

Safety and effectiveness of a novel bimanual phaco chopping-fragmentation technique for retained intravitreal lens fragments

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ABSTRACT

Purpose: To describe a new technique of phaco-fragmentation using a chopper and chandelier endoillumination.

Materials and Methods: In 8 consecutive eyes, by the new technique, after completing vitrectomy in convention 3-port method, a chandelier illumination light source was used for illumination, a phaco-chopper was used in the non-dominant hand and the phaco-fragmentator in the dominant hand. This method was compared with 12 consecutive patients (12 eyes) receiving standard phaco-fragmentation.

Results: Mean age at presentation between the two groups was comparable in demography, and presenting and postoperative vision as follows. Age: Standard method: mean age 69.66±12.01 years (95% C.I. 62.86-76.46), New method: mean age 70.13±11.47 years (95% C.I. 62.18-78.08), p=0.93; Mean pre-operative vision: Standard method-1.93±0.94 logMAR, New method-1.97±0.86 logMAR, p=0.9; Mean postoperative vision Standard method-0.55 + 0.16 logMAR, New method 0.53±0.12 logMAR, p=0.7. The mean duration taken for completion of fragmentation was 3.27±0.87 minutes, (95% C.I. 2.78-3.76 minutes) and 1.91±0.66 minutes, (95% C.I. 1.45-2.37 minutes) p=0.0001 respectively. The mean foveal thickness on day 1 postoperative was 194±84 microns (95% C.I. 10.37-247.63 microns) and 210±62 microns (95% C.I. 149.49-230.51 microns) respectively (p=0.62).

Conclusion: Phaco-fragmentation using chandelier illumination, assisted with a chopper, is a safe and fast alternative technique to standard phaco-fragmentation.

Keywords: Phaco-fragmentation, retained lens matter, chandelier, chopper

INTRODUCTION:

Posterior dislocation of lens fragments into the vitreous cavity usually occurs less than 1% of the time.¹ A safe way of retrieval is pars plana vitrectomy, which facilitates normalization of the intra-ocular pressure, reduces or eliminates corneal edema, and simultaneously provides an opportunity to visualize or treat any vitreoretinal pathology. The dislocated lens fragments are removed by a vitreoretinal surgeon, preferably in the same sitting or within a week

for optimum results.² The visual outcomes of phaco-fragmentation in reported studies are good.^{3,4,5}

Often, perfluorocarbon liquid (PFCL) is used to remove lens fragments. With PFCL, the lens fragments are either floated up in the retro pupillary space or floated up to the mid-vitreous cavity, where they can be safely emulsified.^{6,7} A membrane pick can be impaled into the lens fragment to pick it up and stabilize it while it is emulsified.⁸ Pars plana vitrectomy is considered safe, irrespective of the instrument's gauge.^{9,10} Some of the inherent difficulties are

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repeated slipping of the lens fragments, light dazzling, and non-uniform view of the retina during the procedure. In this study, we describe a new technique of phaco-fragmentation that obviates some of the problems mentioned above. A video clip of the procedure is attached.

METHODS:

A retrospective review of cases undergoing phaco-fragmentation at our center was done. Data regarding age, gender, grade of nuclear sclerosis, phacofragmentation duration (minutes), pre and postoperative best-corrected visual acuity, Central macular thickness (μm) post-surgery were noted. Only those cases where the records showed the time noted during phacofragmentation were included in the study, and only those where the complete nucleus underwent fragmentation were included. The new method was compared with the standard method done during the same period to study the safety and efficacy of the new procedure vis-à-vis the standard method.

Statistical Analysis:

The data was arranged on an Excel spreadsheet. Relevant statistical analysis was done using MedCalc ver 12.2.1.0. For statistical analysis, vision was converted from Snellen to logMAR equivalents. Mean and standard deviations were computed for all continuous variables. In case of non-parametric

distribution, the median was calculated. Pre and postoperative data was compared using the independent-sample t-tests in parametric data. A p-value of <0.05 was assigned as statistically significant.

Surgical Technique:

The step one was a standard 20G pars plana vitrectomy. (Video 1) (see the video: <https://dergisi.org/retinavitreus/uploads/video/P1493493-Frag-in-coloboma-with-chopper-in-posterior-segment.mp4>). Following anterior and core vitrectomy, the posterior vitreous detachment was created with a vitreous cutter whenever required, and vitrectomy was completed to free the lens fragments from all vitreous fibers. A 23G sclerotomy port was made, and a cannula was placed at 7'o clock position 3 mm behind the limbus. A 23G chandelier illumination fiberoptic probe

(Alcon, Chandelier lighting system, Fort Worth, TX, USA) was secured in the cannula. A blunt chopper (Indo German, IG- 1778, Verges, Mumbai, India) now replaced the non-dominant hand superior endoilluminator probe. PFCL was not used; instead, the retained lens fragments were aspirated to the mid-vitreous cavity using the aspiration mode of phacofragmentome and emulsified with the constant assistance of the phaco-chopper. The chopper assisted in directing the fragments to the Fragmentome port and ensured better cleaving of the fragments into smaller pieces. This allowed the emulsification of the fragments with minimal usage of ultrasonic energy. The chandelier illumination ensured adequate visualization of the lens fragments and retina throughout the procedure. Using a stopwatch, a circulating nurse recorded the duration of the phaco chopping-fragmentation time. Postoperative care included a detailed peripheral and central retina examination at weeks 1, months 1, and 3. The thickness of the central macula was measured by optical coherence tomography (OCT) during the one-month visit.

