Research article

Impact on corneal astigmatism following phacoemulsification surgery from temporal approach

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Abstract

Objectives: *To study the change of corneal astigmatism in patients whom had a cataract surgery using a temporal approach and the distribution of corneal astigmatism reference to the axis and magnitude.*

Methodology: *Retrospective analysis of the records of 2700 patients who underwent phacoemulsification surgery at Sri Jayewardenepura General Hospital during the period of May 2011 to May 2019. Pre-operative and one-month post-operative astigmatism obtained using keratometry values.*

Results: *Study population consisted of 2700 patients. Age ranging from 17 years to 94 years. 38% patients were male, and 62% patients were female.*

Mean preoperative astigmatism calculated was 0.86D. In which 63% of patients had against the rule astigmatism. Mean post-operative astigmatism obtained was 0.84D. Results shows overall reduction in post-operative astigmatism compared to pre-operative by 0.02D though this amount is not statistically significant.

However, subgroup analysis of against the rule astigmatism category showed statistically and clinically significant reduction in corneal astigmatism.

Conclusion: *Phacoemulsification using temporal approach reduce or maintains the preexisting astigmatism. Specially for patients having against the rule astigmatism.*

Key words: phacoemulsification, astigmatism, keratometry

Introduction

Phacoemulsification with clear corneal incision is the most commonly used method of cataract surgery. The incision site in clear corneal approach can affect the corneal astigmatism of the patient.

This study analyses data on pre-operative corneal astigmatism on patients who underwent phaco-emulsification and post-operative keratometry data of these patients after temporal clear corneal 2.2 mm approach.

Temporal clear corneal incision is a commonly used surgical method. The goal of cataract surgery is to achieve post-operative zero or minimum astigmatism. Therefore, change of keratometry values following surgery is important for optimum visual outcomes.

Methodology

A descriptive retrospective study carried out in Sri Jayewardenepura general hospital. Study population consisted of patients who underwent phaco-emulsification surgery at Sri Jayewardenepura general hospital during the period of May 2011 to May 2019 using temporal approach, 2.2 mm incision.

Inclusion criteria – Patients who underwent phaco-emulsification using temporal approach.

Exclusion criteria – Patients with preexisting conditions that affect corneal astigmatism e.g. keratoconus, refractive surgery.

Data collection done by using the records of patients who underwent phacoemulsification at SJGH during the period of May 2011 to May 2019.

Study variables included keratometry readings measured using IOL master (pre-operative value and 1 month post-operative, pre- and post-operative values were taken from the same machine by the same technician).

Data analysis done using SPSS 21 software, descriptive data and comparisons made using student "t" test.

Results

Study population consisted of 2700 eyes of patients undergone phacoemulsification using temporal clear corneal approach.

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Age ranged from 17 to 94 years. Of them 38% were male and 62% were female.

Distribution of age as in table 1.

Table 1.

Age range (Years)	*Up to 20*	*20-40*	*40-60*	*Above 60*
Number of patients	1	24	627	2033
Percentage	0.0004%	0.9%	23.2%	75.3%

Categorization of astigmatism according to axis and value.

Pre-operative astigmatism categorized into magnitude and axis. Distribution according to magnitude is as given in table 2.

Table 2.

Pre-operative astigmatism	*Number of patients*	*Percentage*
0-1 D	1911	71.2%
1-2 D	617	23%
2-3 D	106	3.95%
3-4 D	29	1.08%
4-5 D	12	0.45%
More than 5 D	9	0.34%

Astigmatism axis is categorized according to corneal topography steepest keratometry reading axis. This is sub categorized into with the rule, against the rule and oblique astigmatism as follows, 0 to 30 degrees and 150 to 180 degrees – Against the rule astigmatism, 60 to 120 degrees – With the rule astigmatism, 30 to 60 degrees and 120 to 150 degrees are taken as oblique astigmatism. Distribution of astigmatism categories are shown in figure 1.

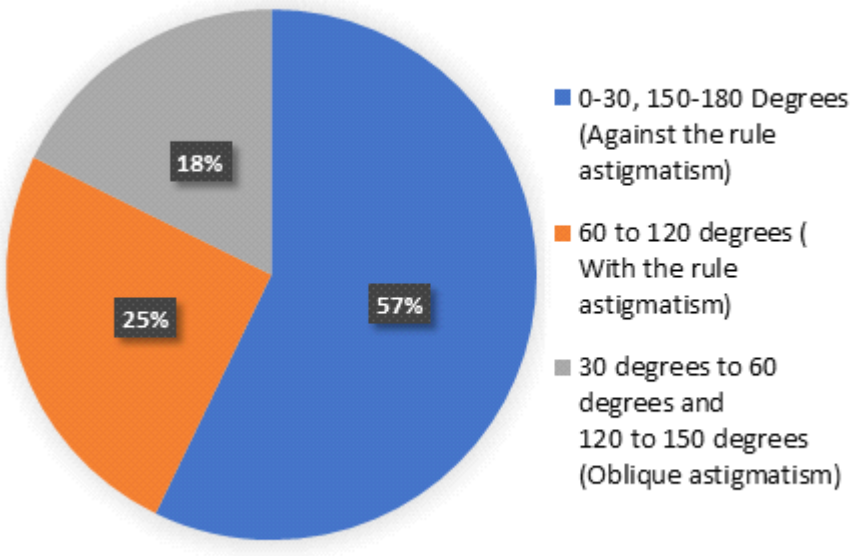

Figure 1. *Distribution of astigmatism categories based on axis.*

Results of change of astigmatism following phacoemulsification

Considering the entire study population, mean pre-operative astigmatism – 0.86 D, mean post-operative astigmatism – 0.84 D, change in astigmatism – 0.02 D. Since these are overall figures, we have analyzed the individual categories of astigmatism groups changed their keratometry values.

