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Morphological variations of condyle, coronoid process and sigmoid notch in orthopantomograms of Kashmiri population: A retrospective study

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Abstract

Introduction: Radiographs play an essential role in forensic dentistry to uncover the hidden facts that cannot be easily noticed by regular physical examination. Maxillofacial radiography by means of Orthopantomogram is used as a routine screening tool in the diagnosis and treatment planning in various fields of dentistry and is found to be less expensive when compared to other advanced imaging modalities like CT, MRI and CBCT. In a panoramic image, different shapes of the coronoid process, condyle and sigmoid notch can often be appreciated and thus this radiographic data when available as ante mortem records and correlated with the post-mortem records can thereby aid in the identification of a person either living or dead.

Aim of the study: To evaluate different morphological variations of the coronoid process, condyle and sigmoid notch, Using digital orthopantomograms for sex dimorphism and Variations between either sides of the individual.

Material and Methods: 100 digital orthopantomograms were collected retrospectively from the archives of Department of oral medicine and radiology. The different shapes of the coronoid process, sigmoid notch and condyle were traced in computer using windows 10 paint software for both right and left sides.

Results: Based on shape: Most common shape of condyle was Angled and Round. Most common shape of sigmoid notch was Sloping and Round. Most common shape of coronoid was triangular and Round. Based on gender: There is no statistical significance between the shapes of condyle, sigmoid notch and coronoid process based on age. Based on variation on either side: Although they are minor variations on right and left sides of condyle, sigmoid notch and coronoid process, they are almost bilaterally symmetrical in morphology.

Conclusion: The results elucidated in our study suggest that various shapes of the coronoid process, condyle and sigmoid notch depicted by means of panoramic images can thus be used as a quite easier and quicker method for identification of an individual especially in cases of mass disasters, provided when the ante-mortem records are preserved.

Keywords: Morphological, variations, condyle, orthopantomograms, population

Introduction

Identification of an individual has always been a prerequisite not only to certify the death but also for various personal, civil and legal aspects pertaining to the individual's identity. For decades DNA matching, and fingerprint analysis have facilitated in identification of a person [1]. But identification of human actually becomes difficult and challenging when the carcass is completely charred and skeletonized. In such circumstances anthropological and dental analysis play a key role in determining the identity of an individual [4]. The human mandible is considered as the largest and strongest bone in the face, it consists of two ascending rami one on either side that in turn bears the coronoid and condyle process. The coronoid process is a flat triangular plate that projects upwards and slightly forwards [2], whereas the condyle is a rounded projection that articulates with the glenoid fossa of the temporal bone. The sigmoid notch; also called as the mandibular notch is a deep notch separating the coronoid process and the condyle [2].

Different morphological variations of the coronoid process (triangular, round, (triangular, round, beak/hook and flat) [3], condyle (angled, round, convex and flat) [5] and the sigmoid notch (wide, round and sloping) [3] have been documented in literature as indispensable aids in anthropological and forensic studies. These variations occur either due to the genetic background or due to functional changes that occur with the progression of growth. Till date most of these studies have been done using the dry mandibles obtained from the cadavers of the deceased individuals. Radiographs play an vital role in forensic dentistry to uncover the hidden facts that cannot be easily noticed by regular physical examination. Maxillofacial radiography by means of Orthopantomogram is used as a routine screening tool [6] in the diagnosis and treatment planning in various fields of dentistry and is found to be less expensive when compared to other advanced imaging modalities like CT, MRI and CBCT. In a panoramic image, different shapes of the coronoid process, condyle and sigmoid notch can often be appreciated and thus this radiographic data when available as ante mortem records and correlated with the post-mortem records can thereby aid in the identification of a person either living or dead. The need for this study was to accomplish more accessible means for personal identification by comparison of various morphological patterns of the coronoid process, condyle and sigmoid notch with the help of panoramic radiographs pertaining to our geographic area. In this regard, the present study was undertaken to illustrate various morphological discrepancies of the coronoid process, condyle and sigmoid notch in our ethnic group so as to aid in personal identification.

