

ORIGINAL ARTICLE

Unveiling the concealed: Variation of Condyle, Coronoid & Sigmoid Notch in the local population of Pakistan

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ABSTRACT

Aim: The objective of this study was to evaluate different morphological variations of coronoid, condyle and sigmoid notch using digital panoramic radiographs.

Methods: The study comprised of 409 orthopantomograms (OPG). The different shapes of condyle, coronoid and sigmoid notch was traced and recorded. Both sides were recorded. The data was then subjected to statistical analysis using SPSS 21.

Results: The most common variation for condylar process was angled, whereas for coronoid process it was round. Wide shape sigmoid notch was the most common type reported. No statistical difference in right and left coronoid and sigmoid notch was present.

Conclusion: The variation in shape of condyle, coronoid and sigmoid notch was found different when compared with different ethnicities. Further studies using a larger group of population can give a further evidence if these OPG's can be used as a mean of personal identification.

Keywords: Forensic odontology, condyle, coronoid, mandible.

INTRODUCTION

Forensic odontology deals with examination and documentation of dental remains. This evidence can be used for civil or criminal proceedings and to attain justice. Forensic odontology can also be used for the 'personal identification' of an individual¹.

Teeth and bone are the strongest structures in the human body which remain unchanged for years². Mandible is the largest and strongest bone in the maxillofacial region. It consists of a central body connecting two ramus having condylar and coronoid processes. The condyle and coronoid are separated by the sigmoid notch³. Various morphological shapes of condyle (round, angled, convex or flat), coronoid (triangular, round, beak or flat), sigmoid (wide, round or sloping) have been documented. These morphological changes can be genetic or due to progressive age changes⁴. Previously for forensic odontology bone was used but nowadays radiographs are being explored as they provide an alternative approach to evidence⁵.

Dental radiographs play an important role in the diagnosis, treatment and prevention of various diseases in the oral and maxillofacial region. Radiographs are the most common means of investigation used in dentistry⁶. They not only can be used as a tool in diagnosis but also as a mean of 'personal identification' of an individual. Previously, DNA and fingerprints were used for personal identification but now dental radiographs can provide an alternative option which is simple, easy and cost-effective⁷.

On one hand these records can be used as a mean of personal identification, on the other hand they can be taken as a record for coronoid reconstruction studies in case of trauma, excision and rehabilitation procedures⁸.

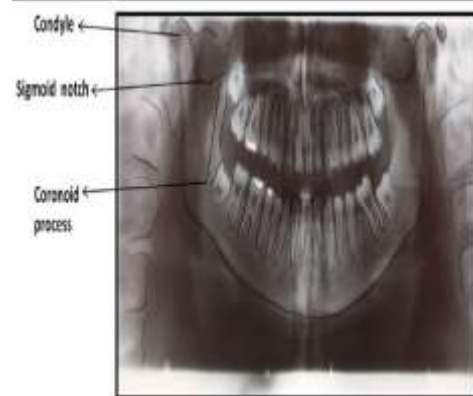
This study aims to identify the different morphological variations in our population with the use of orthopantomograms (OPG) as condyle, coronoid process and sigmoid notch can be viewed simultaneously in relation to each other (Figure 1).

MATERIALS AND METHODS

A cross-sectional study was conducted using OPG from records of Islamic International Dental Hospital. A total of 409 OPGs were taken into consideration after excluding radiographs which did not

meet the criteria. Exclusion criteria included blur and distorted images and syndromic patients. The radiographs were of individuals with ages ranging from 16 - 80years. The study was approved by the ethical committee of the institute. The OPG's were illuminated, the condyle, coronoid and sigmoid notch were traced and interpreted according to criteria given by Shakeye et al and Hedge et al (Figure 2)^{5,9}. The morphological shapes of condyle were documented as round, angled, convex and flat. The various shapes of coronoid process were recorded as triangular, round, beak and flat as shown in figure 3. The variation of sigmoid notch was recorded as sloping round and wide as shown in figure 4. Both sides were recorded separately, and the data was subjected to statistical analysis using SPSS version 21. Chi-square was used to compare the variables. p value of ≤ 0.05 was considered statistically significant.

Figure 1 An Orthopantomogram showing condyle, coronoid process and sigmoid notch



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Figure 2 Morphological shapes of condyle (a) round (b) angled (c) convex (d) flat

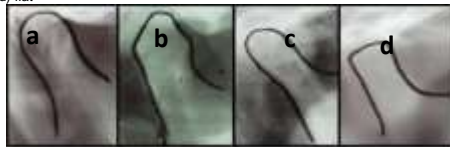


Figure 3 Morphological shapes of coronoid process (a) triangular (b) round (c) beak and (d) flat

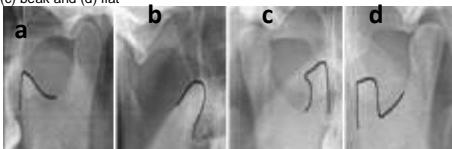
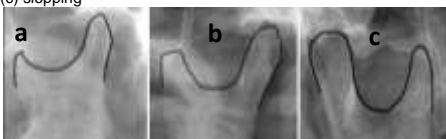


Figure 4 Morphological shapes of sigmoid notch (a) round (b) wide (c) slopping



RESULTS

Amongst the 409 OPG's taken in this study, both sides were observed which corresponded to 818 total sides. Gender-wise distribution revealed 165 males (330 sides) whereas 234 females (468 sides).

