



## Original Research Article

## A study of visco assisted mechanical pupil stretching for nucleus prolapse in cases of non or mid dilating pupil during small incision cataract surgery

Sandhya Ramachandra<sup>1</sup>, Smitha Shyam Kumar<sup>1,\*</sup>

<sup>1</sup>Dept. of Ophthalmology, Sri Devaraj Urs Medical College, Tamka, Kolar, Karnataka, India



## ARTICLE INFO

## Article history:

Received 29-06-2020

Accepted 20-07-2020

Available online 03-09-2020

## Keywords:

Non/mid dilating pupil

Visco assisted

Pupil stretching

SICS

## ABSTRACT

**Purpose:** To evaluate the efficacy of visco assisted mechanical pupil stretching for nucleus prolapse in cases of non or mid dilating pupil during small incision cataract surgery in a medical teaching tertiary hospital.

**Materials and Methods:** This prospective study of 30 patients with mid/non dilating pupil after thorough pre operative evaluation underwent cataract surgery using the technique of visco assisted mechanical pupil stretching.

**Results:** 61-70 years was the major presenting age group; majority of them were females. 60% of patients had senile immature cataract. 46.6% of eyes showed poor pharmacological mydriasis with pupil size ranging between 3-4mm. In 43% pupillary diameter improved 4.6-5mm following 6 point stretch pupilloplasty and 76.6% had pupil dimension of 4.1-5mm post visco elastic stretching. Sphincterotomies were performed in 16.6% of subjects.

**Conclusion:** A substantial increase in size of pupillary aperture was seen following surgical strategy of stretch pupilloplasty and visco elastic stretching with minimal intraoperative complications. This technique is hence an alternative which can be aptly followed as a cost cutting measure in low socio economic scenarios.

© 2020 Published by Innovative Publication. This is an open access article under the CC BY-NC license (<https://creativecommons.org/licenses/by-nc/4.0/>)

### 1. Introduction

Clouding of the human crystalline lens with aging, resulting in cataract is the most common cause of decreased vision.<sup>1</sup> Cataract surgery is the most common elective surgery, small incision cataract surgery being the cheap and effective choice<sup>1,2</sup> done across the country under NPCB. Small incision cataract surgery (SICS), the commonest for cataract performed in a rural tertiary care medical college teaching hospital like ours,<sup>3</sup> may be fraught with deterrents which result in suboptimal conditions for an ideal cataract surgery.

Mid dilating pupil because of pseudoexfoliation, glaucoma, uveitis, previous ocular surgeries<sup>4</sup> is a common challenge which restricts access to the surgical field during cataract surgery. A small pupil can predispose to intra

and post-operative complications such as anterior capsular tear, posterior capsular rupture vitreous loss, retained lens material, increased inflammation, irregular pupil shape,<sup>4,5</sup> and such cases require an extra edge of caution by operating surgeon.

Devices that help in mechanical mydriasis like iris hook, Malyugin ring, Healon<sup>5-7</sup> have revolutionized management of small pupil intra operatively. These add an additional cost and owing to socio economical restrictions may not be affordable to rural patients. As an alternative, visco assisted mechanical pupil stretching can be done to prolapse the nucleus into anterior chamber in cases of non dilating or mid dilating pupil during small incision cataract surgery. This is aimed to evaluate the effectiveness of this study.

\* Corresponding author.

E-mail address: [smithaskumar9@gmail.com](mailto:smithaskumar9@gmail.com) (S. S. Kumar).

## 2. Materials and Methods

This is a prospective study of 30 patients (males and females) aged 50-70 years, admitted for free cataract eye surgery in a medical college hospital in rural setting. Pupillary size of 3- 5mm after 2 attempts of pharmacological mydriasis was defined as mid dilating pupil. No change in the pupillary size was considered as non dilating pupil. Only patients with clear cornea, normal anterior chamber depth on slit lamp examination fit for topical anesthesia were recruited. Patients with pseudoexfoliation, posterior synechiae and systemic co morbidities such as diabetes and hypertension were included in the study.

Exclusion criteria included: pupillary diameters of 5mm or more, corneal opacity secondary to inflammatory or degenerative conditions, signs of uveitis, glaucoma, and posterior segment disease. History of topical use of miotics, alpha blockers (Tamsulosin) and trauma were considered in exclusion criteria.

After taking a written and informed consent as per Helsinki protocol, pre-operative evaluation comprised of-visual acuity, slit lamp examination -cornea, anterior chamber, iris, pupil, lens, Goldmann applanation tonometry, fundus examination with 90 D, A-scan and B-scan. Patients were prepared for cataract surgery after following the hospital protocol. Ringer lactate (500ml) containing 0.5 ml of 1:1000 preservative free Adrenaline was used for the irrigation in all cases.

