EVALUATION OF MORPHOLOGICAL CHANGES IN MANDIBLE OF ELDERLY DENTATE AND EDENTULOUS SUBJECTS BY PANORAMIC RADIOGRAPHY

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ABSTRACT:

Introduction: Edentulous mandible undergoes several dimensional changes related to age and complete loss of dentition. The overall distribution of remodeling fields in the dentulous mandible differs markedly from that in the young, growing mandible.

Objectives: To evaluate and measure gonial angle, condylar height, mandibular height, ramus height and cortical bone thickness in elderly dentate and edentulous subjects using panoramic radiography.

Methods: A total of 240 subjects were selected and equally divided into 2 groups, edentulous and dentate group. A panoramic radiograph was obtained for each subject. Image thus obtained were traced using digital software, and

The morphological changes like gonial angle, condylar height, mandibular height and cortical bone thickness were measured and compared between dentate and edentulous patients and between genders as well.

Results: Results of the present study show that edentulous subjects have larger gonial angle than dentate subjects, while dentate subjects have greater condylar height, mandibular height, ramus height and cortical bone thickness. Women show larger gonial angle than men, while men have greater condylar height, ramus height and cortical bone thickness.

Conclusion: The outcome of present study showed that complete loss of teeth considerably modifies the shape of the mandible. Edentulous women undergo morphological changes of the mandible influenced by the dental status more than men.

Key words: panoramic radiography; mandible; gonial angle; condylar height; ramus height; cortical bone thickness.

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INTRODUCTION

During an individual's life, the morphological changes undergone by mandible are thought to be influenced by the dental status and age of the patient.[8]

Age, systemic factors and also loss of teeth may alter the morphology of mandible. These morphological alterations may include changes in gonial angle, height of ramus, height of condyle and cortical bone thickness.[6]

The shape of the mandibular base, especially the gonial angle correlates with the function and shape of the muscles of mastication.[10] The word **"gonion"** is derived from the Greek word meaning angle. It is also called as mandibular angle or angle of jaw, is the angle at which the lower border of the mandibular body meets the posterior border of the ramus.[8]

In edentulous subjects, lack of full occlusion causes insufficient occlusal forces to be projected to the mandible, which may affect the cortex of the bone leading to low mineral density. Dental radiographs have been used to predict bone mineral density. A number of mandibular cortical indices have been developed to assess and quantify the quality of mandibular bone mass and to observe signs of any resorption [13]

MATERIALS AND METHODS

A total of 240 subjects were selected from the Out Patient Department for this study. Age range of these subjects was from 50yrs.to 80yrs. These subjects were then divided into two groups.

Group I- Dentate group - consisting of 120 patients, who had all the natural teeth present. Presence or absence of third molars was not considered,

Group II- Edentulous group- consisted of 120 patients who were completely edentulous.

Measurement of Gonial angle

A tangent to the lower border of the mandible and another tangent to the posterior border of the ramus were drawn. The intersection of these two tangents formed an angle and this was called gonial angle (as shown in Figure 1). Measurement of this angle was done with the help of software.

Figure 1

Measurement of Condylar height and Ramus height

Measurements regarding the condylar height and ramus height were performed using the method introduced by **Kjellberg**. This technique uses the following points of references as shown in Figure 2.

1. The highest point of the condylar head(CO)
2. Deepest point between the coronoid process and condylar process(MN)
3. Gonion- A point where the line intersecting the gonial angle touches the mandible.(GO)

Tangents parallel to each other passing through these three points were drawn as shown in the figure 2

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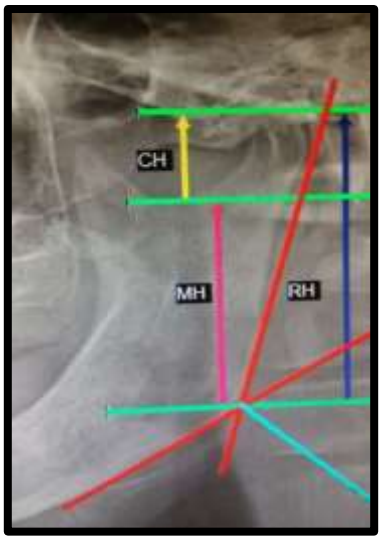


Figure 2

Condylar height (CH) was measured as the distance between the tangent drawn at the level of highest point on the condylar head (CO) to the tangent drawn at the level of deepest point between coronoid process and condylar process (MN).

Mandibular height (MH) was measured as the distance between the tangent passing through deepest point between coronoid process and condylar process (MN) and tangent passing through gonion (GO).

