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COMPARISON BETWEEN ULTRASOUND PACHYMETRY AND GDS ANALYSER IN MEASURING CORNEAL THICKNIESS

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Abstract:

Objective: *Research was aimed at the determination of the of association between mean central corneal thickness observed with the help of Applanation Ultrasound Pachymetry and Galilei dual Scheimpflug Analyzer.*

Study Design: *Descriptive cross-sectional study.*

Place and Duration of Study: *Research was completed from July, 2016 to January, 2017 in Services Hospital, Lahore.*

Material and Methods: *Fifty patients were treated with the measurement of their hundred eyes for the central corneal thickness. Initial three measurements were completed through Galilei dual Scheimpflug analyzer, at the time interval of one minute. Another three measurements were taken from USG pachymetry with the application of the proparacaine (Alcain) 0.5%. Analysis was made on the mean value of the three readings.*

Results: *To measure the mean central corneal thickness of right eye we used Ultrasound pachymetry and Galilei dual Scheimpflug analyzer and observed respectively (546.88 µm ± 27.71) and (544.06 µm ± 27.36) and measurement for left eye (546.52 µm ± 26.15) and (544.72 µm ± 25.47). Both the instruments presented a very positive and strong association (r = 0.969, p-value = 0.000 for right eye & r = 0.956, p-value = 0.000 for left eye).*

Conclusions: *GSA pachymetry readings reflected positive and strong association with ultrasound pachymetry. We can take GSA as an alternative of the ultrasound Pachymetry, for the avoidance of the errors dependent of the operator, related disadvantages and patient discomfort.*

Keywords: *Applanation ultrasound pachymetry, Galilei dual scheimpflug analyzer and Central corneal thickness.*

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INTRODUCTION:

There is a vital role of the measurement taken by the Central corneal thickness (CCT) for the therapeutic and diagnostic approaches of corneal pathology, such as, to measure the intra ocular pressure (IOP) and laser assisted in situ keratomileusis (LASIK). CCT measurement through Applanation ultrasound (US) pachymetry is considered as the gold standard. This system is dry, simple, contact and portable. However, probe placement on corneal center is subjective in nature, there is a possibility of the operator error in the placement of the probe [1]. Additionally, there are few associated disadvantages like discomfort of the patients, infection risk and epithelial damage are also associated. Popularity of the Galilei dual Scheimpflug analyzer (GSA) is increasing day by day. Karimian observed no difference in the measurements taken by CCT or by GSA as the mean CCT was observed as (555.8 ± 29.6 µm) and mean US pachymetry was (CCT) (544.4 ± 33.4 µm). According to Yeter, there is a high correlation ($r = 0.86$; p-value < 0.001) in the measurements of both the devices [2]. No risk is involved in the measurements of the GSA regarding operator errors and infections. It also gives more information about the anterior eye segment and corneal topography. This research is aimed at the exploration of the association between US pachymetry and new GSA in Pakistani eyes for its onward recommendation for the corneal clinics.

PATIENTS AND METHODS:

Design of the research was descriptive cross-sectional. Research was completed from July, 2016 to January, 2017 in Services Hospital, Lahore. After informed consent and ethical approval we studied fifty patients and their hundred eyes. WHO calculator was used for the sample calculation keeping confidence interval, significance level and r respectively as 95%, 5% & 0.86. We included patients without any gender discrimination and the age was in the limit of 20 – 40 years. Patients with normal cornea observed in the OPD of the hospital were made a part of the research through non-probability consecutive technique of sampling. Four groups were made out of the research sample with the variation in the age groups. The age group divisions were as 21 – 25, 26 – 30, 31 – 35 & 36 – 40 years. Detail of the research was shared with the patients and all possible side effects were also communicated to the patients before the start of the procedure. We also documented ophthalmic detailed history and detailed ophthalmic assessment was also carried out in these patients. All the cases having apparent corneal pathology as revealed through evaluation, high ametropia of above (- 6 or + 6 diopters), contact lens wearers and corneal pathology history or previous surgery of the eye were not included in the research.

