

Anthropological Characterization of *Processus Alveolaris Maxillae* and *Palatum Osseum* — Sexual Differences (Osteological Investigation)

S. Nikolova, D. Toneva

*Institute of Experimental Morphology and Anthropology with Museum,
Bulgarian Academy of Science, Sofia*

Summary. The aim of the investigation is to make comparatively assessment of sexual differences in metric and scopic characteristics of *processus alveolaris maxillae* and *palatum osseum* on bone material. The investigation was made on bone material from archaeological excavations of medieval necropolis. The cranial series includes 45 male and 38 female skulls of adult individuals. It was established that all measured breadths and lengths of *processus alveolaris maxillae* and *palatum osseum* have larger sizes in male skulls. According to data about calculated indices, the female *processus alveolaris maxillae* and *palatum osseum* are relatively wider and shorter compared to these in males. The sexual differences are better expressed in the form of *sutura palatina transversa* and the presence of *sutura incisiva* concerning scopics features. The palate length up to *spina nasalis posterior*, the maxillo-alveolar length and the palate's length, have greatest significance for the sexual differentiation, with priority in male crania.

Key words: *processus alveolaris maxillae*, *palatum osseum*, sexual difference.

Introduction

The anthropological characterization of human bones and in particular of cranium is a basis that gives data, which could help the determination of sex and age, the normal limits of metric variation at different features, the manifestation of bilateral asymmetry and differentiating the anatomical variations from the pathological alterations [1].

In our country purposefully investigation of *palatum osseum* on bone material was carried out by Y o r d a n o v [7]. Data for anatomical and anthropological characterization of *palatum osseum* in male crania were published in his PhD thesis. Assessment of some peculiarities in growth and manifestation of bilateral asymmetry of the palate was made as well.

The aim of this investigation is to make a comparative assessment of sexual differences in metric and scopic characteristics of *processus alveolaris maxillae* and *palatum osseum* on bone material.

Material and Methods

The investigation was made on bone material from the medieval necropolis in Drustur (9th – 15th century AD) including 45 male and 38 female crania of adult individuals [5].

The sex of the investigated cranial series was determined on the basis of metric features by the methods of Martin – Saller; Pashkova; Nikityuk [1, 10, 9].

The physiological age of the individuals was determined by the obliteration's degree Olivier [2] and by the degree of attrition of the chewing surfaces of the teeth Gerasimov [6].

The metric characterization of *processus alveolaris maxillae* and *palatum osseum* was made by the classic methods of Martin – Saller and Alekseev – Debetz [1, 4]. Eight linear features were measured and five indices were calculated. Five scopic features were investigated and described taking into consideration the corresponding grades and scales elaborated by Martin – Saller [1] and Movsesian, Mamonova, Raichkov [8].

The data in this investigation were computed by the variation and alternative analysis (SPSS. version 13.0). The established sexual differences of metric features were estimated through the U-test of Mann–Whitney. The quantitative assessment of sexual differences was made through the Wolanski's index for inter-group comparisons [3]. This index is used to determine the sexual differences and is called Index for Sexual Difference (ISD)

$$ISD = \frac{2 \cdot (x_1 - x_2) \cdot 100}{x_1 + x_2},$$

where x_1 – the feature's mean value in male; x_2 – the feature's mean value in female.

The sexual difference's strength is established through percentile analysis of ISD data. For borderlines are accepted the values of P_{25} ($P_{25} = 1.15$ IU) and P_{75} ($P_{75} = 4.66$ IU). The sexual differences are slightly expressed in ISD values lower than 1.15 IU. Values between 1.16 IU and 4.66 IU express moderate sexual differences, and over 4.67 IU – strong sexual differences.

Describing the results, the categories for the different features are defined according to their rubrics collaborated by Martin–Saller and Alekseev–Debetz.

Results and Discussions

Metric characterization

The biostatistician results from this investigation are given in Table 1.

The mean values of *processus alveolaris maxillae* length (60) in male crania fall into the borderlines of “moderate” category and in female crania – into “small” category. The comparison between both sexes shows, that in male crania the length is significant greater with 2.9 mm at $p \leq 0.05$.

