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Original Article

Correlation between Central Corneal Thickness Measurements Using Two Different Ultrasonic Pachymeters

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Purpose: To assess correlation between central corneal thickness measurements using two different ultrasonic pachymeters.

Material and Methods: This prospective study involved normal subjects aged 16 to 45 years. Central corneal thickness was measured in 47 eyes by two ultrasonic pachymeters – Tomey SP – 100 and Sonomed 300 AP. Correlations between CCT measurements assessed by the two pachymeters were tested by Pearson correlation.

Results: Forty seven eyes were included in the study. The mean (± SD) age of the subjects was 27.79 years (± 6.88).The mean (± SD) Tomey Pachymeter CCT was 536.45 m (34.37) and the mean (SD) Sonomed CCT was 540.64 m (33.48).CCT measurements by the two modalities were very strongly correlated (r = 0.98; P <0.0001).

Conclusions: In healthy individuals, Tomey pachymeter measurements of corneal thickness were highly correlated with those obtained using Sonomed pachymeter, and hence the two may be used interchangeably.

Applanation ultrasound (US) pachymetry is the gold standard for corneal thickness (CCT) measurement, which is an important step in ophthalmic evaluations prior to refractive procedures such as laser in situ keratomelisus (LASIK)[1]. This approach uses the ultrasonic principle to determine CCT and requires both topical anesthesia and contact of the probe with the cornea.

In the literature, a variety of methods of measuring CCT have been described[2]. These include contact methods, such as ultrasound and confocal microscopy, or noncontact methods such as optical pachymetry with Scheimpflug cameras, optical coherence tomography and optical coherence pachymetry. In this study, we aimed to assess the correlation between CCT measurements using two different ultrasonic pachymeters (Sonomed pachymeter 300 AP and Tomey SP-100 Handy Pachymeter) in normal subjects.

MATERIAL AND METHODS

This prospective study was conducted at Laser Vision Center, Karachi during June 2012 to 30 Jan 2013. Healthy individuals aged 16 to 45 years with refractive errors were included in the study. Those with corneal abnormalities like corneal scars were excluded. After informed consent, CCT was measured. All readings were taken with Tomey SP-100 Handy Pachymeter first followed by Sonomed pachymeter 300 AP with an interval of 24 hours. The specifications of both pachymeters are shown in Table 1. For both machines measurements, the cornea was anesthetized with topical proparacaine hydrochloride 1% (Alcaine). The calibrated US probe was used to obtain 5 measurements from the central cornea. The highest and the lowest values were excluded, and the mean of the remaining 3 was used for analysis.

Data were entered and analyzed using SPSS v.19 (IBM Corp, Armonk, NY). Correlations between

Sonomed pachymeter 300 AP and Tomey SP – 100 Handy Pachymeter CCT measurements were tested by Pearson correlation. To assess if the two methods may be used interchangeably, Bland-Altman analysis was performed (Figure 2). A p value < 0.05 was considered statistically significant.

Table 1: Specifications of the two pachymeters

	Pachymeter	
	Sonomed 300 AP	**Tomey SP - 100**
Frequency (Mhz)	20	20 ± 20%
Measurement Range (um)	300 - 1000	150 - 1200
Measurement Accuracy (um)	± 5	± 5
Weight (grams)	2700	530

Table 2: Correlation between CCT measurements using two different ultrasonic pachymeters

Pearson Correlation	
r (95% CI)	0.98 (0.97, 0.99)
R square	0.96
P value	< 0.0001
p value summary	****

RESULTS

Forty seven eyes (20 male eye and 27 female eyes) of 24 patients were included in the study. The mean (± SD) age of the subjects was 27.79 years (± 6.88). Of the selected eyes, 23 (48.9%) were right and 24 (51.1%) were left.

The mean (± SD) Tomey Pachymeter CCT was 536.45µm (34.37) and the mean (SD) Sonomed CCT was 540.64µm (33.48). As shown in Table 2, CCT measurements by the two pachymeters were very strongly correlated (r = 0.98, 95% CI 0.97, 0.9; P <0.0001). Bland-Altman plot showed that the average discrepancy between the two pachymeters was not large enough to be important.

