eISSN: 2645-7687. Journal of Clinical Care and Skills. 2022;3(1):27-30.

Evaluation of Morphological Variations of Iranian Mandible Condyles

Journal of Clinical Care and Skills

ARTICLE INFO

Article Type
Original Research

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How to cite this article
Zaheri T, Dabbaghi A, Daneshnia T. Evaluation of Morphological Variations of Iranian Mandible Condyles. Journal of Clinical Care and Skills. 2022;3(1):27-30.

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Article History
Received: January 24, 2022
Accepted: February 12, 2022
ePublished: May 11, 2022

ABSTRACT

Aims The morphology of the condyle varies according to the race of the population in different places. Moreover, the identification of morphologies can be effective in diagnosing the pathogenesis and type of treatment of patients. This study aimed to examine condyle morphology images using digital panoramic imaging.

Material & Methods This study was performed as a retrospective using panoramic images available in the archives of the Private Radiology Center located in Ahvaz in Iran 2021. The digital panoramic images were taken by a South Korean VATECH.PEH 2500 panoramic device. The images were investigated in terms of condyle shape, age, sex, and bilateral symmetry. SPSS 16 software was used for data analysis. The Chi-square test was used for the statistical analysis of data.

Findings The results showed that 47.7% of patients had round morphology, 11.9% had diamond morphology, 21.9% had finger morphology and 18.5% had bird beak morphology. After evaluations, the results showed that there was no significant relationship between age and sex of patients with condylar morphology.

Conclusion Round morphology was higher in all populations than in other morphologies. Also, its prevalence was higher in both sexes than in other morphologies. However, no significant relationship was observed between them.

Keywords Temporomandibular Joint; Mandible Condyles; Panoramic Radiography

CITATION LINKS

[1] Oral radiology: Principles and interpretation [2] Three-dimensional assessment of facial morphology in children and adolescents with juvenile idiopathic arthritis and moderate to severe TMJ involvement using 3D surface scans [3] Volumetric and morphological analysis of condyle and glenoid fossa on computed tomography [4] Morphology of the temporomandibular joints regarding the presence of osteoarthritic changes [5] Changes in temporomandibular joint anatomy, changes in condylar translation, and their relationship with disc displacement: magnetic resonance imaging study [6] Diagnostic image analyses of activator treated temporomandibular joint in growth and maturing stages [7] Size, shape and age-related changes of the mandibular condyle during childhood [8] Bifid mandibular condyle: CT and MR imaging appearance in two patients: Case report and review of the literature [9] Condylar shape analysis using panoramic radiography units and conventional tomography [10] Condylar morphological variants and its association with age, TMD and dentition status: A digital panoramic study [11] Understanding the mandibular condyle morphology on panoramic images: A conebeam computed tomography comparison study [12] Evaluation of normal morphology of mandibular condyle: A radiographic survey [13] Reveal the concealed–Morphological variations of the coronoid process, condyle and sigmoid notch in personal identification [14] Shape and symmetry of human condyle and mandibular fossa [15] Age-related changes in the human mandibular condyle: A morphologic, radiologic, and histologic study [16] Condylar changes and its association with age, TMD, and dentition status: A cross-sectional study

Introduction

Knowledge of the anatomy and shape of the temporomandibular joint (TMJ) is essential to avoid confusing a normal condition with a disorder. The temporomandibular joints are unique [1]. Although these joints are anatomically two distinct joints, they act together as a single unit [2]. Each condyle is articulated with the mandibular cavity of the temporal bone. A disc consisting of cartilaginous fibrous tissue is located between the condyle and the mandibular cavity. A fibrous capsule covered with a synovial membrane surrounds this joint. Ligaments and muscles restrict movement or allow the condyle to move [1].

The condyle is a bony, oval structure that connects to the Ramos mandible through a narrow neck. The approximate length of the condyle is 20mm in the medullary dimension and 10-8 mm in the anterior-posterior dimension [1, 3]. The shape of the condyle varies considerably. The upper view may be flat, round, or slightly convex, while the mediolateral view is usually slightly convex [4]. This variation in shape may cause problems in radiographic interpretation. This emphasizes the importance of knowing the range of normal appearance [2, 5].

