

Review Article

A PANORAMIC STUDY OF THE MANDIBULAR CONDYLE MORPHOLOGY

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ABSTRACT

Objectives: The study aims to evaluate mandibular condyle morphology, gender peculiarities, population predominant shape, and symmetry between condyles in Peshawar district, Khyber Pakhtunkhwa, through visual inspection.

Materials and Methods: A Descriptive cross-sectional study was conducted at Rehman College of Dentistry in Peshawar from February to April 2019. The study included 380 individuals aged 15-35, with 760 condyles. The participants had fully erupted, periodontally healthy teeth and sound temporomandibular joints. The study classified mandibular condyle morphology into four types: oval, bird beak, diamond, and crooked finger.

Results: The study found that the majority of condyles (52.4%) were round/oval, followed by bird beak (24.5%), diamond (24.6%), and crooked finger (12.6%). Females had no significant difference in condyle symmetry, with 188 condyle pairs symmetric.

Conclusion: OPG, a low-dose imaging prescription, provides valuable insights into condyles, particularly oval-shaped ones in both sexes. Expanding sample sizes could increase population-specific information and forensics interest.

Key words: Condylar morphology, condylar abnormalities, Mandibular condyle, Panoramic radiography, temporomandibular joint (TMJ), Morphology, TMJ disorders, panoramic imaging technique

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INTRODUCTION

The temporomandibular joint (TMJ) is a very complex structure of the human body and is an important component of the masticatory system that is helpful in various functions, including chewing, speaking, and deglutition¹. The main apparatus of

TMJ are the glenoid fossa, condylar process, articular eminence, and articular disc². The crucial anatomic part of the mandible is the condyle that is accountable for mandibular bone growth³.

It is of utmost importance to have a comprehensive knowledge of the morphology and anatomy of the mandibular condyle in order to differentiate the pathological conditions from the normal conditions. For this reason, a radiographic examination is necessary for processing the bony changes and abnormalities that can affect the TMJ⁴. Several types of radiographic techniques can be used for the examination of the mandibular condyle, but the most common among them is the panoramic radiograph

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viewed with visual inspection⁵. It is easily available, with low radiation doses and is economical. It is the best screening method for TMJ examination⁶.

The mandibular condyle is subject to morphological changes in life due to increasing age⁷, facial type⁸ malocclusion type⁹ gender, right and left symmetry¹⁰, and functional load¹¹. Several studies have been conducted to evaluate the morphological shapes of the heads of mandibular condyles by observing OPGs with visual inspection; variations were observed in the condylar shapes by these researchers^{4,10,12}.

As far as we are aware, none of the studies to date has taken the same proportion of male and female. This imbalance may limit the reliability of gender-based comparisons, as unequal representation can introduce bias and obscure true differences in condylar shapes. Since sexual dimorphism plays a significant role in craniofacial morphology, it is essential to ensure equal representation of both sexes when evaluating gender differences. Therefore, in the present study, an equal proportion of males and females was deliberately included to facilitate a more valid and meaningful comparison. The objectives of the current study are to assess the morphology of the mandibular condyle, i.e., whether there is a peculiarity in either gender; determine the dominant shape in the population; and find the symmetry between condyles of the left and right sides among people of the Peshawar district in Khyber Pakhtunkhwa by analyzing their OPGs manually.

MATERIALS AND METHODS

A Descriptive cross-sectional study was approved by the Ethical Review Committee of Rehman College of Dentistry, Peshawar vide EC Ref No. RCD-07-24-135 dated 5th March 2024) at Rehman College of Dentistry from 1st February to 30th April 2019. Non-probability purposive sampling was performed. Sample size came out to be 380 individuals (760 condyles) aged between 15-35 years (190 females, 190 males) by using the OPENEPI calculator for sample determination. OPGs of individuals having fully erupted, periodontally healthy sets of teeth (maxillary and mandibular) and sound temporomandibular joints were included. Individuals with a history of trauma to TMJ, a disorder of TMJ, the presence of a bony lesion in the maxilla and mandible, a history of orthodontic treatment, and

errors in radiography technique, and an impacted mandibular condyle were excluded.

The OPG machine CS 9000 (Care stream Dental, Atlanta, GA) operated at 10 mA, 64 kV, and a 12-sec exposure time. Individuals were positioned with reference to instructions delivered by the manufacturer, and radiations were passed. These radiographic images were in JPEG file format, which is an extension for graphics files. These images were examined with visual inspection and hence determined the condylar shapes, symmetry, and peculiarity in either gender of 760 condyles (380 individuals).

Mandibular condyle morphology was classified according to these 4 shapes (Figs. 1 to 4):

Classification of mandibular condyle was done according to the previous study (Chaudhary et al. 2015) (Fig. 1).

SPSS 21 was used to examine the gathered data. To determine the significance level of relationships, the chi-square test was used. A p-value of less than 0.05 was deemed significant with power of 80%.

RESULT

Among the 760 condyles, the most common shape observed was round/oval (199, 52.4%), followed by bird-beak (93, 24.5%), diamond (48, 12.6%), and the least common was crooked-finger (40, 10.5%). The differences were statistically significant ($p < 0.05$). There was insignificant difference between females (94.2 %) and males (90%) in the symmetry of condyral shapes (Tables I and II).

