Relationship between cantho-limbal distance and degree of head turn in a Korean population

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ABSTRACT • RÉSUMÉ

Objective: To evaluate the relationship between cantho-limbal distance and the degree of head turn in Koreans.
Design: Prospective cross-sectional study.
Participants: Thirty patients without strabismus or nystagmus who had visited an ophthalmic clinic at a single medical center were included in the study.
Methods: The distance between the lateral canthus and lateral corneal limbus was measured using a 5 mm scale. The degree of head turn was measured with a goniometer when the cantho-limbal distances were 0, 5, and 10 mm. The degree of head turn was measured 3 times, and the mean value was used as the degree of head turn.
Results: When the cantho-limbal distances were 0, 5, and 10 mm, the degree of head turn values were 42.33, 30.47, and 2.53 degrees, respectively. The shorter the cantho-limbal distance, the higher the degree of head turn ($r = -0.945$, $p < 0.01$). The relationship was expressed as:

Degree of head turn $= -2.98 \times$ cantho-limbal distance $+ 35.07$.

Conclusions: Cantho-limbal distance can be used to estimate the degree of head turn. This method may be simpler and easier in a clinical situation than checking the degree of head turn with a goniometer.

Objectif : Évaluer le lien entre la distance canthus-limbus et le degré de rotation de la tête chez des Coréens.
Méthodes : 30 patients ne souffrant pas de strabisme ni de nystagmus ont participé à cette étude. Nous avons mesuré la distance entre le canthus latéral et le limbus cornéen latéral à l'aide d'une échelle de 5 mm. Le degré de rotation de la tête a été mesuré à l'aide d'un goniomètre lorsque la distance canthus-limbus était de 0, 5 et 10 mm respectivement. Le degré de rotation de la tête a été mesuré trois fois, et la moyenne des trois a servi de mesure du degré de rotation.
Résultats : Lorsque la distance canthus-limbus était de 0, 5 et 10 mm, le degré de rotation de la tête était de 42,33 °; 30,47 °; et 2,53 ° respectivement. Plus la distance canthus-limbus était courte, plus le degré de rotation de la tête était élevé ($r = -0,945$, $p < 0,01$). Le lien s'exprime ainsi: Degré de rotation de la tête $= -2,98 \times$ distance canthus-limbus $+ 35,07$.
Conclusion : La distance canthus-limbus peut servir à estimer le degré de rotation de la tête. Cette méthode peut être plus simple et facile dans un contexte clinique que de mesurer le degré de rotation de la tête avec un goniomètre.

Abnormal head posture (AHP) is a relatively common clinical sign in the ophthalmic field and is an important element in the diagnosis of several disparate conditions and for planning adequate treatment.[1] AHP is adopted to optimize visual acuity or dampen nystagmus amplitude, to bring the monocular or binocular fields of vision into the central area, and to maintain binocular vision or avoid diplopia.[2] Face turn to the right or left is commonly encountered when planning adequate treatment for AHP caused by nystagmus, and the degree of head turn in the shifting null zone is considered to determine the appropriate surgical approach.[3]

Many ophthalmologists measure head posture roughly by simple observation. However, the result may be inaccurate, as this method depends on the clinician's experience. Such observations have errors of 2 to 18 degrees,[4] which increase for patients with more severe anomalous head posture. For example, a 30-degree head turn results in examiner estimates of 10 to 50 degrees.[5] The amount of head posture in degrees can be read directly from a handheld orthopedic goniometer. Thus, goniometer measurements should be used clinically[6] (Fig. 1). However, most ophthalmologists are unfamiliar with a goniometer and may not have one.

Head turn refers to the horizontal rotation of the head. The degree of head turn is associated with the distance between the lateral canthus and the lateral corneal limbus of the abducted eye. Therefore, cantho-limbal distance can be used to assess the degree of head turn. The purpose of this study was to evaluate the relationship between cantho-limbal distance and the degree of head turn in Koreans and to present how this method can be applied in a clinical situation.

METHODS

This prospective cross-sectional study was conducted at a single medical center. We enrolled 30 patients who had visited the ophthalmic clinic. Patients with AHP due strabismus, amblyopia, Duane's retraction syndrome, congenital fibrosis of the extraocular muscles, nystagmus, refractive errors, and visual field defects were excluded.

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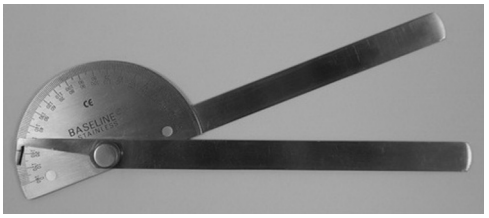

Figure 1—Goniometer.

