White-to-white horizontal corneal diameter compared with keratometry readings and central corneal thickness in Ibsar surgical center for ophthalmology in Najaf

By

Zaid Yousif Hameed Shukur M.B.Ch.B., M.Sc., D.O. University of kufa college of medicine

Salam Jasim Mohammed FIBMS community medicine University of kufa college of medicine

Riyadh W AlEsawi DMRD PhD University of kufa college of medicine

Abstract

This study discusses the relationship between the white to white horizontal corneal diameter and the keratometry readings of the cornea and also compares the WTW with the central corneal thickness in 23 subjects (36 eyes) who prepared to do Visian ICL implantation in their eyes for refractive errors attending the Ibsar surgical center for ophthalmology in Najaf governorate between the period from 1/9/2014 to 30/3/2015 their ages were between (18-40) years age, 14 female and 9 male with variable degrees of myopia with or without astigmatism.
The aim of the study is to find relationship among the variables mentioned above to get prediction in the future for the medical cases that we may discover to follow them by sophisticated tests depending on the white to white (WTW) corneal diameter.

The results showed no significant correlation between the WTW with the average keratometry readings, nor with the central corneal thickness (CCT), and no significant correlation with the advancing age of the patients in both males and females.

**Introduction**

The white-to-white (WTW) corneal diameter is the horizontal distance between the borders of the corneal limbus. The measurement of WTW has been used in management and diagnosis of several ocular conditions such as congenital glaucoma, micro- and megalocornea[1]. In addition, WTW is required for haptic size calculation in angle-supported intraocular lenses (IOLs), anterior chamber IOLs and a phakic IOL implantation, the size of a capsular tension ring (CTR) and IOL calculation in cataract surgery (third generation formulas)[2]-[4]. It has been also shown that the WTW diameter is correlated with the lens diameter[5].

There are several techniques for measurement of WTW diameter, which can be divided into two main groups: manual (i.e. calipers and scales in slit-lamp) and automated devices (i.e. ultrasonic biomicroscopy, IOLMaster, magnetic resonance imaging (MRI), Orbscan II and optical coherence tomography (OCT)[6]-[9]. Between aforementioned methods, caliper and Orbscan II are the most commonly used techniques.

The aim of the current study is to determine the normal horizontal WTW values in patients doing visian ICL for myopia correction that is not fit for excimer laser treatment. In addition, the differences between genders, between right and left eyes and age-related changes were investigated.

**Subjects and method:**

Twenty three healthy subjects (36 eyes) were chosen (age range: 18-40y; 13 females, 9 males) were enrolled in this observational cross-sectional study. A detailed ocular history was taken from each subject and the following exclusion criteria were adopted: a history of any deviation or strabismus, previous ocular or/and refractive surgeries, contact lens wear, corneal anomalies, any ophthalmic or systemic drug consumption.

To ensure that all subjects met the inclusion/exclusion criteria, complete ophthalmologic and orthoptic examination were performed prior to the examination, including slit-lamp biomicroscopy and dilated pupil funduscopy.

Horizontal WTW corneal diameter was measured in all participants with the calipers using the slitlamp biomicroscope type SL3C TOPCON company from Japan, the CCT were taken with the average keratometry readings using the Pentacam corneal topographer from Oculus company, Germany. In the current study, all WTW measurements were performed by the same examiner and three valid repeated measurements were made for each eye and then averaged. For accurate measurement, all participants were asked to keep their head position stable (straight ahead) and the
examiner tried to make adjustment and have a focused sharp image of each eye, using the joystick of the instrument.

**Statistical Analysis:**

Statistical analyses were performed using SPSS Windows version 16 (SPSS, Inc., Chicago, IL, USA). The variables were expressed as mean±SD and the Student's t-test was used to compare differences. Pearson correlation coefficient (r) was used for correlation between the numerical data, t-test had been used for comparison between two numerical data, and a p value of ≤ 0.05 was taken as a significant value for the study.

**Results:**

The result of this study consist of 23 patients, their mean age was 27.39±5.77 years (range 18-40 years). There were 14(60.8%) females and 9(39.2%) males.