Ramus height (RH) was measured as the distance between the tangent passing through highest point on the condylar head (CO) to the tangent passing through gonion (GO).

Measurement of cortical bone thickness

It was done according to **Ledgerton et al** technique. According to this technique, the mental foramen was traced. From the center of this foramen a perpendicular was drawn to the tangent at lower border of mandible as shown in figure 3.

Figure 3

All these measurements were done for both right and left side of mandible and a mean was calculated. This was considered as final measurement value for each subject.

The data collected was subjected to statistical analysis for correct inferences.

RESULTS

A total of 240 subjects were selected and equally divided into 2 groups, edentulous and dentate subjects. In edentulous group, out of 120, 60 (50%) were males and 60 (50%) were females and similarly in dentate group, out of 120, 60(50.0%) were males and 60 (50.0%) were females. Age range for edentulous group was from 50 yrs - 68 yrs with mean age 60.40 (S.D±5.362) yrs and age range for dentate group was from 50 yrs – 69 yrs with mean age 60.80 (S.D±5.281) yrs. The mean age of 60.35 (S.D±4.513) yrs was for edentulous men and 60.45 (S.D±6.133) yrs for edentulous women and the mean age of 60.95 (S.D±4.489)

yrs was for dentate men and 60.65 (S.D±6.005) yrs for dentate women. When compared within the group, females show higher gonial
angle than males and was statistically significant for both the groups (p<.005). When gonial angle was compared for males in both the groups, the males of edentulous group show higher values than dentate group the groups,

TABLE-7-GENDER WISE COMPARISON

PARAMETER	MALES		SIG.	FEMALES		SIG.
	EDENTULOUS	DENTATE		EDENTULOUS	DENTATE	
GONIAL ANGLE	128.096±4.7171	115.489±2.4102	**0.00**	129.720±3.5082	116.41±2.7118	**0.00**
CONDYLAR HEIGHT	2.11 (±.4196)	2.23 (±.3645)	0.133	1.90 (±.2517	2.23 (±.2310)	**0.00**
MANDIBULAR HEIGHT	**5.080±.597**	4.99±.455	.785	4.84±.551	4.86±.423	.959
RAMUS HEIGHT	7.180±.560	**7.18±.477**	.831	6.785±.545	7.13±473	0.002
CORTICAL BONE THICKNESS	.3382±.07716	**.660±.062**	0.01	311±078	**.**564±.787.	0.00

Univariate analysis of variance & Post-hoc tests were used to analyse the difference in each variable with respect to gender and dental status with a significance level of (p<0.05)

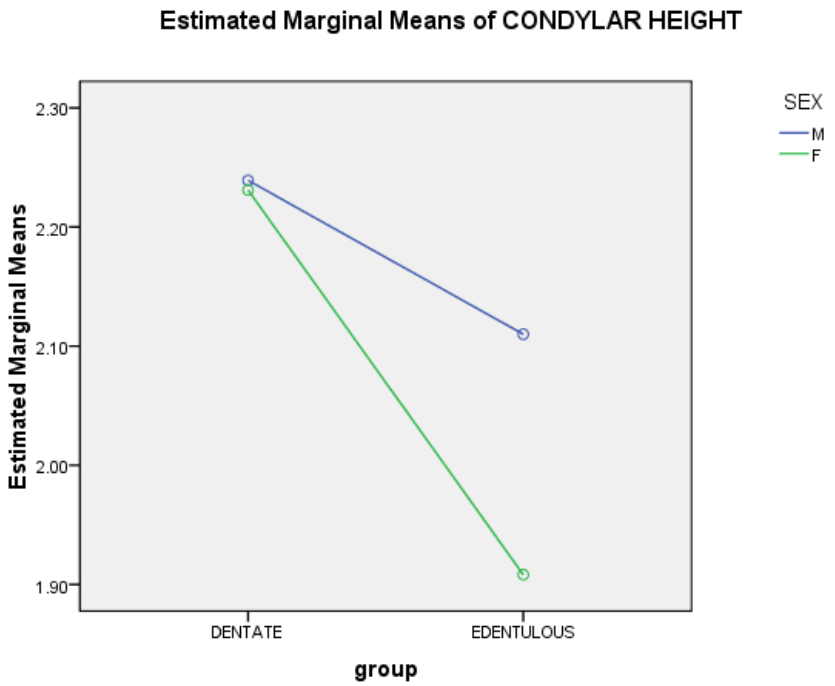
MEASUREMENT OF CONDYLAR HEIGHT-

Average condylar height for edentulous group was 2.009 (S.D±.347) cm whereas the average condylar height for dentate group was 2.235 (S.D±.314) cm. The condylar height in dentate group was higher than that of edentulous group and was statistically significant (p<0.001).

