Evaluation of Amplitude of Accommodation in a Presbyopic Patient Undergoing Stimulation of Sizhukong Acupuncture Point (TH23) – Case Report

Introduction

The term “presbyopia” derives from Aristotle’s description about observation of persons that could see well at distance, but poorly at near after 40 years old of age [1]. Historically, the term presbyopia was used to describe the condition where the near point has receded too far from the eye for normal near-vision tasks. It is the most common refractive error in adulthood and is caused by gradual decrease in the amplitude of accommodation [2], observed by about 40 years of age [3]. Early symptoms are difficulty in focusing on nearby objects under inadequate light and at the end of the day and progress to blurred vision at near. Presbyopia can be corrected by wearing multifocal or reading glasses, contact lenses [4] or surgery in some cases [1]. The physical mechanism of loss of accommodation remains unknown, but Helmholtz’s hypothesis [5,6] is one of the most accepted theories that try to explain it. According to the Helmholtz’s model, the contraction of the ciliary muscle would allow relaxation of crystalline capsule, which, by elastic contraction, would deform the lens, increasing its thickness and, therefore, the optical power. When the ciliary muscle relaxes, the zonular tension will increase, tensioning the lens. This tension reduces its anteroposterior dimension and increases the focal distance.

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Case Report

G. A. L., Female, 56 years old, Brazilian, native of Guaratinga - Ba, from São Paulo, housewife, elementary school incomplete, catholic. This patient complained of progressive loss of vision at near for about fifteen years ago. She refers low vision at near with difficulty in focusing on nearby objects under inadequate light. Early symptoms are difficulty in focusing on nearby objects under inadequate light and at the end of the day and progress to blurred vision at near. Presbyopia can be corrected by wearing multifocal or reading glasses, contact lenses [4] or surgery in some cases [1]. The physical mechanism of loss of accommodation remains unknown, but Helmholtz’s hypothesis [5,6] is one of the most accepted theories that try to explain it. According to the Helmholtz’s model, the contraction of the ciliary muscle would allow relaxation of crystalline capsule, which, by elastic contraction, would deform the lens, increasing its thickness and, therefore, the optical power. When the ciliary muscle relaxes, the zonular tension will increase, tensioning the lens. This tension reduces its anteroposterior dimension and increases the focal distance.

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Table 1

<table>
<thead>
<tr>
<th>Eye</th>
<th>Visual Acuity</th>
<th>Dynamic Refraction</th>
<th>Static Refraction</th>
<th>Keratometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>20/20</td>
<td>+0.25 +0.25 90</td>
<td>+0.25 SPH</td>
<td>45.00 X 45.00 180</td>
</tr>
<tr>
<td>OS</td>
<td>20/20</td>
<td>+0.25 SPH</td>
<td>+0.25 SPH</td>
<td>45.00 X 45.00 180</td>
</tr>
</tbody>
</table>
Discussion

This patient was examined on three different occasions. On the first day, she underwent a complete ophthalmologic exam, including cycloplegia to obtain the static refraction parameters and fundoscopy findings. On the second, 7 days later, the patient was underwent an acupuncture session and her parameters were evaluated during 12 hours. Studies demonstrate variation of the amplitude of accommodation throughout the day [14,15]. To ensure that the increase in accommodation amplitude observed in this case was not as result of circadian variation, we re-examined the patient seven days later after acupuncture. At each evaluation a new kind of Jaeger’s table was used to prevent the patient from respond through training and memorization.

The amplitude of accommodation is the maximum value of increasing dioptr power to promote near vision [16]. Loss of accommodation capacity is the main characteristic of presbyopia. The amplitude of accommodation can be measured in diopeters (D) and represents the inverse of the distance of the fixation in meters. For evaluation of the amplitude of accommodation in this case, we used Sheard’s technique [16-18]. The amplitude of accommodation presented increasing of 3.50 D after the needling. The near visual acuity changed, until the patient reached acuity of J1 on Jaeger’s table. The patient’s description was that she had the feeling of a photographic zoom that made near vision or clear, or blurred. About ten minutes focusing her eyes on Jaeger’s table, she reached J1.

