

Morphological Study of Coronoid Process of Mandible and its Clinical Significance

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Abstract

Introduction: Coronoid process is a beak like projection flattened from side to side at the antero-superior aspect of the ramus. This process gives attachment to two important muscles of mastication –Temporalis muscle attached to apex, whole of the medial surface and anterior part of lateral surface of the coronoid process. **Material and Method:** coronoid process of 110 mandibles was observed on both sides for its shape. The length of the coronoid process was taken from the line tangential to the deepest part of mandibular notch to the apex. **Result:** Rounded type of coronoid process was found in 94 (42.73%), triangular in 74 (33.63%) and hook shape in 52 (23.64%). 74.55% mandibles were showing bilateral symmetry and only 25.45% of mandibles were showing difference in the shapes in both sides. Rounded type more prevalent in females (45%) than males (41.43%), whereas hook shape more prevalent in females (25%) than males (22.86%) and triangular more prevalent in males (35.71%) than females (30%). Mean and SD for length of coronoid process was calculated. **Conclusion:** The knowledge of variation in the shape of coronoid process is important for maxillofacial surgeons for the reconstructive surgeries.

Keywords: Coronoid Process; Mandible; Morphology.

Introduction

In human there are two coronoid process, one present in ulna and another present in mandible. Coronoid process is a beak like projection flattened from side to side at the antero-superior aspect of the ramus. In Greek, “korone” means “like a crown”. This process gives attachment to two important muscles of mastication –Temporalis muscle attached to apex, whole of the medial surface and anterior part of lateral surface of the coronoid process. Rest of the lateral surface gives attachment to anterior fibres of masseter. The shape and size of coronoid process is influenced by dietary habit, genetic constitution, hormone and mainly by temporalis muscle activity. The knowledge of variation in the shape of coronoid process is important for maxillofacial surgeons for the reconstructive surgeries. It can be easily harvested as

donor graft site for reconstruction of orbital floor deformities act as an anthropological marker for detection of races in forensic studies and anthropological studies. Hence the present study was undertaken to shapes of coronoid process and their prevalence in dry adult human mandibles of both male and female of north Gujarat population.

Materials and Methods

The present study was undertaken on 110 dry adult human mandibles (220 sides) available in Anatomy departments of various Medical Colleges of North Gujarat population. Any mandible broken, asymmetrical or deformed was excluded from the study. Out of 110 mandibles 70 were of males and 40 females. In this study, coronoid process of 110 mandibles was observed on both sides for its shape. The shape of coronoid process was classified into 3 types:

1. Triangular- tip pointing directly upwards
2. Rounded- tip rounded
3. Hook- tip pointing backwards.

The length of the coronoid process was taken from the line tangential to the deepest part of mandibular notch to the apex. It was measured by using vernier caliper.

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Results

In present study, we observed rounded type of coronoid process (42.73%) more prevalent than triangular shape (33.63%) and hook shape (23.64%). 74.55% mandibles were showing bilateral symmetry and only 25.45% of mandibles were showing difference in the shapes in both sides (Table 1, Figure 1).

Rounded type more prevalent in females (45%) than males (41.43%), whereas hook shape more prevalent in females (25%) than males (22.86%) and triangular more prevalent in males (35.71%) than females (30%) (Table 2, Figure 2).

The hook shaped coronoid process was present in 52 sides (Figure 3). In 36 mandibles, it was found bilaterally and in 16 mandibles, it was found unilaterally. Of the 6 mandibles which had a hook shaped coronoid process on the right side, the corresponding sides had 4 triangular shaped and 2 rounded coronoid processes. Of the 10 mandibles which had a hook shaped coronoid process on the left side, the corresponding sides had 6 triangular shaped and 4 rounded coronoid processes.

The triangular coronoid process was seen in 74 sides. In 52 mandibles, it was found bilaterally while in 22 mandibles it was found unilaterally (Figure 4). The 14 mandibles, which had a triangular coronoid process on the right side, the corresponding sides had 6 hook shaped and 8 round shaped coronoid process. The 8 mandibles which had a triangular coronoid process on the left side, the corresponding sides had 4 hook shaped and 4 round shaped coronoid process.

The rounded coronoid process was present in 94 sides (Figure 5). In 76 mandibles, it was found bilaterally and in 18 mandibles it was found unilaterally. Of the 8 mandibles which had a rounded coronoid process on the right side, the corresponding sides had 4 triangular shaped and 4 hook shaped coronoid process. Of the 10 mandibles which had a rounded coronoid process on the left side, the corresponding sides had 8 triangular shaped and 2 hook shaped coronoid process.

The length of the coronoid process with three different types observed in 110 dry human mandibles was mention below (Table 3). Gender wise length of different shapes of coronoid process was mention below (Table 4).

