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## A comparative study of intraoperative complications of pseudoexfoliation in manual small incision cataract surgery and phacoemulsification

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### Abstract

**Background:** Pseudoexfoliation Syndrome is an age related generalized disorder involving abnormal production or turnover of extra-cellular matrix in ocular tissues, orbital tissues, skin and visceral organs. Cataract is clouding of the lens in the eye commonly occurring due to increasing age, removed by surgery.

### Objectives

1. To compare the frequency and types of complications of small incision cataract surgery (SICS) and phacoemulsification surgery in patients with cataract with associated Pseudoexfoliation.
2. To determine the clinical outcome of the procedures.

**Materials and Methods:** Study includes a sample of 100 patients diagnosed to have cataract with pseudoexfoliation, 50 of each undergoing either MSICS or Phacoemulsification, during the period of November 2017 to April 2019.

Each case was examined clinically and an elaborative study of history based on chief complaints, significant risk factors, investigations, time and type of surgery performed and intraoperative and postoperative events were recorded. Following which management of these cases, based on facility available here was done. Results were analyzed by using SPSS 22.0 Version Software.

**Results:** Difficult capsular rhexis was encountered in 19 cases that underwent SICS and 10 cases that underwent Phacoemulsification. Difficult nucleus delivery was encountered in 11 cases that underwent SICS and 4 cases that underwent Phacoemulsification. Zonular dialysis was encountered in 4 cases that underwent SICS and 11 cases that underwent Phacoemulsification.

Difficult cortical aspiration was encountered in 19 cases that underwent SICS and 10 cases that underwent Phacoemulsification.

**Conclusion:** Patients with pseudoexfoliation syndrome undergoing Manual Small Incision Cataract Surgery are at a higher risk for the development of intraoperative complications as compared to Phacoemulsification surgery. With appropriate preparation and use of specialized adjunctive devices, phacoemulsification is the preferred method of cataract extraction in eyes with pseudoexfoliation syndrome.

The postoperative visual outcome was comparatively better in the patients that underwent Phacoemulsification than the patients that underwent Manual Small Incision Cataract Surgery.

**Keywords:** intraoperative, pseudoexfoliation, small incision, phacoemulsification

### Introduction

Pseudoexfoliation Syndrome is an age related generalized disorder involving abnormal production or turnover of extra-cellular matrix in ocular tissues, orbital tissues, skin and visceral organs. Renewed interest in this long known entity results from better awareness of the spectrum of intra-ocular risks not only for open angle glaucoma but also in conjunction with/or intra-ocular surgery, especially cataract extraction.

Cataract surgery on eyes with PXF has difficulties related to altered structures due to PXF material, hence, susceptible for increased risk of surgical complications like posterior capsular rupture, zonular dialysis, anterior chamber hyphema and vitreous loss. According to Scroli *et al.*, intraoperative complications are 5 times greater compared to normal eyes.

Manual small incision cataract surgery (MSICS) has become popular in India in the last decade. Cataract is the leading cause of avoidable blindness in India <sup>[1]</sup>, and cataract surgery forms the major workload of most ophthalmic units in the country. An estimated 4 million people become blind because of cataract every year <sup>[2]</sup>, which is added to a backlog of 10

million operable cataracts in India, whereas only 5 million cataract surgeries are performed annually in the country [3]. Thus, a technique of cataract surgery that is not only safe and effective but also economical and easy for the majority of ophthalmologists to master is the need of the hour. Phacoemulsification (PHACO) of the nucleus has become increasingly important in extracapsular cataract surgery. PHACO within the capsular bag has confirmed to be a valuable surgical technique yielding predominantly good results. PHACO in the presence of pseudoexfoliation presents a particular challenge for cataract surgeons [4]. Additionally, timing of the cataract surgery in a pseudoexfoliation eye is critical. It is not advisable to delay surgery in a pseudoexfoliation eye till the cataract is very advanced, since the worse the cataract gets, the more difficult it is to remove without complications.