Table-I: Central corneal thickness measurements of both eyes

Detail	CCT of Right Eye		CCT of Left Eye	
	GSA (in µm)	US pachymetry (in µm)	GSA (in µm)	US pachymetry (in µm)
Number of eyes	50	50	50	50
Mean	544.06	546.88	544.72	546.52
Standard Deviation	27.36	27.71	25.47	26.15

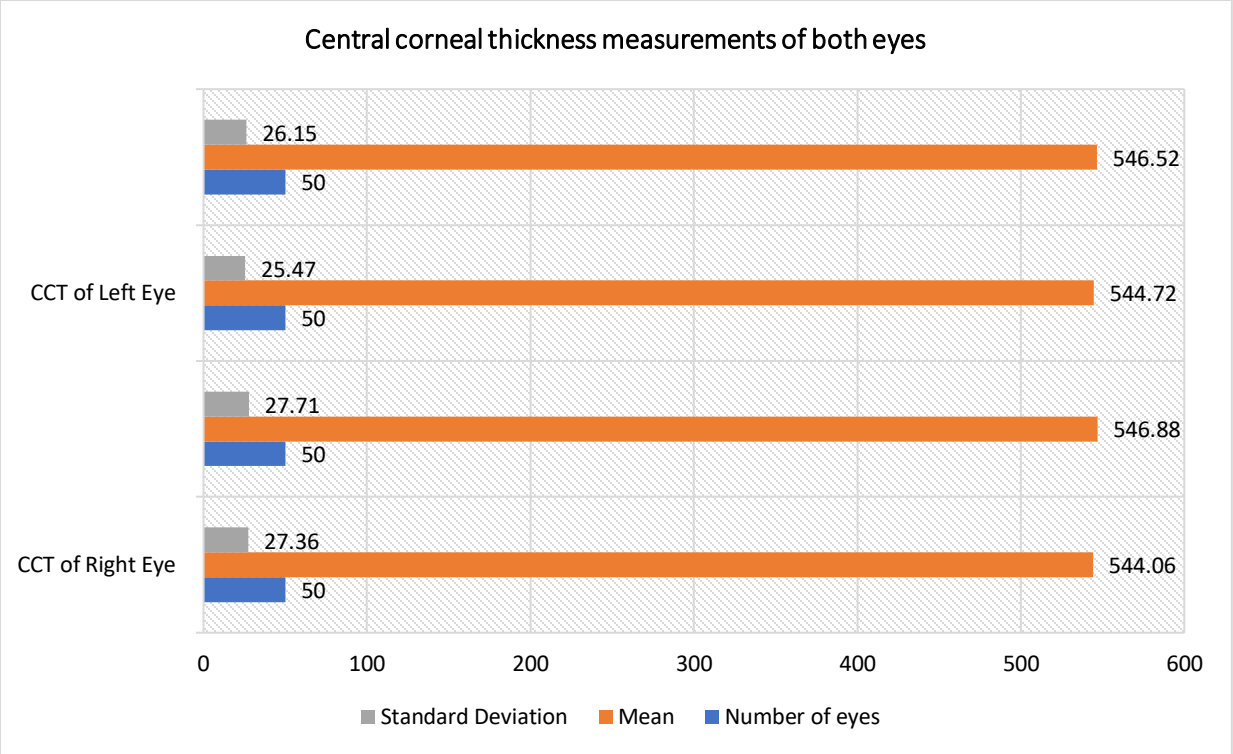

Table-II: Differences in mean central corneal thickness and Pearson's correlations for both eyes

Detail	Right Eye	Left Eye
Difference in mean CCT (in µm)	2.82	1.8
Pearson's Correlation	0.969*	0.956*
Significance (2-tailed)	<0.001	<0.001

Two instruments measurement of CCT was also carried out. First CCT was carried out on the Galilei™ G4 dual Scheimpflug analyzer by experienced operator. Every eye was treated with three readings at the interval of one minute with fresh instrument alignment. Analysis was done on the mean value of the observed readings. Cornea was anesthetized through 0.5 percent topical proparacaine (Alcain) and with the help of US pachymetry three values were also taken for the central cornea, all the procedure was performed by the same operator. Calibration was carried out as per the OEM instructions on the start of every day. Again, analysis was carried out on the mean value of the three readings. After every measurement we sterilized the probe before applying to the new patient. Comfortable and conducive environment was provided for the documentation of the readings. For the avoidance of the variations same operator took all the readings. For the nullification of the diurnal variation effect, readings were taken in the time of 9 – 12 AM. Same conditions were used for the observation of the readings in every case. We documented every collected information on a pre-designed proforma statistical analysis was made through SPSS – 14. Quantitative variables were represented in the form of SD and mean. Frequency and percentage were used for the categorical variables. Pearson correlation (+1 / -1) was calculated for the mean CCT and GSA measurements with significant p-value as ($p \leq 0.05$).

