

Morphological Study of Mandibular Condyles - A Quantitative Approach

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Abstract

Background: In ontogeny, the mandible undergoes substantial morphological and dimensional changes. These changes are largely associated with development of primary and secondary dentition in the human. **Objectives:** To contribute to quantitative aspect of mandibular morphology, that will be of interest to Anatomists, Orthodontists and Anthropologist who need precise information about structural properties of bony parts. **Results:** Length of condyle of right and left side of the mandibles in dentulous group was not significant in while significant in edentulous group. Mean values of width of condyle indentulous and edentulous groups was in significant **Conclusions:** length of condyle is affected by edentulous state in this study.

Key Words: Dentulous, Edentulous, Bicondylar diameter.

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INTRODUCTION

Mandible, the only movable bone of the facial skeleton that forms almost the lower half of the face. It is one of the functionally and cosmetically important structures of the face that contributes to the facial contour. Evolution of Mandible, the lower jaw is of greatest interest in vertebrate history. It is one of the earliest innovations in the evolution of vertebrates. The evolution of jaws allowed gnathostomes (jawed vertebrates) to become effective predators and probably accounted for much of their subsequent success¹. It has been proposed that the origin of jaws was facilitated by a loss of expression of Hox genes (a specific class of homeobox containing

genes) since it has inhibitory effects on jaw formation.^{2,3} According to the classic morphological concept, the jaw in gnathostomes is assumed to have arisen by transforming one of the rostral gill arches. Changes in the jaws in the mandible are first seen in fossil man - in Neanderthal man and well formed in Cro-Magnon with well formed chin. With the evolution of prehensile hand, the coarse functions like tearing and attacking performed by jaw were partially abandoned or modified.⁴ The protruding chin is an attribute that defines modern Homo sapiens to the exclusion of all other primates, including fossil hominids.⁴ Mandibular notch becomes deeper; mandible becomes thin, small in size due to changes in food habit.⁴ During evolution, the angle of mandible (gonial angle) is decreased from straight line in early reptiles to almost a right angle in anthropoids. It has become obtuse in the transition from anthropoid to human. These changes in the gonial angle are associated with evolution of speech and evolution of lateral pterygoid muscle.⁵ From aesthetic point of view, the mandibular or gonial angle plays an important role in ensuring a harmonious facial profile. The mandibular angle, in conjunction with other anthropological parameters may be useful as anthropological tool in racial and / or population studies.⁶ The present study was

undertaken to evaluate the anatomical features of mandible, condyle and the influence of the state of dentition on mandibular symmetry was also studied. We compared these findings with earlier studies. The findings of this study might be useful in providing important data to anatomists, implantologists, orthodontists, archeologists, forensic legal experts and maxillo-facial surgeons.

MATERIAL AND METHODS

Measurements were made on one hundred and ten dry, macerated adult human mandibles of unknown sex. All mandibles were obtained from Bharati Vidyapeeth Deemed University Medical College, Pune and other Medical Colleges in Maharashtra, with prior permission of the concerned authorities. The mandibles were apparently normal, without any structural deformity. Dentulous (teeth ≥ 14; n = 98) and Edentulous (without any teeth; n = 12) mandibles were included for this study. Parameters were measured bilaterally wherever required. In the present study the parameters and their reference points are clearly defined and shown in the photographs. For comparison, we have selected database presented by those researchers who have selected similar reference points as in the present study. Majority of the studies done in different populations have focused their attention on sexual dimorphism. Some of the studies have been performed considering symmetry of the mandibles and have presented, compared values of right and left sides. In present study we have arranged our data in two groups i.e. Dentulous and Edentulous. We have compared the various parameters on right and left sides in these two groups.

Equipments:(1) Geometrical Protractor with marking up to 180° (2) Digital Vernire Caliper with 0.01 mm. precision (3) Measuring scale having marking up to 150 mm (4) Flexible measuring tape (5) Marker Pen and Pencil (6) Plain white papers. All the linear measurements were taken with the help of flexible measuring tape, scale and digital vernire caliper and noted in mm. Before measuring, the various anatomical landmarks were marked with the pencil. Condylion (CO) - The highest point on condylar process was taken as landmark for measurements. The parameters used are as follows:- 1. Length of Condylar process (LCO):- Maximum length of condylar process in mediolateral axis (Photograph.A) 2. Width of Condylar process (WCO):- Maximum width of condylar process in anteroposterior axis. (Photograph.A) 3. Bicondylar diameter (BiCO):- Maximum breadth between the lateral most point of condylar process. (Photograph.B)



Figure 1:

Figure 2:

After completing the measurements of all the mandibles, data was arranged in the following groups: Dentulous group (n=98) and Edentulous group (n=12). 3 different parameters were taken, namely length of condyle (LCO), width of condyle (WCO) and bicondylar diameter (Bico). Mean and standard deviation, p value was calculated.

