Section: Anatomy

Original Research Article

SYMMETRY OF THE MANDIBULAR ANGLE IN RELATION TO DENTITION STATUS: AN ANATOMICAL STUDY

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ABSTRACT

Background: Mandible, also known as lower jaw, is the largest bone of skeleton of face. The mandibular angle plays an important role not only in ensuring a harmonious facial profile, but also in ontogeny. The present study was undertaken to evaluate angles of mandible, its symmetry and effects of edentulousness.

Materials and Methods: The parameters were measured in 110 macerated and dry mandibles from various medical colleges in Maharashtra region.

Results: In the present study, in Dentulous group mandibular angles were symmetrical on both sides (mean of right 119.88˚, mean of left 120.21˚, $p > 0.05$). In Edentulous group, findings of present study show that symmetry of mandible was affected by the absence of teeth. Angles of mandible were significantly different on both the sides (mean of right 128.25˚, mean of left 124.25˚, $p < 0.05$). These findings of this study will be useful to anatomists, orthodontists, implantologists, archaeologists, forensic experts and oral and maxillofacial surgeons.

Conclusion: The study analysed mandibular angles in 110 Indian mandibles and found symmetry in dentulous bones but significant asymmetry in edentulous ones due to tooth loss, with results consistent with previous studies.

Keywords: mandible, angle of mandible, dentulous, edentulous.

INTRODUCTION

Mandible is the largest bone of skeleton of face. It forms almost the lower half of the face. It is one of the functionally and cosmetically important structures of the face that contribute to the facial contour.[1] Its evolution is of greatest interest in vertebrate history. It is one of the earliest innovations in the evolution of vertebrates. This can be correlated with change in food habits, evolution of higher mental abilities like evolution of hand, evolution of brain etc. Jon Mallatt,[2] stated that, jaws are interpreted as the most anterior arches of the ventilatory branchial basket. He also proposed that jaws first enlarged for a ventilatory function. Next, they enlarged and armed with teeth to function as organ of defence or prehensile organs or biting jaws. During evolution, the angle of mandible (gonial angle) is decreased from straight line (1800) in early reptiles to almost a right angle in anthropoids, as shown in [Figure 1]. It has become obtuse in the transition from anthropoid to human. These changes in the mandibular angle are associated with evolution of speech and evolution of lateral pterygoid muscle. 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. From aesthetic point of view, the mandibular angle plays an important role in ensuring a harmonious facial profile. Overall craniofacial morphology and more specifically the mandibular angle has been evaluated for interest in orthodontic, anthropologic and forensic applications.[3] So, the present study was undertaken to evaluate the measurements of mandibular angles, their symmetry and effects of state of dentition.[3]

The findings of this study will be useful for provision of important data to anatomists, orthodontists, implantologists, archaeologists, forensic experts and oral and maxillofacial surgeons.

Where Ag P – Angular process, C – Chin, Cn P – Condylar Process,
Cr P – Coronoid Process, AM – Angle of Mandible

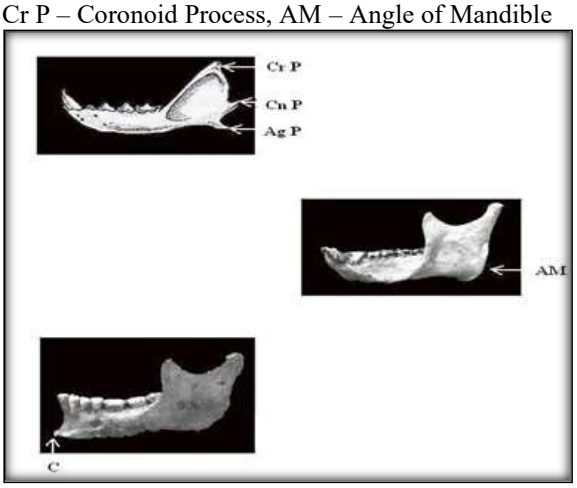


Figure 1: Evolution of Mandible

Aim and Objectives

1. To measure angles of mandible in dentulous and edentulous mandibles.
2. To compare symmetry of angles of mandible in dentulous and edentulous mandibles.
3. To prepare the database useful for surgical purposes.
4. To compare the findings of present study with previous studies.