Aim of the study: To evaluate different morphological variations of
 The coronoid process
 The condyle
 The sigmoid notch

Using digital orthopantomograms

- For sex dimorphism
- Variations between either sides of the individual.

Material and Methods

- 100 digital orthopantomograms were collected retrospectively from the archives of Department of oral medicine and radiology. The different shapes of the coronoid process, sigmoid notch and condyle were traced in computer using windows 10 paint software for both right and left sides
- Study sample was divided into 5 groups based on age. 11-20yrs,21-30yrs,31-40yrs,41-50yrs,51-60yrs
- Each group consisted of equal no. of sample from either sex (10M+10F)

Results

Based on shape:
 Most common shape of condyle was Angled and Round figure 1.
 Most common shape of sigmoid notch was Sloping and Round figure 2.
 Most common shape of coronoid was triangular and Round figure 3.

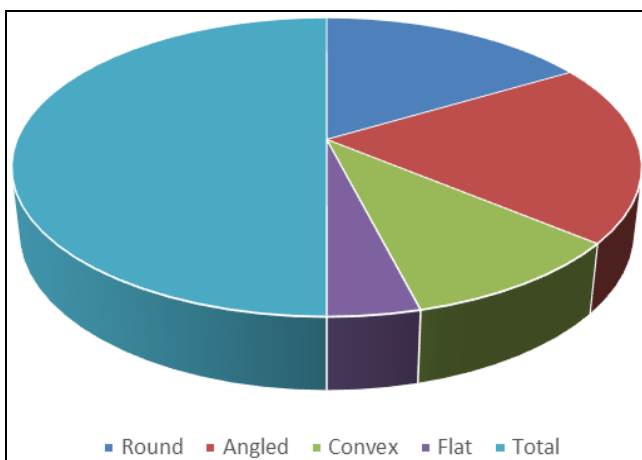


Fig 1: Condyle Frequency

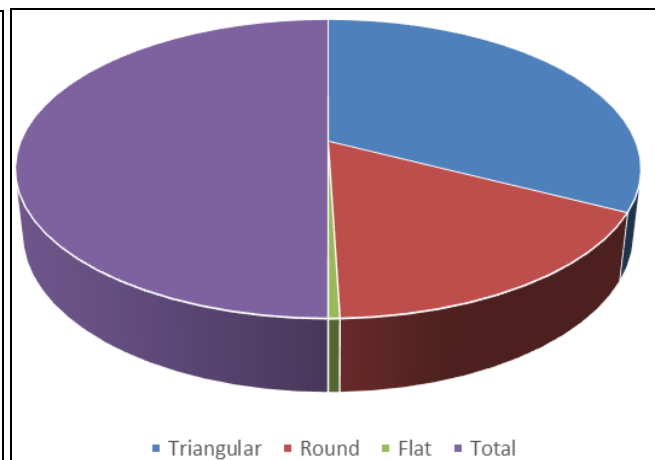


Fig 2: Coronoid process frequency

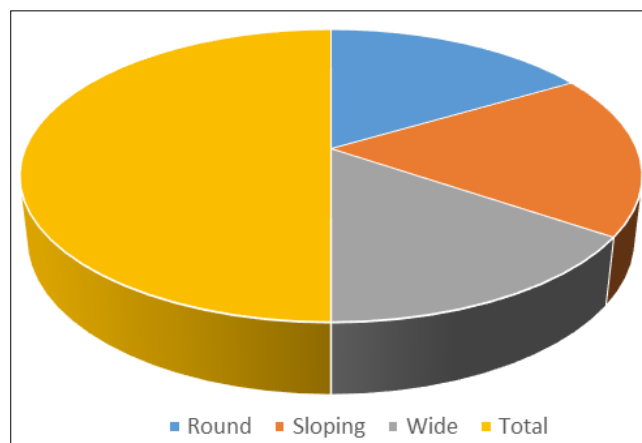


Fig 3: Sigmoid notch Frequency

Based on gender: There is no statistical significance between the shapes of condyle, sigmoid notch and coronoid process based on age.

