Original Research Article

Assessment of mandibular condylar morphology through digital panoramic radiograph: A radiographic study

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ABSTRACT

Background: The temporomandibular joint is one of the most intricate human articulations (TMJ). Each joint is made up of a mandibular condyle and its associated temporal cavity (glenoid fossa and articular eminence). Human mandibular condyle morphology can be divided into six types: Type I: Oval; Type II: Flattened; Type III: Diamond; Type IV: Crooked finger; Type V:Bifid and Type VI: Bird beak. The mandibular condyle appears in several different age groups and individuals in many distinct ways. Condyle remodelling to account for developmental variations, malocclusion, trauma, and other developmental illnesses and diseases are all examples of developmental disorders and diseases that can result from simple developmental variability. Panoramic radiography has been recommended as a screening tool for TMJ patients, and it may be useful to spot major bone abnormalities in the condyle.

Aims and Objectives: The aim of the current study is to observe and record the variations in condyle forms in Punjab (North India) using an Orthopantomographs (OPGs), which were crucial for patient treatment in several branches of dentistry.

Materials and Methods: This retrospective study comprised radiographic evaluation of 400 condylar heads after visualising 200 digitalised OPGs taken for routine investigation.

Results: The most common shape of condyle on right observed was oval (43.5%) followed by Bird Beak (20.5%), Diamond (12.5%), Flattened (12%), Crooked finger(6.5%) and Bifid (5%). The most common shape of condyle on left observed was Oval (51%) followed by Bird Beak (15%), Diamond (14%), Flattened (9%), Crooked finger(8%) and Bifid (3%). In Males, the commonest form of left and right condylar morphology was *Oval* and the least form of right condylar morphology was *Bifid*, whereas the least form of left condylar morphology observed was *Bifid* and *Crooked Finger*. In Females, the commonest form of left and right condylar morphology was *Oval* and the least form of left and right condylar morphology observed was *Bifid*.

Conclusion: The aim of this study was to determine the most typical radiographic forms of the mandibular condyle on the OPG. Six various condyle shapes—Oval, Flattened, Bird beak, Diamond, Crooked finger, and bifid—have been identified in the current study, with the oval form being the most prevalent on both sides and in both sexes. Bifid is the least typical shape for the right and left condyles.

1. Introduction

One of the most complex articulations in the human body is the temporomandibular joint (TMJ). It joins the mandible with the skull synchronously and bilaterally. The mandibular condyle, mandibular fossa, and articular

eminences of the temporal bone, as well as the soft-tissue elements of the articular disc, its attachments, and the joint cavity, are specific anatomic components of the TMJ.[1,2]

A mandibular condyle and it's accompanying temporal cavity constitute each joint (glenoid fossa and articular eminence). The TMJ and the tissues that it is connected to are crucial for controlling mandibular mobility and distributing pressures brought on by activities like eating, swallowing, and speaking.[3–5] A physiological process known as condylar remodelling tries to modify the temporomandibular joint's (TMJ) structure to accommodate the demands of function. It is based on how the condyle's ability to adapt interacts with the mechanical forces supported by the TMJ.

It is believed that the TMJ's components continue to change their structure and morphology even after their ability to grow has stopped.[6,7] Varied age groups and people exhibit the mandibular condyle in very different ways. Simple developmental variability may cause morphological alterations, as well as condyle remodelling to accommodate developmental variances, malocclusion, trauma, and other developmental disorders and diseases.[8–10]

Patients with TMJ issues have been advised to use panoramic radiography as a screening technique, and it may be helpful to identify significant bony changes in the condyle.[7,11] The aim of the current study is to observe and record the variations in condyle forms using an Orthopantomographs (OPGs).

2. Material and Methods

This retrospective study comprised radiographic evaluation of condylar heads after visualising 200 digitalised OPGs taken for routine investigation. Ethical approval was taken for this study. In the study, patients who underwent conventional OPGs for the diagnosis of surgical (for impacted teeth), or orthodontic issues totaled 200 Orthopantomographs were included. The study excluded patients with a history of trauma to the maxillofacial region, panoramic radiographs showing pathology (osteomyelitis, osteoporosis etc.) in the mandible or maxilla, racture plating, Odontogenic cysts or tumors of the jaws, completely or partially edentulous dental arches, TMJ dysfunction and developmental disorders including hemifacial atrophy and Mandibular condyle imaging affected by a radiography technique error. Radiographs of 117 females and 83 males with ages ranging from 18 to 60 were included in the study.

200 digitalized OPGs were collected for analysis to visualise the radiographic evaluation of 400 condylar heads. Selected digital orthopantomograms (OPG) gave a complete view of the condyle on either side with the best density and contrast. All the OPG's were taken by Digital Orthopantomograph machine, with exposure conditions of 10 mA and 85 kV Max.

The sample was divided into groups based on age and gender. There were three age ranges determined: (i) Young Adults (18–35 years), (ii) Middle Age (36–55 years), (iii) Older Adults (56 or above).