Table 1: Incidence of different shapes of coronoid process with their percentage

Shape	Number	Bilateral	Unilateral		Percentage
			Right	Left	
Hook	52	36	6	10	23.64
Triangular	74	52	14	8	33.63
Rounded	94	76	8	10	42.73

Table 2: Gender wise distribution of different shapes of coronoid process with their percentage

Shape	Percentage	Male(N=140)			Percentage	Female(N=80)		
		Bilateral	Unilateral Right	Unilateral Left		Bilateral	Unilateral Right	Unilateral Left
Hook	22.86	12	4	4	25	6	2	6
Traingular	35.71	18	8	6	30	8	6	2
Rounded	41.43	26	2	4	45	12	6	6

Table 3: Length of the coronoid process in 110 dry human mandibles

Shape	Length of coronoid process	
	Right (Mean + SD)	Left (Mean + SD)
Hook	16.12 + 1.82	15.93 + 1.79
Triangular	16.14 + 2.56	17.01 + 2.30
Rounded	16.09 + 1.76	16.24 + 2.38

Table 4: Comparison of various studies on the shapes of coronoid process

Shape	Male		Female	
	Right (Mean+SD)	Left (Mean+SD)	Right (Mean+SD)	Left (Mean+SD)
Hook	17.12 + 1.22	16.96 + 1.20	14.12 + 0.94	14.56 + 1.54
Triangular	17.50 + 1.51	17.95 + 1.84	13.61 + 2.16	14.74 + 1.65
Rounded	17.12 + 1.35	17.33 + 1.64	14.48 + 0.94	14.42 + 2.30

Table 5: Comparison of various studies on the shapes of coronoid process

Author	Type of coronoid process		
	Hook %	Triangular %	Rounded %
Isaac et al.[8]	27.4	49	23.6
Vipul et al.[9]	24.58	54.17	21.25
Pradhan et al.[10]	17.93	46.73	35.3
B. Lalitha et al.[11]	17.12	58.79	28.08
Hossain et al.[12]	45	29.65	25.35
Present study	23.64	33.63	42.73

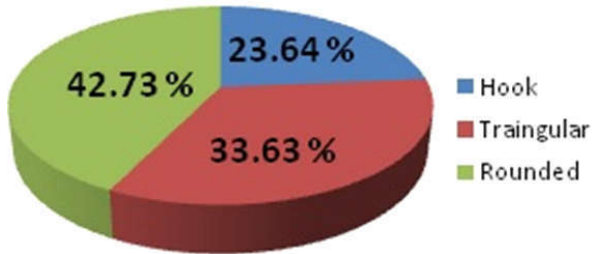


Fig. 1: Pie chart showing the distribution of various shapes of coronoid process in adult human mandible

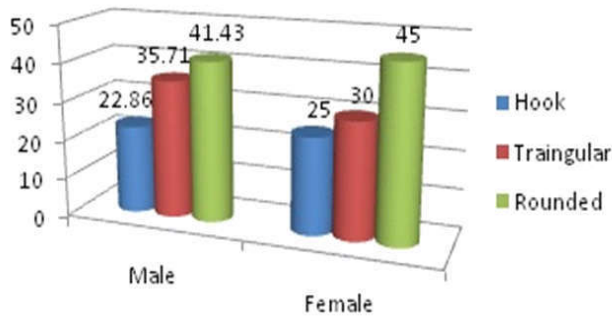


Fig. 2: Bar diagram showing gender wise distribution of various types of coronoid process in adult human mandibles



Fig. 4: Triangular coronoid process



Fig. 3: Hook shape coronoid process



Fig. 5: Rounded coronoid process

Discussion

The coronoid process, coronoid meaning 'crow', has been described as one of the bony processes of the ramus of the mandible [1]. Williams et al described the coronoid process as a flat triangular process [2]. Triangular coronoid processes have been illustrated

by Hamilton [3], Romanes [4], Snell [5], and Basmajian et al. [6], Schafer et al. [7] described the coronoid process as beak-shaped.

In present study, we observed rounded type of coronoid process (42.73%) more prevalent. In contrast to our study, Issac et al. [8], Vipul et al. [9], Pradhan et al. [10], B. Lalitha et al. [11] observed triangular type were more prevalent in their studies (Table 5). In present study, we observed hook shaped coronoid process (23.64%) least prevalent which is similar with Pradhan et al. [10] and B Lalitha et al. [11].

(Table 5) In the present study the, round and hook shaped types were the most and the least prevalent in males (41.43% and 22.86%) and as compared to Isaac et al. [8] and Hossain [12] where triangular and rounded were most and least prevalent in males (46.5% and 23.5%) respectively. The round and hook shaped types were the most and the least prevalent in female (45% and 25%) which is similar with B. Lalitha et al. [11] (39.65% and 25.86%) respectively (Table 6).