### Material and Methods

The present study was conducted in the Department of Ophthalmology at Basaveshwar Teaching and General Hospital, Kalaburagi. Institutional ethical committee clearance was obtained for the conduct of the study and informed consent was taken from all the patients.

Patients attending Ophthalmic OPD for cataract surgery or routine examination, with evidence of material deposit in the anterior chamber were further evaluated for Pseudoexfoliation.

Study includes a sample of 100 patients diagnosed to have cataract with pseudoexfoliation, 50 of each undergoing either Manual Small Incision Cataract Surgery or Phacoemulsification, during the period of November 2017 to April 2019.

Each case was examined clinically and an elaborative study of history based on chief complaints, significant risk factors, investigations, time and type of surgery performed and intraoperative and postoperative events were recorded.

Following which management of these cases, based on facility available here was done.

### Inclusion criteria

Patients above 50 yrs of age belonging to either sex, diagnosed to have cataract with pseudoexfoliation on the basis of slit lamp examination, before and after pupillary dilatation.

### Exclusion criteria

1. Following patients will be excluded from the study,
2. Patients less than 50 yrs of age.
3. Patients with traumatic cataract.
4. Patients with history of exposure to intense infrared lights i.e. glass blowing.
5. Patients with eye diseases other than pseudoexfoliation or early mild cataract.
6. Patients uncontrolled Diabetes Mellitus or other severe systemic and cardiovascular diseases and history of transient ischemic attacks or stroke.

### Statistical analysis

Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; SPSS Inc, Chicago). Descriptive statistics such as mean and standard deviation (SD) for continuous variables, frequencies and percentages were calculated for categorical Variables were determined. Association between Variables was analyzed by using Chi-Square test for categorical Variables. Bar charts and Pie charts were used for visual representation of the analyzed data. Level of significance was set at 0.05.

### Observations and Results

**Table 1:** Association between complications and surgery (N=100)

Complications	Surgery Group		P Value
	SICS (n=50) n (%)	Phaco (n=50) n (%)	
Non Dilating Pupil	32 (64.0)	26 (52.0)	0.224
Difficult Rhexis	19 (38.0)	10 (20.0)	0.047*
Difficult Nucleus Delivery	11 (22.0)	4 (8.0)	0.049*
Floppy Iris	4 (8.0)	1 (2.0)	0.168
Posterior Synechiae	4 (8.0)	2 (4.0)	0.399
Zonular Dialysis	4 (8.0)	11 (22.0)	0.049*
Capsular Bag Dialysis	4 (8.0)	3 (6.0)	0.695
Posterior Capsular Rent	4 (8.0)	2 (4.0)	0.399
Decentered IOL	3 (6.0)	1 (2.0)	0.307
Vitreous Loss	4 (8.0)	2 (4.0)	0.399
Difficult Cortical Aspiration	19 (38.0)	10 (20.0)	0.047*

Chi-Square Test, P Value \* Significant

Table 1 shows the complications that occurred in both the groups.

Difficult capsular rhexis was encountered in 19 cases that underwent SICS and 10 cases that underwent Phacoemulsification.

This accounts to 38% and 20% in SICS and Phacoemulsification, respectively.

'p'=0.047, significant.

Difficult nucleus delivery was encountered in 11 cases that underwent SICS and 4 cases that underwent Phacoemulsification.

This accounts to 22% and 8% respectively. 'p'=0.049, significant.

Zonular dialysis was encountered in 4 cases that underwent SICS and 11 cases that underwent Phacoemulsification.

This accounts to 8% and 22% respectively. 'p'=0.049, significant.

Difficult cortical aspiration was encountered in 19 cases that underwent SICS and 10 cases that underwent Phacoemulsification.

This accounts to 38% and 20% respectively. 'p'=0.047, significant.

4 patients in the SICS group and 2 patients in the Phacoemulsification group had Posterior Capsular Rents and Vitreous Loss.