Astigmatism change in subgroups

Patients with "against the rule" astigmatism

Most of the participants in this study were on pre-operative against the rule astigmatism category. In subgroup analysis of this group patients who had pre-operative astigmatism of 2-3 diopters had a post-operative astigmatism less than 0.44 diopters which is statistically and clinically significant. The details are presented in table 3.

Table 3. Post-operative outcomes in patients with "against the rule astigmatism" 0 to 30 degrees and 150 to 180 degrees in subgroup

Astigmatism range in diopters	*Number of patients (n) astigmatism (D)*	*Mean pre-operative astigmatism (D)*	*Mean post-operative astigmatism (D)*	*Mean change in astigmatism (D)*	*Statistical significance of astigmatism changes by paired "t" test*
0-1 D	943	0.52	0.58	0.06	Significant ($p<0.01$)
1-2 D	457	1.42	1.18	-0.24	Significant ($p<0.01$)
2-3 D	82	2.38	1.94	-0.44	Significant ($p<0.01$)
3-4 D	23	3.4	3.05	-0.35	Not significant ($p=0.098$)
4-5 D	7	4.50	4.37	-0.13	Sample size smaller to perform test
More than 5D	3	5.96	0.9	-5.06	Sample size smaller to perform test

Patients who had "with the rule" astigmatism

Regarding the patients whom had with the rule astigmatism preoperatively there was significant increase of astigmatism in 0 to 1 diopter category. However, this value is 0.1 diopters and unlikely to be clinically significant. Results of subgroup analysis of with the rule astigmatism group shown in table 4.

Table 4. Post-operative outcomes in patients who had "with the rule astigmatism" 60 to 120 degrees in subgroups

Astigmatism range in diopters	*Number of patients (n)*	*Mean pre-operative astigmatism (D)*	*Mean post-operative astigmatism (D)*	*Mean change in astigmatism (D)*	*Significance*
0-1 D	540	0.57	0.7	0.13	Difference in astigmatism not clinically significant
1-2 D	97	1.32	1.2	-0.12	
2-3 D	16	2.44	2.16	-0.28	Not significant (p=0.187)
3-4 D	3	3.38	2	-1.38	Sample size smaller to perform test
4-5 D	5	4.62	2.39	-2.23	Sample size smaller to perform test

Patients with oblique astigmatism

Regarding the patients whom had oblique astigmatism the pre-operative mean astigmatism is 0.62 diopters and post-operative mean astigmatism is 0.64 diopters. Mean value increase of 0.02 diopters which is not statistically significant.

Subgroup analysis of oblique astigmatism group data presented in table 5.

Table 5. Post-operative outcomes in patients with oblique astigmatism

Astigmatism range in diopters	*Number of patients (n)*	*Mean pre-operative astigmatism (D)*	*Mean post-operative astigmatism (D)*	*Mean change in astigmatism (D)*	*Statistical significance of astigmatism changes by paired "t" test*
0-1 D	409	0.48	0.56	0.08	Significant ($p<0.01$) statistically, but not clinically significant
1-2 D	52	1.32	1.02	-0.3	Significant ($p<0.01$)
2-3 D	5	2.36	1.75	-0.61	Not applicable due to small sample size
3-4 D	2	3.18	2.38	-0.8	
4-5 D	0				
More than 5D	1	5.75	4.75	-1	

Discussion and conclusion

Study analyzed 2700 eyes undergone phacoemulsification. Most of the patients (57%) had against the rule astigmatism followed by with the rule astigmatism 25.1% and oblique astigmatism 17.7%. Which is consistent with age since most of patients were above 60 years of age (75.3%). Regarding the magnitude of astigmatism most people had less than 1 diopter astigmatism (71.2%). These descriptive data provide us a reasonable estimation of keratometry characteristics of Sri Lankan urban, sub urban population undergoing cataract surgery due to high sample size of this study.

Considering the group analysis of with the rule, against the rule and oblique astigmatism there was no clinically significant change in astigmatism observed in with the rule astigmatism group.

In oblique astigmatism group 0.3 improvement of astigmatism seen in 1 to 2 diopter pre-operative astigmatism group. Other subgroups do not show meaningful difference.

Against the rule astigmatism subgroup analysis shows 0.44 diopter improvement in astigmatism in pre-operative 2 to 3 diopter astigmatism group and 0.24 improvement in 1 to 2 diopter group which are clinically and statistically significant.

These results favor temporal approach in against the rule astigmatism group specially for 1 to 3 diopter pre-operative astigmatism.

Other groups do not have significant change in astigmatism using temporal approach. Considering the benefits for against the rule astigmatism patients while having a minimal effect on other patient categories and since most of older population having against the rule astigmatism, temporal approach as a routine is generally effective for reducing astigmatism.

However, we haven't compared the different approaches such as superior approach which is also commonly used in phacoemulsification. Advantages and disadvantages, other approaches should be considered on individual patient basis when deciding on incision specially in categories other than against the rule astigmatism.

References

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