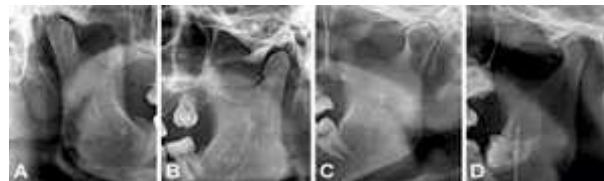


Fig 1: Type 1: Oval shape ; Type 2: Bird beak shape; Type 3: Diamond shape and Type 4: Crooked finger shape

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.530a	3	.057
Likelihood Ratio	6.635	3	.084
N of Valid Cases	380		

Table 1: Symmetry of the condyles among male and female

Condylar shape		Gender				
		Female		Total	Male	
		symmetrical	Asymmetrical		Symmetrical	Asymmetrical
	Total	Count	Count		Count	Count
Oval shaped condyle	110	104	6	89	84	5
Birdbeak condyle	47	45	2	46	42	4
Diamond shaped	19	19	0	29	22	7
Crooked finger shaped	14	11	3	26	23	3

Table 2: symmetry in gender distribution and condyles in different shapes

		Gender			Condylar shape			
		Male	Female		Oval shaped condyle	Birdbeak shaped condyle	Diamond shaped condyle	Crooked finger shaped condyle
Symmetrical	Count	171	179	count	188	87	41	34
	% within the gender	90%	94%	% within condylar shape	94.5%	93.5%	85.4%	85.0%
Asymmetrical	Count	19	11	count	11	6	7	6
	% within the gender	10%	5.8%	% within condylar shape	5.5%	6.5%	14.6%	15.0%

DISCUSSION

Understanding the morphology of the temporomandibular joint (TMJ) can help one better comprehend growth and development, including phylogenetic elements and the skeleton's ability to remodel bone^{13,14}. The mandibular condyle's appearance differs widely in appearance between individuals. Four primary forms of human mandibular condyles can be distinguished: oval, birdbeak, diamond, and crooked finger¹⁵. Condyle morphologic abnormalities can be brought on by radiation therapy, endocrine disorders, trauma, remodeling, developmental differences, and other illnesses¹⁶.

Shapes were classified by looking at structure in the orthopantomographic records obtained from our records of 760 condyles of 380 patients. Several previous studies¹⁷⁻¹⁹. have been done on the morphological shapes of the mandibular condyle based on gender. According to our study, the distribution of condylar shapes showed a greater frequency of the rounded shape in orthopantomogram (52.4%), followed by the birdbeak (24.5%), diamond-shaped (12.6%), and crooked finger (10.5%) types, respectively. Several studies show an agreement with our result.

Anisuzzaman et al. discovered that while oval shapes were the most prevalent (68%), bird beak

shapes were the second most common (20%) in their study of the Bangladeshi population⁴. 200 pairs of condylar heads were analyzed in a different study by Vahanwala et al. The results showed that 60% of the heads had oval shapes, 29% had bird beak shapes, 9% had diamond shapes, and 2% had crooked fingers¹⁰. This pattern resembles our findings, particularly in the predominance of the oval/rounded form, although the relative proportions differ across populations. For instance, while our study found crooked finger morphology in 10.5% of cases, Vahanwala et al. reported only 2%, which may reflect ethnic and geographic variation, sample size differences, or methodological differences in shape classification.

Other regional studies have also demonstrated comparable results but with variations in frequency. Öztürk et al¹⁷ in a Turkish population observed oval shapes as the most frequent, followed by bird beak and diamond, whereas Arayapisit et al¹⁸ emphasized that panoramic images tend to overestimate oval shapes when compared with CBCT, highlighting the role of imaging modality in determining morphology. Jean et al¹⁹, in a Malaysian population, also reported oval as the dominant type, reinforcing the global consistency of oval prevalence, although exact percentages differed. Taken together, these comparisons suggest that while the oval/rounded condyle

is consistently the most prevalent morphology, the distribution of

We found that nearly two-thirds of the participants in this study had the same condyle morphology on both sides. It was found that this frequency was similar to what Oliveira et al²⁰ Their CBCT-based study showed that symmetry was more likely in rounded shapes, while asymmetry was more common in mixed morphologies. This aligns with our observation of high bilateral similarity in rounded condyles, indicating that symmetry may be a biologically stable feature of this morpholo

Many researchers have looked at the symmetry and nonsymmetry in the three perspectives, and they have found some interesting results for both structures in the lateral view: the mixed shape shows nonsymmetry, and the rounded form shows symmetry¹⁶. Again, two-dimensional radiographs depict the three-dimensional TMJ. As a result, several positional factors must be taken into account, especially in light of the condyle's anatomic tilt. Among the many innovative techniques that have recently been developed that can offer comprehensive information on the condyle is cone beam volumetric imaging²¹. Future research incorporating CBCT or 3D imaging could help validate our findings and clarify whether the differences between studies are due to true population variation or methodological limitations of panoramic radiography.

This study's shortcomings include the fact that only one center's study sample was used, which means it might not reflect the entire community.

CONCLUSION

Orthopantomogram (OPG) is a widely preferred imaging modality because of its low radiation exposure and ease of use. Evaluation of the mandibular condyle on OPG provides valuable diagnostic information. The oval shape was identified as the most common condylar morphology in both males and females. Future studies with larger sample sizes and additional parameters are warranted to generate population-specific data and support potential forensic applications

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design: SS. MAS, MR, ZA, AA, AU

Acquisition, Analysis or Interpretation of Data: SS. MAS, MR, ZA, AA, AU

Manuscript Writing & Approval: SS. MAS, MR, ZA, AA, AU

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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