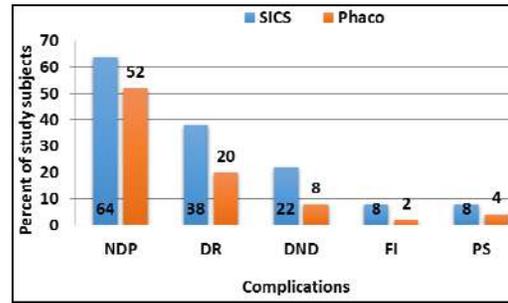
4 patients in the SICS group and 1 patient in the Phacoemulsification group had floppy iris/iris prolapse.

4 patients in the SICS group and 2 patients in the Phacoemulsification group had posterior synechiae.

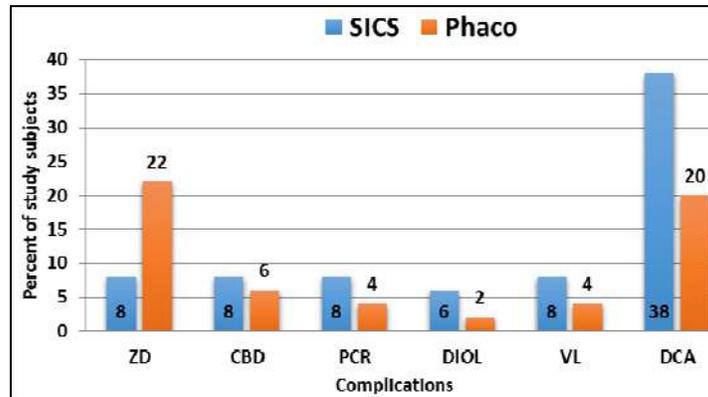
4 patients in the SICS group and 3 patients in the Phacoemulsification group had capsular bag dialysis.

3 patients in the SICS group and 1 patient in the Phacoemulsification group had Decentered IOLs.

'p'=>0.05 for the above complications, not significant.