In male crania the mean value of *palatum osseum* length (62) falls into the borderlines of “moderate” category, as in female ones – into “small” category. The mean values of *palatum osseum* length up to *spina nasalis posterior* (62a) for both sexes are into the borderlines of equal category – “moderate”. Both features are with greater mean values in the male crania. The differences between male and female crania for *palatum osseum*

T a b l e 1. Biostatistical characterization of absolute measurements and indices in *processus alveolaris maxillae* and *palatum durum* of adult individuals from both sexes

No by order	No by Martin	Features	Males ♂						Females ♀						ISD	U-value
			n	mean	min	max	SD	S _r	n	mean	min	max	SD	S _r		
1	60	Length of <i>processus alveolaris maxillae</i>	39	52.86	47	61	3.60	0.58	29	49.95	43	55	3.45	0.64	5.66	0.002*
2	62	Length of <i>palatum durum</i>	25	44.60	37	54	3.73	0.75	20	42.23	36	52	3.72	0.83	5.46	0.013*
3	62a	Length of <i>palatum durum</i> upto <i>spina nasalis posterior</i>	23	50.65	44	57	3.58	0.75	16	46.66	39	54	3.77	0.94	8.20	0.003*
4	61	Breadth of <i>processus alveolaris maxillae</i>	36	62.03	54	69	3.72	0.62	24	60.50	50	67	3.76	0.77	2.50	0.130
5	63	Breadth of <i>palatum durum</i>	33	40.94	33	52	3.85	0.67	23	39.39	35	44	2.40	0.50	3.86	0.096
6	63a	The largest breadth of <i>palatum durum</i>	28	41.98	36	52	4.08	0.77	23	40.59	36	46	2.55	0.53	3.37	0.249
7	63 ₍₁₎	Inner breadth of <i>palatum durum</i>	25	40.92	33	50	4.53	0.91	21	40.02	36	46	2.55	0.56	2.22	0.658
8	64	Height of <i>palatum durum</i>	29	12.28	6	19	3.18	0.59	22	12.20	6	17	2.85	0.61	0.65	0.909
9	61:60	Index of <i>processus alveolaris maxillae</i>	31	119.22	101.72	139.58	9.36	1.68	24	120.83	102.04	142.55	10.53	2.11	-1.34	0.519
10	63:62	Index of <i>palatum durum</i>	21	93.77	71.74	116.85	12.30	2.68	13	92.81	85.37	101.15	4.94	1.37	1.03	0.658
11	63:62a	1 st variant of index of <i>palatum durum</i>	18	83.19	61.11	106.12	11.82	2.79	12	83.69	76.47	89.13	4.37	1.26	-0.60	0.539
12	63 ₍₁₎ :62	2 nd variant of index of <i>palatum durum</i>	17	93.18	71.74	113.95	11.79	2.86	13	94.37	83.15	105.13	6.53	1.81	-1.27	0.983
13	64:63	Index for height of <i>palatum durum</i>	28	30.04	14.29	43.18	7.21	1.36	21	30.49	15.79	41.46	6.48	1.41	-1.49	0.824

* - statistically significant differences at $P < 0.05$

length is 2.4 mm and is almost twice less than this for *palatum osseum* length up to *spina nasalis posterior* — 4.0 mm, as the differences are statistically significant at $p < 0,05$.

The mean values of *arcus alveolaris maxillae* breadth (61) in both sexes are into the borderlines of “moderate” category. As about the mean values of *palatum osseum* breadth (63), sexual difference was already observed, as for the male crania it falls into the borderlines of “moderate” category, while for the female ones — into “large” category. In male crania *arcus alveolaris maxillae* breadth is with 1.5 mm greater compared to the female ones, and *palatum osseum* breadth respectively — with 1.6 mm greater.

The largest breadth of *palatum osseum* (63a) in male crania is greater with 1.4 mm in comparison with female ones, while the sexual difference for inner breadth of *palatum osseum* (63_u) is least, being 0.9 mm in favors of male crania.

The mean value of *palatum osseum* height (64) in male crania is slightly greater compared to female ones, being 0.1 mm.

The calculated mean values for both sexes are given in Fig. 1.

