

Comparison Astigmatism Before and after Phacoemulsification with Superior Versus Temporal Corneal Incision of Senile Cataract

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Abstract: **Introduction:** One of the assessment of the success of cataract surgery is from the low case of surgically induced astigmatism (SIA) post surgery. Incision distance from the optic centre cornea, suturing, incision type, length and location are things that caused surgically induced astigmatism. **Purpose:** To evaluate astigmatism before and after phacoemulsification with superior versus temporal corneal incision of senile cataract. **Methods:** This is a prospective analytic longitudinal study with randomized double blind controlled trial sampling. Subjects 42 eyes divided to 2 group, first group done superior incision and second group done temporal incision. All patients examined with autorefractometry before and after 1st day, 7th day and 30th day post surgery. Operation done by one operator with same width incision, examination tool and phacoemulsification machine. **Results:** There were no significant differences in keratometry value before operation between 7th day and 30th day after phacoemulsification with superior and temporal corneal incision. The research shows that superior corneal incision decrease the cylindrical value than the temporal incision on 30th day after phacoemulsification. A significant differences were not found in types of astigmatism before and after phacoemulsification with superior and temporal corneal incision. From Chi-Square trial, it can be concluded that there were significant changes statistically in astigmatism after phacoemulsification with superior and temporal corneal incision ($p=0,03$). **Conclusion:** There were no significant changes in types of astigmatism before and after phacoemulsification either by superior or temporal corneal incision.

Keywords: Surgically Induced Astigmatism (SIA), Phacoemulsification, Temporal Corneal Incision, Superior Corneal Incision

1. Introduction

Cataracts are the viscosity of the lens that can occur due to the hydration (addition of fluid) of the lens, the denaturation of lens proteins or the effects of both caused by various circumstances. Cataracts can cause various complications even to the point of causing blindness. Prevalence of blindness in the world of 0.7% with 39% cataract causes, refractive disorder 18% and glaucoma 10%. Extracapsular cataract extraction (EKEK) with intraocular lens installation is an option for most ophthalmologists to cope with blindness due to cataracts. The deficiency of this technique compared to the phacoemulsification technique is the greater number of astigmatism events. Astigmatism caused by cataract surgery both corneal and corneal incisions if too high will disturb the visual acuity. One of the successes of cataract surgery can be assessed whether post-surgical astigmatism is low or high. High astigmatism will reduce the sharp function of post-cataract vision. Conventional cataract surgery with a 9-10 mm incision requires longer wound healing process. In contrast to phacoemulsification techniques with smaller incisions of about 3.0 mm. This minimizes the incidence of astigmatism and altered corneal curvature after surgery.

Astigmatism with the rule (AWR) is often seen in patients after cataract surgery. What is meant by astigmatism with the rule (AWR) is astigmatism due to curvature of the cornea on the vertical axis (900) is stronger than the horizontal axis (1800). This causes a vertical object or line to show a clearer image than a horizontal object or line. In astigmatism against the rule (ATR) shows the opposite.

Rho Research (2012) compares the effect of incision sites with surgically induced astigmatism (SIA). Selection of the location of the clear corneal incision is performed on the steepest meridian in order to decrease astigmatism. The results showed SIA in the temporal incision group 0.28 ± 79 diopters, the superotemporal group 0.40 ± 92 diopters.

Research conducted by Sanja Masnec-Paskvalin et al shows the comparison of astigmatism before and after phacoemulsification surgery with superotemporal incision and superonasal incision showed no significant difference.

2. Method

The design of this study is longitudinal analytic prospective that is comparing the change of research subjects within a certain period of time and in follow-up periodically. Data were collected from subjects divided into two groups by randomized single blind controlled trial, with different treatments and both variables compared in one period to the next. The inclusion criteria for this study were all ≥ 40 years old cataract patients who would undergo phacoemulsification, who was willing to be sampled for the study and for follow-up before surgery, and after the 7th 14th and 30th day of operation. Exclusion criteria for this study were patients with intraoperative and postoperative complications, with anterior segment abnormalities, with systemic abnormalities, and non-follow-up.

