

Comparison of the horizontal condyle angle of the dentulous and edentulous patients using cone beam computed tomography

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ABSTRACT

The aim of the present study was to compare the horizontal condyle angle (HCA) between fully edentulous and dentulous patients, as well as to consider the relationship of age and gender with the HCA.

This study included 50 patients aged between 25 and 76 years. Their HCAs were measured on cone beam computed tomography (CBCT) images using specialized software. Then, the relationships between the measured HCA and each patient's age, gender, and dental condition were analyzed.

The results of this study revealed that the patient's gender did not have a significant effect on the HCA ($p=0.850$). Additionally, the patient's dental condition also did not have a significant effect on the HCA ($p=0.772$). There was no significant relationship found between the patient's age and the HCA, although negative correlation was found between these two aspects ($r=-0.25$, $p=0.865$).

In the literature, it has been emphasized that a higher HCA may cause the internal derangement of the temporomandibular joint (TMJ). In our study, as the patient's age increased, so the HCA decreased. In other words, an increase in the HCA was not seen in the older population of patients and increased HCA may cause TMJ internal derangement for some other reasons.

Key Words: Mandible, temporomandibular joint, cone beam computed tomography

Introduction

The angle between the horizontal condyle long axis and the frontal plane is known as the horizontal condyle angle. Westesson et al. were the first to note the relationship between a high HCA and the internal derangement of the TMJ (1). According to their study, which was performed with magnetic resonance imaging (MRI) in 1991, the HCA in healthy TMJs was 21.2° , while the HCA in cases of internal derangement of the joint ranged from 29.7° to 36.5° (2). However, in a study performed using submentovertex radiography by Sato et al., the HCA of a TMJ characterized by internal derangement was found to not be considerably high when compared to the HCA in a normal TMJ (3). Lee et al. measured the HCAs of normal TMJs and TMJs affected by osteoarthritis (OA) using CBCT. The mean HCA was found to be $29.5^\circ \pm 10.5^\circ$ in unilateral joints affected by OA, while the HCA in the other healthy side was $22.5^\circ \pm 7.7^\circ$ (4).

Junhasavasdikul et al. measured the HCAs of pediatric patients on MRI images. They found the mean value to be 22.1° in females and 23.5° in males (5). Further, Ma et al. measured the HCAs of orthodontic patients, and they found the mean values

in the left TMJ to be 21.31° in the CI I hyperdivergent group, 24.57° in the CI II hyperdivergent group, and 19.07° in the CI III hyperdivergent group (6).

In the literature, the standard HCA values and the HCA-malocclusion relationship have been analyzed; however, to the best of our knowledge, the HCA-dental condition relationship has not previously been analyzed. In the present study, the HCAs of dentulous and edentulous patients were analyzed, and it was determined which group was more prone to internal derangement in the TMJ.

Materials and Methods

This study was conducted retrospectively in the Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Van Yüzüncü Yıl University. The CBCT images of fully edentulous and dentulous patients aged between 25 and 76 years were included in the study. The angle between the horizontal condyle long axis and the coronal plane of the patients was measured using eXamVision (KaVo Dental GmbH, Biberach, Germany) software (Figure 1). The condyles of patients who exhibited any anomalies or who were undergoing any surgical procedures were excluded from the study. Approval

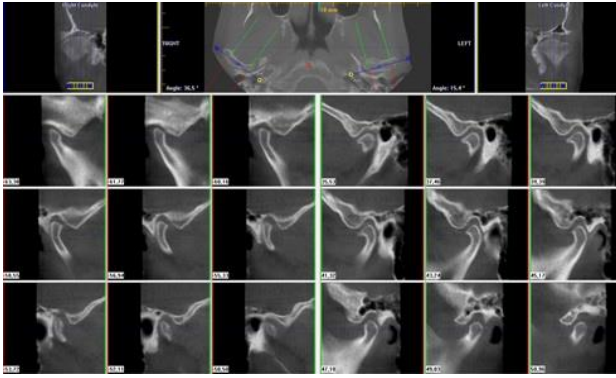


Fig.1. Representation of HCA measurement on sectional images by CBCT

for the study was granted by the Ethical Committee (approval no. YYU-2018/02/16-10).

The CBCT images of the patients were obtained using a KaVo 3D eXam (Biberach, Germany) tomography device. The obtained data were then analyzed using SPSS (IBM SPSS Statistics 20.0; IBM Co., Armonk, NY, USA) software. Student's t-test and the Pearson r correlation were also used in the statistical analysis.