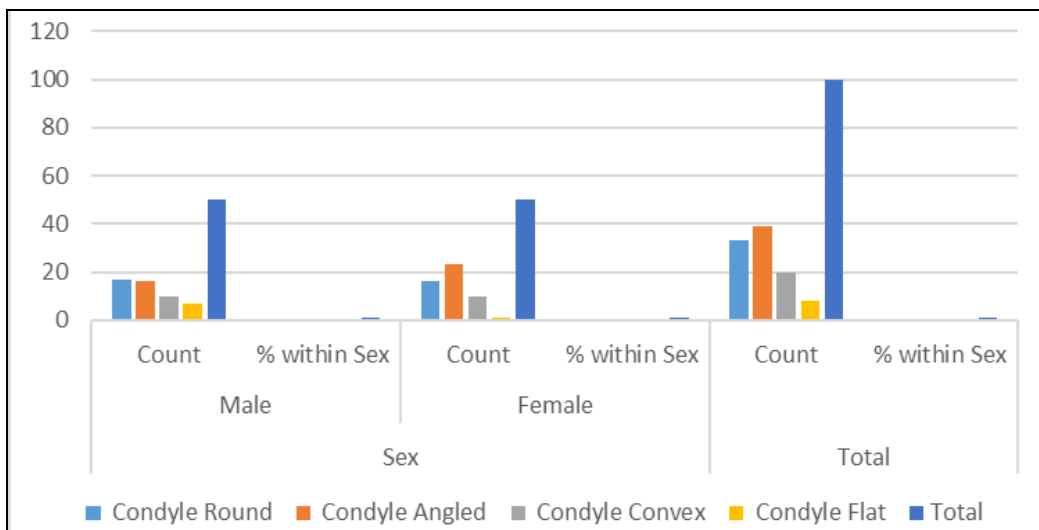


Fig 4: Condyl based on gender

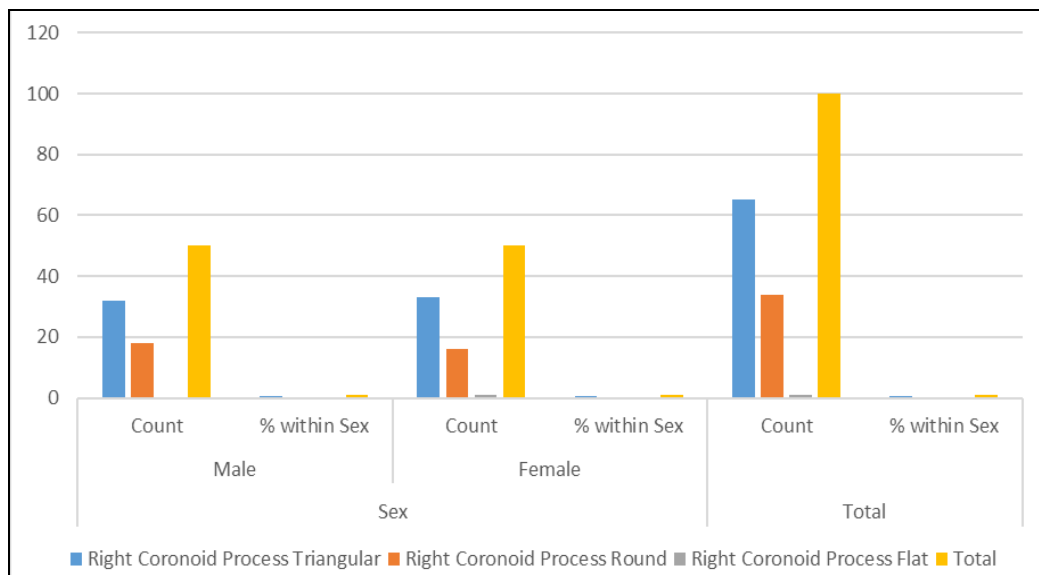


Fig 5: Coronoid process based on gender

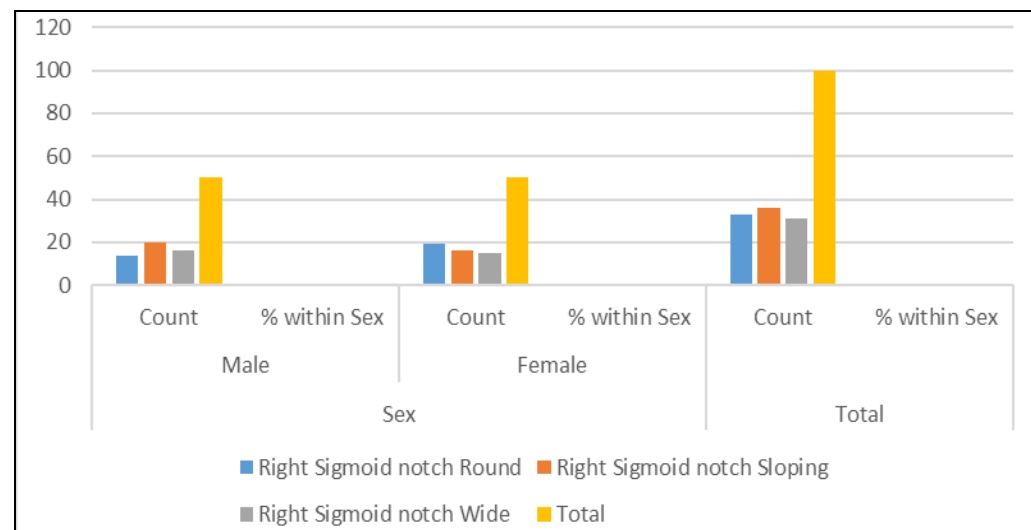


Fig 6: Sigmoid notch based on gender

Based On Variation On Either Side: Although they are minor variations on right and left sides of condyle, sigmoid notch and coronoid process, they are almost bilaterally symmetrical in morphology

