Research Article / Araştırma Makalesi

Evaluation of the Temporal Crestal Canal, A Mandibular Variation, with CBCT According To Gender

Mandibular Bir Varyasyon Olan Temporal Krestal Kanalın Cinsiyete Göre KIBT ile Değerlendirilmesi

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Abstract

Background: The aim of this study was to evaluate the presence of temporal crest canal (TCC) in a group of Turkish population according to gender using cone beam computed tomography (CBCT).
Materials and Methods: CBCT images of 515 individuals were retrospectively analysed. Twenty-seven of these images were excluded because they did not meet the study criteria. All images were analysed in multiplanar planes. The presence of TCC was recorded according to age and gender. Data were analysed with Statistical Package for the Social Sciences (SPSS) version 25. Pearson Chi-Square test was used to evaluate the relationship between categorical variables.
Results: 488 CBCT images were analysed and 2.6% of the total TCC was detected. Right TCC rate was 1.2% and left TCC rate was 1.4%. The rate of TCC was 1.4% in males and 1.2% in females. There was no statistically significant difference in the rate of presence of right and left TCC in males and females ($p > 0.05$).
Conclusions: CBCT is an important radiological method for the detection of TCC. The rate of presence of TCC did not show a significant difference between genders.

Key Words: Anatomical variation, Cone beam computed tomography, Mandible, Ramus, Temporal crest canal

Öz

Amaç: Bu çalışmanın amacı, bir grup türk popülasyonunda temporal krest kanalının (TKK) varlığını konik ışınlı bilgisayarlı tomografi (KIBT) kullanarak cinsiyete göre değerlendirmektir.
Materyal ve Metod: 515 bireyin KIBT görüntüleri retrospektif olarak incelenmiştir. Bu görüntülerin 27'si çalışma kriterlerine uymadığı için değerlendirme dışı bırakılmıştır. Tüm görüntüler multiplanar düzlemlerde incelenmiştir. Hastalarda bulunan TKK' nın varlığı yaşa ve cinsiyete göre kaydedilmiştir. Veriler Statistical Package for the Social Sciences (SPSS) versiyon 25 ile analiz edilmiştir. Kategorik değişkenler arasındaki ilişkinin değerlendirilmesinde Pearson Chi-Square testi kullanılmıştır.
Bulgular: 488 KIBT görüntüsü değerlendirilmesi sonucunda total TKK %2,6 oranında tespit edilmiştir. Sağ TKK oranı %1,2, sol TKK oranı %1,4 olarak bulunmuştur. Erkeklerde TKK varlığı oranı %1,4, kadınlarda TKK varlığı oranı %1,2 olarak izlenmiştir. Kadınlarda ve erkeklerde sağ ve sol TKK bulunma oranı açısından istatistiksel olarak anlamlı bir fark bulunmamıştır ($p > 0,05$).
Sonuç: KIBT TKK tespitinde önemli bir radyolojik yöntemdir. TKK varlığı oranı cinsiyetler arasında anlamlı bir fark göstermemiştir.

Anahtar Kelimeler: Anatomik varyasyon, Konik ışınlı bilgisayarlı tomografi, Mandibula, Ramus, Temporal krest kanalı

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Introduction

Several variations have been identified in the human body (1). The variations observed in the mandible are significant in terms of surgical operations involving the mandible. Due to the found variations, bleeding, anesthesia failure, and neurosensory disorders can occur (2-5). One of the anatomical variations studied in the mandible is the TCC, which was described by Ossenberg in 1986 (6). The TCC is the introsseous canal which spans between one accessory foramen, coinciding with the retromolar foramen and the accessory foramen around the main mandibular foramen. The TCC is located around the retromolar fossa (7). The TCC is thought to be related to the buccal nerve, a branch of the mandibular nerve. Therefore, the clinical significance of this variation becomes significant in mandibular nerve anesthesia and surgical procedures performed at the back of the mandible. To know about the TCC will help prevent potential complications (6-8).

In the past, such variations were primarily reported using cadavers and interventional procedures. However, with the development of imaging systems, it has become possible to perform detailed analyzes of certain variations based on digital data. In recent years, CBCT which has been increasingly used in dentistry, has enabled us to detect even small changes in hard tissues. The ability to provide high geometric resolution and clarity, along with the option for cross-sectional examinations, has made CBCT usage advantageous (9, 10).

There are limited researches available in the literature regarding TCC. Therefore, the aim of this study is to investigate the distribution of TCC based on gender by using CBCT.