Index characterization for form and proportionality

The index of *processus alveolaris maxillae* (61:60) gives idea about *arcus alveolaris maxillae* relative breadth towards its length. The index mean values in male crania are into the borderlines of “moderate” category, while in female ones — into “large” category. The greater value of this index in female crania (1,6%), express a tendency of *arcus alveolaris* in them to be proportionately wider toward its length. According to the frequency distribution, in both sexes with greatest percentage are the crania with “moderate” index. Among all of them these ones within the borderlines of the “brachyuran” category predominate, i.e. the *processi alveolares maxillae* are predominantly wider and shorter.

The index of *palatum osseum* (63:62) is an indicator for the palate’s relative breadth toward its length. The index mean values in both sexes are within the borderlines of “large” category, which show that in all crania the relative breadth towards length of the palate is large. The greater mean value of the index in male crania (about 1%) expresses a tendency for *palatum osseum* in them to be wider toward its length. The frequency distribution shows that among male crania predominate those with “very large” index, while in female ones — with “large” index. In both sexes with greatest frequency are found crania within borderlines of the category “brachystaphylin”, i.e. with relatively wider and shorter *palatum osseum*.

The first-variant of index of *palatum durum* (63:62a) determine the correlation of palate breadth towards its length up to *spina nasalis posterior*. In both sexes the index mean value is of “very large” category, which shows again that the *palatum osseum* relative width towards its length is large. The greater mean value for female crania (0.5%), can be accepted as a tendency for the palates in them to be proportionately wider toward the length up to *spina nasalis posterior*. As about frequency distribution among male crania these with “moderate” index predominate, while in female ones — with “large” index.

The second variant of index of *palatum osseum* (63_u:62), calculated to the inner breadth of palate, has greater mean value in female crania (1.2%), which display again a tendency for the palate in them to be relatively wider toward the length.

The index for height of *palatum osseum* (64:63), which is indicator for the relative height toward palate breadth, has comparatively equal average values in both sexes. The female crania have insignificantly higher index’s value (0.5%), which could be accepted as a tendency for the palates in them to be slightly higher toward the length. In both sexes predominate the crania within the borderlines of “ortostaphylin” category, i.e. such with median high palates.

The calculated mean values for both sexes are given in Fig. 2.

