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Radiomorphological Variations of the Coronoid Process, Condyle and Sigmoid Notch According to Age, Gender and Dentition

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Abstract

Background: The mandible consists of the coronoid process, condyle and sigmoid notch, which have variable shapes and can be a contributor as an identification tool. **Objective:** Morphological analysis of the coronoid process, condyle and sigmoid notch and their correlation with age, gender and dentition using digital panoramic radiographs in the Indian population. **Materials and Methods:** The study was done on 200 digital panoramic radiographs of both gender males and females between the age group of 20-70 years. The shape of the coronoid process, condyle and sigmoid notch were traced by using GIMP 2.8 software and the data obtained were subjected to statistical analysis by using the chi-square test. **Result:** Based on age and gender, the predominant morphology of the coronoid process was found to be triangular. In females, the prevalent shape of the condyle was observed to be angled, whereas the most frequent configuration of the sigmoid notch was wide. According to dentition (teeth present or absent) most common shape of the coronoid process was the beak and the shape of the condyle was convex in completely edentulous patients and the most common shape of the sigmoid notch was wide in completely edentulous patients. **Conclusion:** The shapes of the coronoid process, condyle and sigmoid notch can be used as an identification tool.

Keywords: Age, Condyle, Coronoid Process, Dentition, Gender, Sigmoid Notch

1. Introduction

Human identification becomes challenging when it is found in skeleton form or charred form. In such circumstances, dentists and anthropologists play a key role in determining the individual's identity[1]. The mandible is the largest and strongest bone of the face. The ramus has a coronoid process and the condyle. The sigmoid notch; also called the mandibular notch separates the coronoid process and the condyle from each other[2]. Attachment of temporalis and masseter muscle can alter the shape of the condyle and coronoid process.

Orthopantomogram is used as a routine radiograph in the diagnosis and treatment planning in dentistry. In a panoramic radiograph, varied shapes of the coronoid process (triangular, round, beak and flat), condyle (angled, round, convex and flat) and sigmoid notch (wide, round and sloping) can be used as identification of an individual[1].

The need for this study was to accomplish personal identification by comparison of various shapes of the coronoid process, condyle and sigmoid notch pertaining to our geographic area

2. Materials and Method

The study was approved by the institutional ethical committee (KDDC/Ethical/16227/2023) of the K D Dental college and Hospital Mathura where the study had done.

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2.1 Study Design

Patients undergoing digital panoramic radiographs for diagnostic, periodontal, surgical (for impacted teeth), or orthodontic purposes were recruited for the study. A proforma was used to record the related information. A total of 200 digital panoramic radiographs of the 20-70 year age group, gender (100 males and 100 females) and dentition (completely dentulous, partially edentulous and completely edentulous) were captured using digital panoramic radiograph CS 8100 Carestream at 73 kV 10 mA 10s. GIMP 2.8 software was used for the tracing of the coronoid process, condyle and sigmoid notch (Figure 1). The variable shapes of the sigmoid notch and coronoid process were compared according to Shakya *et al.*,[4] and those of the condyle were according to Hegde *et al.*,[11].