MATERIALS AND METHODS

Material: The present study was conducted on 110 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. Angles of mandible were measured bilaterally with the help of Geometrical Protractor.

Duration: 3 years

Methods: Following parameters were defined.

Gonion (GO) - The most postero-inferior point on the ramus of mandible (at the angle of ramus and body of mandible).

Angle of mandible - (Gonial angle, Mandibular angle; AM): - Angle between posterior border of ramus and inferior border of body of mandible (Figure 2). All the angles were measured by tracing outline of the mandible on plain white paper and were noted in degrees with the help of Protractor.

Statistical analysis and methods: Data was collected by using a structure proforma. Data thus was entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of percentages and proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Comparison of mean and SD within same groups will be done by using paired t test to assess whether the mean difference between groups is significant or not. Descriptive statistics of each variable was presented in terms of Mean, standard deviation, standard error of mean.

A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

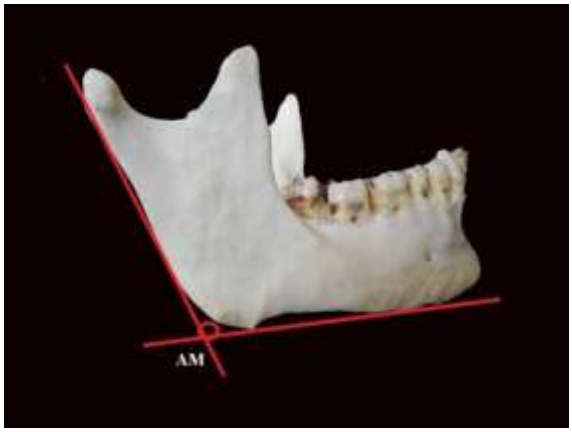


Figure 2: Angle of mandible - (Gonial angle, Mandibular angle; AM):

The data obtained was arranged in a table by calculating Mean, Standard deviation (S.D.), 'P' value. Mean values of AM of right and left side in Dentulous groups was analysed by applying Z test and in Edentulous group by Paired t – test.

RESULTS

The following tables show the arranged data:

Table 1: AM in dentulous mandibles

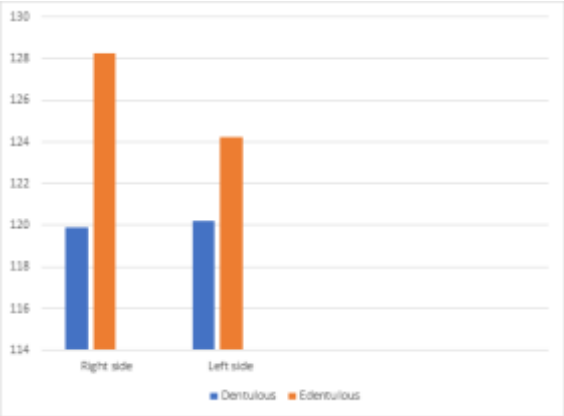
(°)		Maximum	Minimum	Mean ± SD	Mean ± SD (R+L)	P value	Z value
AM	R	140	98	119.88 ± 7.98	120.05 ± 7.82	0.8628	0.1728
	L	137	103	120.21 ± 7.65			

Statistically not significant (p > 0.05)

Table 2: AM in edentulous mandibles

(°)		Maximum	Minimum	Mean ± SD	Mean ± SD (R+L)	P value
AM	R	136	127	128.25 ± 5.26	126.41 ± 4.11	0.0335*
	L	132	121	124.25 ± 1.71		

Statistically significant *(P < 0.05)



Bar Diagram: Bilateral mean values

In the present study, the mean value of Angle of Mandible (AM) in;

- Dentulous group on right side is 119.88˚ (maximum 140˚, minimum 98˚) and on left side is 120.21˚ (maximum 137˚, minimum 103˚) Statistically these two values are not significant i.e., asymmetry in Angle of mandible of right and left side of the mandibles in present study is not significant.
- Edentulous group on right side is 128.25˚ (maximum 136˚, minimum 127˚) and on left side is 124.25˚ (maximum 132˚, minimum 121˚) Statistically these two values are significant. ($p < 0.05$) This suggests that symmetry is affected by edentulous state.
- The mean values of Angle of mandible on both right and left sides in dentulous group are less than in edentulous mandibles.
- In the present study, sexing of mandible was not done.