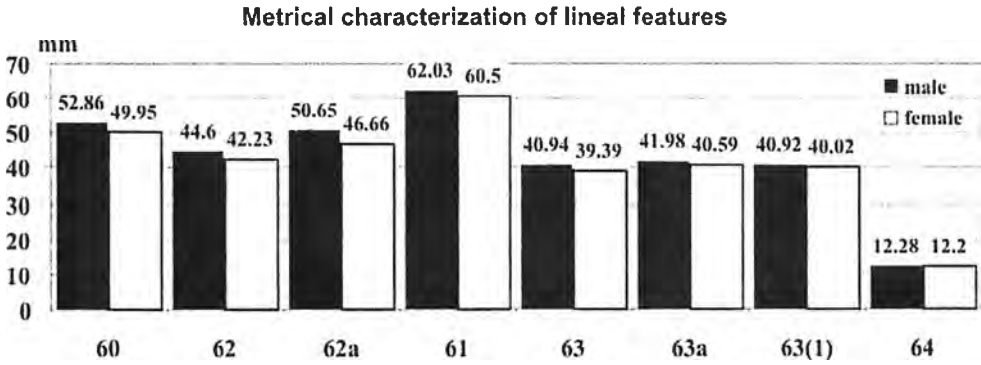


Fig. 1. Metrical characterization of investigated features

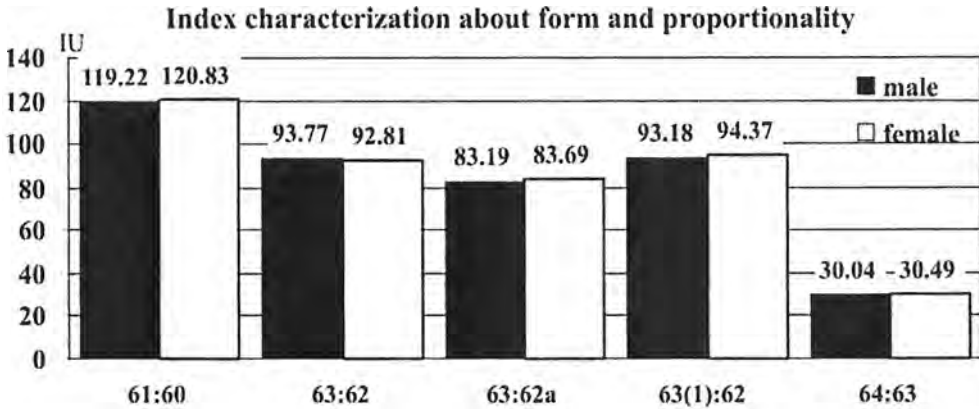


Fig. 2. Index characterization for form and proportionality

Comparatively assessment of the sexual differences on the basis of ISD data

ISD in all measured lineal features shows metric priority of *processus alveolaris maxillae* and *palatum osseum* in male crania. Strongest are the sexual difference of all lengthwise features — *palatum osseum* length up to *spina nasalis posterior* (8.20 IU), *processus alveolaris maxillae* length (5.66 IU) and *palatum osseum* length (5.46 IU). All breadthwise features shows moderately expressed sexual differences — *palatum osseum* breadth (3.86 IU), largest breadth of *palatum osseum* (3.37 IU), *processua alveolaris maxillae* breadth (2.50 IU) and inner breadth of *palatum osseum* (2.22 IU). Only *palatum osseum* height (0.65 IU) shows insignificant sexual differences.

In contrast to the lineal features, more of the calculated indices about form and proportionality show higher values of ISD in female crania. Moderately expressed sexual differences shows the index for height of *palatum osseum* (–1.49 IU), the index of *processus alveolaris maxillae* (–1.34 IU), as well as the 2nd variant of index of *palatum osseum* (–1.27 IU) with priority for female palates. Insignificant sexual differences shows the index of *palatum osseum* (1.03 IU) — with priority for male crania, and the 1st variant of index of *palatum osseum* (–0.60 IU) — with priority for female ones.

Scopic characterization

The form of *arcus alveolaris maxillae* in both sexes is mostly parabolic (the distal ends are moved apart). In male crania with almost equal values are the ellipsoid form (the greatest breadth is in the second molar's level, as the distal ends are slightly approximated to the middle plane) and the U-shaped form (the molar teeth's rows are almost parallel). In female crania the U-shaped form is accounted more frequently in comparison with the ellipsoid one (Fig. 3).

Anatomical variations

The presence of *torus palatinus* is accounted by a 4 grades scale (0-3). In the investigated osteological material for both sexes, most frequently registered is the entirely absence of eminence on the middle plane of the palate (grade 0). The swellings on the middle line of the palate, which cannot form unified bank (grade 1), are accounted at 24% in male crania and at 30% in female ones. There are single cases of small bank in both sexes, almost extending on the entire palate's length on the sagittal line (grade 2). High continuous bank, passing through the middle line of the palate (grade 3) is accounted only at one male cranium (Fig. 4).

The form of *sutura palatina transversa* in male crania is mainly convex (curved) forward while at female ones it is Π -shaped. Following by frequency in male crania is the Π -shaped form, while in female crania is the convex form. In male crania with equal frequency are the straight and the undulate forms of *sutura palatina transversa*, while the concave and the broken ones are missing. In female crania the undulate and the broken forms are represented in a lower percentage, and the concave form is missing (Fig. 5).

Sutura incisiva is an inconstant suture, situated on the backside of the incisors and being accounted within the borders of *palatum osseum*. *Sutura incisiva* among male crania is accounted in a lower percentage in comparison with the female ones. At 25 % from the male crania is found a preserved *sutura incisiva*, while in the female ones this percentage is higher — 47.4%.

Sutura incisiva sometimes appears on the facial surface and separates this region from the remaining part of *maxilla*, forming the *os intermaxillare*. In the investigated cranial series is not found presence of this anatomical variation in both sexes.

Conclusions

All measured breadthwise and lengthwise features of *processus alveolaris maxillae* and *palatum osseum* are with greater measurements in male crania compared to female ones.

According to the indices' characterization for form and proportionality, *processus alveolaris maxillae* and *palatum osseum* in female crania are relatively wider and shorter in comparison with these features in male crania.

