

Abstract colleges. the
size of the process
was



**ASSIGN
BUSTER**

AbstractBackground-The coronoid process derived from a Greek word 'korone' is a flat piece of triangular bone projecting upwards from the anterior margin of the mandible ramus. The coronoid process of the mandible is being used as a graft material in reconstructive craniomaxillofacial surgeries and as a non metric skull variant in assessment of age, sex, race and species.

Hence the present study was undertaken to assess the size of the coronoid process existing in south Indian adult population on both sides and to assess the feasibility of using this knowledge in identification of sex. Material and methods- The study includes 30 male and 30 female mandibles which were collected from various medical colleges. The size of the process was assessed by measuring the height and widths of the coronoid process at its base. Total length of the ramus at the coronoid process was also measured. Results were tabulated and statistically analysed using student paired T test with $p < 0.05$.

05. Results-The height of coronoid process and the length of the ramus at the coronoid process have significant differences on right and left sides in males and female mandibles and can thus be used as metric variants in determination of sex. Key words - coronoid process ; mandible ; size ; sex determination

IntroductionThe mandible is the largest, strongest and the only movable bone of the skull with slow resorption rate. As such it is a frequent entity found in long standing skeletal remains and forms an important marker in identification. It has an arched body with two ascending rami ending in two processes namely the condylar and coronoid processes. The coronoid process derived from a Greek word 'korone' (meaning crow's beak/crown) is a triangular flat piece of bone projecting upwards from the

anterior margin of the mandibular ramus. It receives the insertion of the temporalis on its medial surface, anterior margin, apex and masseter on its lateral surface. These two are important muscles of mastication which show functional as well as morphological dependence 1.

The shape of ramus is species specific amongst primates. Human ramus resembles that of a chimp with relatively slender coronoid process (particularly at its tip), shorter in height, separated from the condylar process by a deep notch. Several other primates resemble gorilla having a broad coronoid process and separated by a shallow mandibular notch 2.

Recently many authors like Isaac, Narayana and M subbaramaiah have described various forms of coronoid process that are evident in human mandibles like triangular, rounded, hook shaped, rectangular, flattened etc 3, 4, 5. The various forms of coronoid process help in determination of age and sex to a large extent 4, 5. The coronoid process is large and projects above the level of condyle at birth. Gradually with the growth of the neck of the mandible, condyles almost reach the same height as coronoid process at adulthood. Further age increase is associated with resorption of the alveolar processes and coronoid process once again becomes taller 1. Bilateral elongation of the coronoids of the mandible made of histologically normal bone goes more in favour of it being hyperplastic.

Elongated coronoid process leads to a progressive, painless difficulty in opening the mouth; due to contact of coronoid process with the temporal surface of the zygomatic bone or medial surface of the zygomatic arch. Coronoid process enlargement may be also seen in some pathological

conditions like osteochondroma, exostosis, osteoma and other developmental anomalies⁶. Hernandez-Alfaro noticed a new joint in between the enlarged coronoid process and the zygomatic bone (Jacob's disease) which causes restriction during mouth opening⁷. The coronoid process of the mandible is gaining vital importance as a graft material in all aspects of reconstructive craniomaxillofacial surgeries like orbital floor reconstruction, paranasal augmentation and temporomandibular joint ankylosis due to its close proximity, slow resorption rate and easy accessibility^{8, 9, 10}. Coronoid process is also being used as a nonmetric skull variant in assessment of age, sex, race and species².

The clinical applications of coronoid morphology in the field of craniofacial reconstructive surgery has already been well documented in literature⁵. The present study was undertaken to assess the size of the coronoid process existing in Indian adult population on both sides and to assess the feasibility of using this knowledge of coronoid morphology in identification of sex.

Material and methods The mandibles were collected from departments of anatomy in and around Bangalore. 30 male and 30 female mandibles were retrieved during routine cadaver dissection for undergraduate M.

B. B. S students, and assessed regarding the size of the coronoid process on right and left sides. Mandibles of adult age group were included in the study.

The mandibles in which the coronoid process was damaged or deformed were excluded from the study. The basal point of mandibular notch was marked as a reference point. The height and width of coronoid process were

measured from the reference point using vernier callipers. Total length of the ramus at the coronoid process was also measured (Photographs A and B).

