

Genealogic Study of Hard Palatal Anthropometric Characteristics in Children with Clefts

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The objective of this study is to perform hard palatal anthropometric measurements in relatives of children with clefts and to compare the results with these in healthy families. This comparison may answer some questions related to the inheritance of various palatal parameters and help the obtained result interpretation in clinical practice.

Key words: anthropometry, hard palate, genealogic study, palatal clefts.

Introduction

The incidence of congenital clefts of the lips, jaws, hard and soft palate occupies the second place among these of all human malformations observed [9].

While cleft hereditary predisposition is commonly agreed, there are contradictions concerning the character of their inheritance [9]. Clefts clinicogenetic polymorphism remains unclear, as the data related to their overall and particularly anthropometric examinations are limited. F r a s e r and C a l n a n [1] suggested a polygenic type of inheritance with a three-shold effect.

The knowledge of palatal anthropometric characteristics is of importance for the contemporary orthodontic treatment closely related to surgical interventions in palatal clefts. This refers especially to palatal indices characteristics, which may suggest the specific methods in cleft complex treatment. Based on them, the palatal correction parameters may be determined.

The inheritance of various biometric characteristics shows the specific features of a certain malformation.

Y. Y o r d a n o v [7, 8] and V. A p o s t o l o v a [6] performed hard palatal anthropometric measurements in adult Bulgarians. The data reported show that Bulgarian hard palate is brachystaphylic, and hypsistaphylic and orthostaphylic, according to Martin's index 58 and Martin's index 59, respectively. The coefficient of sexual dimorphism is higher in men [7]. For further deepening of the study of hard palatal anthropometric familial characteristics in children with clefts, we carried out an assessment of models in two groups of children relatives — of cleft and healthy children, and analyzed the results obtained.

Material and Methods

The relatives of 61 children with clefts and 31 healthy children were examined for palatal anthropometric parameters determination.

After maxillar imprints of children's relatives had been taken, 911 plaster maxillar casts were made for carrying out the anthropometric examinations.

Keeping examination methodology requirements, 4,815 anthropometric measurements were performed on the cast models.

For the aims of comparative genealogic analysis, the control group was determined according to Neel's method [3]. It included healthy children born during the same period as the children with clefts. Coincidence of 10 mother's and 7 proband's characteristics was searched for determining a close family status between the healthy and cleft children [9].

The cleft children were divided in three clinical groups:

I group: CL and CLP — cleft lips and cleft lips and palate with no accompanying malformations;

II group: CP — isolated cleft palate with no accompanying malformations;

III group: CL and CLP or CP with accompanying malformations or a diagnosed syndrome.

The casts of the third generation-relatives, and of the fourth generation-relatives in 13 families, were examined.

The obtained data were registered in a specifically designed statistical chart.

Palatal absolute dimensions were measured by a modified caliper [9] according to Martin — Saller's method elaborated by Y. Y o r d a n o v [7].

Using the sliding adjustable caliper's leg with a runner, simultaneous measurement of both dimensions — width and height, was performed thus achieving higher preciseness and shorter time of measurement.

The measurements included 6 hard palatal dimensions: palatal length, 3 palatal widths and 2 palatal heights. Based on them, 8 hard palatal Martin's indices were calculated - 63_2 : 62 (width-length 1); x : 62 (width-length 2); 63 : 62 (I_{58}) (width-length 3); 64_2 : 62 (height-length 1); 64 : 62 (height-length 2); 64_4 : 63_2 (height-length 1); 64 : 63_2 (height-length 2); 64 : 63 (I_{59}) (height-length 3).

The use of this method elaborated by us enables the comparison of present study results with other already performed palatal metric examinations in Bulgarian healthy population [5, 6, 11].

Results and Discussion

The anthropometric characterization based on hard palatal absolute dimensions is presented in Table 1. The mean values (M) of palatal length are the highest in III clinical group (42.85), and lowest in II clinical group (41.41). The rest palatal dimensions show also the highest mean values in III clinical group.

The indices calculated out of these dimensions give further detailed metric characterization of the palate.

According to classical anthropometry, I_{58} (width-length index 3) and I_{59} (height-length index 3) give the main characterization of human palate.