Figure(1) Correlation between WTW and age
In figure 1 there was no significant correlation between WTW and age of patients.
Figure (2) Correlation between WTW and CCT

In figure 4 there was no significant correlation between WTW and CCT.
Figure(3) Correlation between average K readings and WTW

Table(1) Comparison between male and female in different variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Female</th>
<th>Male</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/years</td>
<td>28.58±5.28</td>
<td>28.57±5.99</td>
<td>0.996</td>
</tr>
<tr>
<td>WTW/mm</td>
<td>11.4±0.26</td>
<td>11.17±0.23</td>
<td>0.066</td>
</tr>
<tr>
<td>CCT/µm</td>
<td>490.8±26.57</td>
<td>493±26.68</td>
<td>0.867</td>
</tr>
<tr>
<td>Average K readings</td>
<td>44.44±1.4</td>
<td>44.2±1.98</td>
<td>0.781</td>
</tr>
</tbody>
</table>

There was no significant difference between males and females in different variables.

Discussion

In the current study, we measured the horizontal WTW corneal diameter in this sample of 23 individuals (36 eyes) to evaluate its correlation with the other parameters which are the average keratometry readings and the central corneal thickness (CCT) and the age of the subjects. The WTW corneal diameter is important parameter in phakic IOL implantation in angle-supported IOLs[6]. Therefore, precise measurements of the WTW prevent several complications resulting from overcalculation or undercalculation of the size of anterior chamber IOLs. In addition, it can be used as an index for monitoring congenital glaucoma[1]. Understanding this
normal value is also mandatory in diagnosis and management of several ocular disorders.

There are several methods for WTW measurement, including automatic devices which are so accurate and less operator dependent, and automated instruments such as IOLMaster, OCT and Orbscan.

The average WTW distance in our study population was reported to be 11.4±0.26mm in females and 11.17±0.23mm in males which agree other studies[13].

It should be noted that in our study, all measurements have been made by the same examiner to minimize the error.

Considering previous investigations, in one study by Khng et al[13], the horizontal corneal diameter-measured in cadavers by calipers - was found to be 11.46 mm which was 0.8 mm more than its vertical diameter. In another study, Kohnen and colleagues demonstrated that the mean±SD of WTW measured with Orbscan II was 11.84±0.40 mm[12]. In addition, the average of WTW, measured with the Orbscan II, was reported as 11.78±0.43 mm by Baumeister et al[6], 11.67±0.29 mm by Salouti et al[7], 11.65±0.32 mm by Dinc et al[11], 11.60±0.37 mm by Srivannaboon et al[14], and 11.72±0.42 mm in Rüfer's et al[10] study. Verkataraman and colleagues noted that the mean WTW was 11.74±0.32 mm, with the Orbscan, and slightly less than values obtained from Eyemetrics software-based measurement (11.92±0.32 mm)[3].

In Tehran eye study, the mean WTW by Orbscan II, reported by Hashemi et al[15], was 11.68 mm. On the other hand, Tananuvat and colleagues measured the mean WTW as 11.61±0.36 mm, with the same technique[16]. The mean horizontal corneal diameter measured by calipers in our study population was very similar to aforementioned studies. In addition, there was no significant difference in the mean WTW between genders in our study population which is different from previous reports[15],[17].

In our study, horizontal WTW distance measured could not found a relationship between WTW distance and age which agree with many previous studies[10],[15],[18],[19]. It should be noted that we have limited our age range up to 40 years because our subjects were chosen for Visian ICL phakic PC IOL implantation.

Suggestion

Further studies to compare WTW with other ocular parameters like the crystalline lens diameter and its relation with IOP and also WTW comparison with axial length(AXL) to find relationship between these variable and observe them.

Further multicenter studies with larger sample size use to evaluate normal range of WTW in Iraqi population in the future, using caliper WTW measurement is easy method and can be done precisely using slitlamp to evaluate if the eye within the normal range and to establish a normal Iraqi average WTW in the future.

References:


