pupil during Small Incision Cataract Surgery-Still a Challenge!? Dr. G. Satyavathi M.S, Dr. D. Uday Kumar M.S, Dr. M. Parni Kumar.
2. Techniques for Managing a Small Pupil during Cataract Surgery.
3. Pharmacologic Approaches to the Small Pupil. By Ladan Espandar, MD, MSc, and Terry Kim, Guzek JP, Holm M, Cotter JB, Cameron JA, Rademaker WJ, Wissinger DH, Tonjum AM, Sleeper LA, Risk factors for intraopertive complications in 1000 extracapsular cataract cases. Ophthalmology.1987;94950;461-466.
4. Gimbel HV, Nucleofractis phacoemulsification through a small pupil.Can J Ophthalmology,1992;279(3);115-119.
5. Susic N, Kalauz-Surac I, Brajkovic J. Phacoemulsification in pseudoexfoliation (PEX) Syndrome. Acta Clinic Croat. 2008;47(2):87-89.
6. Hu YJ, Hou P. Managing iris prolapse. J Cataract Refract Surg. 2010;36(6):1064–1065.
7. Graether JM. Graether pupil expander for managing the small pupil during surgery. J Cataract Refract Surg.1996;22(5):530–535.
8. Mackool RJ. Small pupil enlargement during cataract extraction. A new method. J Cataract Refract Surg.1992;18(5):523–526.
9. Chang DF, Campbell JR. Intraoperative floppy iris syndrome associated with tamsulosin. J Cataract Refract Surg. 2005;31(4):664–673.

10. Oetting TA, Omphroy LC. Modified technique using flexible iris retractors in clear corneal cataract surgery. J Cataract Refract Surg. 2002;28(4):596–598.
11. de Juan E, Jr, Hickingbotham D. Flexible iris retractor. Am J Ophthalmol. 1991;111(6):776–777.
12. Zhong LXY, Zheng DY, Sun Y. Clinical study of the auxiliary management with iris retractor for subluxated lens combined with cataract. Zhonghua Yanke Zazhi. 2011;47(1):45–49.
13. Tint NL, Yeung AM, Alexander P. Management of intraoperative floppy-iris syndrome-associated iris prolapse using a single iris retractor. J Cataract Refract Surg. 2009;35(11):1849–1852.
14. Bohm P, Horvath J, Zahorcova M. Irrigating iris retractor for complicated cataract surgery. J Cataract Refract Surg. 2009;35(3):419–421.