This patient presented a surprising response to acupuncture of the Sizhukong point, with gain of 3.50 D in amplitude of accommodation. The Sizhukong point (Sizhukong means “Silk Bamboo Hole” in Chinese) is located in the depression at the lateral end of the eyebrow, in a bony notch between the frontal process of zygomatic and the zygomatic process of the frontal [19,20,8]. This acupuncture point is related to the orbicularis muscle and its area is vascularized by the frontal branches of the zygomatic orbital artery. It is sensitive territory of the lacrimal nerves (branches of the V2 portion of the trigeminal nerve) and the temporal branch of the facial nerve.

We performed Bird pecking technic [17,18]. This technic consists of to manipulate the needle up and down, like a Bird pecking the ground. We spent one minute each side manipulating the needle, before to leave it resting. According to TCM’s classical writings, this technique enhances the effects of acupuncture. In our personal experience, the result of TH 23 needling without manipulation has a poorer outcome in near visual acuity. The Sizhukong point is last point of the Triple Heater Meridian (TH) [21]. This meridian originates from the tip of the fifth finger passes between the knuckles of the fourth and fifth metacarpal bones until the wrist. From wrist, it ascends between radius and ulna, through the tip of the elbow, and up the back of the arm to the shoulder. It goes forward into the chest, re-emerging at the collarbone. From collarbone, the meridian ascends the side of the neck and around the back of the ear to get the lateral end of the eyebrow. According to TCM, the Triple Heater (TH) meridian improves visual acuity, illuminates the eyes, cleans the heat of the head and face, and disperses the wind and the heat, and

Table 2: Visual acuity, vision at near and addition after Sizhukong’s needling.

<table>
<thead>
<tr>
<th>Hour</th>
<th>Time Elapsed after Acupuncture Session</th>
<th>Visual Acuity</th>
<th>Amplitude of Accommodation</th>
<th>Vision at Near without Correction</th>
<th>Addition to Gain J1 Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 a.m.</td>
<td></td>
<td>20/20</td>
<td>1.25D</td>
<td>J5</td>
<td>+2.50 D</td>
</tr>
<tr>
<td>7:50 a.m.</td>
<td>20 min.</td>
<td>20/20</td>
<td>4.75 D</td>
<td>J1</td>
<td>+0.00 D</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>1h 40 min.</td>
<td>20/20</td>
<td>4.25 D</td>
<td>J1</td>
<td>+0.00 D</td>
</tr>
<tr>
<td>14:00 p.m.</td>
<td>6h 40 min.</td>
<td>20/20</td>
<td>4.00 D</td>
<td>J1</td>
<td>+0.25 D</td>
</tr>
<tr>
<td>16:00 p.m.</td>
<td>8h 40 min.</td>
<td>20/20</td>
<td>2.75 D</td>
<td>J2</td>
<td>+0.75 D</td>
</tr>
<tr>
<td>20:00 p.m.</td>
<td>12h 40 min.</td>
<td>20/20</td>
<td>2.00 D</td>
<td>J4</td>
<td>+1.50 D</td>
</tr>
</tbody>
</table>

Table 3: Visual acuity, vision at near and addition 7 days after Sizhukong’s needling.

<table>
<thead>
<tr>
<th>Hour</th>
<th>Visual Acuity</th>
<th>Amplitude of Accommodation</th>
<th>Vision at Near without Correction</th>
<th>Addition to Gain J1 Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 a.m.</td>
<td>20/20</td>
<td>1.75D</td>
<td>J5</td>
<td>+2.50 D</td>
</tr>
<tr>
<td>7:50 a.m.</td>
<td>20/20</td>
<td>1.50 D</td>
<td>J4</td>
<td>+2.25 D</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>20/20</td>
<td>1.50 D</td>
<td>J5</td>
<td>+2.50 D</td>
</tr>
<tr>
<td>14:00 p.m.</td>
<td>20/20</td>
<td>1.25 D</td>
<td>J5</td>
<td>+2.50 D</td>
</tr>
<tr>
<td>16:00 p.m.</td>
<td>20/20</td>
<td>1.50 D</td>
<td>J4</td>
<td>+2.00 D</td>
</tr>
<tr>
<td>20:00 p.m.</td>
<td>20/20</td>
<td>1.75 D</td>
<td>J5</td>
<td>+2.50 D</td>
</tr>
</tbody>
</table>

relief the pain. The main clinical indications of this meridian are reduction of fever, treatment of redness of the eyes, eyelid edema and chemosis, palpebral tremor, presbyopia, glaucoma, manic psychosis, and epilepsy [8].