Pupillary dilatation was attempted by instillation of mydriatic eye drops at 0 and 20 min pre operatively. Horizontal and vertical diameter values of pupil were measured with Castroviejo's calipers. The first reading was taken before peribulbar block. All surgeries were performed by the same surgeon and as per the standard surgical institutional protocol.

After peritomy and supero-temporal sclerocorneal tunnel (5mm), anterior capsular staining with Trypan blue (under air), 6 point pupil stretching was done using Sinsky IOL dialer under visco<sup>5,6,8</sup> through the main incision. Maximum permissible continuous curvilinear capsulorhexis was done. When the pupil failed to stretch upto atleast 5mm, visco assisted stretch pupilloplasty was done. Visco was injected under the pupillary margin if the pupil was found to be rigid. Pupillary size was then measured after the maneuvers.

Visco synechiolysis was done in cases with posterior synechiae by sweeping a cannula circumferentially and parallel between the iris and lens by avoiding injury to anterior capsule. Complications due to overstretching of pupil such as bleeding, atonic pupil, chronic inflammation, cystoid macular edema, pigment deposition, pupillary intraocular lens capture,<sup>4,5,9</sup> floppy iris syndrome<sup>4,5,10</sup> were kept in mind and minimum manipulations were done. Floppy iris syndrome was identified with characteristic features of iris billowing, prolapse and progressive

intraoperative miosis.<sup>10</sup>

When the above attempts failed, microsphincterotomies (3-5 in number) were performed with Vannas scissors to make the pupil pliant. Also, small capsulorhexis was enlarged by making four radial cuts. The nucleus was then engaged with 26 G needle and gently rotated by hydro free dissection and manual freeing. Nucleus was then dialed into anterior chamber and removed by bimanual technique. Hydro dissection was done whenever pupillary dilatation permitted visualization of red glow. Bleeding when present was controlled by injecting air and by careful pressure and withdrawal of instruments. The state of pupillary dilatation was noted. Cortical wash was given followed by in the bag IOL implantation. Anterior chamber was reformed and subconjunctival injection of antibiotic and steroid was given. Patching was done with regular post op instructions. All patients were put on standard post op regime and follow up as per hospital protocol.

Following parameters were recorded: 1. Pupil diameter-post pharmacological dilatation, post 6 point stretch pupilloplasty or post visco elastic stretching. 2. Whether pupillary dilatation was maintained till- nucleus prolapse, cortical wash, IOL implantation. 3. Intra operative complications such as floppy iris, hyphaema, disruption bag/PC rent and the total duration of surgery.

## 3. Observation

A prospective study was conducted in patients admitted for cataract surgery with mid or non dilating pupil in medical college hospital.

**Table 1:** Age and gender distribution of patients studied

Age in years	Males	Females
50-60	-	2
61-70	7	10
71-80	5	5
81-90	-	1
Total	12	18

**Table 2:** Type of cataract seen

Type of cataract	No.
Immature cataract	18
Mature cataract	12
Total	30

This study showed that 60% of patients had senile immature cataract of mixed variety comprising of posterior subcapsular, nuclear sclerosis and cortical cataract.

3% of patients showed pseudoexfoliation and 10% had posterior synechiae

Post pharmacological dilatation: 46.6% of eyes showed poor mydriasis with pupil size ranging between 3-4mm. Following 6 point stretch pupilloplasty, it was observed that

**Table 3:** Etiological factors for small pupil

Type of cataract	Pseudoexfoliation	Posterior synechiae
Immature	9	1
Mature	4	2
Total	13	3

**Table 4:** Pupillary dimensions at various perioperative time points

Pupil size	Post pharmacological dilatation	Post 6 point stretch pupilloplasty	Post visco elastic stretching
3-3.5mm	2	2	1
3.6-4mm	12	2	1
4.1-4.5mm	6	8	10
4.6-5mm	10	13	13
5.1-5.5mm	-	5	5
Total	30	30	30

in 43% pupillary diameter increased to 4.6 – 5mm. In 76.6% of patients pupil diameter was found between 4.1-5mm post visco elastic stretching.

Pupillary dilatation was maintained on an average upto 3 minutes post 6 point stretch pupilloplasty facilitating subsequent surgical steps. However in 16.6%, pupil failed to stretch and in such cases sphincterotomies was resorted to. Intra operative complications seen were miosis (13.3%), floppy iris (6.6%), hyphaema and posterior capsular tear (3.3%each). Post operatively transient corneal edema was the most common complication (33.3%) seen in the study. On an average total duration of surgery was noted to be around 11 minutes.