RESULTS:

We studied 100 eyes of 50 patients in the age group of 20 – 40 years. Repeated age group was in the age limit of 26 – 30 years (44%). Male were 28 cases (56%) and 22 female cases (44%) were part of the research. To measure the mean central corneal thickness of right eye we used Ultrasound pachymetry and Galilei dual Scheimpflug analyzer and observed respectively (546.88 µm ± 27.71) and (544.06 µm ± 27.36) and measurement for left eye (546.52 µm ± 26.15) and (544.72 µm ± 25.47). Both the instruments presented a very positive and strong association (r = 0.969, p-value = 0.000 for right eye & r = 0.956, p-value = 0.000 for left eye) as shown in

Table I & II respectively. Both the techniques reflected mean CCT difference as 1.80 µm in case of left eye as shown in Table – II. The values of Pearson's "r" for right and left eye were respectively as 0.969 and 0.956, and both the values were positive as shown in Table – II. These outcomes reflect a close and strong association between the measurement of CCT carried out through US pachymetry and GSA. Moreover, p-value was taken significant as (0.000) as shown in Table – II, which is far less than the cut-off value observed as (0.05).

DISCUSSION:

CCT is considered normal with a measurement of about 540 µm. Our research also compared the CCT with US pachymetry and GSA. According to Shah and Ladi, value of mean CCT taken with the help of US pachymetry was observed as (541.83 ± 30.56 µm) SD and measurements taken by the GSA were (541.27 ± 30.07 µm) SD [3]. Difference measured by the both techniques was (0.55 µm). Coefficient of correlation was observed as 0.9784. Both the outcomes can be compared with the outcomes of our research. Yeter also studied in his 161 myopic eyes of 81 patients who underwent refractive surgery [4]. Obtained mean value of the CCTs by US Pachymetry and GSA were respectively (560.41 ± 34.45 µm) and (559.85 ± 30.87 µm), there was also a high correlation as (r = 0.86; p-value > 001) in the values observed through both the devices [5]. High agreement between the devices was the conclusion of their research; GSA was considered as a non-contact technique that may act as an alternative and substitute for the US pachymetry for CCT measurement. All these outcomes were in accordance with our research outcomes [6]. According to Karimian, corneal pachymetry assessment through Galilei, Orbs can – II and US pachymetry was conducted in ninety-two patients and their 184 eyes [7]. Observed mean difference in the measurements taken through US pachymetry with Galilei was observed as (2.3 µm) with coefficient of correlation observed as 0.9475 [8]. Similar observations and outcomes were forwarded by our research outcomes which makes the outcomes of our research even strong and valid [9].

This research is aimed at the exploration of the association between US pachymetry and new GSA in Pakistani eyes for its onward recommendation for the corneal clinics. For more investigations related to the true measurement of CCT in eyes having the incidence of corneal pathologies same natured research is needed for the corneal pathologies assessment in the patients [10].

Research also had few of the limitations related to the instrument dependency. Galilei measurements need repetition due to the incorrect outcomes that may result in the shape of fixation loss, incorrect positioning of head or blinking [11]. We studied normal cornea patients. Therefore, generalization of the outcomes is not possible with the corneal pathologies like keratoconus. For a better assessment of Galilei system's accuracy, same kind of research may help on the patients having corneal pathologies [12].

CONCLUSION

The pachymetry measurements with GSA reflect positive and strong association in comparison to the US pachymetry. We may say that GSA is an alternative and substitute that may replace the US Pachymetry. GSA pachymetry readings reflected positive and strong association with ultrasound pachymetry. We can take GSA as an alternative of the ultrasound Pachymetry, for the avoidance of the errors dependent of the operator, related disadvantages and patient discomfort.

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