In brief, the standard procedure consisted of a 20G complete pars plana vitrectomy with posterior vitreous detachment induction and fragmentation of the retained lens matter with a 20G phacofragmentome assisted with the endoilluminator as the second instrument.

RESULTS:

The dropped lens was grade 4 or 5 as measured by LOCS III.¹¹ The results of the new technique are summarized in Table 1. There was no statistical difference in age, pre-operative visual acuity, postoperative visual acuity or the central foveal thickness postoperatively between the two surgical techniques. A statistically significant difference was noted between the fragmentation duration of the two techniques, with the 'new' technique requiring less duration than the 'standard' technique. (Table 2) In all eyes, there was a total nucleus drop. Of the 20 eyes, 12 were operated in standard technique and 8 operated in new technique, included 4 eyes traumatic dislocation, 2 eyes with spontaneous dislocation and 14 eyes intraoperative complete nucleus drop during attempted cataract surgery. Indirect ophthalmoscopy and slit lamp biomicroscopy did not show any central and peripheral retinal damage or changes in either method.

Table 1. *Clinical features of the subset undergoing the novel technique of fragmentation*

Sl. No	Age/ Gender	Type & hardness of cataract	Cause of lens dislocation*	Phacofragmentation duration (minutes)	Preop logMAR visual acuity	Post-op logMAR visual acuity	Pre-op IOP (mmHg)	Postop IOP (mmHg)	Postop CMT at 1 month (µm)	Duration of follow-up in 1 month
1	72	NO5, NC5	Intraoperative	2.3	1.86	0.4	22	18	187	3
2	70	NO5, NC5	Intraoperative	2.1	1.99	0.3	18	16	168	3
3	71	NO5, NC5	Spontaneous	2.1	2.03	0.66	16	16	190	3
4	68	NO4, NC4	Intraoperative	1.89	1.9	0.54	16	18	170	1
5	74	NO5, NC5	Intraoperative	2.34	1.82	0.36	18	14	160	3
6	61	NO4, NC4	Traumatic	1.83	2.13	0.61	12	14	202	3
7	71	NO5, NC5	Intraoperative	2.2	1.88	0.3	16	16	180	6
8	73	NO5, NC5	Spontaneous	2.3	2.4	0.38	14	18	178	3

According to LOCS grading scale

Table 2. *Comparative table showing the difference between the two surgical groups*

	Standard technique	95% Confidence Interval	New technique	95% Confidence Interval	P value
Mean age (years)	69.66±12.01	62.03-77.29	70.02±4.07	67.29-72.75	0.925
	Intraop-9 Traumatic-0 Spontaneous-3		Intraop-5 Traumatic-1 Spontaneous-5		
Pre-operative VA (logMAR)	1.93±0.94	1.33-2.53	2.01±0.19	1.88-2.14	0.779
Postoperative VA (logMAR)	0.41±0.16	0.31-0.51	0.39±0.14	0.3-0.48	0.771
Phacofragmentation duration (minutes)	3.27±0.87	2.72-3.82	2.13±0.19	2.00-2.26	0.0008
Central macular thickness (µm)	194±84	140.63-247.37	179±14.5	169.26-188.74	0.556

DISCUSSION:

The two most challenging aspects of intravitreal phacofragmentation are maneuvering the lens fragments effectively to the Fragmentome tip and simultaneously maintaining adequate visualization of the operating field. Usually, surgeons use the endo illuminator to maneuver the lens matter toward the Fragmentome tip.^{12, 13} But the endo illuminator tip is too blunt to impale the lens matter. Consequently, the lens matter often rotates around the Fragmentome, preventing adequate occlusion maintenance at the tip. Once fragmentation begins, the proximity of the endoilluminator probe to the Fragmentome, and its relative anterior position, cause glare reflexes. The operating field becomes poorly illuminated because the lens fragment obscures the endoilluminator, and at the same time, the underlying retina is no longer illuminated, thus preventing a simultaneous clear view of the retina. As a result, one may miss a sentinel retinal event should it occur accidentally.^{12, 13} In this study, shorter fragmentation time noted in the newer technique. This could lead to a decrease in cumulative dissipated energy (CDE) and a reduced risk of thermal injury.

In our described technique, the chopper stabilized the lens fragments for faster and complete phacoemulsification. Because the illumination source was farther from the active instruments, glare and intermittent darkening of the field of view were avoided. Chandelier-assisted techniques have been described in the literature in vitreoretinal surgery.¹⁴ While Dhoot et al. advocated for an assistant hand held endoilluminator approach to provide dynamic illumination.¹⁵ In our described technique, the 23G chandelier illumination provided adequate and uniform retina and vitreous cavity illumination. The hypersonic vitrector (Vitesse, Bausch and Lomb) is an ultrasound-based device designed to facilitate minimally invasive removal of retained lens fragments.¹⁶

This study had inherent limitations as it was a retrospective study. The overall sample size was small despite our center being a tertiary referral center. This can be explained by the fact that for the sake of standardization, only those cases were included where the whole nucleus needed to be fragmented. We could also include only those cases where the duration taken for fragmentation was separately noted. Optical coherence tomography scans were available for only 3 patients in the first group and 5 in the second group.

Though surgeon comfort with the new technique is likely to be better because of reduced glare and increased field of view during surgery, it was not possible to quantify due to the study's retrospective nature. We suggest future multicentric studies to further validate this.

The described chandelier-assisted bimanual phacofragmentation technique appears feasible and may improve surgical efficiency in managing retained lens fragments. Larger prospective studies are required to validate safety and determine its comparative clinical benefit.

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Permissions- None

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The study has been evaluated by Ethics Committee of LV Prasad Eye Institute, Hyderabad and ethics approval deemed not required.

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