DISCUSSION

Oksayan R. et al,[4] found no significant difference in the gonial angle when compared in the young dentate, the old dentate and completely edentulous subjects. Qiu-Fei Xie et al,[5] found that elderly edentulous subjects had larger gonial angles than young and elderly dentate subjects. ($p < 0.001$). Aragao J A et al,[6] found that there was no statistically significant difference between right and left gonial angles ($p > 0.05$). They also noted that in edentate mandibles AM was significantly greater than dentate mandibles. ($p < 0.05$).

Study done by Chrcanovic BR et al,[7] showed statistically significant difference in the mean gonial angle when compared dentate and edentate mandibles regardless of gender. ($p = 0.005$).

Huumonen S. et al,[8] showed in their study that in edentulous subjects the gonial angle was significantly larger on both sides compared with dentate subjects. Women had a significantly larger gonial angle on both sides compared with men.

Gungor K et al,[9] showed that there were no differences between right and left gonial angles of the subjects.

In Indian population, Rajalakshmi Rai et al,[3] found the mean mandibular angle greater in females (121˚) than in males (118˚).

Captier G. et al,[10] also found no difference between right and left side of angle of mandible in dentulous as well as edentulous group. In contrast, they found mean values of angle of mandible in edentulous group lesser than dentulous group.

Ceylan G. et al,[11] found no significant differences between the mandibular angles when comparing partially edentulous and totally edentulous subjects.

Raustia AM et al,[12] found the right gonial angle statistically significantly smaller than the left one and correlated negatively with the ramus height in both sides.

Vinter I. et al,[13] described the influence of dentition on gonial angle. He found gonial angle significantly smaller in mandibles with 11 and more teeth (131.85˚) than with less than 11 teeth (135.85˚).

Melnik AK,[14] noted no significant difference between left and right gonial angles in a longitudinally followed sample of growing children.

Engstrom C. et al,[15] reported the gonial angle was significantly greater in both men and women in the edentulous groups than in either sex in the groups in possession of all teeth. Thus, they concluded the basal bone morphology in the mandible seemed to be changed in the same manner in both sexes in the edentulous groups after extraction of all teeth, in contrast to the alveolar bone diminution.

Zivanovic S. et al,[16] observed the mean value of the mandibular angle in male (120.14˚), and in female (127.96˚). Sexual differences were statistically significant and the average values of the mandibular angle for both sexes were characteristic for the Bantu population.

Keen JA,[17] also noted significant difference in mean values of angles of mandible. His findings were as follows, mean value of AM in young dentulous bones 125.40, in old dentulous 1240 and in edentulous bones 1310. He also suggested that prevention of absorption of alveolar border can preserve widening of angle.

CONCLUSION

The present study involved the preparation of morphometric database of Human mandibles in Indian population. One hundred and ten dried, intact human mandibles were selected for the study. They were classified into Dentulous (D) and Edentulous (ED) groups. Mandibular angles of all bones on both the sides were measured. The findings were tabulated, statistically analyzed and discussed, comparing them with similar studies done earlier.

In Dentulous group mandibular angles were symmetrical on both sides (mean of right 119.88˚, mean of left 120.21˚, $p > 0.05$). In Edentulous group, findings of present study show that symmetry of mandible was affected by the absence of teeth. Angles of mandible were significantly different on

both the sides (mean of right 128.25˚, mean of left 124.25˚, $p < 0.05$). The findings of present study support most of the studies done earlier. The limitation of this study is no. of edentulous mandibles (12) is very less as compared to dentulous ones (98). That is because of availability of the bones as these bones were obtained from unclaimed bodies received by Department of Anatomy in Medical colleges in Maharashtra region.

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