The performed anthropometric studies [8] determine the Bulgarian population palate as brachystaphylic, and hypsistaphylic and orthostaphylic, according to I_{58} (85.0-x) and I_{59} , respectively.

Table 1. Bio-statistical characterization of hard palatal absolute dimensions in control and clinical groups

No	n	Group	M	σ	V	m	min-max	Var. width
1. Palatal length	332	Control	42.60	3.89	9.13	0.20	27.5-50.7	23.2
	272	I	41.95	4.41	10.51	0.25	28.5-52.5	24.0
	95	II	41.41	3.87	9.35	0.38	28.1-50.0	21.9
	123	III	42.85	4.08	9.52	0.34	27.0-52.0	25.0
2. Width 4/4 First palatal width	320	Control	28.16	3.05	10.8	0.19	16.0-36.4	20.4
	256	I	27.33	4.17	15.25	0.29	16.0-37.0	21.0
	93	II	28.35	3.12	11.01	0.37	20.0-36.8	16.8
	119	III	28.88	4.25	14.71	0.55	22.0-40.3	18.3
3. Width 6/6 Second palatal width	330	Control	36.10	3.57	9.89	0.55	26.5-46.6	20.1
	262	I	35.69	4.18	11.71	0.25	26.5-48.2	21.7
	95	II	35.10	3.56	10.14	0.29	26.1-43.6	17.5
	125	III	36.98	4.07	11.0	0.42	28.8-45.5	16.7
4. Width 7/7 Third palatal width	325	Control	41.01	3.96	9.66	0.26	28.1-51.8	23.7
	259	I	41.13	4.21	10.24	0.34	32.2-52.6	20.4
	98	II	39.60	4.01	10.13	0.53	28.5-48.0	19.5
	125	III	41.81	4.06	9.71	0.42	31.5-51.5	20.0
5. Height 4/4 First palatal height	320	Control	9.54	1.76	18.44	0.11	4.0-15.0	11.0
	256	I	9.85	1.93	19.59	0.13	4.5-15.0	10.5
	93	II	9.29	2.03	21.85	0.23	4.0-14.0	10.0
	119	III	10.27	1.99	19.38	0.20	5.2-16.5	11.3
Height 76/67 Second palatal height	325	Control	13.64	2.50	18.33	0.14	6.5-22.0	15.5
	259	I	14.14	2.90	20.50	0.18	6.5-23.0	16.5
	95	II	13.64	2.79	20.45	0.29	6.5-23.0	16.5
	119	III	15.17	2.64	17.40	0.24	8.0-20.5	12.5

The distribution of measured palates (%) in the examined groups, according to rubrics, and I_{58} and I_{59} , is given in Table 2. The rubric of brachystaphylic palates shows the highest percentage of I_{58} in all four groups.

The inter-group comparison found no statistically reliable difference of I_{58} . In all four groups, the examined relatives demonstrated brachystaphylic palates, i.e. they show close values to I_{58} of the Bulgarian population.

I_{59} data analysis show closer values of M and G main parameters between the control and II clinical group compared to the control and I and III clinical groups.

The distribution of I_{59} (%), according to rubrics shows more frequent hypsistaphylic palates in I and III group — 29.4% and 31.1%, respectively, than in controls — 17.0% (Table 2).

The inter-group comparison found a statistically reliable difference of I_{59} between the control and I clinical group as well as between the control and III clinical group. This indicates higher values of height-width index 3 (I_{59}), i.e. higher palate in these groups.

The inter-group comparison of different degree of relationship found a statistically reliable difference of I_{59} between the control and I clinical group (in fathers, brothers, mother's side I-line nephews and mother's side grandparents).

A statistically reliable difference is found for all height indices in brothers and I-line nephews from mother's side, and in all height indices except for $I_{64:62}$ in grandparents from mother's side (Table 3). Besides, a statistical difference of index 64 : 62 is found in mothers and fathers, of index $64_a : 62_a$ — in aunts and uncles from mother's side and aunts and uncles from father's side, of index 64 : 63₂ — in fathers.