#### 4. Results

This study included a total of 50 patients having mid/non dilating pupil. Most common presenting age group was 61-70 years, majority being females. Pseudoexfoliation followed by posterior synechiae was the most common attributable etiological factors. A substantial increase in size of pupillary aperture was seen following stretch pupilloplasty and visco elastic stretching with minimal intraoperative complications such as miosis, floppy iris, hyphaema and posterior capsular tear in that order.

#### 5. Discussion

A small pupil with its associated complications often poses a challenge for a cataract surgeon in developing countries, the reason may be diverse and difficult to categorize. A small pupil is the one which does not dilate adequately in response to conventional mydriatics and is usually < 5 mm in size.<sup>11</sup>

The profile of patients with non and mid dilating pupil showed highest incidence (56.6%) in age group of 61-70 years; with female preponderance (60%), conforming to other studies.<sup>12,13</sup> 43.3% of patients showed pseudoexfoliation and 10% had posterior synechiae contributing towards poor pupillary dilatation as evidenced

by other studies.<sup>14,15</sup> Pharmacological dilatation using topical mydriatics can be helpful to some extent in managing small pupil during cataract surgery; limitations being insufficient mydriasis, ocular and systemic side effects.<sup>4,16</sup>

Higher cost and technical difficulties with the use of mechanical stretching devices like iris hooks, Malyugin rings, along with possible complications like bleeding, permanent loss of iris sphincter function and abnormal pupil shape post operatively<sup>5,8,17</sup> support the practice of maneuvers described in this study. These are cost effective, time saving and can be practiced by experienced surgeons/beginners alike.

In this study we attempted to maneuver mid or non dilating pupil with technique of 6 point stretch pupilloplasty and/ or visco assisted mydriasis for nucleus delivery by achieving better pupillary dilatation, augment the visualization and improve the pliance of the pupil without much deviation from the standard surgical techniques. It was observed that in 43% of our patients pupillary diameter was increased to 4.6 – 5mm post 6 point stretch pupilloplasty. Similar inference was drawn by few other researchers also.<sup>18,19</sup> In 43.3% patients pupillary dilatation 4.6-5 mm was achieved post visco elastic stretching.<sup>20,21</sup>

Miosis was the most common intraoperative complication observed following nucleus delivery (seen in all dense cataract) which may be attributable to intraoperative manipulations<sup>22</sup>. In dense cataracts engaging the nucleus by fishhook technique<sup>22</sup> was facilitated by 6 point stretch pupilloplasty and viscodissection. IFIS although associated with use of Tamsulosin, can be present otherwise also. In our study iris billowing and floppiness, tendency to prolapse into the incision and progressive intraoperative miosis was noticed.<sup>10</sup> This may be avoided by gentle hydrodissection, lowering the irrigation inflow rate, directing the irrigation currents away from pupillary margin and strategic use of visco elastics to weigh the iris down.

In this study, gentle and minimal instrumentation, judicious use of ocular viscoelastic devices helped in managing mid/non dilating pupil, maintaining the anterior chamber and avoiding iris prolapse. Zonular dialysis due to extension of anterior capsular tear, posterior capsular rupture and vitreous loss<sup>5,22</sup> can occur in cases of non/dilating pupil during nucleus delivery if any of these maneuvers are done vigorously and repetitively.

Strategic management of small pupil is imperative for a successful visual rehabilitation after cataract surgery and the focus must be upon avoiding post operative complications such as corneal edema, striate keratopathy, anterior chamber inflammatory response, severe uveitis, retained cortical matter and altered pupil shape.<sup>5,22</sup>

## 6. Conclusion

A surgical strategy of visco assisted mechanical pupil stretching in non or mid dilating pupil to mobilize the nucleus during small incision cataract surgery is an inexpensive maneuver which can be easily adapted by ophthalmic surgeons for low cost cataract surgeries. Stretch pupilloplasty technique can effectively expand the pupil in cases of poor pharmacological mydriasis associated with pseudoexfoliation and posterior synechiae, enabling the surgeon to accomplish this tacky cataract surgery with minimal resolvable complications. Flexibility and resourcefulness can compensate for expensive surgical aids, to a great extent if not fully. A thorough understanding of the underlying pathophysiology is most essential, surgeon variable and can be developed with experience. Limitations of the study were smaller sample size and short follow up. Authors would like to acknowledge all the subjects participated in the study.

## 7. Abbreviations in the order of occurrence

NPCB: National Programme for Control of Blindness, SICS: Small incision cataract surgery, IOL: Intra ocular lens, PC: Posterior capsule, IFIS: Intraoperative floppy iris syndrome

## 8. Source of Funding

None.

## 9. Conflict of Interest

None.