Graph 1.1: Complications and Surgery

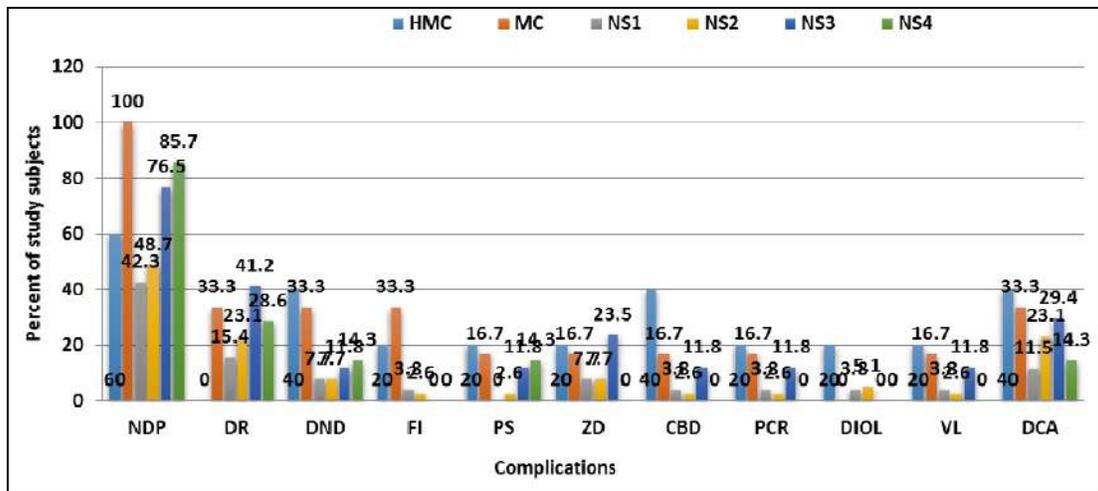


Graph 1.2: Complications and Surgery

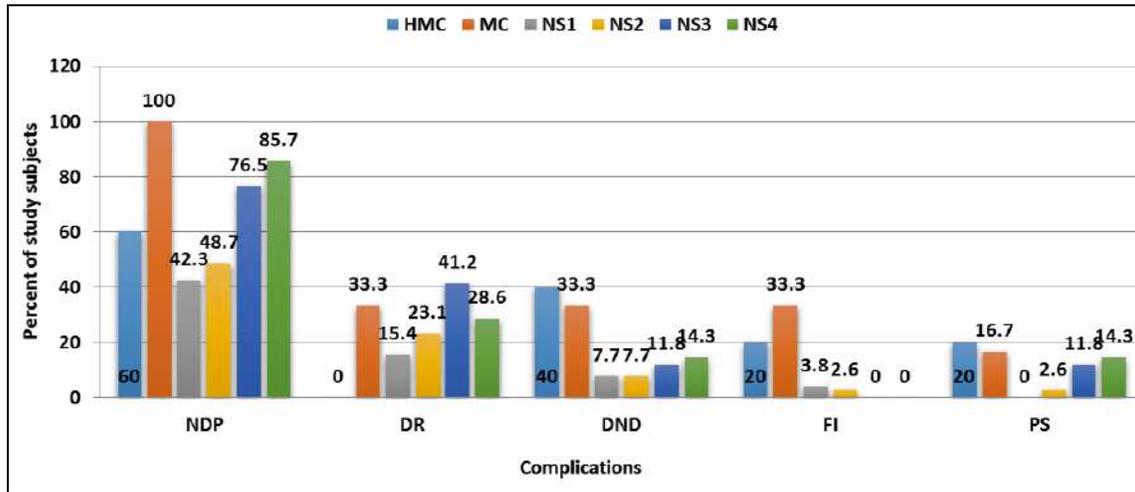
Table 2: Association between complications and type of cataract (N=100)

Complications	Type of Cataract						P Value
	HMC (n=5)	MC (n=6)	NS1 (n=26)	NS2 (n=39)	NS3 (n=17)	NS4 (n=7)	
Non Dilating Pupil	3 (60.0)	6 (100.0)	11 (42.3)	19 (48.7)	13 (76.5)	6 (85.7)	0.023*
Difficult Rhexis	0	2 (33.3)	4 (15.4)	9 (23.1)	7 (41.2)	2 (28.6)	0.329
Difficult Nucleus Delivery	2 (40.0)	2 (33.3)	2 (7.7)	3 (7.7)	2 (11.8)	1 (14.3)	0.187
Floppy Iris	1 (20.0)	2 (33.3)	1 (3.8)	1 (2.6)	0	0	0.013*
Posterior Synechiae	1 (20.0)	1 (16.7)	0	1 (2.6)	2 (11.8)	1 (14.3)	0.200
Zonular Dialysis	1 (20.0)	1 (16.7)	2 (7.7)	3 (7.7)	4 (23.5)	0	0.424
Capsular Bag Dialysis	2 (40.0)	1 (16.7)	1 (3.8)	1 (2.6)	2 (11.8)	0	0.035*
Posterior Capsular Rent	1 (20.0)	1 (16.7)	1 (3.8)	1 (2.6)	2 (11.8)	0	0.366
Decentered IOL	1 (20.0)	0	1 (3.8)	2 (5.1)	0	0	0.560
Vitreous Loss	1 (20.0)	1 (16.7)	1 (3.8)	1 (2.6)	2 (11.8)	0	0.366
Difficult Cortical Aspiration	2 (40.0)	2 (33.3)	3 (11.5)	9 (23.1)	5 (29.4)	1 (14.3)	0.569