Table 5: Comparison of the variations in the shapes of coronoid process in relation to gender with other studies

Author	Hook (%)		Type of coronoid process Triangular %		Rounded %	
	Male	Female	Male	Female	Male	Female
Isaac et al. [8]	30	22.8	46.5	53.5	23.5	23.6
Vipul et al. [9]	21.33	21.11	56	51.11	22.66	27.77
Pradhan et al. [10]	21.87	13.63	45.83	47.72	32.29	38.63
B. Lalitha et al. [11]	11.36	25.86	68.18	34.48	20.45	39.65
Hossain et al. [12]	44.95	45.12	27.27	35.37	27.78	19.51
Present study	22.86	25	35.71	30	41.43	45

In present study, the size of coronoid process was found to be approximately 0.27 mm longer on the left side than on the right side, in contrast to our study, S nayak et al. [13] found the right side coronoid process was 1.5 mm longer than the left side. The size of coronoid process was found to be approximately 3.15 mm longer in males than females which is similar with S nayak et al. [13]. Triangular coronoid process was found to be the longest followed by round and then hook shaped which is similar with S nayak et al. [13]. Male hormonal impact on muscle growth, bone remodeling and psychology probably lead to enhanced functional stress on mandible due to mastication as compared to that in females [13].

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 [9]. The Coronoid process makes an excellent donor graft site for reconstruction of orbital floor deformities [14]. Clauser et al. [15] reported the use of a temporalis myofascial flap both as a single and as composite flap with cranial

bone, as the arteries supplying the coronoid process, arise from vessels that supply the muscles attaching to these processes, and generally not from the inferior alveolar artery which primarily supplies the mandibular body and teeth. Coronoid process skin island can be used in all aspects of reconstructive craniomaxillofacial surgery including trauma, deformities, tumors, temporomandibular joint ankylosis and facial paralysis. No functional limitations were apparent after removing the coronoid process.

Conclusion

Detailed knowledge of variations in the shapes of coronoid process is important for anatomist, anthropologists and forensic researchers. It also important for maxillofacial surgeons as it is used as graft material to reconstruct the osseous defects in maxillofacial regions.

Reference

1. Field E.J. and Harrioso R.J. Anatomical terms: Their origin and derivation, 1st Edn; W. Heffer & Sons Ltd. Cambridge. 1947. pp.34.
2. Soames, R.W. Gray's Anatomy In: Skeletal system. 38th Edn; Churchill Livingstone. New York. 1995. pp. 576-77.

3. Hamilton, W.J. Textbook of Human Anatomy In: Locomoter system 2nd Edn; Macmillan. London. 1976.pp.80.
 4. Romanes G. J: Cunningham's manual of Practical Anatomy In : The head and neck. 15th Edn; Vo III. Oxford University Press. Singapore: 1986.p.12.
 5. Snell, R. S.: Clinical Anatomy for Medical Students In : The head and neck. 3rd Edn; Little Brown and Company (Inc.) Boston. 1986.pp.773.
 6. Basmajian J.V. and Slonecker C.E. Grant's Method of Anatomy In: Side of skull, temporal and infratemporal regions. 11th Edn; Williams & Wilkins, Baltimore. London. 1989.pp.516.
 7. Schafer E. A. and Thane G. D.: Quain's Elements of Anatomy. In : The bones of the head. 10th Edn; Longmans, green & Co. London 1890.pp.60.
 8. Isaac, B.; Holla S.J. Variations in the Shape of the Coronoid Process In the Adult Human Mandible. Journal Anat. Soc. India 2001;50(2):137-39.
 9. Vipul Prajapati, Ojaswini Malukar, SK Nagar. Variations in the morphological appearance of the coronoid process of human mandible. Natl J Med Res 2011;1(2):64-6.
 10. Pradhan S, Bara DP, Patra S, Nayak S, Mohapatra C. Anatomical study of various shapes of mandibular coronoid process in relation to gender and age. J Dent Med Sci 2014;13:09-14.
 11. B Lalitha, N S Sridevi. Variations in the Shape of Coronoid Process of Indian Adult Dry Human Mandibles. International Journal of Scientific Study 2016;4(5):22-25.
 12. Hossain SM, Hossain SM, Banna FA. Variations in the shape of the coronoid process in the adult human mandible. Bangladesh J Anat 2011;9:75-8.
 13. S. Nayak, S. Patra, G. Singh, C. Mohapatra, S. Rath. Study of the Size of the Coronoid Process of Mandible. IOSR Journal of Dental and Medical Sciences 2015; 14(6):66-69.
 14. Mintz S.M., Ettinger, A., Schmakel, T. and Gleason M. J. Contralateral coronoid process bone grafts for orbital floor reconstruction : an anatomic and clinical study. Journal of Oral Maxillofacial Surgery 1998;56(10):1140-45.
 15. Clauser L., Curioni C. and Spanio S. The use of the temporalis muscle flap in facial and craniofacial reconstructive surgery. A review of 182 cases. Journal of Craniomaxillofacial Surgery 1995;23(4):203-14.
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