We did not find in the scientific literature any report similar to what we present in this article, with a serial measuring of amplitude of accommodation and visual acuity after needleling. The literature of traditional Chinese Medicine refers to the stimulation of acupuncture points for presbyopia, such as Suzhukong point [11]. However, we did not find any explanation that could demonstrate the mechanism of the increase of the amplitude of accommodation, with gain of near visual acuity at near. Faced with this unkowning we can only consider conjectures. First, the lens could have moved anteriorly. However, we would not be able to explain the mechanism of this displacement. Another possibility is the stimulation of ciliary muscle contractility. Micro dialysis studies of acupuncture points [22] demonstrate that needle stimulation releases certain substances locally. Eventually, release of some substance could be related to the gain of amplitude of accommodation due to contraction of ciliary muscle. Blurred vision of nearby objects triggers the reflex of accommodation [6]. This reflex consists in the accommodation when a blurred near object is observed and can be provoked by asking the patient to look away and then fix an object placed about 30 cm from their eyes [23]. The patient with presbyopia loses this reflex response [24]. The contraction of the ciliary muscle represents the peripheral mechanism of accommodation, secondary to a central mechanism. This central mechanism is activated by blurred image of near objects. Through the optic pathways, this stimulus reaches areas 17 and continues until area 19 where the efferent response loop begins. A third hypothesis is stimulation of this reflex. However, we observed an increase in the amplitude of accommodation without changes in the pupil diameter. This may be an indication that it was not due to mascalistic stimulation, with contraction of the ciliary muscle.

In fact, we believe, in our case, that, by some mechanism, there was direct brain stimulation. Studies shows that needle stimulation at acupuncture points activate brain areas [25]. Some researchers [26] used the association of acupuncture points L14, L3, and ST36 for analgesia and demonstrated electrical activation of the somatosensory cortex after treatment. This finding was reproduced with use of points separated by other researchers [27]. Needle insertion on the left wrist (TH5) stimulates the left side of the brain [28]. This result is in accordance with triple heater meridian path that connects to the ipsilateral cerebral hemisphere [29]. Being the TH-23 point of the same meridian, could it have some similar action? The ciliary muscle is innervated by the third cranial nerve, with most of the fibers coming from the Edinger-Westphal nucleus of the oculomotor complex through the ciliary ganglion. In cynomolgus monkeys, a bipolar stimulation electrode of the Edinger-Westphal nucleus stereotaxically positioned generates maximum accommodative amplitude [30]. So, could the gain of accommodation amplitude after needling of Sizhukong acupuncture point (TH23) be caused by stimulation of Edinger-Westphal nucleus? Finally, increase of blood perfusion of certain areas of brain [26] could explain better vision at near. Studies in myopic patients [31,32] show a transient refractive effect after acupuncture of certain points [33]. These studies conclude relationship between visual acuity and brain blood perfusion. Could the stimulation of the acupuncture point activate blood perfusion of visual areas of the brain? After a careful bibliographical review, just conjectures remain for us, since the scientific literature simply does not present a plausible explanation for the increase in the amplitude of accommodation after stimulation of the acupuncture point TH23 (Table 4).

Table 4: The following table summarizes theoretical hypothesis we consider.

<table>
<thead>
<tr>
<th>Theoretical Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
</tr>
<tr>
<td>02</td>
</tr>
<tr>
<td>03</td>
</tr>
<tr>
<td>04</td>
</tr>
</tbody>
</table>

Conclusion

We conclude this clinical case stating that, as the ancient books of acupuncture refer, the needleling of the TH23 acupuncture point really can improve (although temporarily) vision at near. We think that great contribution of this report is to awaken the scientific community to perform new studies that can elucidate this result. We hope that it would be the beginning of a new era of understanding presbyopia and offering the presbyopic patient a physiological alternative than simple proposal of optical correction.

Conflict of Interest

None.

Acknowledgement

None.

References


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