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Measurement of Angle of Mandible from Dry Bones and Orthopantomogram in North Indian Population

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Abstract
Introduction: *The mandible also known as jawbone is the largest and only movable bone of face except ear ossicles. It forms the inferior part of the facial skeleton which helps in chewing, speech and facial expressions. It develops from the first pharyngeal arch. The body of mandible is curved and has a pair of rami which project upwards from the posterior end of the body. Angle of mandible is the postero-inferior angle present at the junction of lower part of ramus and body of mandible.*
Aims & Objectives*: Present study was done to determine mandibular angle using dry bones and orthopantomogram in north Indian population.*
Material & Methods: *The study was conducted in the Department of Anatomy, King George's Medical University, Lucknow, Uttar Pradesh, India using 50 dry bones and 50 orthopantomograms. The angle was carefully measured using basic geometrical instruments or goniometer on dry bones and by using free trial version of Klonk Image Measurement Tool on orthopantomogram.*
Results: *The average value of angle of mandible as per findings of 50 dry mandible bone and 50 orthopantomograms was 121.32° for right side and 124.52° for left side. In each and every case the angle of mandible of left side was equal to or greater than the right side.*
Conclusion: *Angle of mandible show changes which may be attributed to physiologic function of the mandible. It also varies in male and female similar to the case of left and right side.*
Keywords: *orthopantomogram, angle, mandible.*

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I. Introduction

The largest bone of face is mandible that forms the inferior part of the facial skeleton which helps in chewing, speech and facial expressions. It is the only movable bone in the skull except the middle earossicles. It stretches from the left temporal bone to the right temporal boneforming a flat arch. The lower set of teeth is rooted in it. It consists of a curved, horizontal body and two perpendicular rami, which unite with the end of the body forming the angle of the jaw.

There have been numerous studies in the past decade that have proven the efficacy of orthopantomogram for the determination of morphological dimensions of the mandible. One more benefit of using orthopantomogram is that it allows bilateral mandibular assessment. The gonial angle is a common parameter used in orthodontic extractions or surgical treatment.

II. Material And Method

The study material included 50 dry mandible bones and 50 orthopantomograms issued by the Department of Anatomy, King George's Medical University, Lucknow, Uttar Pradesh, India. The measuring apparatus included basic geometrical instruments and the free trial version of KLONK IMAGE MEASUREMENT software tool [1]. Fifty mandibular bones and orthopantomograms were placed in five different groups (Table 1 & 2) for the ease of measurement and the average of each group was calculated. The angle of mandible also called the gonial angle is formed by the ramus line (AB) and the mandibular line (CD) where AB is tangent to the posterior border of mandible and CD is the lower border of the mandible through the gnathion.

For dry bones, two extreme points (1 & 2) on the posterior border of ramus and two (3 & 4) on the base of body of mandible were marked (Fig. 1). Points 1 & 2 and points 3 & 4 were joined. The two lines (AB and CD) were extended to intersect each other. The lesser valued angle formed is the angle of mandible measured with the help of goniometer. For orthopantomograms (Fig. 2), KLONK IMAGE MEASUREMENT software

was used. The angle was measured in degrees. All the readings were recorded carefully and were compared on the left and right side.

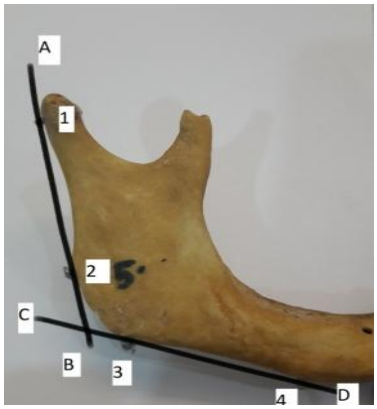

Fig. 1: Photograph showing measurement of angle of mandible in dry bone

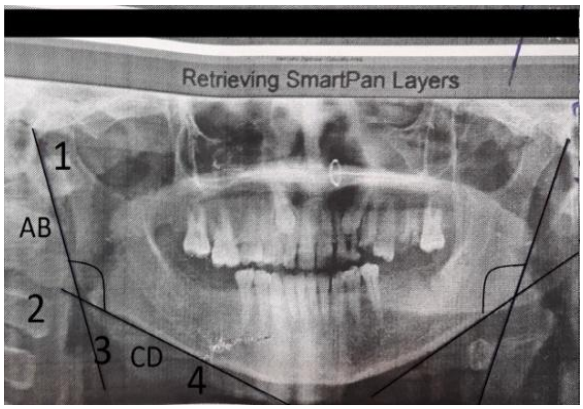

Fig. 2: Photograph showing measurement of angle of mandible in orthopantomogram

III. Observations And Results

50Orthopantomograms were evaluated along with 50 mandibular bones and the results were recorded. The present study showed that the angle of mandible of left side was equal to or greater than the right side. The average angle of mandible of the left side was 124.52° and that of the right side was 121.32°. The minimum value of angle of mandible on the right and left side was 105° and 108° and the maximum value of angle of maximum on the right and left side was 136° and 143° respectively. The maximum frequency of right side was observed 116°-125° and of left side 131°-135° (Fig. 3).