Various conditions such as osteoarthritis and internal disorders of the disc can affect this joint and cause skeletal deformity, malocclusion, and dysfunction of the masticatory system [6]. In some studies, condyle shape is suggested as an etiological factor in causing internal joint disorders [7]. TMJ diagnostic imaging techniques include panoramic transcranial radiographs, tomography, arthrography, computed tomography, and MRI. In patients with clinical signs suggestive of TMJ disorder, the first diagnostic method is panoramic imaging [8]. Panoramic radiography is the most widely used for the diagnosis and treatment of maxillofacial diseases due to its low radiation content, availability, and ease of use. Various studies have been performed to study the dimensions of the condyle and its surrounding structures, while little attention has been paid to the shape of the condyle and its relationship to joint disorders [9].

Ara *et al.* Showed that the condyle morphologies changed with age and the type of morphologies varied according to the type of disease [10]. The morphology of the condyle varies according to the race of the population in different places and the evaluation of morphologies can be effective in diagnosing the pathogenesis and type of treatment of patients [3, 4].

So far, no studies have been conducted in Ahvaz regarding the morphology of the condyle. Determining morphologies in the population of Ahvaz can help determine diseases in dentists. Due to the importance of recognizing the natural shape of the TMJ in panoramic images, in this study, the researchers decided to evaluate the condylar shape in terms of age and sex in panoramic images of patients referred to the radiology center located at Ahvaz Jundishapur University of medical science.

Material & Methods

This is a study on images of patients referred to the Maxillofacial Radiology Center of Ahvaz University of Medical Sciences in 2021. The research subjects were patients who had the mandible radiology record in the archives of the Radiology Center of Ahvaz Dental School in Khuzestan province located in southeastern Iran from 2018 to 2021. The sample size was calculated based on the following formula according to $Z_{1-\alpha/2} = 1.96$, P=0.5, d= 0.08:

$$n = \frac{{Z_{1-\alpha/2}}^2 \, P(1-P)}{d^2} = 151$$

Panoramic images related to the condyle morphology of 151 patients were examined. Samples were selected as available. Inclusion criteria included appropriate image quality. Exclusion criteria included poor quality images, the presence of lesions or fractures in the condylar area, the existence of TMJ disease, and the presence of oral diseases.

Data collection form included age, sex, and type of condyle morphology. The morphologies of the round, diamond, finger, and bird beak were examined. The digital panoramic images were taken by a VATECH.PEH 2500 panoramic device (South Korea). The images under the supervision of a maxillofacial radiologist with 10 years of experience were viewed on a Samsung 14 monitor and evaluated in terms of condyle shape (round, bird beak, crooked finger, and diamond), age and sex.

SPSS 16 software was used for data analysis. The Chi-square test was used for the statistical analysis of data. p-value less than 0.05 were considered as significant differences.

Findings

Panoramic images of 151 patients with a mean age of 37.71±5.1 were examined. Most of the patients were males and in the age group of 30-39 years.

In Females, the highest frequency of condyle shape was related to a round shape (43.3%) and the lowest frequency was related to the diamond shape and bird beak (16.2%). Also in males, the highest frequency of condyle shape was related to a round shape (51.9%) and the lowest was related to a diamond shape (7.8%). There was no statistically significant difference between the two sexes (Table 1).

The majority of round morphology was in the age group under 30 years, and the lowest were in the age group of 30-39 and over 50 years. No statistically significant relationship was found between age groups and condyle morphological type (Table 2).

Table 1) Frequency distribution of condyle morphology of patients by sex (the numbers in the parentheses are in percent)

Shape	Male	Female	p.
Round	40 (51.9)	32 (43.3)	0.29
Diamond	6 (7.8)	12 (16.2)	
Finger	15 (19.5)	18 (24.3)	
Bird beak	16 (20.8)	12 (16.2)	
Total	77 (100)	74 (100)	

Table 2) Frequency distribution of condyle morphology of patients based on age (the numbers in the parentheses are in percent)

Shape	<30	30-39	40-49	>50	p.
Round	23 (60.5)	18 (40.0)	21 (48.8)	10 (40.0)	0.23
Diamond	5 (13.2)	6 (13.3)	4 (9.3)	3 (12.0)	
Finger	3 (7.9)	9 (20.0)	12 (27.9)	9 (36.0)	
Bird beak	7 (18.4)	12 (26.7)	4 (16.0)	3 (12.0)	

Discussion

In the present study, the shapes of the condyle observed in the panoramic images include round, diamond, finger, and bird's beak. The results showed that the frequency of round shapes is more frequent than other shapes. On the other hand, the shape of the condyle was evaluated based on gender. The results showed that round bird beak shapes were more common in men than women. On the other hand, it was shown that diamond and finger shapes were more in women than men, however, it was shown that these differences were not statistically significant.

