The Egyptian Journal of Hospital Medicine (April 2023) Vol. 91, Page 4663-4666

Femtosecond Laser Assisted Cataract Surgery versus Phacoemulsification Effects on the Corneal Integrity.

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ABSTRACT

Background: Femtosecond Laser Assisted Cataract Surgery has benefits and drawbacks, our work was to study its effects on the corneal integrity.

Objectives: To study the effect of femtosecond laser assisted cataract surgery on the corneal integrity in comparison with phacoemulsification.

Patients and methods; This prospective comparative randomized controlled study was done at Cortoba eye center, Cairo. It was conducted on 40 eyes suffering from cataract graded from 2 to 4. They were divided into 2 equal groups. Group (A) femtosecond laser assisted cataract surgery was done using Victus Femtosecond Laser Platform (Bausch and Lomb). Group (B) conventional phacoemulsification was done using Alcon Infiniti Phaco Machine. Full preoperative ophthalmological examination, best corrected visual acuity (BCVA), corneal thickness and endothelial cell count were done and repeated postoperatively. Main outcome measures included visual acuity, corneal oedema, corneal thickness, and endothelial cell count. Data was collected and statistically analyzed.

Results: Regarding corneal thickness; there was no significant difference between groups and it significantly increased in both groups. Corneal endothelial cell count in Group B was significantly lower after one month and it significantly decreased in both groups but more in group B.

Conclusion: Femtosecond laser assisted cataract has a transient corneal edema and loss of endothelial cell count with less effects on the corneal integrity than phacoemulsification.

Keywords: Femtosecond laser, phacoemulsification, cataract, corneal integrity.

INTRODUCTION

The cornea is a complex structure that requires all its layers to work together to maintain corneal integrity. Any disruption to any one of its layers can lead to corneal injury or disease[1,2].

Phacoemulsification and femtosecond laser-assisted cataract surgery (FLACS) are surgical techniques for cataract extraction[3,4]. (FLACS) is a technique that utilizes a femtosecond laser to perform key steps of the procedure.[5,6].

The use of the femtosecond laser has been shown to improve the precision, reproducibility, and safety of certain steps of cataract surgery, including the creation of the corneal incision, capsulorhexis, and lens fragmentation[7].

Recent studies have suggested that FLACS has several advantages over traditional cataract surgery [8,9], such as enhanced visual outcomes, reduced surgical time, and reduced risk of complications[10].

Although both methods have proven to be effective [11], there is ongoing debate regarding their impact on corneal integrity.

AIM OF THE STUDY

To report the effects of femtosecond laser user in Femtosecond Laser Assisted Cataract Surgery on the corneal integrity in comparison with Phacoemulsification.

PATIENTS AND METHODS

Our prospective randomized study was done at Cortoba Eye Center, Cairo, (Private Sector). Forty eyes of forty patients suffering from cataract were included in this study. They were randomly divided into two groups, each group containing twenty eyes. Group (A) for them Femtosecond laser assisted cataract surgery were performed. Group (B) for them traditional phacoemulsification was done.

Inclusion criteria:

Patients subtending forward cataract extraction without any complications either with femtosecond or phacoemulsification, having matching age group and hardness of the nucleus. Their age ranged between 45 and 60 years old, without any systemic diseases except diabetes and or hypertension, cataract grading ranged from grade 2 to grade 4 according to Lens Opacity Classification System (LOCS). Their preoperative visual acuity ranged between 0.1 and 0.2, their average central corneal thickness ranged from 490 to 590 micron, with their endothelial cell count not less than 2000 /mm^2.

Exclusion criteria

Any uneventful cataract extraction with any complication during the procedures were excluded.

Received: 01/10/2022
Accepted: 01/12/2022

Preoperative preparation was the same for all patients in the form of full ophthalmological examination, corneal thickness, and endothelial cell count.

Ethical consent: **An informed written consent was obtained from the patients. The study was done after approval from the Ethical Committee in National Institute of Laser Enhanced Sciences and Cortoba eye center. The Declaration of Helsinki, the World Medical Association's code of ethics for studies involving humans, guided the conduct of this study.**

Statistical analysis

Data collected throughout history, basic clinical examination, ophthalmological investigations, and outcome measures coded, entered, and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD, the following tests were used to test differences for significance; difference and association of qualitative variable by Chi square test (X^2). Differences between quantitative independent groups by t test or Mann Whitney, correlation by Pearson's correlation or Spearman's. P value was set at <0.05 for significant results & <0.001 for high significant result.

RESULTS

There was no significant difference between groups as regard age and sex (Table 1).

Table 1: Age and sex distribution between studied groups

			Group A	Group B	P
Age			54.45±5.63	56.10±4.95	0.331
Sex	Female	N	10	10	
		%	50.0%	50.0%	
	Male	N	10	10	1.0
		%	50.0%	50.0%	
Total		N	20	20	
		%	100.0%	100.0%	

No significant difference was found between groups regarding their medical history (Table 2).