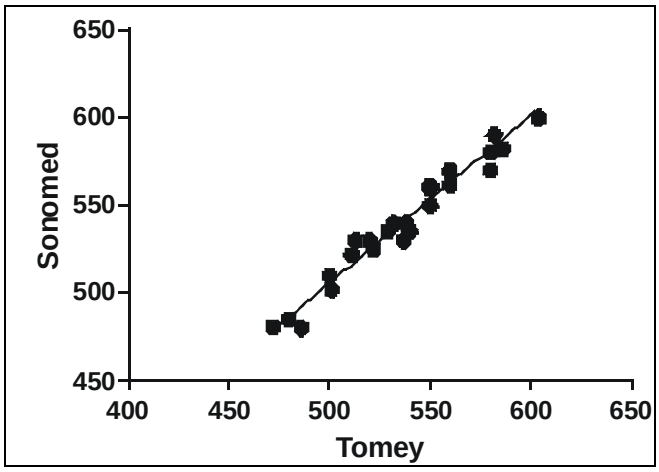

Fig. 1: Scatter plot of CCT measurements between ``Sonomed 300 AP and Tomey SP-100

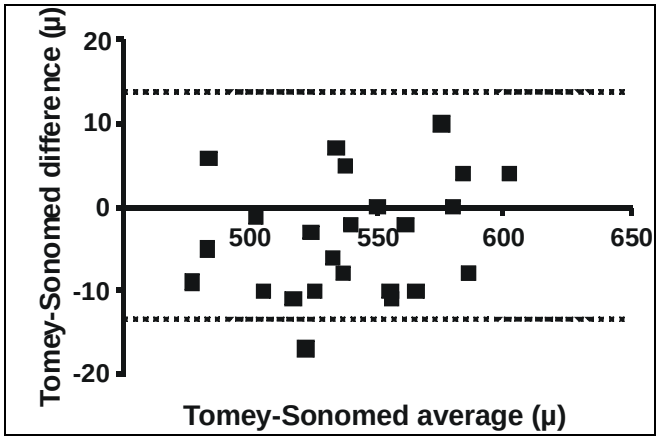

Fig. 2: Bland – Altman plot of the difference in CCT measurements versus average CCT measurements

DISCUSSION

To the best of our knowledge, this is the first study to assess the correlation between CCT measurements using two different ultrasonic pachymeters (Sonomed pachymeter 300 AP and Tomey SP-100 Handy Pachymeter) in normal subjects in a Pakistani population. Our study showed that both the measurements were highly correlated and hence the two pachymeters may be used interchangeably. Comparative data is limited as most previous studies have compared pachymeters that use different principles (ultrasonic and optical) to use to measure CCT.

Accurate measurement of CCT is important for detection, evaluation, and treatment of many eye conditions. Key diagnostic and therapeutic decisions are made based on these readings. Accurate

measurement of CCT is also important before refractive procedures to minimize the risk of iatrogenic keratectasia which is one of the most dreaded complications of LASIK procedure[3]. As mentioned earlier both contact and non-contact methods of measuring CCT have been described including ultrasonic pachymetry, optical pachymetry by rotating Scheimpflug camera, corneal **con focal** microscopy, and OCT[4,5]. Studies have shown difference in measurements between optical and ultrasonic pachymetry which is currently considered the gold standard[6-8]. However, this kind of contact examination still has some problems, including the need to anesthetize the cornea, corneal indentation during measurement, and corneal epithelial damage and cross infections[9]. Despite these problems, the measurements of CCT by means of ultrasonic pachymetry are very accurate and highly reproducible, with a low intra-observer and inter-observer and variability. Hence it is still the most common method for measuring corneal thickness.

Although several different models of ultrasonic pachymeters are available, they all work on the same principle, are inexpensive and easy to use. The two most commonly used such pachymeters in our setting are Tomey and Sonomed and we conducted this study to see if the two could be used interchangeably. Our results showed that readings of the two pachymeters were highly correlated.

CONCLUSION

In healthy individuals, there is a high co-relation between CCT measurements of Tomey SP-100 and Sonomed 300 AP pachymeters, and hence the two may be used interchangeably.

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