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CILIARY BODY THICKNESS IN RELATION TO AXIAL MYOPIA

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Abstract:
Propose: To determine and compare, the ciliary body thickness (CBT) of high axial myopia and relatively emmetropic eyes.
Methods: Thirty eyes of 18 patients, [22 – 45] years old, were recruited. CBT was measured using ultrasound biomicroscopy, at one & two mm posterior to scleral spur (CBT1, CBT2). Cycloplegic refractive error was measured & axial length using ultrasound biometry was determined.

Patients were divided into two groups, group A (10 patients) of high myopic eyes and group B (8 patients) of emmetropic eyes.
Results: Myopic eyes with long axial length have thicker measurements at CBT1 (P < 0.03) and CBT2 (P = 0.05).
Conclusion: Myopia with long axial length has thicker ciliary body measurements.

INTRODUCTION

Ultrasound biomicroscopy (UBM) allows in vivo, real time imaging of the ciliary region, including structures not otherwise visible and quantitative assessment can be readily made. In a study using magnetic resonance imaging (MRI) for analysis of globe shape, myopic globe is relatively prolact than emmetropic globe, and the myopic eyes having dimensions that are more elongated axially than in horizontal or vertical dimension. A variety of explanations have proposed to account for the relatively prolact shape of myopic globe. Several studies suggested that the crystalline lens could lead to the prolact globe shape through an internal equatorial growth restriction.

Equatorial enlargement during ocular growth may increase tension on the zonules, and may affect ciliary body thickness. Recently Oliveira et al. suggested possible source of the altered globe shape in myopia. They reported that adult patients with myopia were found to have thicker ciliary body than those without myopia.

SUBJECTS AND METHODS

Thirty eyes of eighteen patients who came to outpatient clinic Benha University Hospital, were divided into two groups, group (A) and group (B). Group (A) included 15 eyes of 10 patients with high myopic eyes of more than – 6.00 D (5 unilateral & 5 were bilateral). Group (B) included 15 eyes of 8 patients of nearly emmetrope (one unilateral & 7 bilateral). The study procedures and design were approved by the ophthalmology department of Benha university hospital. All measurements were made at temporal quadrant. Patient's age ranged between (22 – 45) years with mean age (35.07) years. Exclusion criteria were included: the presence of central nervous system or systemic diseases, presence or history of ocular disease, previous ocular surgery or trauma, and use of systemic or ocular medications. Subjects who were enrolled underwent an ophthalmological examination, that included corrected visual acuity, slit lamp biomicroscopy and fundus examination. After twenty five minutes of instillation of 4 drops of 1% tropicamide, all eyes underwent axial length measurement using ultrasound (Sonomed, Inc. USA). Ciliary body thickness (CBT) measurement were made using (Dicon P45 plus, UBM, paradigm instrument Salt Lake City, UT ah, USA). All ciliary body measurements were made under cycloplegia condition. UBM was performed at the temporal corneoscleral limbus, with a 50 MHz transducer allowing 4-5 mm tissue penetration. Surface anesthesia was achieved after instillation of 0.5 % proparacaine under room light. Ciliary body thickness (CBT) was measured on radial section at 1.00 mm and 2.00 mm posterior to the scleral spur (CBT1 – CBT2) respectively (Fig. 1). The relationship between CBT, refractive error and axial length was assessed, with CBT as an outcome and axial length and refractive error as predictors (Fig. 1, Oliveira, 2005).

Measurement

All images for a given subject were taken after precise identification of the location of the scleral spur in each one. Once the scleral spur was identified, one end of a caliper 1.00 mm long was placed on the scleral spur; the other end of it was placed along the border between

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the sclera and the ciliary body. This procedure was repeated for caliper that of 2.00 mm long taking care to keep the first point of it at the same point of the sclera spur. Using the software, CBT measurements were then made 1.00 mm and 2.00 mm posterior to the scleral spur. The first end of the caliper was moved to the point of junction where a perpendicular was formed extending from this point to the ciliary pigmented epithelium, which was the second point. This will record the CBT1. The same procedure was repeated at the point 2 mm distance from the scleral spur to record CBT2, (Fig 1). The statistical analysis was performed with the SPSS. A P-value less than 0.05 was considered statistically significant.

