

## Original Article

# Evaluation of Coronoid Process Morphology in Gender Determination Using Orthopantomograms in Western Part of Maharashtra

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ABSTRACT

**Objective of the Study:** To evaluate the morphological variations of the coronoid process using Orthopantomograms in the western part of Maharashtra population.

**Materials and Methods:** The study was carried out using 300 orthopantomograms (OPGs) comprised of both gender, the different shapes of the coronoid process were traced on both the right and left sides. The data obtained were subjected to statistical analysis.

**Results:** The most common shape of the coronoid process was observed to be triangular followed by beak shape, round shape and flat shape.

**Conclusion:** Based on the present study in western population of Maharashtra, triangular shape of coronoid process was most common in males and females.

**KEY WORDS:** *Beak shape, coronoid process, flat shape, round shape, triangular*

## INTRODUCTION

From decades, DNA matching and fingerprint analysis have facilitated in the identification of person. Identification of person actually becomes challenging and difficult when only remnants are available. Gender determination in human bones is most reliable by skull and pelvic bones. When skull remnants are remaining, the identification of person becomes much more challenging; during these cases, mandibular structures play a major role for forensic dentist. The morphological features of mental foramen, height of alveolar bone, position of mandibular foramen, coronoid process, condylar process, and size of dentition help in gender and age determination.<sup>[1]</sup>

In the human body, there are two different structures named coronoid process. The first coronoid process is in the mandible and the other coronoid process is seen in ulna, a long bone which is found in forearm. Coronoid process in both the areas has an appearance of triangular shape. The mandibular coronoid process projects upward and slightly forwards. The margins and medial surface of coronoid process give attachment to temporalis muscle.<sup>[2]</sup> The shape of coronoid process acts as evolutionary marker and is helpful in forensic identification.

In forensic identification, radiographs play an essential role to uncover the hidden facts. Maxillofacial radiographs including orthopantomograms (OPGs) paranasal sinus views, computed tomography (CT), and cone beam CT (CBCT) help in gender determination. Out of all, OPG was found to be less expensive when compared to other advanced imaging modalities such as CT and CBCT. In OPG, different shapes of the coronoid process can often be appreciated bilaterally.

Various *in vivo* and *in vitro* studies have done previously to evaluate the morphological variations of coronoid process in different population of the world.<sup>[2,3]</sup> In this regard, the present study was undertaken to depict variations in morphology of coronoid process in western part of Maharashtra population.

## MATERIALS AND METHODS

The study was conducted in the Department of Oral Medicine and Radiology during March 2015–2016 after obtaining the Institutional Ethical the period from Clearance from Krishna Institute of Medical Sciences, Deemed University. The patients were explained about the objectives of the study, and informed consent was obtained before enrolling them in the study. Patients undergoing conventional OPG for diagnostic, periodontal, surgical (for impacted teeth), or orthodontic purposes were recruited for the study. A total of 328 radiographs were taken, out of which only 300 OPGs were included in the study since 28 radiographs did not meet selection criteria.

### INCLUSION CRITERIA

- Patients aged 20 years and above
- High-quality OPGs with respect to angulation and contrast.