Results were tabulated. The data was statistically analysed for the purpose of comparison and correlation by calculating the mean, range and standard deviation of width, height of coronoid process and length of ramus at coronoid process. Student's paired t-test with two-tailed distribution was applied for comparison of the different parameters on both sides in male and female mandibles. P-value > 0.05 was considered as statistically significant. Results From the present study it was noted that the length of the ramus at the coronoid process and the height of coronoid process have significant differences on right and left sides in males and female mandibles.

(Table and Graph) Coronoid height - Average height of coronoid process in Indian population - 1.39 ± 0.34 cm (0.6-2.

2 cm). Average height of coronoid process was greater on right side by 0.21 cm. Difference is statistically significant (p-value 0.046). No significant variation in height of coronoid process between male and female mandibles. However when side was taken into consideration female mandibles showed higher variation. Coronoid width - Average width of coronoid process in Indian population - 1.

1.67 ± 0.23 cm (1.1-2.2 cm).

No significant variation in width of coronoid process between male and female mandibles on right and left sides. However when sex was taken into

consideration male mandibles showed higher variation between right and left sides. Ramus length at coronoid process - Average length of ramus at coronoid process in Indian population - 5.89 ± 0.51 cm (4.4-7.1 cm).

Average length of ramus at coronoid process was greater on left side. Significant variation was seen in length of ramus at coronoid process between male and female mandibles (p-value 0.038). When side was taken into consideration male mandibles showed greater length on left side. Thus from the present study it was noted that the length of the ramus at the coronoid process and the height of coronoid process have significant differences with respect to laterality and sex of the mandible.

Discussion The mandibular coronoid process derived from a Greek word 'korone' meaning crow's beak or crown is a flat piece of triangular bone projecting upwards from the anterior margin of the mandibular ramus. Initially development of coronoid process begins on the 55th day of intrauterine life (24mm stage) in membranous form. At about the 70th day of intrauterine life (43mm stage) two bony processes are mapped out.

At 13th week of intrauterine life, a strip of cartilage appears along the anterior border of coronoid process which is later displaced by the membrane bone. This cartilage usually disappears before birth but can persist as subcoronoid sutures. Further development of coronoid process is associated with much variation in morphology and morphometry of the coronoid process. This can be attributed to various factors like- a) sociodemographic profile of the individuals (eating habits, occupation) which has a direct or indirect affect on the size of the temporalis muscle altering the size and shape of the

coronoid process . b) Diet as we know has a vital role in affecting the muscular pull on the bony process thereby altering the final shape and size of the process 11, 12. c) Masseter-Temporalis (M-T) component is active in the robust vertical thrust during mastication. The functional factors necessitate the right coronoid process to be longer than the left as most people tend to chew on the right side. This is vindicated by the data of previous studies in the dentulous mandibles.

Lateralization of the M-T-lever effect largely depends upon the individual masticatory behavior. . This is also reflected in the shape of the coronoid process as larger stress helps it to get remodeled as triangular with pointed tip, less stress for rounded and furtherless being the hooked coronoid process. d) Male hormonal impact on muscle growth, bone remodelling and psychology probably lead to enhanced functional stress on the mandible due to mastication as compared to that of females¹³. Hook shaped coronoid process goes in favour of female mandibles⁵. e) Genetic impact also play a role in remodelling of the coronoid process¹³.

As such samples taken from different population may lead to variation in size and form of the process. The final form and size of coronoid process depend on all the above factors. According to S. Nayak et al. the size of coronoid process was found to be approximately 1.5 mm longer on the right side than on the left side. Triangular coronoid process was found to be the longest followed by round and then hook shaped¹⁴. The findings of the present study are consistent with most other previous studies done, the size of the right coronoid process being greater than the left.

This difference was even more marked when sex was taken into consideration. However the actual height, width of the coronoid process and length of ramus at coronoid showed variation which could be due to any of the above factors or due to sample variation. Thus larger population needs to be included in order to generalise the data^{14, 15, 16}.

Conclusions The coronoid process is a membranous bone showing less resorption and remains unaltered for a long time and can serve as a very useful anthropological marker. From the present study it can be said that coronoid process exists in many sizes. Numerous factors either directly or indirectly affect the final appearance of the coronoid process. The data of size of the mandibular coronoid process as seen from the study can be utilised for comparison of anthropometric results from different population.

The height of coronoid process and the length of the ramus at the coronoid process have significant differences on right and left sides in male and female mandibles and can thus be used as metric variants in determination of sex. The data will also help the dental and maxillo-facial surgeons in planning graft implants and reconstructive surgeries.