Arayapisit *et al.* conducted a study to evaluate changes in the shape of the mandibular condyle in panoramic images at Mahidol University in Thailand. In this study, smooth, point, angular, round, and irregular shapes were observed among patients. Based on the data, the results showed that the round shape was more in men than women, which was statistically significant The results of this study were consistent with our study(according to the condyle morphology) [11]. Singh *et al.* conducted a study to evaluate the morphology of condyles in patients referred to dental clinics at Kerala University in India. The results of this study showed that there were round, dotted, angled, and smooth shapes among the subjects. The results showed that the frequency of round shapes is higher than other shapes in individuals, which was consistent with our study. It was also shown that the round shape was more present in women compared to men. This result was not in line with the results of our study because the round shape was more common in our study in men than in women. This could be due to racial differences and differences in the sample size [12].

Sahithi *et al.* conducted a study using morphological diversity of the shape of the coronoid appendage, condyle, and sigmoid fissure in the individual identification of individuals at Vishnu University in India. In this study, 200 OPG images were taken to compare condyle shapes in both sexes. In this study, it was shown that these shapes varied in patients depending on their condition. Based on this, it was shown that angular and round shapes were the most known shapes in men and women, respectively. Finally, it was concluded that using panoramic images, the unknown aspects of the condyle shape can be evaluated and people can be identified based on it. The results of this study were not in line with the results of our study because in our study the aim was to evaluate the normal morphology of the condyle while in the Sahithi *et al.* study the study of mandibular changes in patients with age [13]. Also, Ribeiro *et al.* conducted a study to evaluate the condyle shape of lateral, posterior, and superior views in adults and to compare them between men and women at the University of Sao Paulo in Brazil. Round condyles had the highest frequency in the lateral view (57%) and posterior views (53%), and the mixed shape (59%) had the highest frequency in the upper view, and no significant difference was observed between the two sexes in terms of shape. The results of this study were not in line with our results, which could be due to the low sample size [14].

Age is another factor that affects the shape of the condyle. According to studies, the prevalence of diseases and disorders increases with age. These diseases can affect the type of condyle and its morphology. In addition, exposure to different environmental conditions in old age can affect the shape of the condyle with more underlying diseases [15]. The present study showed that in the age range of 30 years, the round shape of the condyle was more compared to other shapes, while in the age range of 30-39 years, the diamond shape was in the age range of 40-49 years, the finger shape was in the age range. 30-39 years and the shape of the bird's beak is more common than other forms. However, these differences were not statistically significant. In the study by Arayapisit *et al.* it was shown that round shape in people under thirty years (age range between 20 to 29 years) has the highest frequency compared to other morphologies such as angular, smooth, point and irregular. The results of this study were in line with the results of our study [11]. Mathew *et al.* conducted a study to evaluate the morphology of the mandibular condyle and its association with age and TMD at Kerala University in India. 75 patients participated in this study. The rate of morphological changes in patients was 81% and the clinical signs of TMD in patients were 18.6%. The results showed that the morphological abnormalities of the mandibular condyle were more visible in panoramic images with age. After evaluations, the results showed that smooth morphology was more observed in group C compared to the other two groups. The results of this study are different from our study in terms of morphology. This difference can be due to the choice of type of people to participate in the study as well as different races of people [16].

One of the limitations of this study is that the sampling method is not random and can reduce the generalizability of data to the population. It is better

to study more sample sizes in future studies and randomization of sampling should be considered. The relationship between morphologies and the type of disease of patients should also be investigated.

Conclusion

Round morphology was higher in all populations than in other morphologies. Also, its prevalence was higher in both sexes than in other morphologies. However, no significant relationship was observed between them.

Acknowledgments: None declared.

Ethical Permissions: All the procedures performed in the studies involving human participants were under the ethical standards of the local ethics committee of Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1399.679), as well as 1964 Helsinki declaration. Written informed consent was obtained from all patients and normal subjects.

Conflicts of Interests: None declared.

Authors' Contributions: Zaheri T (First Author), Introduction Writer/Main Researcher/Methodologist (40%); Dabbaghi A (Second Author), Assistant Researcher/Methodologist/Data Analyst (20%); Daneshnia T (Third Author), Introduction Writer/Main Researcher/Discussion Writer (40%).

Funding/Support: This work was financially supported by grant U-99268 from the vice chancellor for research affairs of Ahvaz Jundishapur University of Medical Sciences in Ahvaz, Iran.

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