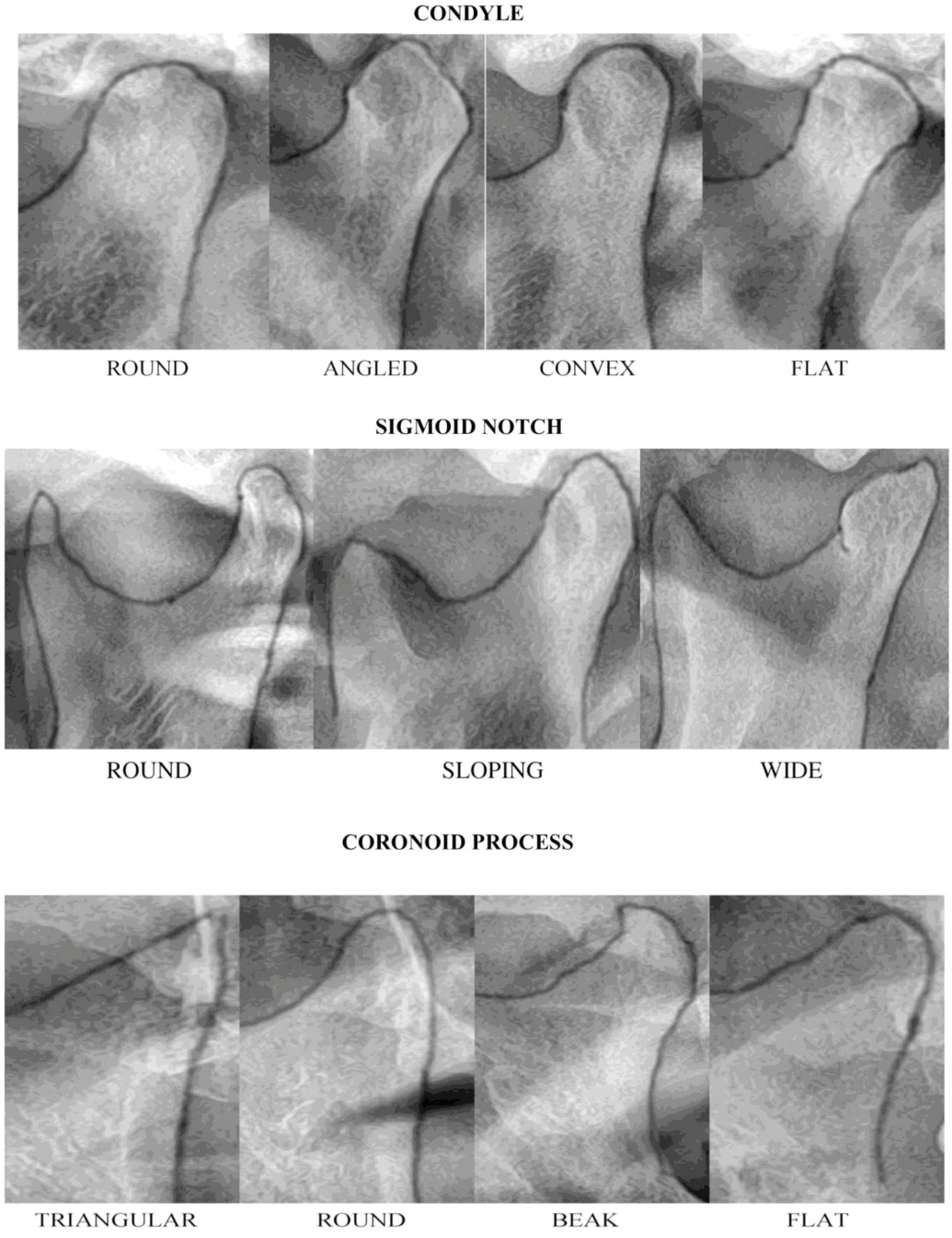


Figure 1. Showing various shapes of the condyle, sigmoid notch and coronoid process.

2.2. Statistical Analysis

The IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) software was used for the analyses of the data. Any p-value less or equal to 0.05 was considered to be statistically significant. For comparative analysis, chi-square test was employed.

3. Results

The most common shape of the coronoid process observed was triangular in the age group 51-70 years and the least shape observed was flat. According to gender most common shape of the coronoid process was triangular in females and the least shape observed was the flat which was absent in females. The shape of the coronoid process on both sides of male and female shows a significant difference (Right side p-value = 0.015 and left side p-value = 0.004). Among different dentitions most common shapes of the coronoid process completely dentulous, partially edentulous and completely edentulous were triangular and the least flat. The shape of the coronoid process on both sides shows no significant difference (Right side p-value = 0.620 and left side p-value = 0.115).

In the 20-40 years age group, the most common shape of the condyle was angled followed by round and flat. In the 41-50 age group most common shape was round and the least was flat. In the 51-70 age group most common shape was convex and the least was flat (Figure 2). Among the genders, the most common shape of the condyle in males was convex and in females was angled the least flat in both genders. There were statistically significant differences observed on the left side (p-value = 0.02) not on the right side (0.075). Among different dentitions, the most common shape of the condyle was angled and the least was flat in completely dentulous patients. In partially edentulous and completely edentulous most common shape was convex and the least was flat (Figure 4). There were no statistically significant differences noted on the right (p-value = 0.263) and left (p-value = 0.186) sides.

In the 20-40, 41-50 and 51-70 age groups, the most common shape of the sigmoid notch was wide and the least was round (Figure 2). Among genders most common shape of the sigmoid notch in males and females was wide and the least was round (Figure 3). There were no statistically significant differences noted on the right side (p-value = 0.490) and left side (p-value = 0.108). Among different dentitions, the most common shape of the sigmoid notch is completely dentulous, partially edentulous and completely edentulous wide (Figure 4). There were no statistically significant differences were noted on the right side (p-value = 0.185) and left side (p-value = 0.078).

