Morphology and Morphometry of Coronoid Process of Dry Mandible- A Comprehensive Study

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ABSTRACT

BACKGROUND

The coronoid process of mandible is thin, triangular projection, gives attachment to two muscles of mastication i.e. Temporalis & Masseter. Coronoid process being membranous bone is used as autogenous bone graft for cranio-maxillo-facial surgeries & has medicolegal importance. The study was done to determine the shape & size of coronoid process of mandible in both male & female, compared with previous studies.

METHODS

The study was conducted on 110 dry human mandibles in the Department of Anatomy, Subharti Medical College, Delhi-Haridwar Bypass Road, Meerut (U.P.). The measurement was done with the help of vernier callipers & the values were analysed to determine the shape and size of coronoid process of mandible in both male and female and was compared with the previous studies. It is useful for cranio-maxillo-facial surgeons, in correction of Alveolar defects, in the study of anthropology & medicolegal issues.

RESULTS

Results showed that 60% of population was with triangular process followed by 29% of hook shape & least being round shape i.e. 11%. Gender-wise calculation of length, breadth with standard deviation was calculated and compared.

CONCLUSIONS

The detailed knowledge of variation in shape of coronoid process is important to anatomists, forensic experts, maxillo-facial surgeons & to anthropologists. In the present study the triangular shape coronoid process is predominant in both male & female. It is used as graft for reconstruction of bony defect & in non-united fractures of mandible and also has medicolegal significance.

KEYWORDS

Coronoid Process, Tendon of Temporalis, Shapes (Triangular, Round, Hook), Autogenous Graft, Mandible

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BACKGROUND

The mandible is the largest, strongest & lowest bone of the face. It has horizontal curved body with 2 broad ramii ascending posteriorly. Mandibular ramus is Quadrilateral with- 2 surfaces namely - medial & lateral; 2 borders- anterior & posterior; 2 processes- Coronoid & Condylar process.[1] Coronoid process (Processus Condyloidus) means Crow's Beak.[2] The coronoid process projects upward & slightly forward as a triangular plate of bone. Its posterior border makes anterior border of mandibular notch & its anterior border continue with anterior border of ramus of mandible. The coronoid process provides insertion to muscles of mastication, namely, Temporalis & few anterior fibres of Masseter. The coronoid process is rarely getting displaced in fractures as it is strongly supported by strong tendinous insertion of Temporalis muscle.[3] Several authors have described various shapes of coronoid process. According to Issac B;[4] Khan & Sharieff;[5] Prajapati et al,[6] coronoid process is triangular, hooked & round shaped. The size & shape of coronoid process is influenced by dietary habit, genetic constitution& majorly by Temporalis muscle activity.

Coronoid process enlargement may be seen in some pathological conditions as Exostosis, Osteomas & Osteochondromas. In Jacob's Disease, Hernandez-Alfro F,[7] noticed a new joint formation between enlarged coronoid process & Zygomatic bone, which causes restriction during opening of mouth. Fracture of mandible is common but that of coronoid process is rare & requires no treatment unless impingement on zygomatic arch is present. Being a membranous bone, it can be removed intra-orally without functional deficiency & skin scarring,[8] so used for various cranio-maxillo-facial surgeries, reconstruction of orbital floor deformity, alveolar defects, paranasal air sinuses augmentation, non-union fractures of mandible.[9] It also acts as an Anthropological marker for detection of races. Bones like Ilium, Ribs& clavicle are used as Autogenous bone graft (i.e. bone taken from one's own body & used on same person). This reduces the chances of infection, bleeding & tissue rejection, but each has its own associated morbidity.

But coronoid process as a graft has minimal morbidity & can be harvested intra-orally with shorter surgical & hospitalization time. Study of Bakirci,[10] stated that human skull is valuable in forensic study for race & sex estimation too. The present study was conducted to determine various shapes & size of coronoid process in dry mandibles both morphologically & morphometrically and is compared with standard literature & studies done by previous authors.

METHODS

The present study was conducted on, 110 mandibles, i. e. 220-coronoid processes, in the department of Anatomy, Subharti Medical College, Swami Vivekanand Subharti University, Delhi-Haridwar Bypass Road, Meerut (U.P.), India. The shapes & size were noted, counted, recorded & photographed. Morphometric measures were recorded for the measurement of coronoid process for length, breadth and height. For this, three points were marked as-

1. lowest point on mandibular notch, from base of mandible & named as 'B'.
2. one at the level of- point-1(B), on the anterior border of mandible & named as 'A'.
3. one at the level 'B' on posterior border of ramus of mandible as 'Q'.

RESULTS

A line was drawn joining all the 3 points taken i.e. AB & Q, & a perpendicular was drawn from apex of coronoid process to join line' ABQ', the point of intersection was marked as 'C', and apex as 'D', so, 'DC' was the height of coronoid process & 'AD'; 'DB' & 'AB' were the 3 sides of coronoid process, helps to give shape of coronoid process (figure 1). Midpoint of coronoid process are measured by calliper, gives the measure of thickness, helpful in the measurement of the built (robust and juvenile) of the process. So, depending on the length, thickness & shape of triangle made by 3 sides helps establishing the shape of coronoid process & are found to be of 3 types-

Type-1 - Triangular
Type-2 - Rounded.
Type-3 - Hooked.