## References

1. Vemparala R, Gupta P. National Programme for Control of Blindness (NPCB) in the 12th Five year plan: An Overview. *Delhi J Ophthalmol.* 2017;27(4):290–2.
2. Gogate P. Comparison of various techniques for cataract surgery, their efficacy, safety, and cost. *Oman J Ophthalmol.* 2010;3:105.
3. Devendra J, Agarwal S, Singh PK. A comparative study of clear corneal phacoemulsification with rigid IOL versus SICS; the preferred

surgical technique in low socio-economic group patients of rural areas. *J Clin Diagn Res: JCDR.* 2014;8(11):VC01.

4. Satyavathi G, Kumar DU, Kumar MP. Management of the Small/Mid dilated Pupil during Small Incision Cataract Surgery-Still a Challenge! *Int J Sci Res (IJSR)* . 2015;4(1):2720–2.
5. Malyugin B. Cataract surgery in small pupils. *Indian J Ophthalmol.* 2017;65:1323.
6. Melgar MY, Buchan J. Managing cataract surgery in patients with small pupils. *Community Eye Health J.* 2019;31(104):84–5.
7. Chatziralli I, Halkiadakis I, Drakos E, Katzakis M, Skouriotis S, Patsea E, et al. Causes and management of small pupil in patients with cataract. *Oman J Ophthalmol.* 2017;10(3):220.
8. Akman A, Yilmaz G, Oto S, Akova YA. Comparison of various pupil dilatation methods for phacoemulsification in eyes with a small pupil secondary to pseudoexfoliation. *Ophthalmol.* 2004;111(9):1693–8.
9. Rumelt S. Management of Small Pupil during Phacoemulsification. Management; 2008.
10. Flach AJ. Intraoperative floppy iris syndrome: pathophysiology, prevention, and treatment. *Trans Am Ophthalmol Soc.* 2009;107:234.
11. Chaudhuri Z, Vanathi M. Postgraduate Ophthalmology, Two Volume Set. Wife Goes On; 2011.
12. Prasad M, Malhotra S, Kalaivani M, Vashist P, Gupta SK. Gender differences in blindness, cataract blindness and cataract surgical coverage in India: a systematic review and meta-analysis. *Br J Ophthalmol.* 2020;104(2):220–4.
13. Gudlavalleti MVS, Pant HB, Bandyopadhyay S, John N, Chandran A. Differential cataract blindness by sex in India: Evidence from two large national surveys. *Indian J Ophthalmol.* 2017;65:160.
14. Kovač B, Vukosavljević M, Resan M, Janković J, and MPJ. The prevalence of pseudoexfoliation syndrome and possible systemic associations in Serbian patients scheduled for cataract surgery. *Vojnosanitetski Pregled.* 2014;71.
15. Joshi RS, Singanwad SV. Frequency and surgical difficulties associated with pseudoexfoliation syndrome among Indian rural population scheduled for cataract surgery: Hospital-based data. *Indian J Ophthalmol.* 2019;67(2):221.
16. Moisseiev E, Loberman D, Zunz E, Kesler A, Loewenstein A, Mandelblum J, et al. Pupil dilation using drops vs gel: a comparative study. *Eye.* 2015;29(6):815–9.
17. Wilczynski M, Wierchowski T, Synder A, Omulecki W. Results of Phacoemulsification with Malyugin Ring in Comparison with Manual Iris Stretching with Hooks in Eyes with Narrow Pupil. *Eur J Ophthalmol.* 2013;23(2):196–201.
18. Bacskulin A, Kundt G, Guthoff R. Efficiency of Pupillary Stretching in Cataract Surgery. *Eur J Ophthalmol.* 1998;8(4):230–3.
19. Dinsmore SC. Modified stretch technique for small pupil phacoemulsification with topical anesthesia. *J Cataract Refractive Surg.* 1996;22:27–30.
20. Dick HB, Schwenn O. Viscoelastics in ophthalmic surgery. Springer Science & Business Media; 2012.
21. Liesegang TJ. Viscoelastic substances in ophthalmology. *Survey Ophthalmol.* 1990;34:268–93.
22. Sharma U, Sharma B, Kumar K, Kumar S. Evaluation of complications and visual outcome in various nucleus delivery techniques of manual small incision cataract surgery. *Indian J Ophthalmol.* 2019;67:1073.

## Author biography

Sandhya Ramachandra Professor and HOD

Smitha Shyam Kumar Junior Resident

**Cite this article:** Ramachandra S, Kumar SS. A study of visco assisted mechanical pupil stretching for nucleus prolapse in cases of non or mid dilating pupil during small incision cataract surgery. *IP Int J Ocul Oncol Oculoplasty* 2020;6(3):212-215.