Institute of Experimental Morphology and Anthropology with Museum
Bulgarian Anatomical Society

Acta morphologica et anthropologica, 14
Sofia • 2009

Measurements on Temporomandibular Joint of Bulgarians

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The literature abounds with conflicting data on various morphometric aspects of the temporomandibular joint (TMJ). In spite of that, the amount of such records is not so massive for our local geographic region. The purpose of this study is to add sufficient information on the study of the osseous morphology of the human TMJ (i.e., the mandibular condyle, mandibular fossa, and articular tubercle). These structures were measured directly on 245 dry skulls and 149 matching mandibles. Analysis of variance, principle component analysis, and cluster analysis were performed. The skull is a source of taxonomic information but to date, measurements have generally been considered of value if they possess discriminate power. We have taken on mind the assertion that the TMJ must not be considered as a single morphological structure but rather viewed as functional unit with component parts, which subordinate to completely different sets of influences.

Key words: temporomandibular joint, mandibular fossa, condylar process, morphometrics.

Introduction

The skull is a source of taxonomic information. To date, measurements have generally been considered of value if they posses discriminate power regardless of whether their variation has been taxonomic, functional, or genetic in origin [6, 8, 11]. The present study of temporomandibular joint (TMJ) osseous morphology will attempt to shift the focus from variation to stability. Studies of the osseous morphology of the human TMJ (i.e., the mandibular condyle, mandibular fossa, and articular eminence) have been manifold in anthropological literature [5, 11]. The present contribution describes variation of the mandibular fossa and condyle of Bulgarians from Gabrovo region. We aim to characterize the size of TMJ components and to compare two different collections of skulls and between left and right measurements in each group.

Material and Methods

Samples

1. First group: The historical museum bone collection of rebels against Turkish Yoke in Dryanovo monastery was used for the present study. The material consists of total 144 skulls and 49 matching mandibles. All samples were from male individuals.

2. Second group: We measured 121 skulls and 100 matching mandibles from various collections from present time. The origin of the majority of the samples of the two groups is from the same geographic region in Bulgaria situated around Gabrovo.

Metric features

The three major metrical features of length, breadth and depth of the mandibular fossa were measured. Measurements of mandibular fossa length (anteroposterior dimension), breadth (mediolateral dimension) and depth (superoinferior dimension) were taken directly on the cranium. Measurements were made following the methods employed by Weidenreich (1943) and Tobias (1991), which have been used widely in biological anthropology [2].

Measurements for both groups were recorded and the average of the two sides was used. For the evaluation of articular tubercle dimensions, though no reliable caliper methods for measuring these features are present, we have measured its length and breadth. The same metric features were used for the condylar process of the available mandibles.

The values of each group were conveniently divided for the purpose of calculation on the following indices: TAL — articular tubercle length; TAW — articular tubercle width; FMD — mandibular fossa depth; FML — mandibular fossa length; FMW — mandibular fossa width; CML — mandibular condyle length; CMW — mandibular condyle width.

Statistical methods

Analysis of variance, principle component analysis, and correlation analysis were performed.

Results

Table 1 provides values for all measurements of mandibular joint components and indices for individual skulls from Draynovo Monastery (1st group) and from the different modern collections (2nd group).

The coefficient of variation (CV) calculations for both sides — left and right of the two groups for the different indices is up to 20%. For TAL, FML и CML the dispersion is weak ($V \leq 10\%$). The rest indices values show average dispersion. Therefore, the both studied groups are sufficiently homogeneous.

In Table 2 the results of comparison between the left and right TMJs in each of the two groups are revealed. No significant correlation is established. Table 3 compares the values of the left side between the two collections of skulls and of the opposite side measures of the same groups. The statistically obtained results show no significance between these calculated values.

Discussion

From the results of the present study, we find that there is no outlined heterogeneity of TMJ components metric features considering the sex and age, as well as the different period of living, which is supported by the available literature [1, 3, 7, 10]. Young individuals present the first group while the second includes persons that are more elderly. The second group is mixed in sex while the first is entirely composed of men.