Feature	Male	Female
Angulation of Mandible	Prominent	Less prominent
Ramus	Robust	Juvenile shape
Chin	Square	Rounded

Morphologically gender was determined as per Loth & Henneberg.[11] The collected bones were also calculated for age**.**

Group 1 -Young- Where 3rd molar was not erupted & mental foramen was present towards the base (Figure 2a).
Group 2- Adult- Where 3rd molar erupted& mental foramen present in middle (Figure 2b).
Group 3- Old, resorption of alveolar fossa & mental foramen towards the alveolar margin (Figure 2c).

In the present study, out of 220 coronoid process (110 mandible), 122 CP (61 mandible) are classified as male coronoid process & 98 CP (49 mandible) as female processes. The shapes were classified as Type 1: Triangular Shaped (Figure 3a), where apex is pointed with straight anterior & posterior border, Type 2: Round Shaped (Figure 3b) where apex is blunt with straight anterior & posterior borders and Type 3: Hook Shaped (Figure 3c) where apex is pointed with convex anterior & concave posterior. Hence the variation in the shape of 220 coronoid processes in the total population was calculated as 60% triangular shaped, 29% hooked shaped and 11% round shaped. Results showed that 60% of population was with triangular process followed by 29% of hook shape & least being round shape

i.e. 11%. Gender-wise calculation of length, breadth with standard deviation was calculated and compared (Table 2 and 3). In present study on 220 coronoid process (122-Male: 98-Female); the triangular shape coronoid process was most common (78-Male; 56-Female) i.e. 60%, followed by hook-shape (34-Male; 28-Female) i.e. 29%, & the least was Round shaped (05-Male; 07-Females) i.e. 11%.

Shapes	Male	Female
Triangular	78(39)	56(28)
Round	10(05)	14(07)
Hook	34(17)	28(14)

Table 1. Showing Variation in Shapes of Male & Female Coronoid Process

Shape	Male	Female	Mean	SD
Triangular	2.08 cm	1.95 cm	2.015	0.0919
Rounded	2.75 cm	2.20 cm	2.475	0.3889
Hooked	1.70 cm	1.09 cm	1.395	0.4313

Table 2. Length of Type of Coronoid Process in Male & Female Mandible

Shape	Male	Female	Mean	SD
Triangular	1.02 cm	1.0 cm	1.01	0.0141
Rounded	1.30 cm	1.15 cm	1.225	0.106
Hooked	1.85 cm	1.0 cm	1.425	0.601

Table 3. Breadth of Coronoid Process in Male & Female Mandible

Sex	AB	AD	DB	DC	Area of Triangle
Male	2.8 cm	2.7 cm	2.5 cm	1.9 cm	2.16 cm^2
Female	2.0 cm	1.95 cm	2.0 cm	1.7 cm	1.7 cm^2.

Table 4. Comparison of Average Length of Each Arm of Triangle of Coronoid Process in Males and Females as per Figure 1

Authors	Triangular	Round	Hooked
Issac B et al	49%	23.60%	27.40%
Khan et al	67%	03.00%	30.00%
Prajapati et al	54.17%	21.25%	24.58%
Present Study	60.00%	11.00%	29.00%

Table 5. Comparison of Various Studies of Coronoid Process with Present Study in Percentage

Figure 1

Figure 2a

Figure 2b

Figure 2c

Figure 3a

Figure 3b

In present study, the average length of male triangular coronoid process was 2.08 cms & that of females it was 1.95 cms & S.D. being +/- 0.0919; Of Round shaped - in males it was 2.75 cm & in females 2.20 cms with standard deviation of 0.388; Of hook shape in males 1.70 cm; in females 1.09 cm, the standard deviation being 0.431. The average breath in male triangular C.P. being 1.02 cm, of females 1.0 cm with S.D. being 0.0141; in Round shaped, in males 1.30 cm, in females 1.15 cm with S.D. being 0.106; in Hook shaped, of males -1.85 cm, of females 1.0 cm, the S.D. being 0.601. Taking the area of the process, in males it was 2.16 cm^2; that of females, it was 1.7 cm^2. Comparing the average of length, breadth & area of C.P. in male was greater than females, as shown in chart- 1, 2 & 3. So, with these measurements and calculations we can assess the gender of bone (mandible), even if a fragment of coronoid process is present, as it is seen that coronoid process in males is more robust than female, and this depends on chewing and eating habits& on genetic constitution of a person.

DISCUSSION

Coronoid means 'crow', as one of the bony process of ramus of mandible is describe as 'Crow's beak',[2] later it was described as triangular shaped process,[12,13] It is of great clinical significance to the cranio-maxillo-facial surgeons, being membranous bone, it shows less resorption & is safely used as Autogenous bone graft, intraorally with minimum morbidity.[14] It can also be used to repair other bony defects of orbital floor, maxillary & paranasal sinuses augmentation, alveolar defects & correction of non-union of mandibular fractures.[8] The medial aspect of Coronoid process lies close to distal molar tooth, so variations in

shape can cause narrowing of vestibular space leading to restricted movement of mandible.[8] The result of present study is similar to most of the previous studies as Issac B et.al, Khan et.al, Prajapati et al.[4,5,6] has been postulated that among different shapes of coronoid process the triangular being the most common & rounded being the least. The different shapes & size are also related to the traction of Temporalis muscle along with hormonal, genetic and unilateral eating habits.[9]

CONCLUSIONS

The detailed knowledge of variation in shape of coronoid process is important to anatomists, forensic experts, maxillo-facial surgeons & to anthropologists. In the present study the triangular shape coronoid process is predominant in both male & female. It is used as graft for reconstruction of bony defect & in non-united fractures of mandible and also has medicolegal significance.

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