4. Discussion

Dental records provide evidence for the investigation of the unidentified person or a body. Morphological variations of anatomic characteristics occur either corresponding to developmental disorders through hereditary determinants or due to the functional variations that arise during the growth process[3]. Nagraj *et al.*[2] concluded round was the most common shape of condyle among the south Indian population in the 30-39 years' age group. There are no significant differences in the shapes of condyles among the right and left sides of all patients.

In our study the most common shape of the sigmoid notch was wide followed by sloping then round in right side and in left side. Nagraj *et al.*,[2] concluded in their study that sloping type of sigmoid notch was the most common among Bengaluru population. According to Ashwinirani *et al.*,[4] in this study relating to western part of Maharashtra population the wide form of the sigmoid notch was commonly observed followed by the sloping form and the least common was round. Where as in a study conducted by Sahithi *et al.*,[1] the most common form was wide followed by round and sloping form. There are not significant differences in shapes of sigmoid notch among right and left side of all the patients The distribution of condylar shapes among gender were not significant in the right side and significant on the left side in our study in accordance with Nagaraj T. *et al.*, and Sahithi *et al.*[1] studies show non-significant differences on both side. However, in our study the variation of sigmoid notch when compared in both the genders shows statistically significant which were similar to the Nagaraj T. *et al.*, and Shakya *et al.*,[4] studies. According to statistical analysis, no significant differences were observed in shapes of coronoid, condyle and sigmoid notch of males and females. In Varsha Kanjani *et al.*,[7] study on north Indian population shows wide is the most common shape of the sigmoid notch was sloping followed by wide and round. Most common shape of the condyle was round followed by angled, convex, and flat[7].

Coronoid shapes in males of the 20-40 age group were more common was triangular and the least was flat and in females more common was triangular. Among males