According to Chaudhary et al. (2015) and Gupta A, Acharya G, Singh H, Poudyal S, Redhu A, Shivhare P,[12] the mandibular condyles' morphology was divided into following shapes. (Figures 1, 2, 3, 4, 5 and 6)

Type I: Oval; Type II: Flattened; Type III: Diamond; Type IV: Crooked finger; Type V: Bifid and Type VI: Bird beak.
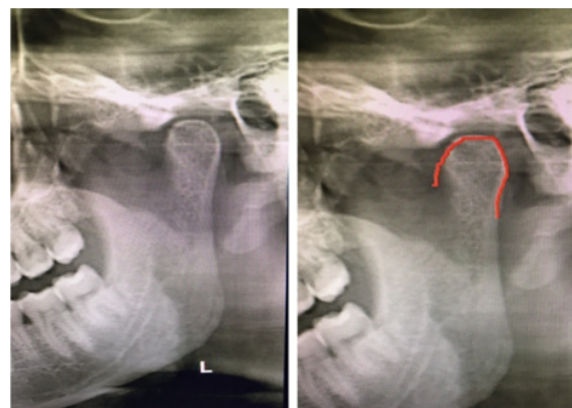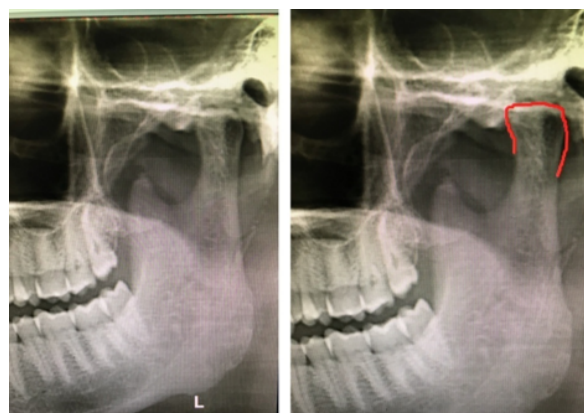

Fig. 1: Round/Oval

Fig. 2: Flattened

The recorded data was then complied and entered in the Microsoft excel; and was analyzed.

3. Results

Total of 200 OPG's were studied, out of which 83 were of males and 117 were of females (Table 1).

As demonstrated in Table 2, the majority of participants with radiographs were in Young Adults (18-35 Years) age groups.

Table 1: Distribution according to gender.

Gender	Frequency	Percentage
Male	83	41.5
Female	117	58.5

Table 2: Demographic distribution according to gender and age

Gender	Age			
	Young adults (18-35 years)	Middle age (36-55 years)	Older adults (56 or above)	Total
Male	53(63,8%)	29(34.9%)	1 (1.2%)	83
Female	88(75.2%)	27(23.07%)	2(1.7%)	117
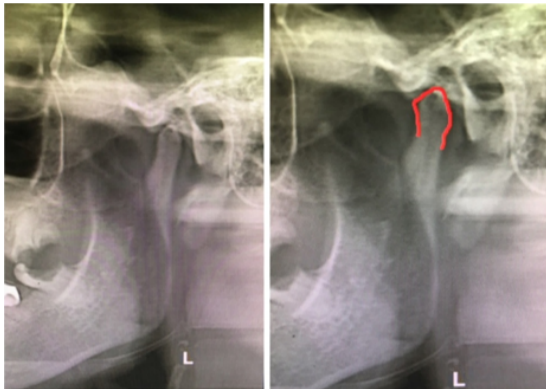
Fig. 3: Diamond/Angles

Fig. 5: Bifid
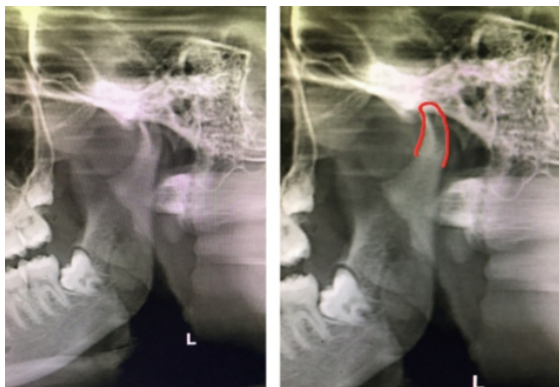
Fig. 4: Crooked finger
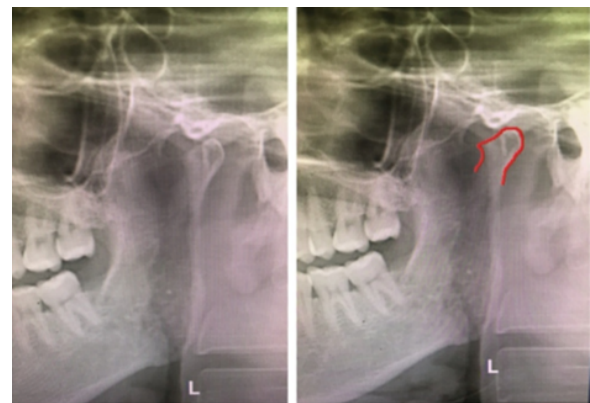
Fig. 6: Bird beak