From all scopic features strongest are the sexual differences of *sutura palatina transversa* and the presence of *sutura incisiva*. *Sutura palatina transversa* is predominantly convex in male crania and Π -shaped in female ones and the presence of *sutura incisiva* is represented at greater percentage in male crania.

According to ISD data strongest are the sexual differences of the lengthwise features — length of *palatum durum* upto *spina nasalis posterior*, length of *processus alveolaris maxillae* and the length of *palatum durum*, with metrical priority for male crania.

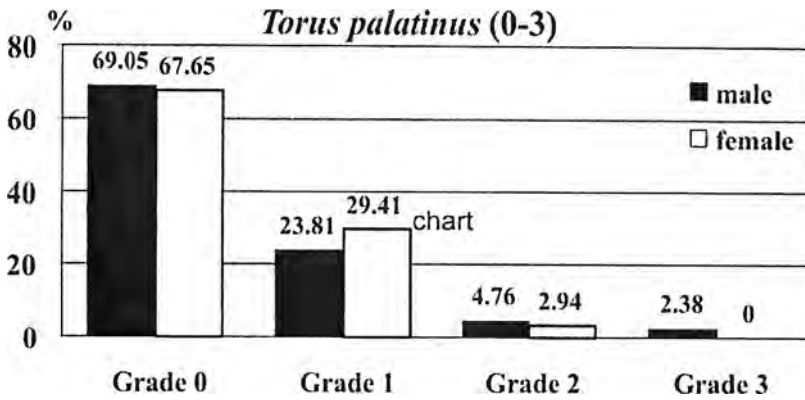


Fig. 3. Percentage distribution of *torus palatinus* by grades (0 – 3)

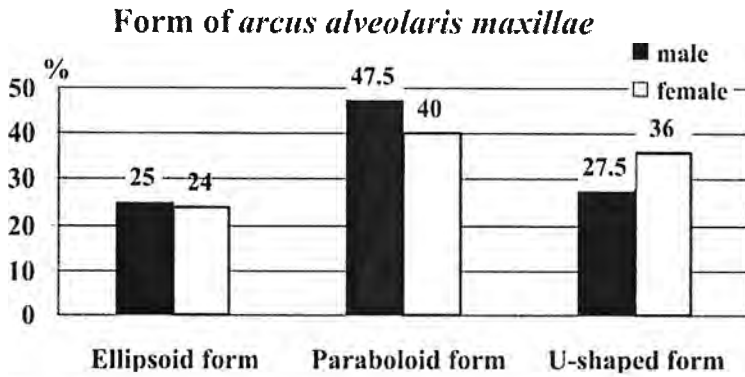


Fig. 4. Percentage distribution of the *arcus alveolaris maxillae* form

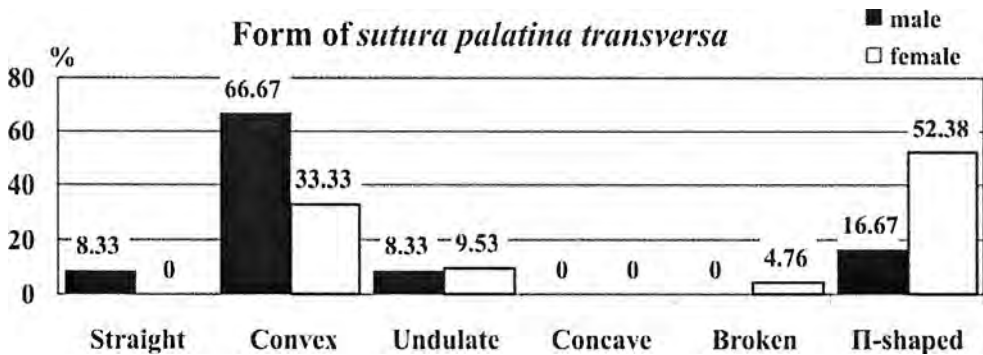


Fig. 5. Percentage distribution of the *sutura palatina transversa* form

These results are basis which could help to elaborate new quantitative indicators (indices, regression equations, etc.). The results could give additional information for determination of the sexual affiliation of buried individuals.

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