Results

The mean HCA values of the male ($n=26$) and female ($n=24$) patients were $24.86^{\circ} \pm 7.48^{\circ}$ and $24.46^{\circ} \pm 7.53^{\circ}$, respectively, and there was no significant difference found between the genders ($p=0.850$) (Table 1). The mean HCA value of the dentulous group ($n=25$) was $24.36^{\circ} \pm 6.35^{\circ}$, while the mean value of the edentulous group ($n=25$) was $24.98^{\circ} \pm 8.50^{\circ}$. Again, there was no significant difference between the two groups ($p=0.772$) (Table 2). In terms of the correlation between the mean HCA and the patient's age, there was a weak negative and non-significant relationship between the two aspects ($r=-0.25$, $p=0.865$). The age range was between 31 and 68 years in the female patients and between 25 and 76 years in the male patients. Moreover, the mean age was 49.08 ± 13.90 years in the female patients and 49.19 ± 17.35 years in the male patients (Table 3).

Discussion

Many prior studies concerning the morphology of the TMJ have been conducted using two-dimensional projection methods. However, the presentation of the actual location of the joint structures is impossible when using such two-dimensional methods. A three-dimensional imaging system is therefore essential when investigating structures such as the articular eminence and glenoid fossa circumstantially (7). Due to the above-mentioned technical deficiencies, a CBCT system was used in the present study rather

than a two-dimensional projection, for example, a submentovertex projection.

Ueki et al. assessed whether the HCAs of patients changed following a sagittal split ramus osteotomy. They found that the mean preoperative and postoperative HCA values were not significantly different (8). Yet, in a study using computed tomography (CT), the CT images of patients were obtained preoperatively and one year after the performance of a sagittal split ramus osteotomy, and a significant difference was found between the preoperative and postoperative HCA values (9). The discrepancy between the results of these two similar studies may be related to the different operation approaches as well as the different image acquisition intervals between the preoperative and postoperative conditions.

Crusoé-Rebello et al. acquired MRI images of the TMJs of 72 patients and analyzed the relationship between the HCA and internal derangement. In their study, the mean HCA in the normal TMJs was 21.78° , while it was measured as 23.82° in TMJs with internal derangement. Hence, the authors concluded that the HCA values of TMJs with internal derangement may be higher than the HCA values of normal TMJs (10).

Al-Rawi et al. measured the HCAs of 38 males and 32 females using CBCT images. They found the mean HCA of the males with healthy TMJs to be 23.18° , while the mean HCA of the males who had a temporomandibular disorder was found to be 18.36° . The mean HCA of the females with healthy TMJs was found to be 21.19° , while this value for the females with a temporomandibular disorder was 15.63° (11). In our study, there was no significant difference found between the HCAs of the male and female patients, although in the study by Al-Rawi et al. there was a significant difference in favor of the males. Additionally, in the present study the HCA of a healthy TMJ was found to be higher than the HCA of a TMJ with internal derangement, which is incompatible with the findings of prior studies (2, 10).

Rodrigues et al. compared the HCA values of the left and right TMJs in 30 patients with Class I malocclusion using CT. According to their results, there was no significant difference between the values (12). In a similar study (13), the CT images of patients with Class II division 1 malocclusion and Class III malocclusion were acquired. Then, the HCAs of the right and left TMJs were compared, and no significant difference was observed. Huang et al. assessed the HCAs of the Class I and Class II sides of 32 patients with Class II subdivision malocclusion. The mean HCAs of the Class I and Class II sides were found to be 19.74° and 21.49° , respectively, and no significant difference was found between the HCAs of the two

Table 1. Mean HCA values comparison with regard to gender

	Gender	Mean± standard deviation	T test (p value)
Mean HCA	Male	24.86± 7.48	0.850
	Female	24.46± 7.53	

Table 2. Mean HCA values comparison with regard to dental condition

	Dental condition	Mean± standard deviation	T test (p value)
Mean HCA	Dentulous	24.36± 6.35	0.772
	Edentulous	24.98± 8.50	

Table 3. Descriptive statistics of patients

Gender	N	Age	
		Mean± standard deviation	Range
Female	24	49.08±13.90	31-68
Male	26	49.19±17.35	25-76

N: Number

sides (14). In another study, a significant difference was found between the HCA values of Class I, Class II, and Class III malocclusion patients (6). When incompatible results have been achieved in similar studies concerning the HCA, it is possible that the use of different patient populations may have been responsible for the difference.

The HCA has been studied in maxillofacial surgery follow-up studies (8,9), analysis of TMJ internal derangement (1-3,10) and several malocclusion studies (6,12-14). However, the HCA has not previously been studied with regard to a comparison between dentulous and edentulous patients. According to the results of the present study, there was no difference between the HCAs of dentulous and edentulous patients. Moreover, neither age nor gender had a significant effect on the HCA values. An age increase was not concordant with an HCA increase, which has previously been speculated to be responsible for TMJ disorders.

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