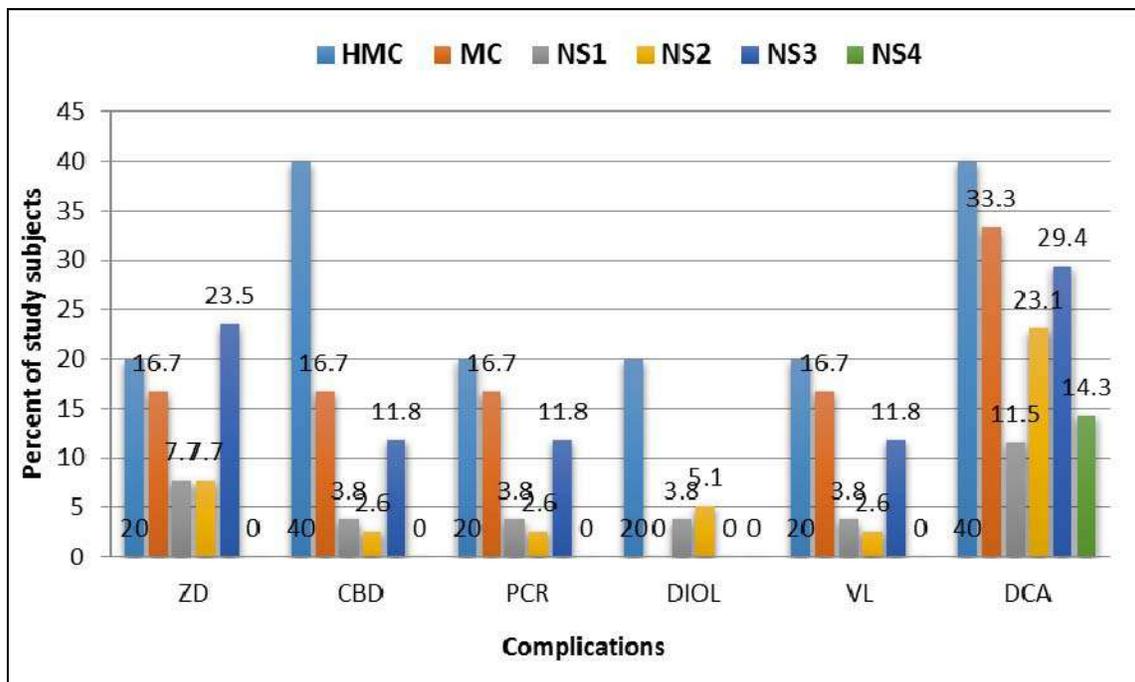
Table 2 shows the various complications that occurred in the various types of cataracts. Non-dilating pupils, floppy iris and capsular bag dialysis hold significance in this study, 'p'<0.05.



Graph 2: Type of cataract & complications



Graph 2.1: Type of cataract & complications

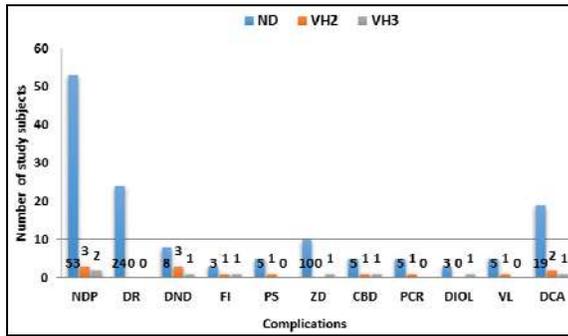


Graph 2.2: Type of cataract & complications

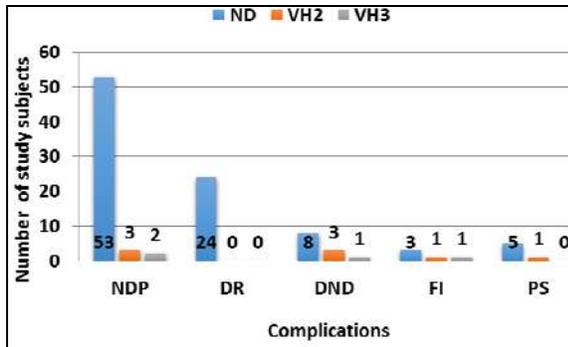
Table 3: Association between complications and AC depth (N=100)

Complications	AC			P Value
	ND (n=93) n (%)	VH2 (n=4) n (%)	VH3 (n=3) n (%)	
NDP	53	3	2	0.738
DR	24	0	0	0.304
DND	8	3	1	<0.001*
FI	3	1	1	0.010*
PS	5	1	0	0.244
ZD	10	0	1	0.362
CBD	5	1	1	0.061
PCR	5	1	0	0.244
DIOL	3	0	1	0.029*
VL	5	1	0	0.244
DCA	19	2	1	0.335