### EXCLUSION CRITERIA

- Patients who have undergone surgical intervention in coronoid region

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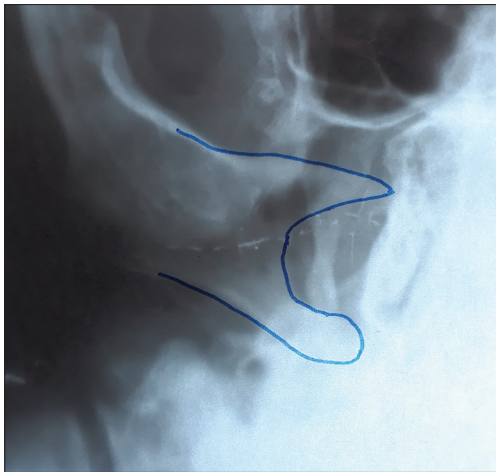
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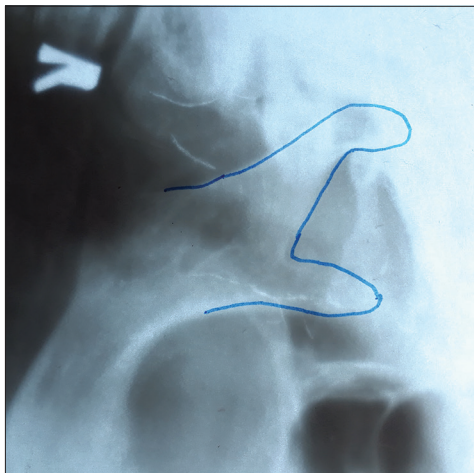
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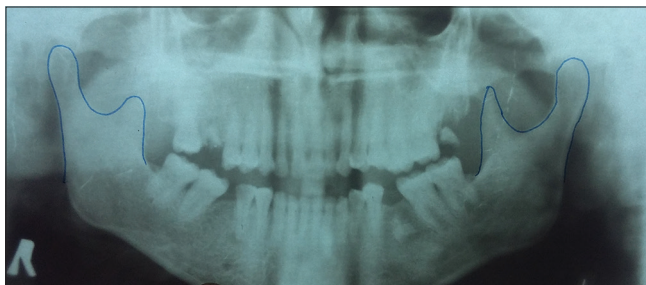
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**Figure 1:** Orthopantomogram showing beak-shaped coronoid process



**Figure 2:** Orthopantomogram showing triangular-shaped coronoid process



**Figure 3:** Orthopantomogram showing round-shaped coronoid process on the right side and beak-shaped coronoid process on the left side

- Patients with disorders affecting bone such as Paget's disease, fibrous dysplasia, and hyperparathyroidism
- Patients with hemifacial malformations
- Patients with previous history trauma in orofacial region.

All OPGs were captured using Xtropan 2000 system (tube potential: 50–85 KV, tube current: 12 mA, and time: 14 s) using Carestream (T Mat GIRA) films. The OPGs were then traced in the coronoid region using marker pencil. The coronoid process shapes were interpreted as given by Shakya

*et al.*<sup>[3]</sup> A total of 600 sides were evaluated and compared for both sides and in both the gender [Figures 1-3].

## RESULTS

Out of 300 OPGs, 178 were males and 122 were females. The most common shape of coronoid process among 600 sides was triangular (340) which was distributed as 180 (60%) on the right side and 160 (53.3%) on the left side. The second common shape was beak shape (136), of which 64 (21.3%) were on the right side and 72 (24%) on the left side and then followed by the round shape (115), of which 51 (17%) were on the right side and 64 (21.3%) on the left side. Flat-shaped coronoid process was the least common accounting for 9, which was slightly more on the right side (1.6%) [Table 1].

In males, triangular coronoid process was more on the right side about 57.8% than the left side about 54% followed by beak shape and round shape. In females, triangular coronoid process was more common followed by beak, round, and flat shape. In our study, flat-shaped coronoid process was present only in females [Tables 2 and 3].

## DISCUSSION

The coronoid process derived from a Greek word *korone* (meaning crow's beak) is a flat piece of triangular bone projecting upward from the anterior margin of the mandibular ramus.<sup>[10]</sup> In the early stage of mandibular development, coronoid or condylar process cannot be distinguished. At 24 mm stage (55<sup>th</sup> day), these processes begin to be mapped out in membrane, and by 43 mm stage (70<sup>th</sup> day), it will take the form as bony processes. At around 13<sup>th</sup> week of intrauterine life, a strip of cartilage appears along the anterior border of coronoid process which is invaded and displaced by the membrane bone. This cartilage usually disappears before birth but can persist as subcoronoid sutures.<sup>[11]</sup>