Materials and Methods

Ethics committee approval for this research was taken by Harran University clinical research ethics committee, decision numbered 22.22.18. The CBCT images, obtained from 515 individuals at Harran University Faculty of Dentistry using the Castellini X-Radius Trio Plus (Imola, Italy) tomography device with irradiation parameters of 90 kVp and 16 mAs, and having a field of view (FOV) size of 13 x 10 and 13 x 16 cm, were retrospectively examined by a dento-maxillofacial radiologist (MED) with five years of experience. During the image analysis, reconstruction images were obtained using the IRYS viewer 15.1 software program. The images had a voxel size of 0.3 mm and a section thickness of 1 mm. All CBCT images were evaluated in multiplanar planes using a full HD screen with a maximum screen resolution of 1920 x 1080 and a screen size of 15.6 inches. The exclusion criteria for the images included the images belonging to individuals under 17 years of age, the presence of metabolic bone diseases, pathological lesions in the examination area, fracture lines in the imaging area, distortions in the imaging area, magnifications, and artifacts. The remaining 488 images were evaluated in axial, coronal, and sagittal planes to detect the presence of TCC, its location (unilateral or bilateral), and its distribution by gender (Figure 1-2-3). Data were analyzed with Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were used to obtain number and percentage. Pearson Chi-Square test was used to evaluate the relationship between categorical variables. Kappa was used to evaluate intraobserver agreement.

Figure 1. Sagittal CBCT image of TCC

Figure 2. Axial CBCT image of TCC

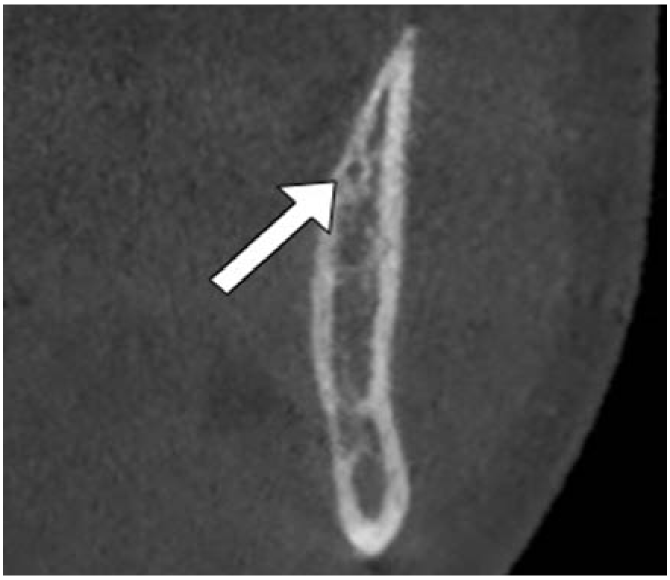

Figure 3. Coronal CBCT image of TCC

Results

The presence of total TCC was evaluated based on the assessment of 488 CBCT images. In this study, 488 CBCT images were evaluated, consisting of 48.6% (237) males and 51.4% (251) females, with an average age of 34.99 ± 17.72 years. The intra-observer agreement value was found to be excellent level at 0.90. Table 1 shows the distribution of the TCC by gender. As a result of the evaluation of these images, the total percentage of TCC was detected in 2.6% of the cases. The rate of TCC on the right side was 1.2%, and on the left side, it was 1.4%. In terms of the presence of TCC in males and females, there was no statistically significant difference between them (p > 0.05).

Table 1. Distribution of temporal crest canal by gender

	Right TCC		Left TCC		P
Gender	**Presence n (%)**	**Absence n (%)**	**Presence n (%)**	**Absence n (%)**	
Female	3 (0.6)	248 (50.8)	3(0.6)	248 (50.8)	
Male	3 (0.6)	234 (48.0)	4(0.8)	233 (47.7)	0.647
Total	6(1.2)	482 (98.8)	7 (1.4)	481 (98.6)	