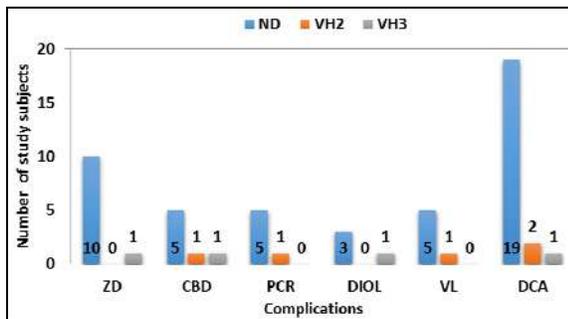
Table 3 shows that  
 Difficult nucleus delivery 'p'<0.001, highly significant  
 Floppy iris 'p'<0.05, significant  
 Decentered IOL 'p'<0.05, significant



Graph 3: AC & Complications



Graph 3.1: AC & Complications



Graph 3.2: AC & Complications

**Discussion**

**1. Intraoperative complications of PXF patients**

In Phaco group, 52%. In the SICS group, 64% of the patients' maximum dilation was 6 mm. Mechanical dilators like Iris hooks, pupil dilating devices were used to dilate the pupils. Visco-dilation and intraoperative use of adrenaline also helped to dilate the pupils up to an extent.

**Difficult rhexis/capsulotomy**

38% in SICS group, 20% in Phaco group had difficulty with rhexis due to the deposition of pseudoexfoliative material on the anterior lens capsule. Running off of the rhexis margin was noted in few patients. To prevent this most cases were given smaller rhexis marginal diameters, which in some cases became a cause for incomplete and difficult cortical aspiration. Capsulotomy by CCC was noted to be better in the Phaco group as compared to the SICS group. This was statically proved, 'P'= 0.047, significant.

**Difficult nucleus delivery**

22% patients in the SICS group and 8% patients in the Phaco

group had difficult nucleus deliveries. This was evidently more in the SICS group. Various factors were responsible for this, like the incomplete or small capsulotomy rhexis; posterior synechiae, floppy Iris, zonular and bag dialysis and hard cataracts. Although the same factors presented in the Phaco group, the ease of the technique resulted in smooth emulsification of the nucleus. This group of patients with harder cataracts encountered this difficulty mainly. The softer cataracts proved to be less eventful despite the complications.

**Zonular dialysis**

8% patients in SICS group and 22% patients in the Phaco group had zonular dialysis due to pseudoexfoliation deposits in the zonules.

This proved to be more challenging in the SICS group as it had immediate affects on a nucleus delivery and cortical aspiration. On the other hand Phacoemulsification of the nucleus inside the bag with caution led to better post operative results. This was proved to be statically significant, 'P'= 0.049.

Capsular Tension Rings were used wherever possible.

**Posterior capsular rent**

8% of patients in SICS group and 4% of patients in Phaco group had PC rents.

This was more in SICS group because of the zonular and capsular bag dialysis. This also occurred during cortical aspiration.

In the Phaco group, 2 patients had posterior capsular rent, both of them during irrigation and aspiration after emulsification of the nucleus.

All of these patients had vitreous loss and were left aphakic.

In one of these patients, PCIOL was placed in the sulcus and postop Vn was satisfactory, considering the complications.

All of the above aphakic cases were posted for secondary IOL implantation at a later date.

4 patients from SICS group- 2 of them had iris claw lens placed in the anterior chamber, 1 had a scleral fixated Lens and 1 was left aphakic. 2 patients from Phaco group.- both of them had iris claw lens placed in the anterior chamber.

**Difficult cortical aspiration**

38% of the patients in the SICS group had difficult cortical aspiration. This was due to zonular dialysis, small un dilated pupils, floppy Iris and sticky cortex along with irregular rhexis margins. Capsular Tension Rings were used wherever possible.