The most common shape of condyle on right observed was oval (43.5%) followed by Bird Beak (20.5%), Diamond (12.5%), Flattened (12%), Crooked finger(6.5%) and Bifid (5%).[Table 3]

The most common shape of condyle on left observed was Oval (51%) followed by Bird Beak (15%), Diamond (14%), Flattened (9%), Crooked finger(8%) and Bifid (3%).[Table 4]

In Males, the commonest form of left and right condylar morphology was *Oval* and the least form of right condylar morphology was *Bifid,* whereas the least form of left condylar morphology observed was *Bifid* and *Crooked Finger.*[Table 5]

In Females, the commonest form of left and right condylar morphology was *Oval* and the least form of left condylar morphology observed was *Bifid.* [Table 6]

4. Discussion

The condylar process and mandibular head make up the mandibular condyle. The deepest part of the sigmoid notch is connected to the masseteric tuberosity by an extension line that is referred to as the condylar process and head

Table 3: Distribution of variations in the mandibular right condyle.

Right condyle	Frequency	Percentage
Oval	87	43.5
Flattened	24	12
Diamond	25	12.5
Crooked finger	13	6.5
Bifid	10	5
Bird beak	41	20.5
Total	200	100.0

Table 4: Distribution of variations in the mandibular left condyle.

Left condyle	Frequency	Percentage
Oval	102	51
Flattened	18	9
Diamond	28	14
Crooked finger	16	8
Bifid	6	3
Bird beak	30	15
Total	200	100.0

Table 5: Distribution of condylar process shapes in males.

	Shape		Right condyle	Left Condyle
	Oval	Number	36	43
Males		% within males	43.37	51.8
	Flattened	Number	8	6
		% within males	9.63	7.22
	Diamond	Number	13	12
		% within males	15.66	14.45
	Crooked finger	Number	5	4
		% withinmales	6.02	4.81
	Bifid	Number	3	4
		% within males	3.61	4.81
	Bird beak	Number	18	14
		% within males	21.68	16.86
	Total	Number	83	83

Table 6: Distribution of condylar process shapes in females.

	Shape		Right condyle	Left Condyle
	Oval	Number	51	59
Females		% within females	43.58	50.42
	Flattened	Number	16	12
		%within females	13.67	10.25
	Diamond	Number	12	16
		% within females	10.25	13.67
	Crooked finger	Number	8	12
		% within females	6.83	10.25
	Bifid	Number	7	2
		% within females	5.98	1.7
	Bird beak	Number	23	16
		%in males	19.65	13.67
	Total	Number	117	117

subunit. The head, neck, and subcondylar region make up the condylar process and head subunit. [13]

When compared to more modern imaging modalities like CT, MRI, and CBCT, maxillofacial radiography using an orthopantamogram is reported to be more affordable and is utilised as a standard screening tool [14,15] in several sectors of dentistry. [15]

In this study, done in Punjabi population (Northern India), it was observed that the most common shape of the condyle on the right and left side was Oval, which was in accordance with Pranay Ratna et al.' s study. [16]

In our present study, among males and females, the most common shape of the condyle was Oval on the right and left side. This finding supports the result of previous study [17] by Aqeel Ibrahim Lazim Al-Saedi et al., which also concluded that in both males and females of all ages, the oval shape was the most prevalent.

The least common shapes of condyle noted in our study were bifid and crooked finger, which was similarly seen in the previous study by Singh et al. [18] and Gupta A et al. [12]

The second most common shape of the condyle noted in our study was Bird beak on both the sides, which was at contradiction with the results of the study conducted by Nagaraj et al., [19] in which flattened shape was noted as the second most common.

The third most common shape of the condyle seen in our study on both the sides was Diamond, which was similar to the study by Sonal et al. [20]

In our study, it was noted that the fourth most common shape of the condyle was flattened.

The three-dimensional TMJ is depicted in two dimensions on radiographs. Therefore, it is necessary to consider several positional aspects as well, especially when considering the anatomical tilt of the condyle. Condyle information can now be obtained in depth using a number of additional modalities, such as cone beam volumetric imaging and CT scan. [21]

5. Conclusion

This study was done to identify the mandibular condyle's most common radiographic forms on the OPG. In our present study, six different shapes (Oval, Flattened, Bird beak, Diamond, Crooked finger, and bifid) of the condyle is identified, out of which oval shape is the most common on both the sides and is also most common in both the genders. The least common shape of the right and left condyle is Bifid.

6. Source of Funding

None.

7. Conflict of Interest

None.

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