Biometrical and Morphological Analysis of the Mandibles in the Ancient Anatolian Communities

SUMMARY

In this study, mandible was assessed both metrically and morphologically. 39 mandible that we employed in our study belonged to the communities from different settling regions. Mandibles were provided from the collection of the Palaeontology Department of the Ankara University. Out of these mandibles, 31 were single, 8 being coupled with maxillae.

In Anatolia in the Contemporary and Middle Ages; it was established that there was not a direct relation between the medio-lateral condylar length, antero-posterior condylar length, mandibular length and the age. Condylar morphology was detected to tend to flatten proportionally with age at the horizontal and frontal planes. Attritional patterns of the teeth revealed the fact that they were generally fed on soft food.

Keywords: Mandible; Mandibular Condyle; Morphological Analysis; Biometrical Analysis; Anatomy

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Introduction

Teeth and physically powerful jaw musculature of the earliest human beings were their most effective weapons in collecting food, defence and attacking, and choosing a mate. Intelligence and culture are the most important characteristics that keep man superior to animals. As a result of the fact that people started to feed on soft food due to the discovery fire and mills, the decrease in the necessity of masticatory muscles gave rise to a lesser degree of development in these muscles in phylogenetic evolution, followed by a diminution in the osseous structure4,5,11,12.

It could be noticed from literature that, due to an excess of post-mortem dental losses, edentulous mandibles were investigated more than dentate mandibles1,6,7,10,22,29,31. Particularly, investigations on temporomandibular joint, which constitute condylar head and glenoid cavity, as well as its dysfunctions, occupy a great space2,3,8,9,13-28.

The different life style of the populations from dissimilar regions or Ages makes the morphogenesis characteristic of this people also different. It has been speculated that morphological and metric changes in bone structure could be noticed as a result of microevolution and the effect of the masticatory muscles.

The aim of this study was to investigate the morphological and metric differences among the mandibles belonging to 3 different regions of Anatolia, in the medieval and contemporary age.

Material and Methods

In this study, mandibles were assessed both metrically and morphologically. Those 39 mandibles belonged to the communities from the middle and contemporary ages, all of which were obtained from different settling regions (Aşvankale, Sardis, Bursa) in Anatolia. Mandibles were provided from the collection in the osteology laboratory of the Palaeontology Department, Faculty of Language, History and Geography, Ankara University. A total of 18 mandibles had both condyles, whereas 17 mandibles had only one condyle, and 4 mandibles had no condyle. Thus, the measurements could be completed on 53 condyles. Out of 39 mandibles, 31 were single and the remaining were coupled with maxillae.

Detection of age was carried out anthropologically in those coupled with the maxillae, whereas in single mandibles attempts were made to determine an approximate age statistically, depending on the teeth and metric measurements that were carried out. Such measurements, as mandibular length, were calculated directly on the “mandibulometer”13. Furthermore, the medio-lateral, and antero-posterior condyle dimensions were measured by a
guided compass of 1/10 scale. Mandibular condyles were evaluated morphologically at 3 different planes\textsuperscript{22}. Shapes of condyles were classified according to the classification by Solberg et al\textsuperscript{22} as follows (Fig. 1):

- **Horizontal plane**: elliptic, cylindrical, irregular;
- **Frontal plane**: slightly rounded, flat, gable;
- **Sagittal plane**: convex, locally concave or wedge.

Figure 1. Shapes of condyles, classified by Solberg et al\textsuperscript{22}

Results

Attempts were made to investigate whether there were any regional or periodical differences in terms of dimension between mandibles obtained from those that lived in 3 different regions of Anatolia in the middle and contemporary ages. In compliance with these, it was observed that there was no dimensional difference among groups in terms of their mandibular length, medio-lateral (M-L) and antero-posterior (A-P) condylar length. When the distribution of the mandibular length, M-L and A-P condylar length were investigated, the difference between parameters and age distribution were not found to be statistically significant.