In reconstructive craniomaxillofacial surgeries such as orbital floor reconstruction, paranasal augmentation, and temporomandibular joint ankylosis, the coronoid process of the mandible is gaining vital importance as a graft material.<sup>[12,13]</sup> Coronoid process is also being used as a nonmetric skull variant in the assessment of age, gender, race, and species. The clinical and other applications of coronoid morphology are in the field of reconstructive surgery, and anthropology has been well documented in the literature.<sup>[13]</sup>

In the present study, the most common shape of coronoid process was triangular [Figure 2] (56.6%) followed by beak shape [Figure 1] (22.6%) and round shape [Figure 3] (19.1%) with least common as flat-shaped process (1.5%). The results of the present study were similar to studies done by Tapas and Isaac studies in different parts of the world [Table 4].<sup>[7,2]</sup>

Kadam *et al.*<sup>[14]</sup> conducted an *in vitro* study to evaluate the variations in the shape of coronoid process in Maharashtra population and found triangular has most common type followed by hook shape and round type which was in accordance with our study.

Shakya *et al.*<sup>[3]</sup> and Sahithi *et al.*<sup>[9]</sup> conducted a retrospective study using OPGs radiographs to analyze the morphological

**Table 1: Sidewise distribution of coronoid process shapes**

	Right (%)	Left (%)	Total (%)
Triangular	180 (60)	160 (53.3)	340 (56.6)
Beak	64 (21.3)	72 (24)	136 (22.6)
Round	51 (17)	64 (21.3)	115 (19.1)
Flat	5 (1.6)	4 (1.3)	9 (1.5)
Total	300	300	600

**Table 2: Shapes of coronoid process in males (178)**

	Right (%)	Left (%)	Total (%)
Triangular	103 (57.8)	96 (54)	199 (55.8)
Beak	39 (22)	44 (24.7)	83 (23.3)
Round	36 (20.2)	38 (21.3)	74 (20.7)
Flat	0	0	0
Total	178	178	356

**Table 3: Shapes of coronoid process in females (122)**

	Right (%)	Left (%)	Total (%)
Triangular	77 (63.1)	64 (52.4)	141 (57.8)
Beak	25 (20.4)	28 (23)	53 (21.7)
Round	15 (12.3)	26 (21.3)	14 (5.7)
Flat	5 (4.1)	4 (3.2)	9 (3.6)
Total	122	122	244

**Table 4: Comparison of various studies of coronoid process with the present study**

Authors	Triangular shape (%)	Hook shape (%)	Rounded shape (%)	Flat shape (%)
Isaac and Holla <sup>[2]</sup>	49	27.4	23.6	-
Khan and Sharieff <sup>[4]</sup>	67	30	3	-
Prajapati et al. <sup>[5]</sup>	54.1	21.2	24.5	-
Nirmale et al. <sup>[6]</sup>	65	28	7	-
Tapas (2014) <sup>[7]</sup>	60	22	18	-
Subbaramaiah et al. <sup>[8]</sup>	14	61.5	12.5	12
Sahithi et al. <sup>[9]</sup>	53.7	8.5	35.7	2
Present study	56.6	22.6	19.1	1.5

variations of coronoid process and found triangular shape as most common type followed by round shape, beak shape, and flat shape. The results of their studies were contradictory to our results [Table 4]. Prajapathi et al.<sup>[5]</sup> conducted a study on dry mandible to study the variations of coronoid process; the results were also in contradictory to our results. Flat-shaped coronoid process was present only in females which accounted for less percentage in our study which was in accordance with the previous study.<sup>[9]</sup>

Morphological variations of anatomic structures occur either corresponding to the developmental discrepancies through hereditary determinants or due to the functional variations that arise during the growth process. Various factors such as attachment and action of temporalis muscle,<sup>[15]</sup> unilateral chewing habit,<sup>[16]</sup> and hormonal factors lead to differences in the shape of coronoid process.

## CONCLUSION

Within the limitations, the present study showed more common shape of coronoid process as triangular followed by beak shape and round shape. Future studies with larger sample size and different age group patients should be conducted.

## FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

## CONFLICTS OF INTEREST

There are no conflicts of interest.

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