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Original Article

Differences in palpebral fissure height depending on patient's intraoperative head position

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ABSTRACT

Background: Blepharoptosis operations are performed under local anaesthesia, and it is necessary to determine the location where the levator aponeurosis is fixed to the tarsus by checking opening and closing of the eyelids during surgery. Changes in posture during the operation affect the facial condition in various ways. This study was performed to clarify the differences in palpebral fissure height according to intraoperative head position.

Methods: Sixty subjects (48 women and 12 men aged 20–76 years) were enrolled in the study. The palpebral fissure height of the dominant eye was measured in the head-neutral position and 30° head-down position.

Results: The total fissure height in the 30° head-down position was lower than that in the head-neutral position.

Conclusions: The head-down position affects the patient's fissure height and may mislead the operator. Blepharoptosis operation under local anaesthesia should be performed with the patient in the head-neutral position.

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Introduction

There is an ideal intraoperative posture of the patient for each type of surgical procedure. The requirements for the intraoperative posture of patients under local anaesthesia are as follows: the patient should be safe and relaxed during the operation, and a sufficient surgical field should be provided to the operator. During facial operations, the operator is usually located on the cranial side of the patient and observes the patient's face from the front (Figure 1). Therefore, the slight head-down position provides a good surgical field of view and improves the surgical conditions.

Several types of physical irritation to the eyelids, such as habitual rubbing of the eyelids, contact lens use, and cataract surgery, cause disinsertion as well as attenuation and elongation of the aponeurosis, which result in transmission failure between the levator muscle and the tarsus as well as between the levator muscle and the mechanoreceptor of Mueller's muscle, leading to clinical blepharoptosis.[1,2,3,4] Blepharoptosis operations are performed under local anaesthesia, and it is necessary to determine the location for fixing the levator aponeurosis to the tarsus by checking opening and closing of the eyelids during surgery (Figure 2).[5] During blepharoptosis operations, palpebral fissure heights change under the head-neutral position and the head-down position.

The posture change during the operation affects the facial condition in various ways.[6] This study was performed to clarify the differences in palpebral fissure height according to intraoperative head position.

Figure 1. At the time of the facial operation, the operator is located on the cranial side of the patient and observes the patient's face from the front.

Figure 2. Blepharoptosis operation. Determining the location of fixation of the levator aponeurosis to the tarsus by checking opening and closing of the eyelids during surgery.

Figure 3. (Left) head-neutral position. (Right) 30° head-down position.

Methods

Sixty subjects (48 women and 12 men aged 20–76 years old) were enrolled in the study. The study protocol was reviewed and approved by our institutional review board (Institutional Review Board of Medicine, Kofu Municipal Hospital, code#30-2). All subjects were fully informed about the study and provided written consent prior to participation. All subjects were asked to lie down on the operating bed in the head-neutral position and in the 30° head-down position (Figure 3). To take pictures under fixed conditions, two frontal photographs were taken with the head in the standard (FH) position.[7] The palpebral fissure heights of the dominant eye were measured in the head-neutral position and 30° head-down position. We drew a transverse line between the internal and external canthus, and then divided the palpebral fissure heights into the upper fissure height and the lower fissure height. These fissure heights were measured on images calibrated for size using image editing software (Adobe Photoshop; Adobe Systems Inc., San Jose, CA, USA) and a 10 × 10 mm square scale sticker (CASMATCH; Bear Medic Co., Tokyo, Japan) attached to the skin adjacent to the fissure.

Results

The upper fissure height was greater in the head-neutral position than in the 30° head-down position (0.58 ± 0.16 cm vs. 0.36 ± 0.13 cm, respectively; $p < 0.01$). The lower fissure height in the head-neutral position was smaller than that in the 30° head-down position (0.24 ± 0.07 cm vs. 0.30 ± 0.08 cm, respectively; $p < 0.01$). The total fissure height was greater in the head-neutral position than in the 30° head-down position (0.82 ± 0.19 cm vs. 0.66 ± 0.15 cm, respectively; $p < 0.01$) (Figure 4).

Discussion

Reason for the change in fissure height

The results indicated that the eyelids tend to close in the head-down position compared to the head-neutral position (Figure 5). In the head-down position, gravity acts on the upper eyelids resulting in a tendency to downgaze therefore closing the fissure during surgery. The intraoperative stretching of Mueller's muscle electromyographically induces involuntary reflex contraction of the levator palpebrae superioris muscle (LPSM).[8,9,10,11] In the downgaze position, stretching of the mechanoreceptor of Mueller's muscle in the upper eyelid can be reduced and the LPSM relaxes. On the other hand, during downgaze, stretching of the mechanoreceptor of Mueller's muscle in the lower eyelid is increased and the lower eyelid retractors, such as the inferior rectus muscle, contract to move the lower eyelid in the caudal direction. However, the amount of increase in the lower eyelid is less than the amount of decrease in the upper eyelid, so the total fissure height decreases.

