Original Article

Change in Central Corneal Thickness after Trabeculectomy

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Purpose: To determine the change in central corneal thickness after trabeculectomy.

Study Design: Prospective interventional study.

Place and Duration of Study: Isra postgraduate institute of ophthalmology, Al-Ibrahim eye hospital, Karachi. January 2014 to June 2016.

Materials and Methods: One hundred Thirty eyes of 113 glaucoma patients who underwent trabeculectomy were assessed for the change in central corneal thickness from January 2014 to June 2016. The study approval was granted by the institutional Ethical Review committee. Patients' characteristics, including demographics, clinical details and management were recorded in a detailed Proforma.

Results: The mean age of our patients was 53.3 ± 12.3 years (Range 13 to 84 years). The mean CCT before trabeculectomy was 524.25 ± 38.53 µm. After 12 months follow-up the mean CCT was 521.95 ± 38.25 µm with correlation of 0.855 which was not statistically significant.

Conclusion: In our study there was no statistically significant change in central corneal thickness after trabeculectomy at the mean follow-up of 12 months.

Keywords: Central Corneal Thickness, Trabeculectomy, Mitomycin C.

Intraocular pressure (IOP) is an important factor in the management of glaucoma. Therefore, it is necessary that it should be measured using a technique with a high degree of accuracy. As Goldman applanation tonometry (GAT) is most commonly used and currently being the "gold standard"for IOP measurement[1], the variations in readings of IOP measured with GAT are proportional to the central corneal thickness (CCT). However, multiple studies have proven that there is variation in the mean CCT among individuals with healthy eyes[2,3], in patients suffering from different types of glaucoma and due to presence of pseudo-exfoliation[4]. In the absence of corneal disease, Goldman and Schmidt very rarely observed significant CCT changes, thus assumed a normal CCT of 520 µm for their instrument[5].

The corneal thickness can help to identify the glaucoma suspects among primary open angle glaucoma (POAG), ocular hypertension (OHT) and normal tension glaucoma (NTG)[6]. As CCT is a predictive factor for the conversion of OHT to POAG that is why its measurement has been recommended by the ocular hypertension treatment study (OHTS)[7]. Central Corneal Thickness can help to diagnose the likelihood of disease progression[8].

There are multiple treatment options available for the management of glaucoma. Although medical therapy in the form of topical eye drops is considered to be the treatment of choice[9], surgical intervention remains popular in selective cases. In developing countries, where patients' follow-up is poor and standard preparations of topical medications are not available or expensive, surgery remains the first line in management strategy[10].

The most common glaucoma surgery performed is trabeculectomy, a type of drainage surgery. The use of

anti-metabolites adjuncts like Mitomycin – C (MMC) has led to its improved success rate, but it is not without its risks and complications[11]. Various randomized trials have demonstrated the loss of corneal endothelial cells after MMC – augmented trabeculectomy. The combined effect of MMC and per-operative surgical trauma may lead to endothelial cell compromise, resulting in subtle corneal edema, and subsequent alteration in CCT[12]. If this is proven then the need for adjustment in postoperative IOP values corresponding to CCT change, or use of Dynamic Contour Tonometry (DCT) which is less affected by alteration in CCT, can be recommended[13].

The aim of our study was to determine the change in CCT after MMC- augmented trabeculectomy in Pakistani population. To the best of our knowledge no study till date has depicted the effect of trabeculectomy on CCT in our population and with this sample size.

MATERIALS AND METHODS

This prospective single group cohort study involving patients who underwent trabeculectomy for the different types of glaucoma was carried out from January 2014 to June 2016 at Isra Postgraduate Institute of Ophthalmology/Al-Ibrahim Eye Hospital, Karachi. All phakic patients who underwent trabeculectomy during study period were included in the study. Those patients who had history of ocular trauma, any corneal disease, or those who underwent any other ocular surgery were excluded from the study. Patients who underwent combined phacoemulsification and trabeculectomy procedure and those who had per-operative complications were also excluded from the study. Cairns-type trabeculectomy was performed in all cases.

A detailed proforma was generated with pre-operative details of patients' demographics, best corrected visual acuity as recorded by Snellen's chart, IOP measurement using Goldman's Applanation Tonometer (GAT), anterior segment examination with gonioscopy and dilated fundus examination (+ 90 D and + 78 D) with emphasis on optic disc evaluation.

Central corneal thickness was measured in all patients by ultrasonic pachymetry (US 800 Nidek). Topical Proparacaine (Alcain-Alcon) was used to anaesthetize the eye before the procedure. On an average 10 readings of central cornea were taken as the reference CCT of patients. All the measurements were taken between 9:00 am and 11:00 am by the same technician. Similar details were recorded at 1, 6 and 12 months postoperatively after trabeculectomy.

The statistical analysis was done using SPSS program, version 19.0. Categorical variables like gender were described in terms of frequencies and percentages. Continuous variables like age and CCT were described in terms of mean ± standard deviation. Paired t-test was used to analyze the change in central corneal thickness measured pre-operatively and post-operatively. P value of < 0.05 was considered to be statistically significant.

RESULTS

One hundred thirty (130) eyes of 113 patients were included in the study. The mean age of patients was 53.3 ± 12.3 (range 13 – 84 years). Out of 113 patients 66.2% were male and 33.8% were female. The pre-operative characteristics including age, refractive error and gender are summarized in Table 1.

Table 1: Biographic data, frequency of eyes, gender predilection, refractive error n = 130.