The distribution of condylar morphology according to the age groups in frontal and horizontal planes was found to be statistically significant (Figs. 2 and 3). There was a noticeably flattening of the condyles at these 2 planes with the increased age. However, there was no statistically significant difference of condylar morphology in sagittal plane among different age groups (Fig. 4).

The attritional conditions of existing teeth were also evaluated. The results indicated that molars were mostly affected by attrition (Fig. 5).
Discussion

This study revealed that in 3 communities that lived in different ages and regions, there were no statistically significant differences between mandibular length and M-L condylar length measurements. In the measurements of mandibular length and mandibular condyle, shorter and greater lengths manifested a frequency more than expected in younger and older age groups, respectively. However, the differences were not statistically significant. While Whittaker et al observed sex related difference in the M-L condylar measurements in Romano-British materials belonging to the date of 400 A.D.; no sex related difference was detected in A-P dimensional measurements. This condition was interpreted by functional compressions on the masticatory system that directly affected M-L dimension, adding that functional compression was greater in males. Both the M-L and A-P dimensions of the condyles of the individuals in the Spitalfields community exhibited a proximity to the dimensions of European Medieval skulls. However, the A-P dimensions were significantly smaller than the corresponding dimension in the Romano British material. Although the M-L dimension of the condyle remained considerably the same from the Neolithic age until 19. Century, a substantial decrease was observed in its A-P dimension.

Evaluating morphology of the condyles, Oberg et al classification was used and the results were compared with those of the previous researchers. Oberg et al classification was preferred instead of Yale et al classification. The reason for this selection is the fact that the condyle form can be evaluated in 3 planes by Oberg et al classification. Whereas “flat shape” was observed more frequently by Wedel et al and Whittaker et al who adapted the same classification. The “curved-round” shape was encountered more frequently in the present study. When the correlation between condyle morphology and age was evaluated at the horizontal plane, the distributional difference between them was found to be statistically significant.

At ages younger than 30, elliptical condyle frequency was observed to be higher than the expected values, and at ages older than 30, cylindrical condyle frequency was determined to be higher than the expected values. Slightly
rounded condyle morphology was more frequent at frontal plane at ages younger than 30, flat shape was seen more frequently at ages over 30 at the sagittal plane. However, no statistically significant correlation was found between morphology and age. A more uniform condyle shape was observed at younger age groups at the frontal and horizontal planes and there was a flattening in the appearance of the upper edge of the condyle at the frontal plane as the age increased. This finding can be explained by the fact that upper edge of the condyle was more functional than the other surfaces.

Attempts were made in many studies to investigate the correlation between the variances of the condyle form and the attrition in the teeth or ante-mortem dental loss. The results indicate: the more dental loss and/or the more attrition, the more flattened the condylar shape will be. Yet, those groups with dental loss and attrition were encountered mainly in the advanced age groups. Considering that dental loss increases with age, it can be speculated that the reason may be a result of aging only. Whittaker et al selected their research group among skulls from the 18th century that belonged to people who fed on softer food and in this population, although the rate of dental attrition was minimal, flat condyle shape was encountered with at a rate of 45.7%; 69.6% of the population was in the 35-90 age group. According to Richards, dental attrition may be effective in the alteration of condylar shape. According to Whittaker et al, dental attrition was minimal, and no correlation was observed between condylar shape and attrition. Whereas sole dental loss might cause some remodelling and pathological alterations, it should not be considered as the only responsible factor for alterations in the condyle. Having minimal dental loss but feeding on a diet difficult to masticate may lead to more serious problems than having excessive dental loss but feeding on a softer diet.

In the present study, it was observed that teeth in the mandible were lost more often in the post-mortem period. The attritional diagrams of the existing teeth were examined and, from their attritional condition, it was detected that people who lived in those periods were generally fed on soft food.

Conclusion

In the mandibles obtained from those who lived in 3 different regions in Anatolia in the contemporary and middle ages:

1) Condylar morphology was detected to tend to flatten proportionally with age at the horizontal and frontal planes;
2) Attritional patterns of the existing planes revealed the fact that they were generally fed on soft food.

References


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