Discussion

The first study on TCC was conducted by Ossenberg (6), who investigated these accessory canals in the human mandibles by inserting wires into them. His study, variations were found more in males than in females. His found the frequency of this variation in Eskimos 3.8%, in a village in northern Alaska 9.5%, in Kialegak 18.4%, and in Apogak 23.1%. In his studies conducted in 1986 and 1987, he categorized the variations into three types. In the classification of the identified canals, the first two categories are associated with the mandibular canal, as the third category is not associated of the mandibular canal. Ossenberg (11), noted that Type 3 canals accounted for less than 2% of the total canals found. Han et al. (7), in their study considered TCC as an accessory canal which was not associated with the mandibular canal. They categorized TCC into two types. In Type 1, the anterior foramen is narrower than the posterior foramen and it became narrower along the canal. In Type 2, the width of the canal remains uniform along its course. In Han et al. (7), examined CBCT images from 446 cases, and TCC was detected in 0.9% of them. All of TCC was observed in men. In the study conducted by Hasani et al. (12), TCC was categorized into two types. Type 1 TCC originates from the mandibular foramen and exhibits a curvature towards the end of its course. Type 2 TCC originates from an accessory foramen. In this study, TCC was observed in 1.5% of 327 cases. All of the detected TCC was found in females. Hasani et al. (12), described Type 2 canal in only 1 case. Kawai et al. (13), used 48 resected mandibles in their study. In this study, the resected mandibular was examined with CBCT. Kawai et al. (13), categorized the TCC into two types. In their categorization, as similar as to Hasani et al. (12), they considered the relationship of the originating point of the TCC with the mandibular foramen. Type 1 starts from the mandibular foramen, as Type 2 starts from an accessory foramen around the mandibular foramen. They detected TCC in 4 mandibles, one of which was bilateral, out of 48 mandibles, and found TCC frequency of 8.3% in mandibles. In this study, only two cases of Type 2 canals were observed (13). Naitoh et al. (14), evaluated TCC as a canal between two accessory foramina, one around the mandibular foramen and the other in the retromolar area. They examined 292 cases and detected 4 TCCs, one of which was bilateral, resulting in a frequency of 0.68%. Piskórz et al. (15), categorized the retromolar canal into three different subtypes. Type B corresponds to TCC. They examined 200 cases in total and identified one case with a Type B retromolar canal. Nikkerdar et al. (16), also categorized the retromolar canals into 4 types. Among these 4 types, Type 2 and Type 4 are not associated the mandibular foramen. Type 2 does not match our definition of TCC since it extends toward the root of the third molar tooth within the retromolar fossa. Type 4 defines a canal that starts from an accessory foramen around the mandibular foramen and extends to the retromolar fossa, but none of these 200 cases examined by Nikkerdar et al. (16), had this type of canal. Yeşiltepe et al. (17), accepted TCC as accessory foramen, one located around the mandibular foramen and the other in the retromolar area. CBCT images of 121 cases were examined. The presence of TCC was detected in 3 female and 2 male patients. In their studies, all of TCC was located on the right side. In the study conducted by Yalçın and Akyol (8) in 2019, the categorization of Han et al. was used. Of the 7 TCC observed in 1023 cases, 5 were observed As one Type 1 and one Type 2 were observed in women, three Type 1 and two Type 2 TCCs were observed in men. All TCCs were unilateral, two on the right side and five on the left (7, 8).

Han et al. (7), Naitoh et al. (14), Yeşiltepe et al. (17), Yalçın and Akyol (8) categorizations allow comparison with each other and with the TCC definition in our study. The TCC frequency we found is less than the TCC frequency observed in Yeşiltepe et al. (17) in study, and is higher than the frequency in the studies of Han et al. (7), Naitoh et al. (14), Yalçın and Akyol (8). As Han et al. (7), Yalçın and Akyol (8) found the frequency of TCC to be higher in men, as in our study, Naitoh et al. (14) and Yeşiltepe et al. (17) found the frequency of TCC to be higher in women. There are differences between the categorization of Ossenberg (6, 11), Hasani et al. (12), Kawai et al. (13), Piskórz et al. (15) and Nikkerdar et al. (16) and our definition. Ossenberg's (6,11) Type 3 canal, Hasani et al. (12) and Kawai et al. (13) Type 2 canal, Piskórz et al. (15) Type 2 canal, Nikkerdar et al. (16) Type 4 canal comply with the TCC definition of this study. The frequency of Ossenberg's (6, 11) Type 3 canal is lower than the Type 2 canal frequency found in Hasani et al. (12) study and the Type 2 canal frequency found in Piskórz et al. (15) study is less than the TCC frequency in our study. The

Type 2 canal frequency in Kawai et al. (13) study was observed to be higher than in our study. Type 4 canal were not found in Nikkerdar et al. (16) study. The reasons for variations in the frequency of TCC among studies can be attributed to several factors, including the criteria used to define TCC, the size of the sample, the methods and potential racial differences (6-8, 11-17). Ossenberg (6, 11) suggests that the buccal nerve can pass through the TCC. Then, Kawai et al. (13) performed a histological examination after scanning CBCT images of TCCs in the resected mandibles and found vascular and nerve tissues in two of the TCCs. Accessory canals in the retromolar area can potentially cause complications during surgical procedures in that area (18). The presence of canals causes insufficient anesthesia and allows tumor cells and infection to spread more easily (19-21).

Limitations

- Insufficient evaluation of TCC content
- Inability to examine the histological structure of TCC
- Conducting the study in a single center
- Inability to access current clinical conditions due to obtaining all information retrospectively from hospital records

Conclusion

In our study, the rate of TCC was not significantly different between genders. To know the presence of TCC can help prevent complications that may occur. CBCT is a very useful method to evaluate the presence of TCC, but ultrasonography, magnetic resonance imaging and histological examination of resected mandibles may be more useful to understand the presence of TCC.

Ethical Approval: Ethical approval was obtained from Ethical Committee of Harran University (approval number: HRÜ./ 22.22.18)

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Concept: M.E.D., M.S.K.
Literature Review: M.E.D., M.S.K.
Design : M.E.D.
Data acquisition: M.E.D., M.S.K.
Analysis and interpretation: M.E.D., M.S.K.
Writing manuscript: M.E.D., M.S.K.
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