Original Research Article

# A comparative study of superior scleral tunnel versus superior clear corneal phacoemulsification for senile cataract

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## Abstract

**Background:**Cataract is one of the common cause of reversible causes of visual impairment specially in older population. Cataract surgery has been evolving since many decades and phacoemulsification as described by Kelman has emerged the surgery of choice for cataract. Ithas the distinct advantageof better patient compliance, early stabilization of refraction, and better improvement in visual acuity.The two commonly used techniques of phacoemulsification are by clear corneal incision and phacoemulsification by scleral tunnel incision. We conducted this study to assess the merits and demerits of clear corneal incision in comparison with scleral tunnel incision in cases of cataract treated by phacoemulsification.**Materials and Methods:**This was a prospective interventional study conducted in the ophthalmology department of a tertiary care medical college situated ina rural area. The patients who presented with senile cataract to ophthalmology outpatient department during study period were included in this study on the basis of a predefined inclusion and exclusion criteria. Patients were divided into two groups: those to undergo Superior scleral tunnel (group A) and Superior clear corneal (group B) phacoemulsification followed by (Foldable) IOL implantation. Statistical analysis was done by using descriptive and inferential statistics,SIA calculator version 2.1 by Dr.Sawhney and Dr.Aggarwaland online calculator Social Science Statistics.**Results:** The overall study population consisted of 29.76% Females and 70.24% males in the present study. The most common affected age group was 61-70 years (52.38%) followed by 51-60 years (38.10) and 71-80 years (9.52%). In group A 6/6-6/9 uncorrected and best corrected visual acuity was found in 22 (52.38%) and 39 (92.86%) patients respectively; Similarly in group B they were 28 (66.67%) and 41(97.62%) patients respectively.Mean value of postoperative astigmatism in groupA and group B was 0.86 ± 0.59 and 0.65 ±0.47 respectively. Most common type of postoperative astigmatismwas found to be against the rule astigmatism which was seen in 29 (69.05%) and 26 (61.90%) patientsin group A and group B respectively.There were no majorcomplications seen in any of the group where as the most common minor complication in group A and Group B was found to be Striate keratopathy (23.81%) and corneal edema (16.67%) respectively. **Conclusion:** Phacoemulsification is the surgery of choice for cataract and is preferred by majority of the ophthalmologists for early stabilization and better visual outcome. Clear corneal phacoemulsification as well as Scleral tunnel incision both procedures have found to have comparable results as far as surgically induced astigmatism is concerned.

**Key Word:**Cataract, Phacoemulsification, Superior scleral tunnel, Superior clear corneal, Astigmatism.

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## INTRODUCTION

Globally, cataract is the most important cause of blindness, and the second most common cause of moderate and severe vision impairment as shown by Global Burden of Disease, Injuries and Risk Factors Study. Cataract is the cause for blindness in 10.8 million of overall 32.4 million blind; and also results in visual impairment in 35.1 million individuals of 191 million visually impaired population[1]. It is the most significant

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cause of correctable visual impairment. With no medical treatment yet available, surgery forms the sole way of treating cataract providing utmost satisfaction to both patient as well as to a surgeon. The surgery for cataract has undergone a commendable revolution from 17th century practice of couching to Intracapsular cataract extraction, extracapsular cataract extraction, and small incision cataract surgery[2]. In 1967 Kelman revolutionized the treatment of cataract by introducing a novel method of cataract surgery known as phacoemulsification. It consistedof ultrasonical fragmentation of nucleus followed by aspiration of softened lens through a small incision which doesn't require suturing[3]. It enabled ophthalmologists to extract cataracts through the smallest possible incision using an ultrasound probe or laser probe, to break the lens without damaging the lens capsule[3]. It has the advantage of better patient compliance, early stabilization of refraction, and better improvement in visual acuity. It has a minimum rate of complications as compared to other type of surgeries[4]. One of the important aspect of phacoemulsification is that it can also be done in patients who are on antiplatelet drugs and can't discontinue it due to unacceptably high risk of thromboembolic events[5]. The refractive aspect of cataract surgery has received considerable attention with advent of phacoemulsification and with advances in surgical management of cataract it is becoming more of refractive procedure than simple removal of cataractous lens[6]. The amount of surgical induced astigmatism can be thus better controlled and the faster wound stability leads to early visual recovery. Phacoemulsification surgery is characterized by a valvular incision which is so small that it does not need suturing and heals on its own[7]. Now a days phacoemulsification is preferred by surgeons as well as patients because of smaller incision size, low induced astigmatism, no restriction on everyday activities and early visual rehabilitation[8]. The visual outcome of surgery depends on degree of postoperative astigmatism which in turn depends on the type, length, and position of incision and also on the method of wound closure. Depending on site this phacoemulsification can be done superiorly, supero–temporally or temporally[9]. Depending on position of incision it can be clear corneal, limbal or scleral tunnel. Irrespective of the site and size of incision the end result which is crucial from the point of view of patient as well as operating surgeon is early visual rehabilitation and better safety profile[10].The two commonly used techniques of phacoemulsification are by clear corneal incision and phacoemulsification by scleral tunnel incision. Recently clear corneal approach has gained popularity over scleral tunnel approach. We conducted this study to assess the merits and demerits of clear corneal incision in comparison with scleral tunnel incision in cases of cataract treated by phacoemulsification.