RESULT

Comparison of ciliary body thickness at one & two mm distance from the scleral spur in myopic and emmetropic eyes were shown in table (1). There were a statistically significant difference between refractive error, CBT1 and CBT2.

Table (1): Ciliary body thickness (CBT) measurements by refractive error.

<table>
<thead>
<tr>
<th></th>
<th>Myopia *</th>
<th>Emmetropia *</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT</td>
<td>Mean±SD</td>
<td>Mean±SD</td>
</tr>
<tr>
<td>CBT1</td>
<td>930.35±(100.4)</td>
<td>899.50±(99.7)</td>
</tr>
<tr>
<td>CBT2</td>
<td>595.57±(91.55)</td>
<td>± (68.1)</td>
</tr>
</tbody>
</table>

* Emmetropia, spherical equivalent refractive error ≤ 2.00 D.  ** High myopia, spherical equivalent refractive error of > - 6.00 D

Table (2) displayed the relation of CBT and axial length. There were a significant difference between the location of the CBT measurement and axial length. CBT1 (P< 0.03), CBT2 (P< 0.005), (Figures 2 & 3).

![Figure 1. Schematic illustration and ultrasound biomicroscopy image of the measurement of ciliary body thickness. Ciliary body thickness was measured perpendicular to the inner surface of the sclera at 1 mm (CBT1, arrows) and 2 mm (CBT2, arrows) posterior to the scleral spur (S, arrow).](image)

Table (2): The spherical equivalent, AL, CBT of eyes with high axial myopia and emmetropic eyes.

<table>
<thead>
<tr>
<th>Mean</th>
<th>High myopic Group A</th>
<th>Emmetropic Group B</th>
<th>Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCVA</td>
<td>(0.05–1.00)</td>
<td>(0.00–0.05)</td>
<td>-0.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>AL(mm)</td>
<td>28.05</td>
<td>23.52</td>
<td>4.53</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CSE</td>
<td>-10.50</td>
<td>-1.50</td>
<td>-9.00</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>CBT1µm</td>
<td>930.35</td>
<td>899.50</td>
<td>30.85</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>CBT2µm</td>
<td>595.57</td>
<td>395.70</td>
<td>199.87</td>
<td>&lt;0.005</td>
</tr>
</tbody>
</table>

BCVA: Best corrected V.A.
CSE: Cycloplegic spherical equation.
AL: Axial length
DISCUSSION

Measurement of the ciliary body thickness or dimensions is not a routine practice in clinical vision care. We studied the correlation between CBT and high axial myopia and compared the results with subjects with emmetropia of relatively normal AL. To overcome the possible influence of the ciliary body configuration changes during accommodation, we performed UBM scanning 25 minutes after instillation of 1.00% tropicamide. The thickness of the ciliary body was measured at two locations CBT1 and CBT2, which showed that it was significantly thicker in eyes with high axial myopia compared to those of relatively normal eyes. Oliveira et al. found similar results with the strongest associations found between CBT2 and refractive error and axial length. In another study, using anterior segment OCT, documents CB thickness are much more in children who have myopic refraction compared to children who are not. There are also human clinical studies demonstrating that children with myopia accommodate less than children who do not have myopia. For the sake of argument, if one assumes the thickening of the ciliary body is due to a thickening of the ciliary muscle, an explanation of ciliary muscle hypertrophy could be considered. In hypertrophy of smooth muscle organs the smooth muscle cells become enlarged and contract poorly. A thickened poorly contracting ciliary muscle could explain the accommodative abnormalities that are a hallmark of juvenile myopia. Biochemical processes may underlie both muscle thickening and axial elongation simultaneously. The increased activation of MMP-2 that is
known to lead to sclera remodeling in the tree shrew model of myopia is also expressed by ciliary muscle cells.\textsuperscript{12} As hyperope accommodates more than emmetrope and myope,\textsuperscript{13} we expect that hyperopic eyes have more strong ciliary bodies irrespective of its thickness, which appears to be controversial.

**SUMMARY**

This study documents the existence of a thicker ciliary body in adult myopic eyes compared to emmetropic one. Further investigations are needed to cover a good number with wide range of myopic errors as well as hyperopes to reach a final conclusion.

**REFERENCES**