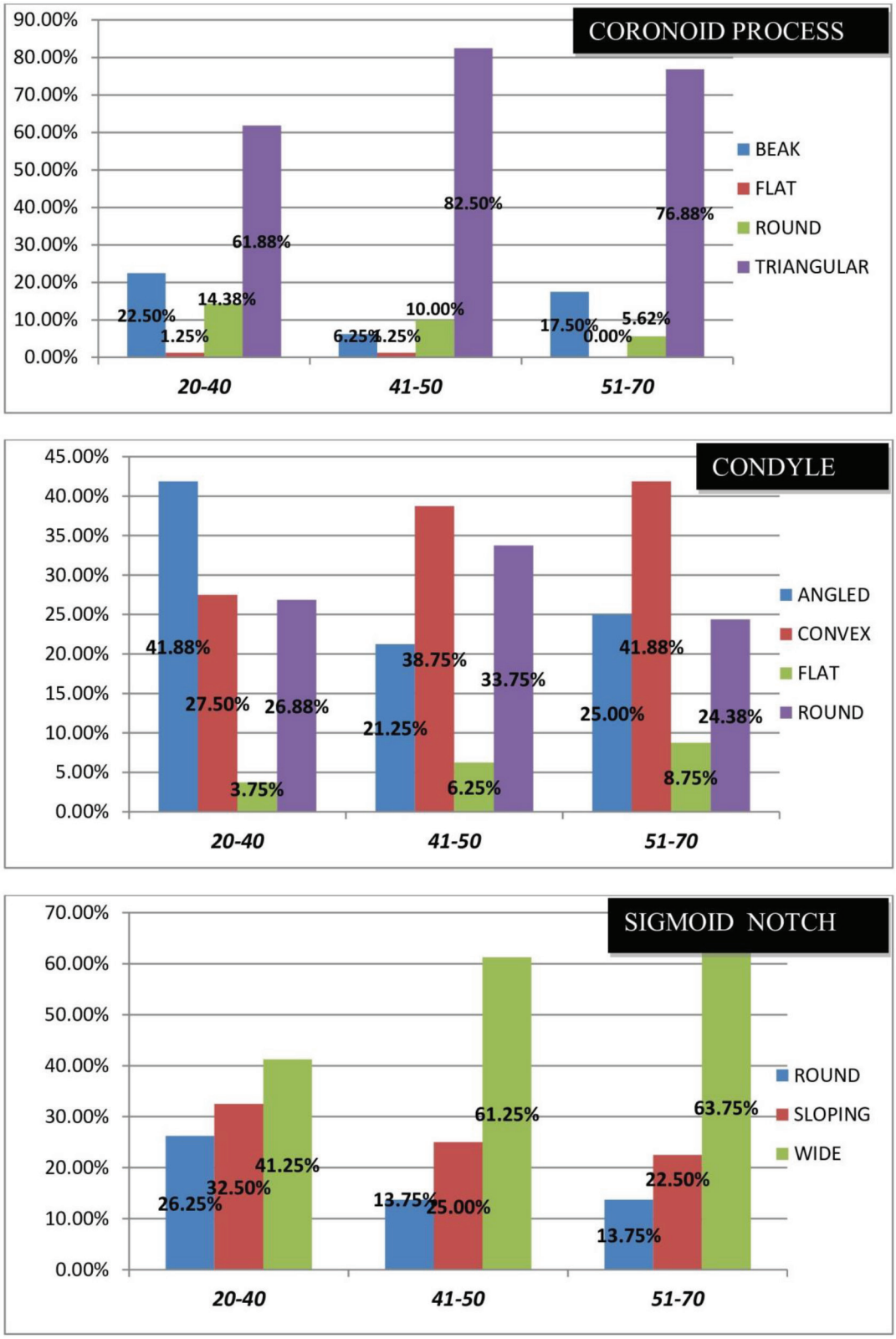


Figure 2. Comparison of the shapes of coronoid process, condyle and sigmoid notch in different age groups using chi square test.