Table 2. Distribution of measured palates (%) in the examined groups, according to Martin's index 58 and Martin's index 59

Index	Martin's index 58 (%)			Martin's index 59 (%)		
	Lepto-staphylia X-79.9	Meso-staphylia 80-84.9	Brachy-staphylia 85.0-X	Hame-staphylia X-27.9	Ortho-staphylia 28.0-39.9	Hypsi-staphylia 40.0-X
Control group (n=294)	4.9	8.9	86.2	12.8	64.1	17.0
I group (n=252)	3.9	7.2	88.9	6.5	70.2	29.4
II group (n=87)	-	12.3	87.7	7.3	71.9	20.8
III group (n=110)	1.1	6.7	92.2	7.8	61.1	31.1

The bio-statistical data of indices in these relatives show higher mean arithmetic values (M) and standard deviation (σ) compared to these of controls. These results indicate that the observed statistically reliable difference is due to the higher palate in them (Table 3).

Among the degrees of relationship with established statistically significant difference, these of the first clinical group show higher M values of I_{59} , a result that indicates higher palate availability.

As for the rest indices, a significant correlation is found only for height indices between the control and I clinical group, and the control and III clinical group, and for width-length index 1 (63_2 ; 62) between the control and II clinical group.

The mean arithmetic values (M) of height indices — 64_a : 62, 64 : 62, 64_a : 63_2 and 64 : 63_2 are greater in I clinical group compared to control, a result that indicates higher palate availability (Table 3).

The inter-group comparison of different degree of relationship found a significant correlation of the four height indices between the control and I clinical group, mainly in mother's side relatives.

Conclusion

The examined groups having involved for a certain period all born cleft children [9] show that clefts in boys are two-fold more frequent than in girls as unilateral left-sided clefts are the most common. The higher frequency of height indices statistical differences in mother's side relatives suggests sexual related recessive inheritance of the various morphologic anthropometric characteristics.

The inheritance of certain familial pathologic characteristics is identical to this of normal anthropologic facial characteristics in a family reported by Sanders [4].

Palatal anthropometric characterization based on palatal indices show that although closeness of values to the typical for the Bulgarian population brachystaphylic palates [8] and data for individuals with normal dental arch [7], there is a reliable difference of height indices observed.

In I and III groups, the number of hypsistaphylic (high) palates predominates compared to control group, a result that indicates higher palate availability in these relatives.

These data are in consent with other authors' results [10], Mills [2], however, only in reference to clinical examination.

The results of anthropometric data comparison may serve as a basis for topographic anatomic characteristics determination in reconstructive treatment methods of cleft children.

T a b l e 3. Bio-statistical characterization of indices $64_1 : 62$, $64 : 62$, $64_1 : 63_2$, $64 : 63_2$ for the different degrees of blood relationship in the control and I clinical group ($P < 0.05$)

Degree of relationship	Group	Parameters											
		Height Length ($64_1:62$)			Height Length ($64:62$)			Height Length ($64_1:63_2$)			Height Length ($64:63_2$) index 59		
		M	σ	m	M	σ	m	M	σ	m	M	σ	m
Mother's side grandparents	Control I gr.	-	-	-	28.21	5.40	1.15	30.54	7.02	1.87	44.82	8.53	
					34.06	4.52	1.16	37.49	5.94	2.10	59.03	7.13	
Mothers	Control I gr.	-	-	-	32.25	5.30	0.95	-	-	-	47.25	8.93	
					35.77	5.09	0.98	-	-	-	57.75	10.02	
Fathers	Control I gr.	-	-	-	32.23	4.89	0.92	-	-	-	-	-	-
					35.80	6.74	1.27	-	-	-	-	-	-
Mother's side aunts & uncles	Control I gr.	-	-	-	-	-	-	31.45	4.04	0.90	-	-	-
					-	-	-	37.09	11.24	2.70	-	-	-
Father's side aunts & uncles	Control I gr.	-	-	-	-	-	-	40.24	8.96	2.24	-	-	-
					-	-	-	31.94	5.81	1.67	-	-	-
Mother's side I line-nephews	Control I gr.	22.32	4.77	0.72	31.52	4.64	0.65	33.37	6.32	0.95	46.71	7.65	
		26.06	5.26	0.88	34.69	5.41	0.87	38.06	7.20	1.20	51.66	9.88	
Brothers	Control I gr.	22.47	3.25	0.74	30.63	5.19	1.19	33.56	4.99	1.15	45.83	8.38	
		27.18	4.88	1.30	36.52	4.24	1.09	40.51	7.02	1.88	55.45	10.10	

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