## MATERIALS AND METHODS

This was a Prospective Interventional Study conducted in ophthalmology department of a tertiary care medical college situated in a rural area. The patients who presented with senile cataract to ophthalmology outpatient department during study period were included in this study. Institutional ethical committee approved the study and an informed and written consent was taken from all the patients after detailed ocular and systemic examination. Patients were divided into two groups: those to undergo Superior scleral tunnel (group A) and Superior clear corneal (group B) phacoemulsification followed by (Foldable) IOL implantation. Postoperative Visual Acuity, Astigmatism and Complications were assessed and compared at 6 weeks postoperatively. Statistical analysis was done by using descriptive and inferential statistics, SIA calculator (SIA calculator version 2.1 by Dr.Sawhney and Dr.Aggarwal) and online calculator Social Science Statistic. Software used in the analysis was SPSS 22.0 versions and Graph Pad Prism 6.0 version. For statistical purposes $p<0.05$ was considered as significant.

### Technique of Phacoemulsification Surgery

**Superior Scleral Tunnel (Group A)**

In this group a scleral triplanar incision (1-1.5mm) in the superior quadrant posterior to the limbus was taken with 11 no. blade after making a fornix based conjunctival flap. Bipolar cautery was used to cauterize the bleeding vessels. Scleral tunnel dissected with crescent blade (angled bevel up 20 Gauge). Depth of incision was about 1/3rd of scleral thickness. Dissection was extended into the clear cornea for 1 mm and anterior chamber was entered with 2.8 keratome. Two side ports were made and capsulorhexis was done through the side port. Then hydrodissection, hydrodelineation and phacoemulsification was done through the main section. After cortical clean up foldable acrylic posterior chamber IOL was implanted in the bag. Side ports and main port was hydrated to seal the chamber. Finally the incision tested for water tightness and conjunctival flap re-approximated with bipolar forceps cauterization.

**Superior Clear Corneal (Group B)**

In this group a clear corneal incision was madeat the anterior edge of the vascular arcade superiorly by using the keratome (2.8 mm). By depressing the posterior lip of the groove the point of keratome was slid into the cornea for 2 mm and entry into the anterior chamber was made. After completion of procedure the incision was tested for water tightness.

**Inclusion Criteria**

- Senile cataract (Nuclear Sclerosis Grades 1, 2, 3; posterior Sub-capsular cataractsand cortical cataract)

**Exclusion Criteria**

- Previous ocular surgery
- Cases of glaucoma
- Cases with pseudo exfoliation
- Cases with corneal opacity
- Cases with retinal pathology
- Patients not giving informed consent.

## RESULTS

This Study comprised 84 patients, 42 of which underwent phacoemulsification by scleral tunnel approach and 42 underwent phacoemulsification by superior clear corneal approach. The Gender distribution of the studied cases showed that in group A (Superior Scleral Tunnel) there were 30 males and 12 females while in Group B (Superior clear corneal) there were 29 males and 13 females. The overall study population consisted of 29.76% Females and 70.24% males in the present study.The analysis of age groups of the patients showed that in group A the most common affected age group was 61-70 years (52.38%) followed by 51-60 years (38.10) and 71-80 years (9.52%). In group B the most common affected age group was 61-70 years (47.62%) followed by 51-60 years (45.24) and 71-80 years (7.14%). The mean age of the patients in group A was found to be 62.57 ± 4.28 years while in Group B the mean age was found to be 61.52 ± 3.98 years. The overall mean age was found to be 62.04 years. The age groups were comparable and there was no statically significant difference in the age groups of patients (P=0.24).

**Table1:** Age distribution in studied cases.

| | Mean Age | Std Deviation | |
|---|---|---|---|
| Group A | 62.57 | 4.28 | P= 0.24 |
| Group B | 61.52 | 3.98 | Not Significant |

22 out of 42 (52.4%)patientsof group A (superior scleral tunnel) patients achieved uncorrected Visual Acuity (**UCVA**) (6/9 to 6/6) at 6 weeks while 28 out of 42(66.7%) group B (superior clear corneal) patients achieved uncorrected Visual Acuity (**UCVA**) (6/9 to 6/6) at 6 weeks. Whereas 39 (92.86 %)of group A (superior scleral tunnel) patients achieved Best Corrected Visual Acuity (**BCVA**) (6/9 to 6/6) at 6 weeks while 97.62 % group B (superior clear corneal) patients achieved Best Corrected Visual Acuity (**BCVA**) (6/9 to 6/6) at 6 weeks.