The most common morphological variation of condyle was found to be angled (Table 1). On right side 39.2% of the population had angled shape whereas on left 44.1%. The second most common variation was found to be convex shape. Convex condyle was more common in females. It was observed in 88 females whereas only 48 males had convex condyle. The percentage analysis showed 34.2% and 32.6% at right and left respectively. Only 2.3% of the individuals had flat condyle on left side whereas on right 1.5%. However there was no reported flat condyle in females on right side. The distribution of condyle amongst the sides showed statistical difference (p=0.008).

No significance difference was found between the coronoid morphology at right and left side (p=0.78). The most common morphological variation of coronoid was reported to be round. On the right side 67.4% of the individuals had round coronoid process whereas on the left 66% had it. The second most common morphological variation triangular, it was observed in 25.4% and 29.6% at right and left side respectively. The least common morphological variation, it was found to be present in 2.8% and 1.4% on right and left side.

No significant difference was found in the shape of sigmoid notch between right and left side (p=0.68). The most common morphological variation was found to be wide (Table 3). As it was reported in 41.9% and 38.3% on right and left side respectively. The least common type was observed was round. Reported in 28.7% and 23.9% on right and left respectively.

Table 1: Distribution of condyle shape on right and left side

Shape of condyle	Right side	Left side
Round	100	84
Angled	156	176
Convex	136	130
Flat	6	9

Table 2: Distribution of coronoid process shape on right and left

Shape of coronoid process	Right side	Left side
Triangular	92	102
Round	244	229
Beak	10	5
Flat	16	8

Table 3: Distribution of shape of sigmoid notch on left and right

Shape of sigmoid notch	Right side	Left side
Wide	165	146
Slopping	116	144
Round	113	91

DISCUSSION

The cross-sectional study comprised of evaluation of morphological variation of mandible condyle, coronoid and sigmoid notch using OPG's. Previously these studies have been conducted using dry mandible bone¹⁰. However using radiographs provide an easier and cost-effective alternative for assessment of mandibular morphology¹¹. Various studies have been done previously for the assessment of condyle and sigmoid notch on OPG. However no study has been done to assess the prevalence of various morphological shapes of condyle, coronoid and sigmoid notch in our population.

In our study angled shape of the condyle was the most common. Bhupender et al reported round shape condyle as the most common type (57%)¹². Similarly Oleiveria et al has reported round condyle as the most common type being¹³. Both these studies were conducted on Indian population. However Sonal et al study reported angled as the most common (60.2%)¹⁴. The least common condyle shape was flat (2.3%). A study on Iranian population also reported angled condyle as the most common variation with female dominance⁵. This goes in line with various studies reporting flat condyle as the least common type¹⁴. Studies have also revealed that condyle undergoes age related changes. There are osteogenic changes which lead to bone erosion and flattening of the condylar head. Flat condyles have been associated with symptomatic temporomandibular joint disorders¹³.

In this study the most common shape of coronoid was round (67%) with a female predominance (42%). This goes in contrast with the study conducted by Isaac et al who reported triangular shape as the most common and beak shape being the least common¹⁵. Tapas et al conducted a study on dry mandibles and compared it with different ethnicity. It was reported that the prevalence of morphological shapes of coronoid were more versatile as compared to condyle¹⁶. There are multiple factors which effect it, temporalis activity, genetics, uni-lateral chewing habits and aging. Keeping this fact in mind morphological analysis of coronoid head is an important parameter for surgical reconstruction procedures^{10,16}.

In this study the most common variation of sigmoid was wide (41%). This goes in line with the study conducted by Shakya et al¹⁰. However another study by Dar et al on Kashmiri population of Srinagar reported slopping as the most common morphological shape¹⁷.

CONCLUSION

The difference in the results of current study with previous literature suggest that condyle, coronoid and sigmoid process show variation in morphology in different ethnic groups. For further studies it is recommended to observe the age-wise morphological variation of the anatomical structures. Within the limits of this study, it can be said that condyle, coronoid and sigmoid morphology can be combined and used as an aid for 'personal identification'. This will provide an alternative method which are invasive. Provided that previous dental records are maintained. Although OPG is 2-D image and has more chances of error as compared to CBCT. However it is the most common dental investigation done and can be kept in record.

Commented [SG1]: This para is slightly confusing as which anatomical part it is addressing.

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