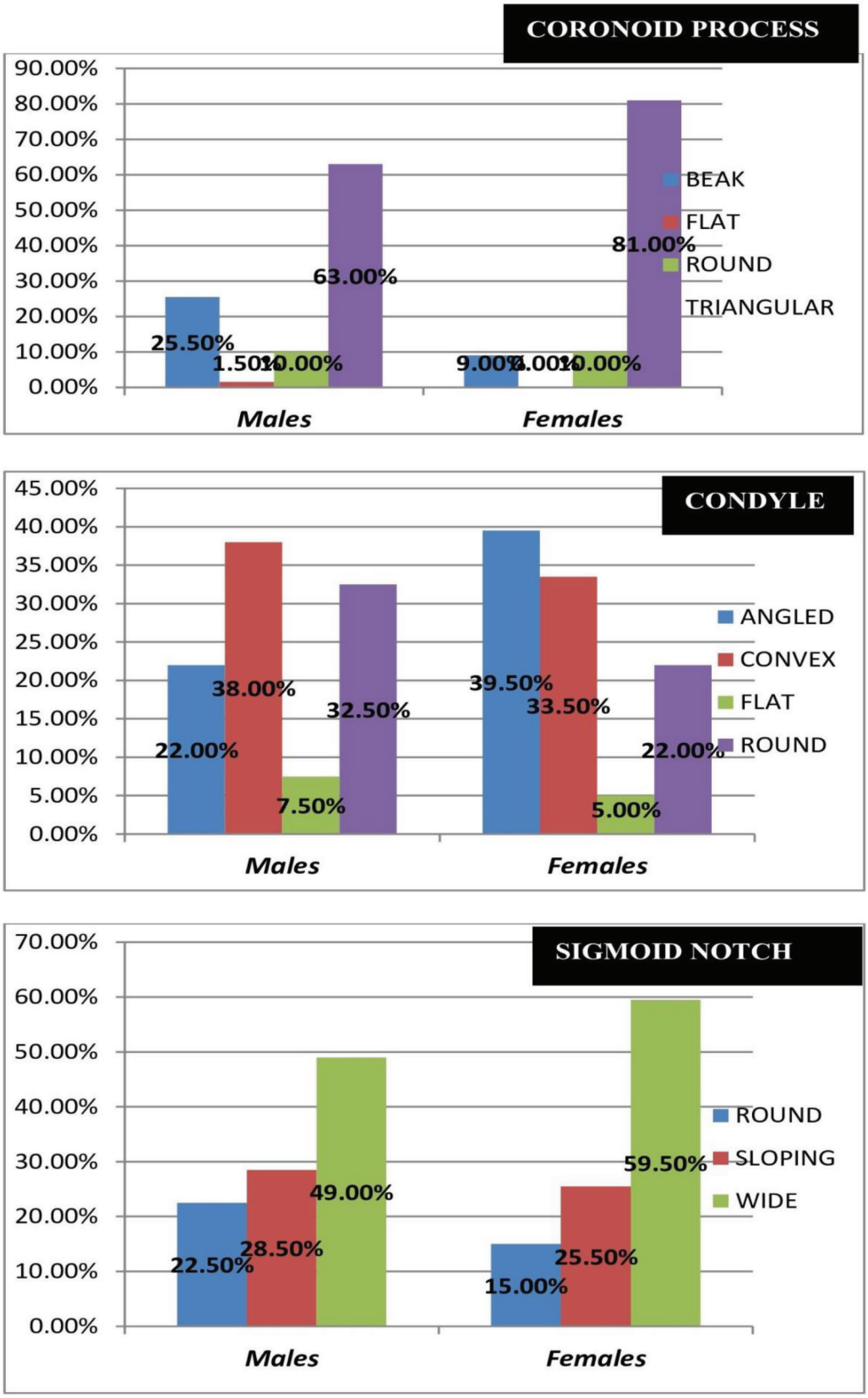


Figure 3. Comparison of the shapes of coronoid process, condyle and sigmoid notch in male and female using chi square test.

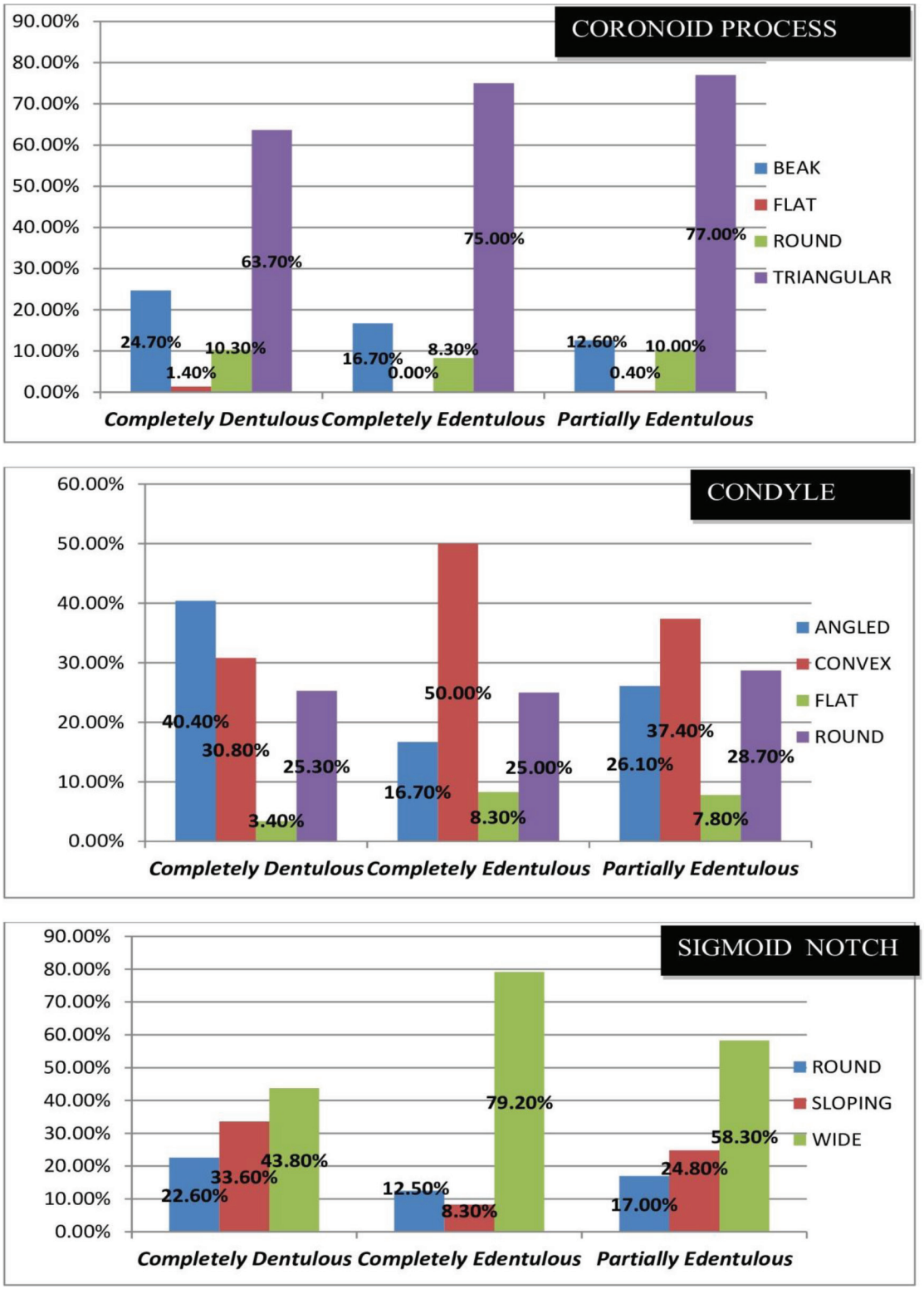


Figure 4. Comparison of the shapes of coronoid process, condyle and sigmoid notch in completely dentulous, partially edentulous and completely edentulous patients.