Subjects 42 eyes divided to 2 group, first group done superior incision and second group done temporal incision. All patients examined with autorefractometry before

and after 1st day, 7th day and 30th day post surgery. Operation done by one operator with same width incision, examination tool and phacoemulsification machine

3. Result

Table 3.1: Characteristics of Senile Cataract Sufferers Who Gained Foemulsification Operation Action Based on Sex

Gender	Frequency (n)	Percentage (%)
Male	22	52.4%
Female	20	47.6%
Total	42	100.0%

Table 3.2: Characteristics of Senile Cataract Sufferers Who Gained Foemulsification Operation Action by Age

Age (Year)	Frequency (n)	Percentage (%)
41 – 50	2	4.8%
51 – 60	19	45.2%
>60	21	50.0%
Total	42	100.0%

Table 3.3: Characteristics of Buratto Patients with Senile Cataract who Gave Foemulsification Surgery Action

Buratto Cataract	Frequency (n)	Percentage (%)
1	0	0%
2	11	26.2%
3	13	31.0%
4	15	35.7%
5	3	7.1%
Total	42	100.0%

Table 3.4: Differences K1 and K2 Before and After Phacoemulsification with Superior Incision Cornea

Corneal Changes	n	X ± SD	Mean Diff	p.
K ₁ Day 0	21	43.07 ± 1.23	0.06	0.568
Day 7	21	43.01 ± 1.39		
K ₁ Day 7	21	43.01 ± 1.39	0.11	0.216
Day 30	21	42.90 ± 1.22		
K ₂ Day 0	21	43.83 ± 1.29	0.09	0.423
Day 7	21	43.92 ± 1.42		
K ₂ Day 7	21	43.92 ± 1.42	0.17	0.10
Day 30	21	43.75 ± 1.33		

Table 3.5: Differences K1 and K2 Before and After Phacoemulsification with a Temporal Corneal Incision

Corneal Changes	n	X ± SD	Mean Diff	p.
K ₁ Day 0	21	43.36 ± 1.48	0.19	0.115
Day 7	21	43.17 ± 1.39		
K ₁ Day 7	21	43.17 ± 1.39	0.15	0.112
Day 30	21	43.01 ± 1.51		
K ₂ Day 0	21	44.36 ± 1.49	0.01	0.928
Day 7	21	44.37 ± 1.98		
K ₂ Day 7	21	44.37 ± 1.98	0.22	0.122
Day 30	21	44.15 ± 1.79		

Table 3.6: Changes in Cylindrical Value Before Operation and 30th Day After Phacoemulsification with Superior and Temporal Corneal Incision

Cylindris Value	Incision Position			
	Superior		Temporal	
	n	%	n	%
Kategori Downhill	18	85.71	14	66.67
Permanent	3	14.29	5	23.81
Rising	0	0.00	2	9.52
Total	21	100.00	21	100.00

Table 3.7: Changes in Astigmatism Types Before and After Phacoemulsification with Superior Incision Cornea

Variabel	Astigmatism		Ranking Change		p.
	Day 0	Day 30			
	n	n		n	
Kategori AWR	11	9	Negative Ranking	12	0.366
ATR	10	12	Positif Ranking	9	
			Ties	0	

Table 3.8: Hypothesis Test Comparison of Astigmatism after Phacoemulsification with Superior and Temporal Corneal Incision

Astigmatism	Incision Position				Amount		p.
	Temporal		Superior				
	n	%	n	%	n	%	
AWR	8	38.1	15	71.4	23	100.0	0.031*
ATR	13	61.9	6	28.6	19	100.0	
Total	21	100.0	21	100.0	42	100.0	

4. Discussion

In this study from 42 subjects, 22 men (52.4%) and 20 women (47.6%) were found. Number of patients aged 41-50 years are 2 persons (4.8%), age 51-60 are 19 persons (45.2%) and over 60 years old are 21 people (50.0%).

In table 3.3 above shows that buratto cataracts on research subjects performed fakoemulsifikasi mostly found in buratto with grade 4 that is as many as 15 people (35.7%).