Table 1: Mean of angle of mandible in each group measured in Orthopantomogram

Group	Right Side	Left Side
Group 1	126.9°	131.3°
Group 2	120.5°	123.8°
Group 3	117.0°	122.1°
Group 4	121.0°	123.0°
Group 5	121.2°	122.4°

Table 2: Mean of angle of mandible in each group measured in dry Mandibular Bones

Group	Right Side	Left Side
Group 1	121.7°	119.7°
Group 2	119.6°	134.3°
Group 3	125.3°	123.4°
Group 4	123.4°	120.9°
Group 5	119.3°	123.0°

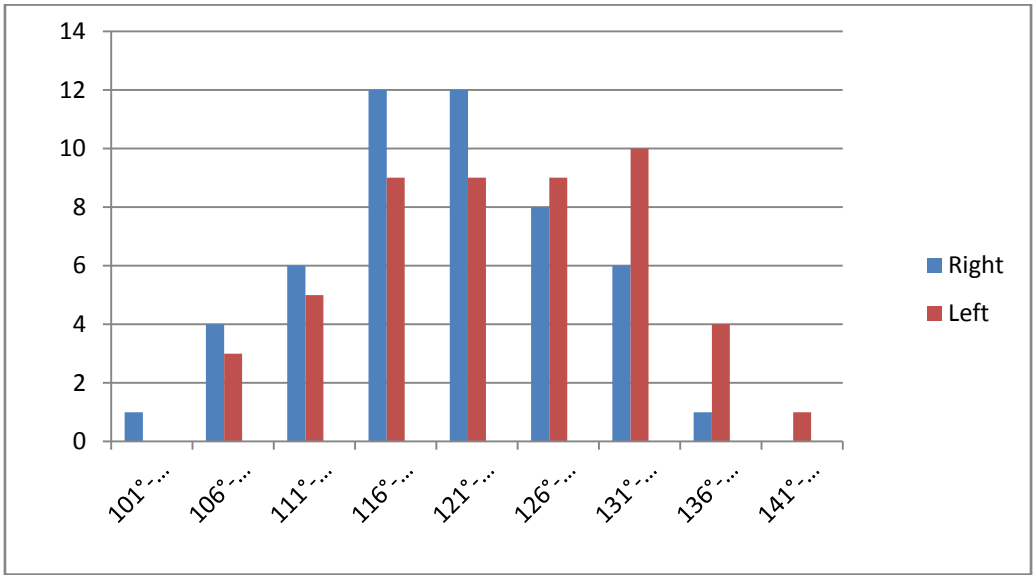

Fig. 3: Bar diagram showing frequency of angle of mandible on right and left side

IV. Discussion

The present study showed the similarity between the values obtained from dry bones and Orthopantomograms. Also it reflects that the angle on the left side is equal to or greater than the right side. This could be because the human population prefers to eat with the help of left side of mandible. Also men apply more masticatory force than women thus the angle is greater in males than females.

During evolution, the angle of mandible has decreased from an almost straight line in reptiles to almost a right angle in arthropods. It has become obtuse again in the transition from arthropods to man. The angle changes because of the altered function of the jaw [1]. A mandible with a broad and solid ramus has a smaller gonial angle than a mandible with a slender ramus [1].

Fractures at the mandibular angle account for the highest percentage of mandibular fractures in most of the studies. According to a theory, the third molar would weaken the angle by reducing the total available bone mass in the region. Therefore the mandibular angle would become more susceptible to fracture. In other words, the more deeply impacted are the third molars, the greater would be the risk for angle fractures. However, this hypothesis was not confirmed by several clinical studies. Instead, recent studies suggest that the risk of angle fracture is greater for partially erupted third molars and is decreased for deeper impactions [2].

Difference in the gonial angle of the two sexes has been found in the previous studies, and the general trend was that the gonial angles in males are greater than those measured in females [3]. Usually the mean angle is 3–5° greater in males [4].

This is consistent with the knowledge that males generally have a larger mandible than females. Findings concerning gender differences may also be explained by the fact that, on average, men have greater masticatory force than women [5].

Casey and Emrich (1988) used panoramic radiographs and found that the mean size of the gonial angle was 126.3 for the edentulous and 123.9 for dentate patients [4]. Taleband Beshlawy(2015) selected Egyptian population sample, the mandibular ramus showed a high sexual dimorphism and proved to be beneficial in sex and age estimation; while, the gonial angle could assist in sex estimation only [6].

Another study showed that the gonial angle and antegonial region are influenced by gender but not by age and dental status. Thus, changes taking place in gonial angle, antegonial angle, and antegonial depth can be implicated as a forensic tool for gender determination but not suitable for age determination [7]. However, the present study has no correlation between gender with gonial angle, and this is in context with various studies [8,9]. The findings of our study is in concordance with Faleh (2008) who did not establish any significant difference between sexes and gonial angle [10].

V. Conclusion

The angle of mandible depends on the physiology of the person. It states that more the use of a particular part of mandible bone more will be the angle of mandible. Thus, men have more value of angle of mandible than women. Also the maximum population prefers eating by the help of left side thus the left side angle is greater. The mean value of the angle of mandible of left side was greater or equal to that of the right side. The readings of the angle were similar when compared to the dry bones or the Orthopantomograms. There

seems to be a difference in the gonial angle with different age groups and sex, but it is not much significant or reliable.

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