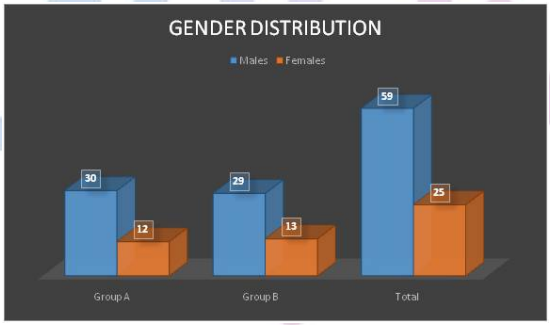


**Figure1:** Gender Distribution of the studied cases

**Table 2:** Uncorrected and best corrected visual acuity

| | Visual Acuity | uncorrected Visual Acuity | | Best corrected Visual Acuity | |
|---|---|---|---|---|---|
| | | No Of Patients | Percentage | No Of Patients | Percentage |
| **Superior Scleral Tunnel (Group A)** | 6/6 to 6/9 | 22 | 52.38% | 39 | 92.86% |
| | 6/12 to 6/18 | 15 | 35.71% | 3 | 7.14% |
| | 6/24 to 6/36 | 5 | 11.90% | 0 | 0 |
| **Superior Clear Corneal (Group B)** | 6/6 to 6/9 | 28 | 66.67% | 41 | 97.62% |
| | 6/12 to 6/18 | 11 | 26.19% | 1 | 2.38% |
| | 6/24 to 6/36 | 3 | 7.14% | 0 | 0% |

The comparison of post-operative astigmatism between 2 groups was done and it was found that mean value of postoperative astigmatism in group A and group B was 0.86 ± 0.59 and 0.65 ± 0.47 respectively. The difference between mean postoperative astigmatism was found to be statistically “not significant” (P=0.11).

**Table 3:** Mean Postoperative astigmatism in studied cases

| | Mean post-op Astigmatism | SD | |
|---|---|---|---|
| Group A | 0.86 | 0.59 | P = 0.11 Not Significant |
| Group B | 0.65 | 0.47 | |

In studied cases against the rule astigmatism was the most common type of astigmatism seen which was seen in 19 (45.24%) and 21 (50%) patients in preoperative period. While in post-operative period against the rule astigmatism was seen in 29 (69.05%) and 26 (61.90%)patients. The other common type of astigmatism seen was with the rule astigmatism which was seen in 14 (33.33%) and 16 (38.10 %) patients in preoperative period. While in post-operative period with the rule astigmatism was seen in 9(21.43%) and 11 (26.19%)patients respectively. Oblique astigmatism was seen in relatively less number of patients.

**Table 4:** Various types of Astigmatisms in Both the groups.

| Type Of Astigmatism | Superior Scleral Tunnel (Group A) | | | | Superior Clear Tunnel (Group B) | | | |
|---|---|---|---|---|---|---|---|---|
| | Preoperative | | Postoperative | | Preoperative | | Postoperative | |
| | No of cases | % | No of cases | % | No of cases | % | No of cases | % |
| Against the rule (ATR) Astigmatism | 19 | 45.24% | 29 | 69.05% | 21 | 50.00% | 26 | 61.90% |
| With the rule (WTR) Astigmatism | 14 | 33.33% | 9 | 21.43% | 16 | 38.10% | 11 | 26.19% |
| Oblique Astigmatism | 05 | 11.90% | 2 | 4.76% | 3 | 7.14% | 2 | 4.76% |
| No Astigmatism | 04 | 9.52% | 2 | 4.76% | 2 | 4.76% | 3 | 7.14% |

The analysis of surgically induced astigmatism showed that its mean value was 0.78 and 0.66 in group A and group B respectively. When the test of significance was applied the difference in mean surgically induced astigmatism was not found to be significant (P=0.25)

**Table 5:**Comparison of surgically induced astigmatism in studied cases

| | Surgically induced Astigmatism | SD | |
|---|---|---|---|
| Group A | 0.78 | 0.52 | P =0.25 Not Significant |
| Group B | 0.66 | 0.43 | |

Although no major complications were observed, striate Keratopathy (24%) was commonest and wound burn and DM detachment (2.4 %) were the least to occur in group A patient while in group B patients corneal edema (16.8%) had highest incidence with postoperative iritis (2.4%)having least incidence. Minor complications like wound burn and DM detachment was uncommon in group B than group A.