20% of the patients in the Phaco group had difficult cortical aspiration. This was better overcome with Phaco than in SICS. In one case, there was capsular bag dialysis which caused aspiration of it whole, along with cortical matter, leading to aphakia.

This was statically significant 'P' =0.047.

Similar results were found in the following studies, Mohammad Jawad *et al.* (2009), in their study on PXF patients found zonular dehiscence of 4%, posterior capsular rupture of 9% and vitreous loss of 10.5% [5].

Hueyin Bayramlar and Cihan Unlu (2008) in their study of PXF patients found that there is an increased rate of intraoperative complications like zonular dialysis, posterior capsular rupture and vitreous loss in manual small incision cataract surgery [6].

Abid Naseem *et al.* (2007) in their study found 15.6% patients with zonular dehiscence, 15.6% had posterior capsular rupture and 9.4% had vitreous loss [7].

Dr. Ravindra kumar Choudhry (2007) in his study reported that, the intraoperative complications in SICS in PXF cases were

zonular dialysis, posterior capsular rupture and vitreous loss<sup>[8]</sup>. Dr. Prashant Bhagat *et al.* (2006), in his study reported that the intraoperative complications of PXF in cataract surgery were zonular weakness, shallow anterior chamber, poor mydriasis, altered capsular integrity and thick lens<sup>[9]</sup>. Ritch R (2001), in his study noted that zonular fragility in PXF increases the risk of lens dislocation, zonular dehiscence and vitreous loss upto 10 times<sup>[10]</sup>. Kuchle *et al.* (2000), found that 6.9% of their 11 patients had intraoperative complications like zonular dialysis and vitreous loss<sup>[11]</sup>. Lucia Scorolli *et al.* (1998), have found that PXF patients were 5 times more likely to develop intraoperative complications than compared to patients without PXF<sup>[12]</sup>. Avramides S, Travamides P, Sakkias (1997) found the incidence of posterior capsular rent to be 10.4% and vitreous loss 7.14% in a study of 84 eyes with PXF undergoing cataract surgery. Lumme P, Laatikanan (1993) observed the incidence of zonular dehiscence to be 14.8%. Schonherrs U *et al.* (1989) found a statistically significant increase in intraoperative and postoperative complications in eyes with PXF in 436 patients undergoing cataract surgeries<sup>[13]</sup>. Leyla Niyaz, Hakika Erdogan, Turkiyeklinikleri J ophthalmol 2013; 22(3) study shows that postoperative corneal oedema occurred in 54% of eyes with PXF undergoing cataract surgery<sup>[14]</sup>. Hyams M, MATHALONE N, HERSKOVITZ M, HOD Y, ISRAELI D, GEYER O (2005) noted that in their study of 137 eyes with PXF undergoing phacoemulsification, there was no significant increase in intraoperative complications like zonular dialysis, capsular breaks and vitreous loss<sup>[15]</sup>. Bradford J Shingleton MD, Anne Rowland MD (2010), in their study on 1059 eyes with pseudoexfoliation, noted that there was no statistically significant difference in the need for vitrectomy in patients with and without zonular dialysis due to pseudoexfoliation<sup>[16]</sup>. Kaštelan S, Tomić M, Kordić R, Kalauz M, Salopek-Rabatić J (2013) reported that with appropriate preparation and use of specialized adjunctive devices, phacoemulsification is the preferred method of cataract extraction in eyes with pseudoexfoliation syndrome<sup>[17]</sup>. Busic M, Kastelan S (2005), in their study reported that complication rates during phacoemulsification were less than with extra capsular extraction but still greater than in eyes without pseudoexfoliation. Despite the existence of a higher number of intraoperative and postoperative complications, experience with phacoemulsification technique along with the improvement of the apparatus and instruments used enable good results in eyes with phacoemulsification<sup>[4]</sup>.