Effects on blepharoptosis operation

We ask patients to open their eyelids in frontal viewing during the operation and check whether the patient has obtained sufficient fissure height. However, if the blepharoptosis operation is performed in the head-down position, there is a risk of misestimating that the patient has insufficient

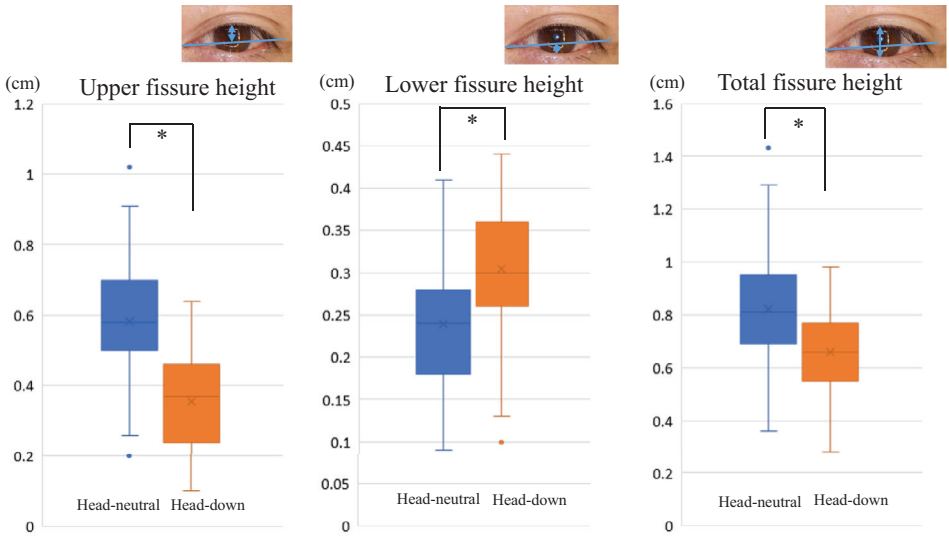

Figure 4. (Left) Upper fissure height during surgery. The upper fissure height in the head-neutral position was greater than that in the 30° head-down position ($^*p < 0.01$). (Centre) Lower fissure height during surgery. The lower fissure height in the head-neutral position was lower than that in the 30° head-down position ($^*p < 0.01$). (Right) Total fissure height during surgery. The total fissure height in the head-neutral position was greater than that in the 30° head-down position ($^*p < 0.01$).

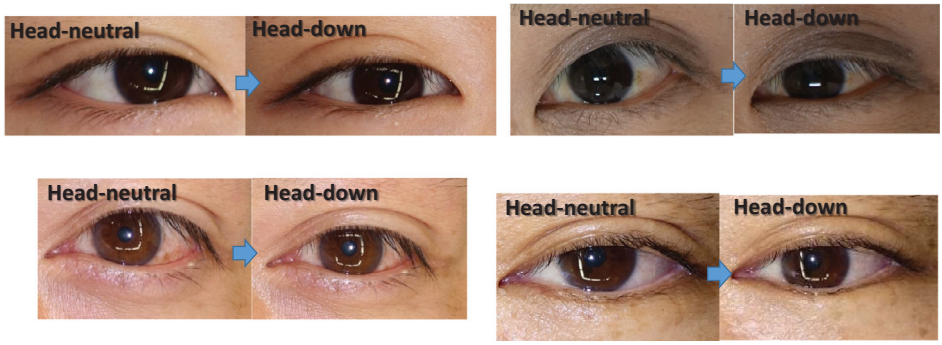

Figure 5. Photograph of the eyes in the head-neutral position and 30° head-down position.

fissure height, which may lead to fixing the levator aponeurosis and the tarsus at excessive advanced positions. Having the patients in the sitting position during the operation represents a possible countermeasure, but frequent position changes would be a burden to the patient. There have been some reports regarding the incidence of reoperation surgery for blepharoptosis with an incidence rate of 4.1–8.9%.[12,13,14] The head position during the operation may be one reason for requiring reoperation surgery.

Ideal posture for blepharoptosis operation

The ideal operative posture of the patient for blepharoptosis surgery is sitting or standing, neither of which is feasible. Therefore, during blepharoptosis operation, the patient's head should be maintained in a neutral position using a surgery pillow that would not affect the operation and keep both upper and lower eyelids neutral, neither increasing nor deceasing stretching of the mechanoreceptor

of Mueller's muscle. The patient's palpebral fissure height should be estimated in the sitting position at least once during the operation to achieve definitive results. Intraoperative measurements in the sitting position can more accurately predict postoperative eyelid height than measurements with the patient in the head-neutral position.[15,16]

Limitations and future studies

The final goal of blepharoptosis surgery is to achieve a natural and adequate fissure vertical height in the upright position. Therefore, it is important to predict the postoperative results in the upright position, while the operation is performed in the supine position. Although this study indicated that the fissure vertical height changes with head position, not only the vertical height but also the intercanthal width, binocular width, and other parameters, may change depending on posture due to changes in the facial soft tissue. The patients evaluated in this study varied in age and sex. Morphological changes of the face with posture may vary depending on these factors, and further studies are required to clarify these differences.

We presumed that the change in stretching of the mechanoreceptor of Mueller's muscle caused by head position change would be the main cause of the change in fissure vertical height with posture. Further studies are required to determine how changes in fissure vertical height with posture are influenced by increasing or decreasing the stretching of the mechanoreceptor of Mueller's muscle using stimulating (phenylephrine) or blocking (lidocaine) eye drops to verify our hypothesis.[17]

Conclusions

It is important to check the patient's palpebral fissure height during blepharoptosis surgery. The head-down position affects the patient's fissure height and may mislead the operator. Blepharoptosis operation under local anaesthesia should be performed with the head in a neutral position and the patient's palpebral fissure height should be estimated in the sitting position at least once during the operation.

Conflict of interest statement

The authors have nothing to disclose. No funding was received for this article.

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