RESULTS

Table 1: Showing measurements (in mm) of Length and Width of Condyle on Right and Left side of mandibles in Dentulous and Edentulous groups respectively

Type	Variables	Side	Maximum	Minimum	Mean±SD	Mean±SD	P value
Dentulous	LCO	R	22.65	9.89	18.64±2.56	18.63± 2.51	0.9572
		L	23.13	8.99	18.62±2.47		
	WCO	R	11.05	5.46	8.57±1.06	8.57±	
		L	16.9	5.57	8.57±1.46	1.26	
Edentulous	LCO	R	21.07	17.01	18.66±1.62	19.57± 1.92	0.0342*
		L	23.06	15.89	20.48±2.23		
	WCO	R	9.55	6.98	7.83±0.91	7.82± 1.02	
		L	9.43	6.40	7.80±1.13		

LCO–length of condyle WCO – width of condyle R- Right L- Left, *Statistically significant (P < 0.05)

Table 2: Showing measurements in (mm) of Bicondylar diameter (BiCO)

Denture status	Diameter	Maximum	Minimum	Mean±SD
Dentulous	BiCO	124.93	98.25	111.91±6.02
Edentulous		119.09	101.87	111.54±6.96

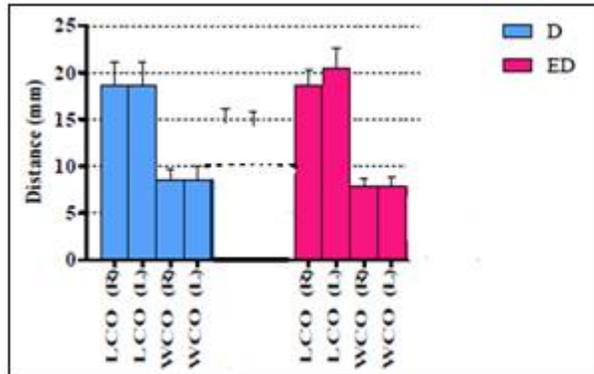
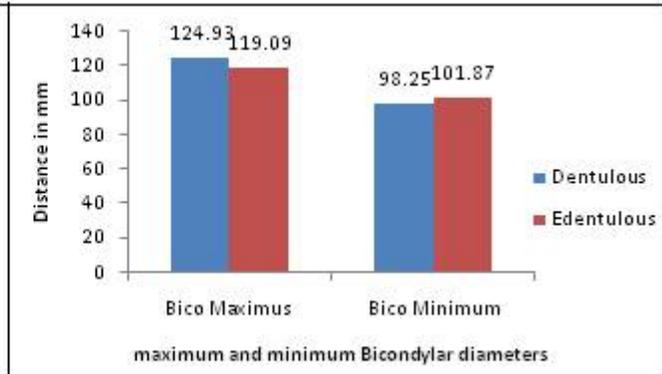
**Figure 1****Figure 2**

Figure 1: Showing measurements (in mm) of Length (LCO) and Width of Condyle (WCO) on Right (R) and Left (L) side of mandibles in Dentulous (D) and Edentulous (ED) groups respectively; **Figure 2:** Bar diagram showing measurements in (mm) of Bicondylar Diameter (BiCO)

DISCUSSION

Mandible presents a large number of parameters for morphometric study and has been widely studied over the last century. The method of selecting the various points of reference for morphometric study should remain constant. However difference of opinions is obvious in all these studies. In the present study mean values of Length of Condyle (LCO) in- Dentulous group on right side is 18.64 mm (maximum 22.65 mm, minimum 9.89 mm) and on left side is 18.62 mm (maximum 23.13 mm, minimum 8.99 mm). Statistically these two values are not significant i.e. asymmetry in length of condyle of right and left side of the mandibles in present study is not significant. Length in Edentulous group on right side is 18.66 mm (maximum 21.07 mm, minimum 17.01 mm) and on left side is 20.48 mm (maximum 23.06 mm, minimum 15.89 mm). Statistically these two values are significant. ($P < 0.05$). This indicates that length of condyle is affected by edentulous state. However, the mean values of LCO on both right and left sides in Dentulous group are less than in Edentulous mandibles. Ferrario *et al.* observed significant condylar asymmetry for shape as distinct from size was found on an 'intra-subject' basis, i.e. the left and right condyles of a single individual had a different shape with a large intra-individual variability. Conversely the mean condyle shape of the male and female was symmetric. Guillaume Captier *et al.* have recorded no significant difference between right and left side of length of condyle in dentulous as well as edentulous group. Mandke NK⁹ also did similar study showing comparison between mean

values of length of Condyle (LCO) and results were similar with our study. In the present study mean values of width of condyle (WCO) in Dentulous group on right side is 8.57 mm (maximum 11.05 mm, minimum 5.46 mm) and on left side is 8.57 mm (maximum 16.9 mm, minimum 5.57 mm). Statistically these two values are not significant which suggests that asymmetry of both sides is insignificant. Edentulous group on right side is 7.83 mm (maximum 9.55 mm, minimum 6.98 mm) and on left side is 7.80 mm (maximum 9.43 mm, minimum 6.40 mm). Statistically these two values are not significant which also suggests that asymmetry of both sides is insignificant. Guillaume Captier *et al.*⁸ noted no difference between right and left side of width of condyle in dentulous as well as edentulous group, this result was similar with our study. Mandke NK⁹ study had mean values of width of condyle 7.75mm and 7.58mm in males and females respectively, while in our study mean values of width of Condyle was 7.82 mm. In the present study mean values of Bicondylar Diameter (BiCO) in; Dentulous group is 111.91 mm (maximum 124.93 mm, minimum 98.25 mm) Edentulous group is 111.54 mm (maximum 119.09 mm, minimum 101.87 mm).

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