## 2. Association of complications with type of cataract

Small non-dilating pupils were encountered in all types and grades of cataracts, but the most difficulty faced was in mature cataracts (100%), NS4 (85.7%) and NS3 (76.5%). This was particularly difficult in in hard cataracts, as the consecutive steps posed difficulty. Difficult nucleus delivery was the most common challenge posed in our surgeries. Floppy Iris was seen in 33.3% of the patients with mature cataract, which goes on to prove that harder cataracts are tougher to deliver. Bag dialysis is another complication that is usually noted on table during rhexis or nucleus delivery. All of these complications occurred in lesser frequency in the Phaco group, probably because harder cataracts were not chosen for Phacoemulsification considering all the established

complications that might occur.

In our study, we have noted that softer cataracts that are operated at an earlier date had better visual outcome and uneventful surgeries. The harder the cataracts, the higher the frequency and type of complications in phacoemulsification. Bayramlar *et al.* (2007) interpreted that in MSICS in pseudoexfoliation, the rate of posterior capsular complications increases as the cataract grade increases. Hence it is advisable to operate earlier in patients with PXF to have better results.

## 3. Association of anterior chamber depth with intraoperative complications

In either group, the most common complication that was encountered was the nucleus delivery. Shallow anterior chambers provide less space to prolapse and deliver the nucleus out. This leads to corneal complications like oedema and DM detachment along with other complications like vitreous prolapse; floppy Iris; and decentered PCIOLs in cases with zonular and bag dialysis.

These complications occurred at a higher frequency in the SICS group. In the Phaco group of patients, anterior capsule rhexis was difficult to perform according to some surgeons.

Nucleus emulsification was comparatively without complications provided the the patient had no zonular dialysis.

Jennifer Calafati *et al.* (2009) observed that anterior chamber depth of less than 2.5mm poses a risk for intraoperative complications<sup>[18]</sup>. Dr. Prashant Bhagat *et al.* (2006) in his study found difficulty in performing capsulorrhexis in all patients with pseudoexfoliation with anterior chamber depth less than 2.5mm<sup>[9]</sup>.

M. Kuchle *et al.* (2000) suggested that shallow anterior chamber depth of less than 2.5mm preoperatively was indicative of zonular instability and should alert the surgeon of intraoperative complications. In his study, AC depth was significantly less in eyes with pseudoexfoliation and its complications<sup>[11]</sup>.

## Conclusion

### The following conclusions were drawn from this study.

The patients with pseudoexfoliation and cataract posted for manual small incision cataract surgery or phacoemulsification surgery, have to be carefully evaluated for zonular dialysis, insufficient mydriasis, raised IOP, subluxation and dislocation of cataractous lens because these preoperative factors have bearing on the intraoperative complications and in turn the postoperative complications also.

Inadequate mydriasis is one of the major preoperative risk factor in eyes with pseudoexfoliation syndrome which could cause complications like posterior capsular rent and vitreous loss. Intraoperatively zonular dialysis and difficulty in nucleus delivery, corneal endothelial touch and subsequent corneal edema was seen in higher frequency in the MSICS group as compared to the Phacoemulsification group.

Adequate surgical modifications like synechiolysis, sphincterotomy and pupil stretching in eyes with inadequate mydriasis reduce the intraoperative complications. These pupillary enlargement procedures are advocated during cataract surgery.

To conclude, patients with pseudoexfoliation syndrome undergoing Manual Small Incision Cataract Surgery are at a higher risk for the development of intraoperative complications as compared to Phacoemulsification surgery. With appropriate preparation and use of specialized adjunctive devices, phacoemulsification is the preferred method of cataract extraction in eyes with pseudoexfoliation syndrome. In addition,

proper follow-up of patients after surgery is needed to evaluate endothelial cell function, IOP rise, inflammation and intraocular lens dislocation.

The postoperative visual outcome was comparatively better in the patients that underwent Phacoemulsification than the patients that underwent Manual Small Incision Cataract Surgery.

Hence, preoperative detailed clinical examination, early surgery, knowledge of complications, ability to manage these complications and use of viscoelastic material can help the surgeon to improve the outcome of the cataract surgery.

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