T a b l e 1. Values of mandibular joint components

		1st Group							2nd Group						
		n	min	max	mean	SD	SEM	V	*n*	min	max	mean	SD	SEM	V
TAL	L	144	18	27	23.01	1.76	0.147	7.7	121	18	27	22.69	1.82	0.165	8
	R	144	18	28	22.87	1.74	0.145	7.6	121	18	27	22.71	1.78	0.167	7.8
TAW	L	144	8.5	16.5	11.42	1.33	0.111	11.6	121	8.5	16.5	11.16	1.38	0.132	12.4
	R	144	7.5	15	11.21	1.24	0.103	11	121	8	15	11.14	1.2	0.11	10.8
FMD	L	144	4.5	11	7.81	1.3	0.108	16.7	121	4	11	7.74	1.49	0.136	19.2
	R	144	3.5	13	7.85	1.48	0.123	18.8	121	4.5	11	7.66	1.37	0.125	17.9
FML	L	144	17	26	22.26	1.72	0.143	7.8	121	17	26	21.97	1.78	0.162	8.1
	R	144	18	26	22.08	1.7	0.142	7.7	121	18	25	21.77	1.7	0.155	7.8
FMW	L	144	7	13	9.99	1.14	0.095	11.6	121	7	13	10.14	1.19	0.108	11.7
	R	144	7	13	10.18	1.16	0.097	11.4	121	7	12.5	10.34	1.22	0.111	11.7
CML	L	49	16	22	19.38	1.62	0.231	8.4	100	16	22	19.3	1.61	0.161	8.4
	R	49	16	23	19.36	1.94	0.277	10	100	16	23	19.33	1.93	0.193	9.9
CMW	L	49	5	10.5	7.36	1.02	0.146	13.8	100	5	10.5	7.31	1	0.1	13.7
	R	49	5	10	7.38	1.07	0.153	14.5	100	5	10	7.35	1.01	0.101	13.7

T a b l e 2. Correlation analysis between the two sides in the each groups

		Group	*N*	Mean	SD	U	*P*
TAL	I Gr	L	144	23.01	1.76	0.68	>0.005
		R	144	22.87	1.74		
	II Gr	L	121	22.69	1.82	1.24	>0.005
		R	121	22.71	1.78		
TAW	I Gr	L	144	11.42	1.33	1.39	>0.005
		R	144	11.21	1.24		
	II Gr	L	121	11.16	1.38	1.05	>0.005
		R	121	11.14	1.2		
FMD	I Gr	L	144	7.81	1.3	0.25	>0.005
		R	144	7.85	1.48		
	II Gr	L	121	7.74	1.49	0.43	>0.005
		R	121	7.76	1.37		
FML	I Gr	L	144	22.26	1.72	0.89	>0.005
		R	144	22.08	1.7		
	II Gr	L	121	21.79	1.78	0.89	>0.005
		R	121	21.77	1.7		
FMW	I Gr	L	144	9.99	1.14	1.38	>0.005
		R	144	10.18	1.16		
	II Gr	L	121	10.14	1.19	1.29	>0.005
		R	121	10.34	1.22		
CML	I Gr	L	144	19.38	1.62	0.06	>0.005
		R	144	19.36	1.94		
	II Gr	L	121	19.3	1.61	0.12	>0.005
		R	121	19.33	1.93		
CMW	I Gr	L	144	7.36	1.02	0.1	>0.005
		R	144	7.38	1.07		
	II Gr	L	121	7.31	1	0.28	>0.005
		R	121	7.35	1.01		

T a b l e 3. Correlation analysis between each side in the two groups

		Group	*N*	Mean	SD	U	*P*
TAL	L	I Gr	144	23.01	1.76		
		II Gr	121	22.69	1.82	1.45	>0.005
	R	I Gr	144	22.87	1.74		
		II Gr	121	22.71	1.78	0.74	>0.005
TAW	L	I Gr	144	11.42	1.33		
		II Gr	121	11.16	1.38	1.56	>0.005
	R	I Gr	144	11.21	1.24		
		II Gr	121	11.14	1.2	0.46	>0.005
FMD	L	I Gr	144	7.81	1.3		
		II Gr	121	7.74	1.49	0.4	>0.005
	R	I Gr	144	7.85	1.48		
		II Gr	121	7.76	1.37	1.08	>0.005
FML	L	I Gr	144	22.26	1.72		
		II Gr	121	21.97	1.78	1.34	>0.005
	R	I Gr	144	22.08	1.7		
		II Gr	121	21.77	1.7	1.47	>0.005
FMW	L	I Gr	144	9.99	1.14		
		II Gr	121	10.14	1.19	1.03	>0.005
	R	I Gr	144	10.18	1.16		
		II Gr	121	10.34	1.22	1.08	>0.005
CML	L	I Gr	144	19.38	1.62		
		II Gr	121	19.3	1.61	0.28	>0.005
	R	I Gr	144	19.36	1.94		
		II Gr	121	19.33	1.93	0.09	>0.005
CMW	L	I Gr	144	7.36	1.02		
		II Gr	121	7.31	1	0.28	>0.005
	R	I Gr	144	7.38	1.07		
		II Gr	121	7.35	1.01	0.16	>0.005

In the available literature, the discussion about TMJ variety of its components is quite massive and conflicting but there is supporting evidence for the independence of TMJ dimensions of the intrinsic factors [7, 9, 11]. We suggest that this anthropologic homogeneity is dependent on the function of this structure, which needs future trials that are more concrete. The mechanism of mastication is not unique for mammals, especially for omnivorous, and close to human primates [4].

In conclusion, the TMJ and its osseous components are universal according to their metric values and no intrinsic (ethnic origin, sex) or extrinsic (like edentulism) factors can influence their alteration.

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