Table 3.4 above shows the average change of K1 value on the 7th day after the operation of 0.06 diopters with p = 0.568 (not statistically significant), and the 30th day of 0.11 diopters with p = 0.216 (not significant statistics). Likewise, the average value of K2 changed on the 7th day after the operation of 0.09 diopters with p = 0.423 (not statistically significant), and the 30th day of 0.17 diopters with p = 0.10 (not statistically significant).

With the T-Paired test it can be concluded that there was no significant difference in keratometry values before and after phacoemulsification with superior corneal incision. Whether it is keratometry before surgery compared with day 7 after surgery, or keratometry on day 7 after surgery compared with day 30 after surgery.

In table 3.5 above shows the change in average value of K1 on the 7th day after the operation of 0.19 diopters with p = 0.115 (not statistically significant), and the 30th day of 0.15 diopters with p = 0.112 (not significant statistics). Likewise, the average value change of K2 on the 7th day after operation was 0.01 diopters with p = 0.928 (not statistically significant), and day 30 was 0.22 diopters with p = 0.122 (not statistically significant). With T-Paired test it can be concluded that there is no significant difference in keratometry value before and after phacoemulsification with temporal corneal incision. Whether it is keratometry before surgery compared with day 7 after surgery, or keratometry on day 7 after surgery compared with day 30 after surgery.

Table 3.4 and Table 3.5 show no statistically significant differences in keratometry values before and after phacoemulsification with superior and temporal corneal incisions, either prior to phacoemulsification surgery, day 7

after operation or 30th day after surgery. Keratometric reading on superior corneal incision before phacoemulsification was 43.07 and on the 30th day after 42.90 with an average decrease of 0.11 diopters with $p > 0.05$. In the temporal corneal incision keratometric reading before phacoemulsification was 43.36 and on the 30th day thereafter 44.15 with an average increase of 0.22 diopters with a value of $p > 0.05$. This is in line with a study conducted by Joshi in 2009 stating that phacoemulsification did not significantly alter corneal curvature and did little to induce astigmatism, and also in line with research conducted by Sanja Masnec-Paskvalin et al in 2007 on preoperative comparisons and postoperative astigmatism after a superotemporal or superonasal clear corneal incision of phacoemulsification with no significant difference results. But not in line with research conducted by Windi Indira Rini in 2016 in dr. Soetomo Surabaya, which stated that the clear cornea incision in the temporal region showed smaller SIA compared to superior corneal incision in the superior area although there was no statistically significant difference. Likewise, research conducted by Stan J et al which states the incision of the corneal temporal produce minimal SIA and UCVA (Under Correction Visual Acuity) is good.

Table 3.6 shows a decrease in cylindrical value of superior corneal incision by 18 subjects (85.71%), 3 subjects (14.29%) showed a fixed cylindrical value and no subjects with an increase in cylindrical value from pre-surgery to day 30th after phacoemulsification surgery. Whereas in the research subjects performed by temporal corneal incision showed 14 people (66.67%) showed a decrease of cylindrical value, 5 subjects of research (23.81%) showed a fixed cylindrical value and found 2 subjects (9.52%) who experienced an increase of cylindrical value from before surgery by the 30th day after phacoemulsification surgery.

From the above table it can be concluded that superior corneal incision position further decreases the cylindrical value compared with a temporal corneal incision on the 30th day after phacoemulsification surgery. This is not in line with a study conducted by Ermis et al showing a decrease in post-phacoemulsification astigmatism in patients with temporal corneal incisions. Likewise with Tetsuro Oshika et al which states superior corneal incisions produce a cylindrical value after greater phacoemulsification surgery.

Table 3.7 Wilcoxon test results show $p = 0.166$, thus according to statistical tests not found significant changes in the type of astigmatism changes before and after phacoemulsifikasi with superior corneal incision.

5. Conclusion

After phacoemulsification with temporal corneal incision more astigmatism with type ATR is found as many as 13 people from a total of 21 people (68.4%) and with superior corneal incision more commonly encountered astigmatism with type AWR as many as 15 people from a total of 21 people (65.2%) with chi square test results showed a statistically significant difference in the astigmatism type comparison after phacoemulsification with superior and temporal corneal incisions, with $p = 0.031$.

There were no significant changes in types of astigmatism before and after phacoemulsification either by superior or temporal corneal incision.

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