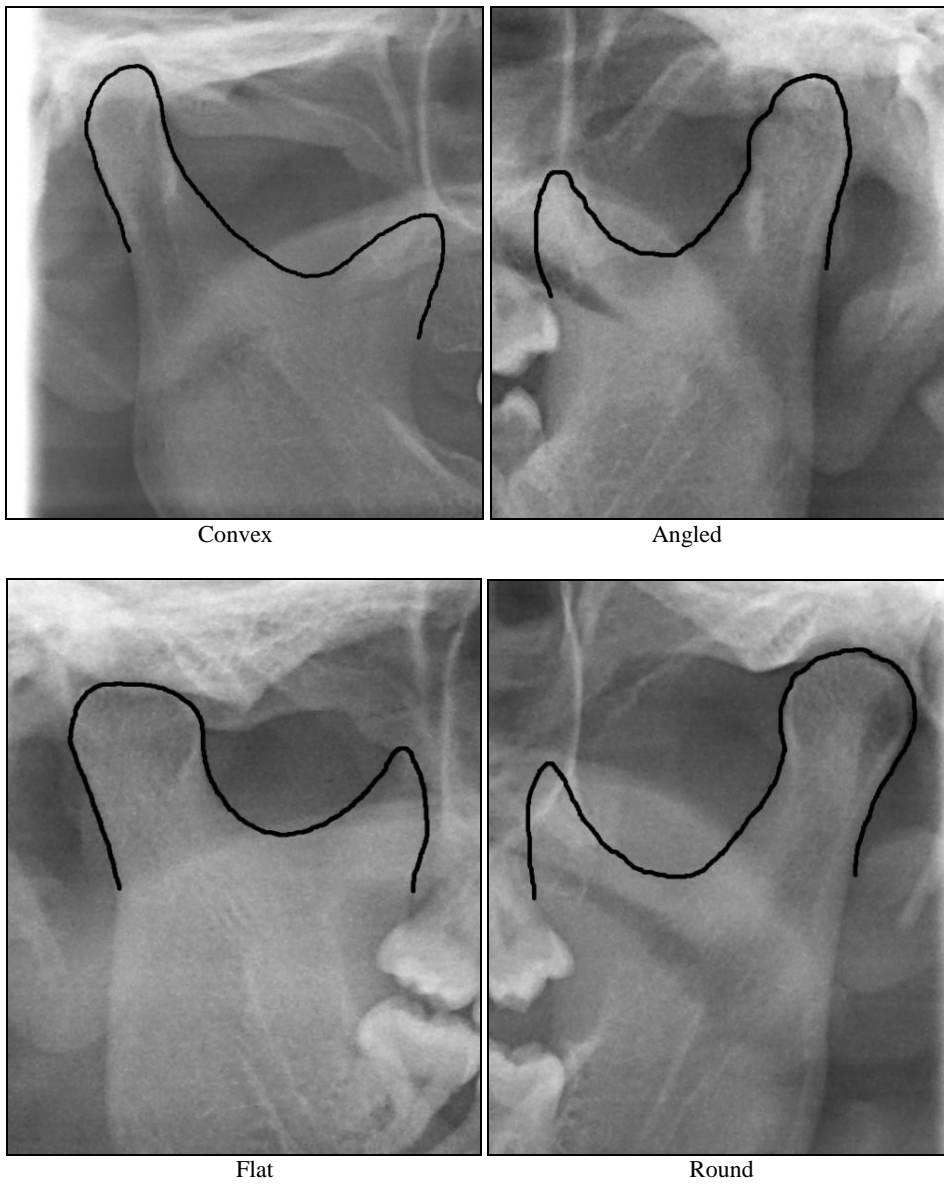


Fig 7: Morphological Shapes: Condyle

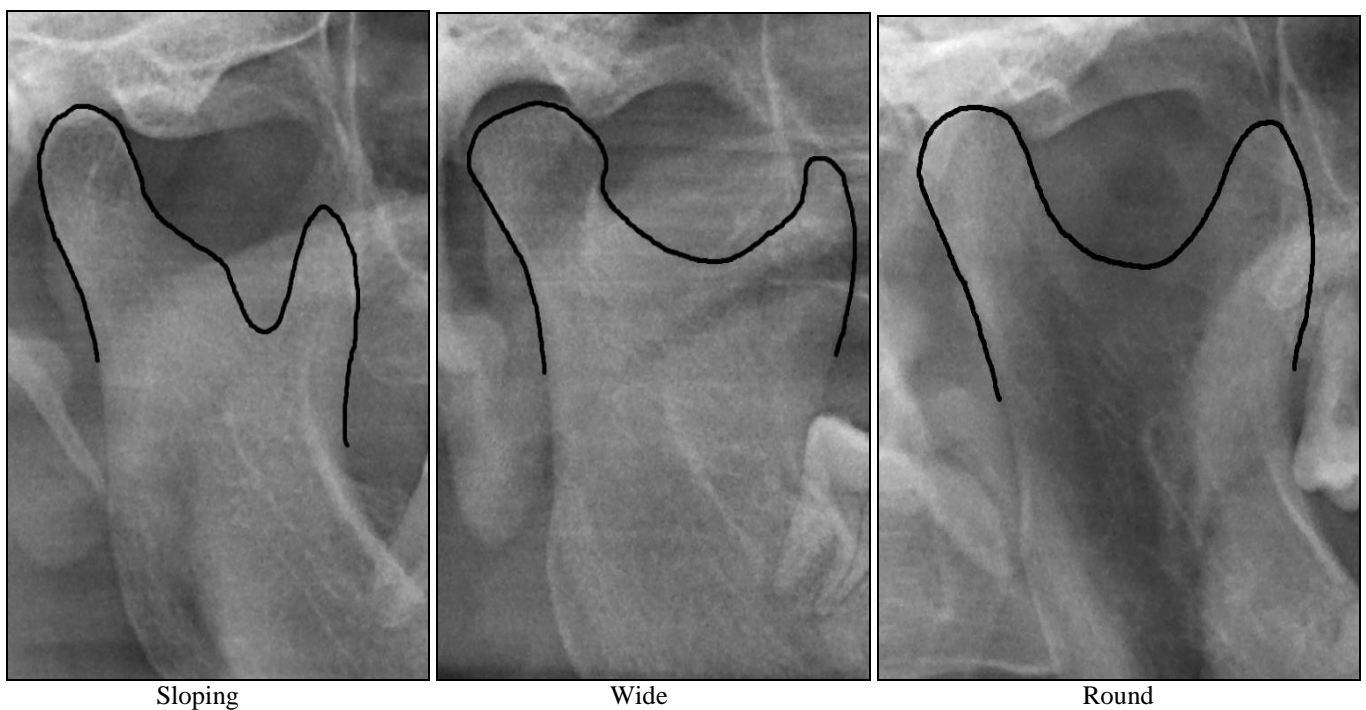


Fig 8: Morphological Shapes: Sigmoid notch

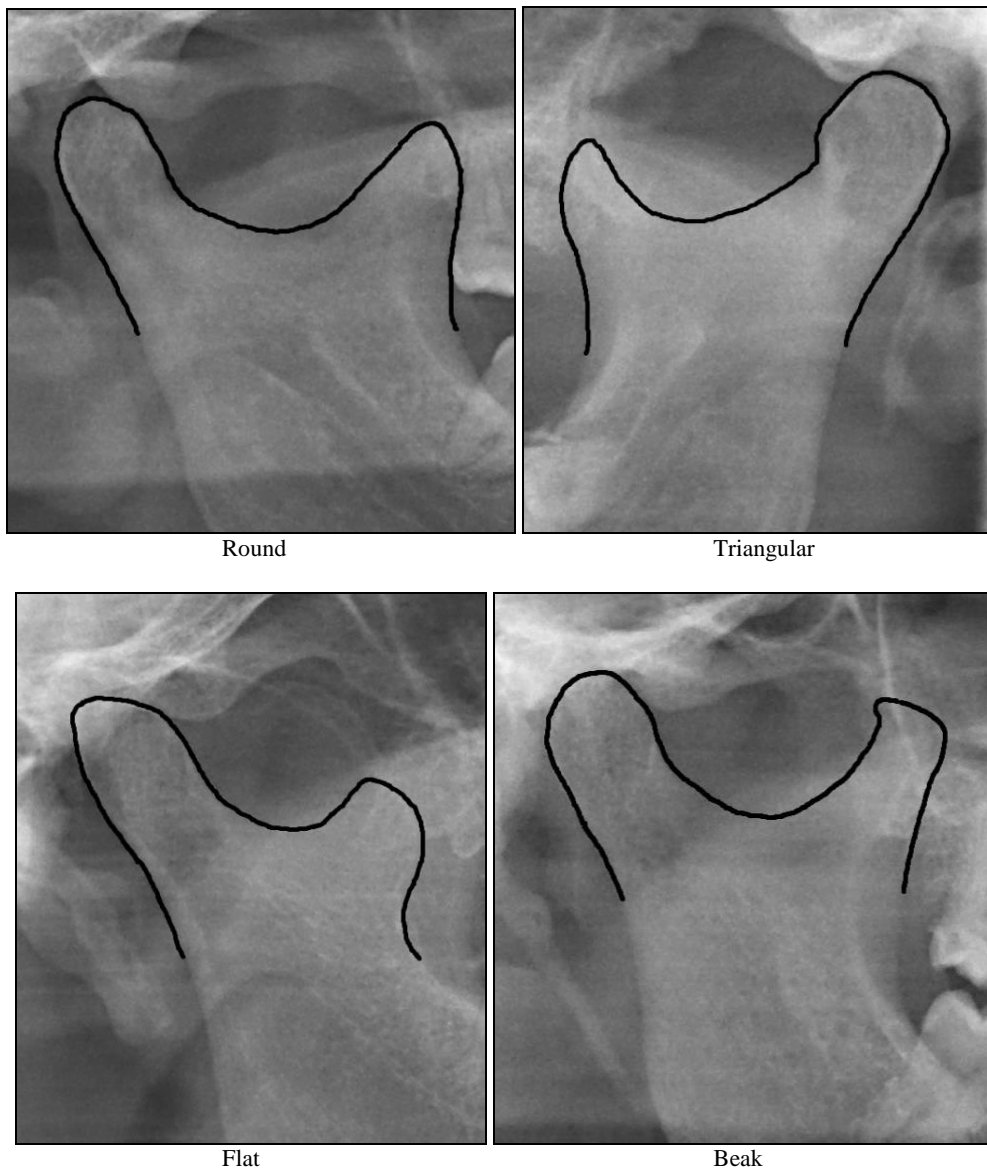


Fig 9: Morphological Shapes: Coronoid process

Discussion

For decades various anthropological studies using dry skulls had been conducted for identification of a deceased person. Forensic analysis by means of comparison of ante-mortem and post-mortem radiographs are one of the most unswerving and rapid methods used for personal identification⁶. Panoramic images are the most frequently advised radiographs for diagnosis as well as to monitor the prognosis of various treatment procedures in dentistry. In addition, panoramic radiography has been described to be reliable in representing the condyle and in evaluating the temporomandibular joint abnormalities [7, 8]. Nevertheless, these radiographs when preserved can serve as ante-mortem records in personal identification process. 