**Table 6:** Complication of surgery in both the groups

| Type Of Surgery | Superior Scleral Tunnel (Group A) | | Superior Clear Tunnel (Group B) | |
|---|---|---|---|---|
| | No of cases | % | No of cases | % |
| MAJOR | No major complications | | No major complications | |
| MINOR | | | | |
| Wound Burn | 1 | 2.38% | 0 | 0 |
| Descemet Membrane Detachment | 1 | 2.38% | 0 | 0 |
| Corneal Edema | 4 | 9.52% | 7 | 16.67% |
| Striate Keratopathy | 10 | 23.81% | 6 | 14.29% |
| Post-operative irits | **3** | 7.14% | 1 | 2.38% |

## DISCUSSION

Cataract is the most common ocular condition which causes reversible visual disability and cataract surgery is one of the most gratifying rehabilitative procedures, whereby, a person may achieve up to complete 6/6 vision.In the past 20 years, a revolution has occurred in the techniques and technology of cataract operations. Nowadays, phacoemulsification is preferred by surgeons

as well as patients because of smaller incision size, low induced astigmatism, no restriction on everyday activities and early visual rehabilitation[11].The two commonly used approaches for phacoemulsification are scleral tunnel approach and clear corneal approach.The present study was done to compare merits and demerits of superior scleral tunnel phacoemulsification and superior clear corneal phacoemulsification.In our study, 52% of the patients belonged to 61-70 yrs of age group in Superior Scleral tunnel group(Group A) while, 48% of the patients belonged to 61-70yrs of age group; 47% were between 51-60 yrs of age group in Superior clear corneal group (Group B).In this study against the rule astigmatism was the most common type of astigmatism seen in 19 (45.24%) and 21 (50%) patients in preoperative period. While in post-operative period against the rule astigmatism was seen in 29 (69.05%) and 26 (61.90%) patients. The other common type of astigmatism seen was with the rule astigmatism which was seen in 14 (33.33%) and 16 (38.10 %) patients in preoperative period. While in post-operative period with the rule astigmatism was seen in 9 (21.43%) and 11(26.19%)patients respectively. Study by LathaNV*et al*[12] showed surgically induced astigmatism (SIA) calculated with SIA Calculator for Superior corneoscleral, temporal corneoscleral, superior clear cornealand temporal clear corneal to be 0.79 D, 0.52 D, 0.60 D and 0.73 D respectively. In this study against the rule astigmatism showedhigh incidence pre-operatively(45%) than post-operatively (42%). There was no statistically significant difference between all four types of incisions following post phacoemulsification with least SIA value for temporal corneal-scleral incision owing to itbeing away from the visual axis and thus had lowest effect on the curvature of cornea. Thus findings of our study and study by Latha*et al* are coherent. The study by Reddy B *et al*[13] foundthat for Phacoemulsification group the SIA for clear corneal incision was 1.08 ± 0.36 D while that for scleral tunnel was 1.23 ± 0.71 D.Thus findings of our study showed that SIA was less in our study groups (Both A and B) than the similar counterparts in study by Reddy *et al*. The uncorrected Visual Acuity (UCVA) (6/9 to 6/6) at 6 weeks postoperatively in our study was 52.4% for group A and 66.7% for group B, with higher incidence in group B was due to early stabilization of astigmatism resulting in early visual recovery. The study by Dr.Sujithra H *et al*[14]mentions that in superior scleral tunnel group, 63 % of patients got 6/6 UCVA and that in clear corneal group 80 % got UCVA of 6/6 at 6 weeks postoperatively.Thus findings of our study and study by Sujithra*et al* are coherent in context of UCVA achievement in clear corneal group "versus" scleral tunnel group.In our study although No major complications were present. Few minor complications occurred with Striate Keratopathy having higher incidence in group A (23.81 %) than group B (14.29 %); while that of corneal edema having higher incidence in Group B (16.67 %) than group A (9.52 %); while incidence of postoperative iritis were 7.14 % in group A and 2.38% in group B.In study by Tanushree V*et al*[15]reported that the Complications of phacoemulsification with Clear corneal incision group were corneal edema (10%), post-operative iritis (7.5%) while in Scleral tunnel group 7.5% patients had corneal edema and 10% suffered with post-operative iritis. Thus findings of our study and study by Tanushree*et al* are coherent.

## CONCLUSION

Clear corneal phacoemulsification as well as Scleral tunnel incision both procedures have found to have comparable results as far as surgically induced astigmatism is concerned. Though in our study no major complication was seen in any of the procedure the minor complications such as striate keratopathy was found to be more common in Superior Scleral Tunnel group than Superior Clear Tunnel group whereas complications such as corneal edema was found to be more common in Superior Clear Tunnel group.We recommend temporal site for Clear Corneal and Scleral Tunnel Incisions for future studies.

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