and females, the most common was triangular which was more common in females as compared to males and the least was flat which was more common in males. In S. Pradhan *et al*., most common shape of the coronoid shape was triangular in adults and old age[5]. Condyles shapes in males of 20-40 age group more common was round and convex and the least was flat and in females more common was angled followed by convex and the least was flat. Among males and females more common shape was angled which was more common in females and second most common was round and convex which was more common in males and the least common was flat which was more common in males. Sigmoid notch in males of 20-40 age group more common was round and the least was wide and in females more common shape was wide and the least was round. According to Ishwarkumar S. *et al*.,[8] most common shape of the sigmoid notch observed was round in both sexes. Among males and females more common shape was wide which was more common in females and the second most common shape was round which was more common in males and the least common shape was sloping which was more common in males. According to Mohd Arif Dar *et al*.,[9] most common shape of condyle was angled, sigmoid notch was sloping and the coronoid was triangular. According to Manpreet Manoj *et al*.[10] study shows most common shape of the sigmoid notch was wide, condyle was convex and the coronoid was round.

Coronoid shapes in males of the 41-50 age group were more common as triangular and the least was flat and in females more common was triangular and then round, beak and flat were absent. Among males and females more common was triangular which was more common in females and the second most common was beak in males, in female's beak and flat shapes were not found. Condyle shapes in males of the 41-50 age group more commonly were convex and the least was flat and in females more common shape was round and the least was flat. Among males and females the most common shape was round which was more common in females, in males more common was convex and the least was flat. Sigmoid Notch shapes in males of the 41-50 age group more common was wide and least was round and in females more common was wide and the least was round and sloping. Among males and females, the most common shape was wide and the least was round which was in males.

Coronoid shapes in males of the 51-70 age group more common were triangular and flat were absent. In females more common was triangular and flat was absent. Among males and females more common shape was triangular which was more common in females and the flat was absent. According to SR Ashwinirani *et al*.[6] study in western part of Maharashtra shows triangular shape was most common shape among both genders. Condyle shapes in males and females of the 51-70 age group more commonly were convex and the least was flat. Sigmoid Notch shapes in males of the 51-70 age group more commonly were wide and the least was round and in females more commonly were wide and the least was round. Among males and females, the most common shape was wide and the least was round. According to S. Pradhan *et al*., the incidence of triangular coronoid process predominates in adults and old age of either sex. Rounded was more in young after that in adult and old of either sex. The hook-shaped coronoid process was more frequently found in males and older age but absent in younger age groups. Ashwirani *et al*.[6] shows in both genders the most common shape of the coronoid process was observed to be triangular followed by beak, round and shape[7].

In our study among completely dentulous coronoid shapes, the most common was triangular and the least was flat and the most common shape of the condyle was angled and the least was flat and the most common shape of the sigmoid notch was wide and the least was round. Among partially edentulous coronoid shapes, the most common were triangular and the least were flat. The most common shapes of the condyle were convex and the least was flat and the most common shape of the sigmoid notch was wide and the least was round. Among completely edentulous the most common shape of coronoid shapes was triangular and the least was round and the most common shapes of the condyle were convex and the least was flat and the most common shape of the sigmoid notch was wide and the least was sloping. Static analysis shows there was no significant difference in the shape of the coronoid, condyle and sigmoid notch of the right and left sides in completely dentulous, partially edentulous and completely edentulous patients.

5. Conclusion

A process of personal identification through the use of radiographs has gained utmost importance due to its availability, as it is possible to have antemortem records preserved in conjunction with the radiographs, thus

allowing forensic dentists to uncover concealed facts. The present study showed various morphological shapes of the coronoid process, condyle and sigmoid notch using panoramic radiographs as a probable approach for personal identification.

5.1. Limitation

If the study was done on a large population, it may have provided a better result for the study and large data from other parts of the world with different regions can help in contributing to the generalizability of study results.

5.2 Future Perspectives

The process of personal identification using radiographs by providing antemortem and postmortem records has gained importance in identification by preserving the data for the future. In addition, it gives information regarding temporomandibular joint-related problems or abnormalities which can affect at a young age or in old age, associated with bony or muscular changes.

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