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 [1, 2]. The coronoid process, coronoid meaning 'crow', has been described as one of the bony processes of the ramus of the mandible (Field *et al.*, 1947). Triangular coronoid processes have been illustrated by Hamilton (1976), Romanes (1986) Snell (1986), and Basmaijan *et al.* (1989) [9-12]. Because the coronoid process is a membranous bone, it also shows less resorption. Autogenous bone grafts can be obtained from ilium, rib and

calvarias; but each site has its own associated morbidity. A local bone graft from Coronoid process of mandible can be used as it can be harvested easily, minimal morbidity, no cutaneous scarring as bone is harvested intraorally. A Coronoid process graft can be used for alveolar defects repair, orbital floor repair, maxillary augmentation, repair of non-union fracture of mandible. The grafts are widely used in reconstruction of osseous defects in oral and facio-maxillary region. The Coronoid process makes an excellent donor graft site for reconstruction of orbital floor deformities, (Mintz *et al.*, 1998) [13]. Various authors have described coronoid process as a bony process with different shapes like triangular, beak and flat. Attempts had been made by various authors to classify coronoid process according to their shapes. We followed the classification given by Narayana [1]; the shape of the coronoid process was observed in the OPG. The comparison was done for variation in shape in either side of same subject and among males and females. Our study showed that triangular shape was more common, followed by rounded, and flat shape. This is similar to those reported by Romanes (1986) [11] Snell (1986) [15] Prajapati (2011) [16]. Our study had showed the most common shape of condyle was Angled followed by round. Which goes in accordance with Dathar Sahithi *et al.* which showed that the shape of condyle in males is angled and in females was round. In the current

study, pertaining to our population the sloping form of the sigmoid notch was frequently observed followed by the round which were in accordance with the study reported by Shakya *et al.* [3] wherein the sloping forms were commonly observed followed by round and wide forms. However, in our study the variation of all the three entities when compared on either side and among both the sexes were not statistically significant. The results elucidated in our study suggest that various shapes of the coronoid process, condyle and sigmoid notch depicted by means of panoramic images can thus be used as a quite easier and quicker method for identification of an individual especially in cases of mass disasters, provided when the ante-mortem records are preserved.

Conclusion

In the latest scenario the process of personal identification by means of radiographs had gained utmost importance owing to its feasibility. These radiographs render to uncover the concealed facts in forensic dentistry, provided the ante-mortem records have to be preserved. Within its limitations, confining to our population, the present study had witnessed various morphological shapes of the coronoid process, condyle and sigmoid notch using the panoramic radiographs as a probable approach for personal identification

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