Table 1—Relation between cantho-limbal distance or palpebral fissure length and degree of head turn

	Correlation Coefficient	*p*	Control Variable
Cantho-limbal distance	−0.948	< 0.01*	Palpebral fissure length
Palpebral fissure length	+0.172	0.107	Cantho-limbal distance

*Partial correlation, $p < 0.05$.

Patients with comorbidities, such as hearing loss, spine and neck abnormalities, or atlantoaxial instability were also excluded.

The subjects were asked to turn their head to the left and to fixate their eyes on a target 5 m away. The degree of head turn was measured with a goniometer when the distance between the right lateral canthus and the right lateral corneal limbus was zero. This procedure was performed 3 times, and the mean value was adopted as the degree of head turn. In the same way, the degree of head turn was measured when the distances of the lateral canthus and the lateral corneal limbus were 5 and 10 mm (Fig. 2). Palpebral fissure length was also measured, as it may affect cantho-limbal distance.

SPSS 18.0 was used for all statistical analyses (SPSS Inc, Chicago, Ill). A partial correlation analysis was used to evaluate the relationships among the degree of head turn, cantho-limbal distance, and intercanthal distance. A p value of < 0.05 was interpreted as statistically significant. Regression analysis was used to develop an interaction formula between statistically significant factors.

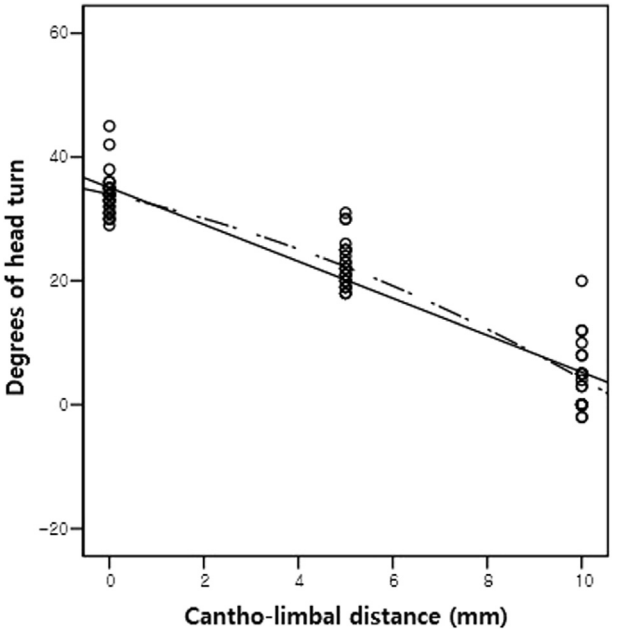

Figure 3—The inverse relationship between cantho-limbal distance and the degree of head turn: ($r = -0.948$; $p < 0.01$).

Results

The mean age of patients included in the study was 34 ± 19.21 years (range, 4–84 years). The degree of head turn values were 34 ± 3.37, 22.3 ± 3.56, and 4.2 ± 4.84 degrees when the cantho-limbal distances were 0, 5, and 10 mm, respectively. The average palpebral fissure length in the study was 28 ± 2.2 mm.

The partial correlation analysis revealed that the longer the cantho-limbal distance, the smaller the degree of head turn, regardless of palpebral fissure length ($r = -0.948$; $p < 0.01$). However, the converse that the longer the palpebral fissure length, the larger the degree of head turn was not significant ($r = +0.172$; $p = 0.107$; Table 1).

The regression analysis revalued the relationship (see Fig. 3):

$$\text{Head turn in degrees} = -0.13 \times \text{cantho-limbal distance (mm)}^2 - 1.7 \times \text{cantho-limbal distance(mm)} + 34 \text{ (90.8\%CI) or}$$

$$\text{head turn in degrees} = -2.98 \times \text{cantho-limbal distance (mm)} + 35.07 \text{(89.4\% CI).}$$

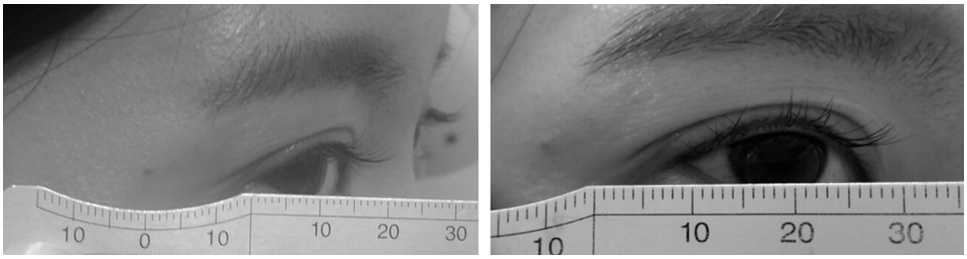

Figure 2—Measurements of cantho-limbal distance.