	Frequency	Percentage
Eye		
Right	64	49.2
Left	66	50.8
Gender		
Male	86	66.2
Female	44	33.8
Refractive Error		
Emmetropia	01	0.8
Myopia	84	64.6
Hypermetropia	45	34.6

The mean CCT of our study population before trabeculectomy was 524.25 ± 38.53 µm. The mean CCT postoperatively was 523.75 ± 38.12 µm, 521.53 ± 37.95 µm and 521.95 ± 38.25 µm at 1, 6 and 12 months respectively. Using paired *t-test* the p value of 0.855 was obtained, suggesting that the difference between CCT measurement before and after surgery at 12 months follow-up was not statistically significant. The results are summarized in Table 2.

The preoperative IOP in our group of patients was 25.4 ± 8.0 with range of 16 – 39 mmHg. The mean IOP at 12 months follow-up was 12.9 ± 4.0 with range of 8 – 19 mmHg. Using paired sample t-test p value of 0.0003 was obtained which is statistically significant (Table 3).

Table 2: Pre-operative and post-operative central corneal thickness change.

Pre-operative	**Mean CCT**	**524.25 ± 38.53 µm**
Post-op Visit	**Mean CCT**	**P value**
1 month	523.75 ± 38.12 µm	0.855
6 months	521.53 ± 37.95 µm	
12 months	521.95 ± 38.25 µm	

Table 3: Pre-operative and post-operative Intra ocular pressure change.

IOP (SD) mm Hg	**Mean**	**Range**	**p value**
Pre-operative (SD)	25.4 ± 8.0	16 – 39	0.0003
Post-operative (SD)	12.9 ± 4.0	8 – 19	

DISCUSSION

The corneal thickness has been reported to change with the age and after intraocular procedures such as cataract surgery. Multiple intraocular surgeries are also shown to cause changes in CCT[14]. However, there are scanty reports in the literature about changes in CCT after MMC augmented trabeculectomy.

Since 2002 when OHTS was carried out, apart from the other factors, thin corneas were labeled as poor prognostic factor for the progression of glaucoma[15]. In 2007, a report by American Academy of Ophthalmology concluded that CCT is a risk factor for progression from ocular hypertension to POAG[16]. It is now well recognized that abnormally thick corneas (> 530 µm) can overestimate the IOP and thin corneas (< 520 µm) can erroneously register less IOP.

It has been observed that CCT is greater in the early morning at the wakeup time due to possible hydration of the cornea during the night but it goes back to its normal thickness 2 hours after eye opening[17]. For this reason, in our study CCT measurements were taken between 9 am to 11 am to avoid any diurnal variation.

Multiple authors have investigated the effect of IOP lowering drugs on the CCT. Sen et al[18] in their study of group of patients using Latanoprost and Bimatoprost found mean reduction of 2.7 ± 6.9 µm at 6 months, 6.6 ± 7.4 µm at 12 months and 10.7 ± 14.2 µm at the end of 24 months follow-up in patients using Latanoprost. The amount of CCT reduction for Bimatoprost group at same visits were 6.8 ± 5.7 µm, 11.3 ± 11.9 µm and 15.8 ± 10.2 µm. Lass and colleagues[19] found the decrease of approximately 6 µm in CCT with the use of Latanoprost and fixed combination of Timolol and Latanoprost at the end of 12 months follow-up. Whether decrease in CCT by antiglaucoma medication is due to direct effect of the compound or due to lowering of the IOP is not known. If the change in CCT is due to lowering of the IOP then this should also occur after trabeculectomy. In our cohort of 113 patients, however, there was no change in the CCT at the end of 12 months follow-up irrespective of postoperative IOP variation.

Williams and coworkers[20] postoperatively evaluated patients undergoing primary or repeat trabeculectomy with measurement of CCT and corneal endothelial cell count. Their conclusion was that neither CCT nor endothelial cell count changed to statistically significant degree as compared to their pre-operative value.

A study by Wickham and colleagues[21] has shown that the measurement of CCT requires multiple readings to avoid any significant variability. For this reason, an average of 10 readings was taken for our patients.

Ultrasonic pachymetry has been shown to be accurate and reliable[22]. As it can be subject to inter observer bias so all our CCT readings were carried out by the same technician.

Soro-Martinez et al[23] assessed CCT changes in 80 eyes of 62 patients between 60 to 83 years of age. Mean (± SD) CCT was 542 ± 38.15 µm in the control group and 522 ± 34.70 µm, 540 ± 34.22 and 51.9 ± 32.91 in group I (Trabeculectomy), group II (Combined Trabeculectomy with phacoemulsification) and group III (Trabeculectomy followed by phacoemulsification). There was no significant difference between all groups showing changes in CCT postoperatively. Storr-

paulsen and coworkers[24] looked at 14 eyes of 14 patients undergoing MMC augmented trabeculectomy in regard to change in the corneal endothelial cell density and CCT. The pre-operative value of CCT was 527 ± 32 μm and remains at 531 ± 30 μm at 12 months after surgery suggesting no significant difference statistically.

Though there was significant decrease in IOP in our patients at 12 months follow -up but this was not related to the change in CCT.

CONCLUSION

In our prospective study we found that at 12 months follow-up there was no statistically significant change in central corneal thickness. As this is a single center study, we think that similar studies should be conducted onlarge number of patients'population and in coalition with other centers to confirm our findings.

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