Table 2: Medical history distribution between studied groups

			Group		P
			Group A	Group B	
Medical history	NO	N	7	5	
		%	35.0%	25.0%	
	Diabetes Mellitus (DM)	N	10	10	
		%	50.0%	50.0%	
	Hypertension (HTN)	N	3	3	0.506
		%	15.0%	15.0%	
	HTN and DM	N	0	2	
		%	0.0%	10.0%	
Total		N	20	20	
		%	100.0%	100.0%	

Regarding distribution of cataract grades, no significant difference was found between the two groups and most of them were grade III (Table 3).

Table 3: Cataract grade distribution between studied groups

			Group		P
			Group A	Group B	
Cataract grade	II	N	5	3	
		%	25.0%	15.0%	
	III	N	11	10	0.505
		%	55.0%	50.0%	
	IV	N	4	7	
		%	20.0%	35.0%	
Total		N	20	20	
		%	100.0%	100.0%	

Corneal edema was significantly associated with Group B at one day and one week, but no significant difference was found between the two groups at one month and both groups significantly improved (Table 4).

Table 4: Corneal edema distribution between studied groups at different times

			Group		P
			Group A	Group B	
Corneal edema one day post-operatively	No	N	1	0	
		%	5.0%	0.0%	
	Degree 1	N	13	0	<0.01**
		%	65.0%	0.0%	
	Degree2	N	6	20	
		%	30.0%	100.0%	
Corneal edema one week post-operatively	No	N	20	13	
		%	100.0%	65.0 %	
	Degree 1	N	0	7	0.004*
		%	0.0%	35.0 %	
Corneal edema one month post-operatively	No	N	20	20	
		%	100.0%	100.0%	1.0
	Yes	N	0	0	
		%	0.0%	0.0%	
P between one day and one month postoperatively			0.00**	0.00**	

*: significant
**: Highly significant

No significant difference was found between groups regarding corneal thickness, which significantly increased in both groups (Table 5).

Table 5: Comparison of the corneal thickness between studied groups at different times

	Group A	Group B	P
Corneal thickness preoperatively	540.25± 59.44 micro meter	551.0± 23.69 micro meter	0.457
Corneal thickness one day postoperatively	588.45± 31.52 micro meter	596.0± 20.28 Micro meter	0.373
P between preoperatively and one day postoperatively	<0.01**	<0.01**	

**: Highly significant

Regarding endothelial cell count, no significant difference was found between the groups preoperatively, but Group B had significantly lower count at one month postoperatively, and both groups had significantly decreased count, but more in group B (Table 6).

Table 6: Comparison of endothelial cell count between studied groups at different times

	Group A	Group B	P
Endothelial Cell Count preoperatively	2564.75± 234.07 cells per mm^2	2534.10± 172.05 cells per mm^2	0.640
Endothelial Cell Count one month postoperatively	2477.25± 175.46 cells per mm^2	2265.70± 159.25 cells per mm^2	<0.01**
P between preoperatively and one month postoperatively	<0.01**	<0.01**	

**: Highly significant

DISCUSSION

Regarding the potential benefits of femtosecond laser assisted cataract surgery over phacoemulsification, beside its precision cut, customized creation of the corneal wound, capsulorhexis and nucleus fragmentation, there is less phaco ultrasonic energy power required for lens removal that will be reflected on endothelial cell loss, corneal edema, corneal wound healing with less effect on corneal integrity[4] .

In our study corneal edema was detected and increased corneal thickness was observed as a documentation of corneal edema in both groups but it was temporarily and disappears after one week, while endothelial cell loss was detected in both groups, but loss was less with (FLACS) than phacoemulsification.

meta-analysis of 25 randomized controlled trials found that FLACS was associated with a significant reduction in phacoemulsification energy and lower rate of posterior capsule rupture compared to traditional manual cataract surgery [3]. Another systematic review and meta-analysis of 17 randomized controlled trials found that FLACS was associated with improved visual outcomes and a lower risk of anterior capsule tears compared to manual cataract surgery[4].

One study found that FLACS caused significantly higher endothelial cell loss at 3 months post-surgery compared to phacoemulsification in patients with nuclear cataract[11]. Another study also reported higher endothelial cell loss with FLACS compared to phacoemulsification[12]. A third study found that FLACS caused greater corneal edema at 1-day post-surgery and 1-week post-surgery compared to phacoemulsification[13].

Possible limitations of this study are the sample size, one center study and one femtosecond laser platform machine as there are other machines provided from other

companies and a new generations of phacoemulsification machines. Further studies are needed with longer duration of follow-up to investigate the long-term effects that need longer observation to confirm this result.

CONCLUSION

Femtosecond laser assisted cataract surgery and phacoemulsification are two effective procedures of cataract extraction with transient corneal edema and loss of endothelial cell count that was less with femtosecond laser assisted cataract surgery with less effect on the corneal integrity than conventional phacoemulsification.

Conflict of interest: None**.**

Funding: This research did not receive any external funding.

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