The mean value of condylar height among males in edentulous group was 2.11 (S.D±.419) cm and 1.90 (S.D±.251) cm among edentulous females. The condylar height for males in dentate was 2.23 (S.D±.364) cm and for females it was 2.23 (S.D±.231) cm.

When compared within the group, males show higher gonial angle than females and was statistically significant for both the groups (p<.013). When condylar height was compared for males in both the groups, the males of dentate group shows higher values than edentulous group and it was not significant (p>0.05),

when condylar height was compared for females in both the groups, the dentate females shows higher value than the edentulous ones and it was highly significant ($p<0.001$) as shown in Table 7, Graph 2.



GRAPH 2-
Males show higher values for condylar height than females. Females of dentate group shows significant higher values than edentulous group

MEASUREMENT OF MANDIBULAR HEIGHT-

Measurement of mandibular height for all subjects in both edentulous and dentate group was as shown in Table 6. Average mandibular height for edentulous group was 4.950 cm (S.D±.5869) whereas the average mandibular height in dentate group was 4.929 cm (S.D±.4425). The mean value among edentulous group and dentate group was statistically not significant ($p>0.05$).

When compared within the group, Males show higher mandibular height than females and was significant for both the groups ($p<0.004$). When mandibular height was compared for males in both the groups, no significant difference was found, similarly for females in both the groups, no statistical differences was found.

MEASUREMENT OF RAMUS HEIGHT-

Measurement of ramus height for all subjects in both edentulous and dentate group was as shown in Table 6. Average ramus height for edentulous group was 6.9833 cm (S.D±.5854) whereas the average ramus height for dentate group was 7.196 cm (S.D±.4782). The ramus height in dentate group was higher than that of edentulous group and was statistically significant ($p<0.002$).

When compared within the group, Males show higher ramus height than females and was highly significant for both the groups ($p<0.000$). When ramus height was compared for males in both the groups, males in dentate group had higher values than males in edentulous group and it was not significant. When, ramus

height was compared for females in both the groups, females in dentate group had higher values than females in edentulous group and it was significant ($p<0.002$)

DISCUSSION

Bone tissue undergoes constant change due to the simultaneous osteoclastic and osteoblastic activity, generally termed as bone remodeling. This turnover ensures the continuous replacement of old bone tissue, which, in turn, affects bone adaptation to various mechanical forces exerted on the skeleton.[7]

Out of all bones in the body, mandible is a unique bone as it develops within the mandibular arch, embedding teeth and forming an articulation of the jaw with the cranium: the temporomandibular joint (TMJ).[11] There is considerable mandibular growth during the first and second decade of life and mandible undergoes further secondary remodeling changes which can last into old age. During an individual's life, the morphological changes undergone by mandible are thought to be influenced by dental status and age of the patient.

Shape of the mandible correlates with occlusal condition and functions of the masticatory muscles. Longitudinal studies have shown that remodeling of mandibular bone occurs with age.[1,4] The distribution of remodeling fields in the edentulous mandible differs markedly from that of the young, growing and fully dentate mandible.[4]

Although the panoramic radiographs have some limitations, like difficulties in controlling the distortion and magnification of the images, an important advantage of this technique is that they are often a part of the routine examination of patients, thus their use for research purpose does not infer any extra exposure, in spite of being good source for studies and research.[11] Therefore, it is considered the gold standard for measuring the gonial angle.

In the complete dentition, all masticatory muscles take part in mastication. The function of the temporal and masseter muscle is reduced in partial or complete loss of teeth. In this study, female subjects had higher values of gonial angle than males. The Pearson correlation for assessing the correlation between males and females of both group show highly significant values for edentulous group ($p <0.001$). So, out of all groups edentulous females show highest value for gonial angle. The results of this study were in agreement with various other studies quoted in literature that showed the similar results of increase in size of gonial angle.[3] Our results correlate with **Huumonen et al (2010)** who found significantly larger gonial angle in females as compared to male.[12]

Our results showed that the condylar height and ramus height in dentate group were higher than that of edentulous group and were statistically significant.

It seems that the functional activity of the masticatory muscles influence the bone structure of the mandible in edentulous subjects. It has been noted that the muscle insertion regions respond to the increased muscular activity with increased bone density

The location of the mental foramen relative to the inferior and superior borders of the mandible appears to be a more useful reference mark and constant enough to justify its use as a reference point in clinical studies.[2,5,9]

Our results were in accordance with **Joo et al (2013)**[8] who suggest that edentulous subjects had a larger gonial angle than dentate subjects, while dentate subjects had greater cortical bone thickness and condylar height.

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