Evaluation of Contractility of Ciliary Muscle by Umb after Cataract Extraction

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Purpose: To evaluate the changes in the pilocarpine–induced contractility of the ciliary muscle in eyes with presbyopia before and after cataract extraction using ultrasound biomicroscopy (UBM).

Patient And Methods: A clear corneal phacoemulsification and posterior chamber intraocular lens (AcrySof SA60AT; Alcon Laboratories, Fort Worth, Texas, USA) was implanted in 23 eyes in 19 subjects. UBM was performed with and without instilling 2% pilocarpine, as well as before and after cataract extraction.

Results: The CBAXL value with and without pilocarpine before cataract extraction was 1.699 ± 0.150 mm and 1.685 ± 0.180 mm, respectively, which was not significantly different. The CBAXL value with and without pilocarpine after cataract extraction was 1.998 ± 0.257 mm and 1.668 ± 0.279 mm, respectively, which was significantly different.

Conclusions: Pilocarpine induced only subtle movement of the ciliary body before cataract surgery. However, after cataract extraction, it induced significant centripetal movement of the ciliary body compared with that without pilocarpine. This shows that a lenticular sclerotic component may influence both lens movement and the contractility of the ciliary muscle.

Magnetic resonance imaging (MRI) has shown age-related decreases in the ciliary ring diameter in humans, which might affect accommodation and presbyopia\(^1\).

The accommodative changes in the ciliary body ring diameter was reduced neither by age nor by the implantation of an intraocular lens (IOL). Ultrasound biomicroscopy (UBM) has shown greater displacement of the characteristic contour points of the ciliary body in younger volunteers than in older volunteers during accommodation\(^2\).

UBM study shows that centripetal movement of human ciliary body increases significantly after cataract extraction. Before surgery there was no significant forward or centripetal movement of the ciliary body with pilocarpine instillation. However, the pilocarpine–induced centripetal movement increased significantly after cataract extraction.

This indicates indirect recovery of the ciliary muscle contractility, and suggests the following mechanisms.

First, the decrease in accommodative movement of the ciliary body before cataract surgery might be caused by increased tension of the zonules.

Cataract extraction resulted in a decrease in lens thickness, which might reduce the tension of the zonules and improve ciliary body movement. However, it is also possible that geometric changes in the ciliary body after cataract extraction can affect its configurational response\(^3,4\).

Because of its high resolution UBM has been used in the clinical diagnosis of ocular disease and for biometry of the anterior segment. It also can be used to examine the ciliary body. Accommodation is the ability of the eye to alter overall refractive power to produce a sharp, image of near objects on the retina\(^5\) as ciliary muscle contract, the ciliary body moves and release tension on the zonules that allow the lens equator to move away from sclera. The lens equatorial diameter decrease with concomitant increase in the antero posterior thickness UBM has shown greater displacement of the contour of the ciliary body in younger persons than in older\(^6\) this study evaluated the effectiveness of UBM to examine and evaluate the changes in the pilocarpine induced contractility of ciliary muscle in eyes with presbyopia before and after cataract extraction using UBM.

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Table (1): Shows the UBM measurement of the angle configuration of the eyes with and without prolocarpine instillation before and after cataract surgery.

<table>
<thead>
<tr>
<th></th>
<th>Pre operative</th>
<th>Post operative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pilocarpin -</td>
<td>Pilocarpine +</td>
</tr>
<tr>
<td>ACD</td>
<td>3.533</td>
<td>2.968</td>
</tr>
<tr>
<td>CBAL</td>
<td>1.699</td>
<td>1.685</td>
</tr>
<tr>
<td>SCPA</td>
<td>10.11</td>
<td>39.50</td>
</tr>
</tbody>
</table>

ACD: anterior chamber depth, CBAL: ciliary body axial length, SCPA: Scleral ciliary process angle, Pilocarpine (-): before pilocarpine, Pilocarpine (+): After pilocarpine.

Patients and Methods

23 eyes of 19 patients with high myopia of age ranged between 45-70 years. Each eye under went complete ophthalmic examination, that included the best-corrected visual acuity and refraction, slit lamp biomicroscopy, indirect ophthalmoscopy, jop were performed both pre operatively and postoperatively. All cataract operations consisted of phacoaspiration, followed by the implantation of foldable IOL (Acrysof SA 60 AT) in the bag. We used UBM 840 system (paradigm) to obtain high frequency ultrasonic scans, the UBM unit uses a 50 mega hertz transducer probe that allows 4-5mm tissue penetration and approximately 50 μm resolution.

The examination was performed before, and 30 minutes after instilling 2% pilocarpine hydrochloride. All scans were performed on patients. Images of the irido corneal angle including the ciliary body at the superior, inferior, nasal and temporal quadrants were performed. The following parameters were measured ACD (anterior chamber depth) CBAXL (axial length of ciliary body) SCPA.
(scleral ciliary process angle). The parameters were measured using the methods reported by pavlin and associates\(^6\) the average of the parameters from the temporal quadrants were used in the analysis. Two months after operation. The same parameters were measured again using UBM.

**Results**

The UBM parameters from the temporal quadrants were used for statistical analysis. The CBAL value with and without pilocarpine before cataract extraction was \(1.699 \pm 0.150\) mm and \(1.685 \pm 0.180\) mm, respectively the increase in the mean CBAL value of no statistically significant while the CBALL value with and without pilocarpine after cataract extraction was \(1.898 \pm 0.257\) mm and \(1.668\) respectively which show statistically significant (Fig. 1 & 2).

The ACD central anterior chamber depth decreased significantly after pilocarpine instillation, as \(3.533\) mm and \(2.968\) before and after pilocarpine respectively. Cataract surgery deepened the anterior chamber significantly, the ACD before and after pilocarpine instillation was \(3.870\) mm before and \(3.690\) after instillation.

As regard SCPA with and without pilocarpine instillation both before and after cataract extraction. Cataract surgery resulted in a significant increase in the SCPA compared with those before cataract extraction.

**Discussion**

The amount of ciliary muscle contraction needed to produce a unit change in accommodation progressively increases with age\(^6\) the precise role and functional relation sips between the age related changes in the ciliary muscles, zonular fibers, and lens are unclear due to lack of dynamic measurement and difficulties in imaging the ocular element. Our study aimed to determine the influence of lens on the contractility of ciliary muscle, UBM was used to study the changes in the shape of human ciliary body with and without instillation of 2% pilocarpine after cataract extraction in eyes with presbyopia pilocarpine is the most commonly used drug for this purpose, it was shown that application of pilocarpine was effective in inducing changes in anterior chamber depth and lens curvature that were similar to those found during near point fixation\(^7\).

Before cataracts surgery, a slight but significant decrease in the ACD was detected. The absolute and percentage variation between active and relaxed accommodation indicate the ciliary process move forward which met the finding reported by Koeppl and associates\(^8\).

The CBAL was used together with SCPA as indicator of centripetal ciliary body movement during accommodation this parameter were similar to that of that measured by tello and associates\(^9,10\) the increase in centripetal ciliary body axial length after cataract surgery is an indicator of recovery of ciliary muscle contractility\(^10\).

**References**
