Morphometric Features of Periodontal Phenotype and Anthropometric Parameters of the Maxillary Central Incisor in Patients with Generalized Periodontitis and Various Blood Types

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Abstract

Objective of the research was to identify dominant morphometric features of periodontal phenotype and anthropometric parameters of the maxillary central incisor in patients with generalized periodontitis and various blood types.

570 patients aged 20–55 years with established diagnosis of generalized periodontitis of the initial, I, II and III stages were examined. Determination of blood groups according to the AB0 system was performed using gel technology on the immunohematological analyzer. Study sample distribution considering different blood types demonstrated the following pattern: 0 (I) – 32.28%, A (II) – 29.65%, B (III) – 21.05%, AB (IV) blood group – 17.02%. Provided analysis revealed that cluster A1-ThinS (thin scalloped gingival phenotype with a thin tooth shape) was present in 39.30% patients (224 persons), cluster A2-TS (thick scalloped gingival phenotype with a thin tooth shape (or medium)) was detected in 28.77% patients (164 persons), and cluster B-TF (thick flat gingival phenotype with a square tooth shape) – in 31.93 % patients (182 persons). Carriers of 0 (I) and A (II) blood types with generalized periodontitis demonstrated morphological predisposition to the occurrence and intensification of dystrophic-inflammatory alterations within the periodontium due to the higher prevalence of periodontal A1-ThinS and A2-TS clusters among them.

Carriers of B (III) and AB (IV) blood types, among which the thick phenotype of periodontium was prevailed, characterized with greater prevalence of the mild generalized periodontitis, and lesser prevalence of II and III stages of periodontitis. No statistically significant difference in the length of the maxillary central incisor crown was found considering potential impact of blood type and periodontal cluster affiliation of the subjects ($p > 0.05$).

It was noteworthy that the maxillary central incisor crown width/crown length ratio in patients with generalized periodontitis belonging to the B-TF cluster was significantly higher than in those with the A1-ThinS cluster, and did not depend on the blood group.

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Introduction

Even though evidence base of periodontitis' treatment and prevention is one of the greatest one available for dental practice, but data on susceptibility to periodontitis considering potential impact of blood type remains aspect of discussion and further investigation.[1,2,3]

Evidences of blood group-specific features of generalized periodontitis remain insufficient, which leads to the search for new approaches and methodologies focused on these aspects within theoretical and clinical dentistry.[3,4,5,6]

Some associations between periodontitis and blood type have been explained through variations of periodontal biotype/phenotype, while also through the links with number of other morphological and anthropometric features of periodontium and teeth' crowns.[3,4,5,6]

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Periodontal biotype is one of the anatomical factors influencing the development of periodontal pathologies, while also having an impact on the outcomes of aesthetic restorations, implant and orthodontic treatment.[7,8]

The clinicians' awareness of periodontal biotypes is of primary importance in achieving optimal treatment results.

Initially, two gingival biotypes were considered – thin and thick, which were determined on the basis of anatomical criteria of the teeth (height and width of the crowns), alveolar bone thickness and gingival tissue volume, as well as the size of the attached gingival zone.[9,10,11,12] Later further detalization within biotype categories was proposed: thin scalloped gingival biotype, thick scalloped gingival biotype and thick flat gingival biotype, which allowed to expand the differential approach to the choice of treatment method (invasive, non-invasive methods), as well as to the prediction of treatment results and disease outcome.[7,13]

Different gingival biotypes react differently to inflammation, trauma, changes of the patient's somatic status (endocrine pathology, cardiovascular diseases, etc.).[14]

Recent 2017 classification of periodontal and peri-implant diseases and conditions highlights the change of the term periodontal biotype to term of periodontal phenotype.[15] Three types of periodontal phenotype have been introduced, classified by the specificity of the teeth, the mucogingival complex, and bone morphotype.[15, 16] Thin scalloped phenotype is described by slender triangular tooth crowns, subtle cervical convexity, interproximal contacts located closer to the incisal edge, narrow zone of keratinized tissue (KT), delicate and thin gingiva, and relatively thin alveolar bone.[15, 16] Thick flat periodontal phenotype is characterized by a square-shaped tooth crowns, pronounced cervical convexity, large interproximal contact point located more apically, wide zone of KT, thick, resilient, fibrotic gingival tissues, and relatively thick alveolar bone plate.[15, 16] The description of the thick scalloped periodontal phenotype (PP) consists of a thick fibrotic gingiva, slender teeth, narrow zone of KT, and pronounced gingival scalloping.[16] The clinical significance of the periodontal tissues and the search of different strategies to improve its quality leads to the development of a variety of clinical approaches for periodontal phenotype modification.[17,18]

Considering the ontogenetic commonality of periodontal and hard dental tissues, associations of periodontal biotype with the anatomical structure of teeth seems to be morphologically argumented.[19] The reason why the shape and size of the teeth determine the bone contour of the alveolar bone is that during human embryogenesis and ontogeny, the development and growth of the alveolar bone is stimulated by mechanical microimpulses transmitted from the tooth to the bone, which is termed as mechanotransduction phenomenon.[20] The more massive the tooth and the wider its occlusal surface, the more actively it participates in the act of chewing, stimulates the growth of alveolar bone, takes part in thick periodontal type formation, which in turn leads to less intense inflammatory and destructive changes within the periodontium.[21]

The periodontal phenotype varies from one individual to another, while also within different areas of the dentition in the same person.[21, 22] It has been noted that in some populations there is a significant dominance of certain periodontal phenotype.[22] According to some authors, variations in the structure of periodontal tissues allow to predict with a certain degree of probability the variant of development and the degree of pathological processes expression within the periodontium.[9, 23] Since the specifics of the PP can influence the periodontal health and the future treatment of patients, it is crucial to evaluate it before planning and executing any treatment strategies.

The ABO blood group system is a system of balanced polymorphism in means of increasing the population's adaptive capacity, resistance to diseases and environmental hazards.[2, 5] There are still controversial arguments available in the literature regarding the relationship between blood type and susceptibility to various dystrophic-inflammatory diseases of periodontal tissues.[3, 4, 5, 6] Also blood group-specific features which may potentially impact pathogenesis of generalized periodontitis have not been studied enough to make some consensus conclusions. Therefore, the establishment of relationships between morphoanthropometric characteristics of periodontium and various blood types potentially may help to identify patients groups with

increased risk of inflammatory and dystrophic-inflammatory periodontal diseases development, while also it may help to identify groups with some specific feature of the disease's course, which in turn may impact the choice of the most appropriate treatment approach.

Objective: To identify dominant morphometric features of periodontal phenotype and anthropometric parameters of the maxillary central incisor in patients with generalized periodontitis and various blood types.

Materials and methods

The study was conducted at the Department of Pediatric Dentistry (I. Horbachevsky Ternopil National Medical University) in the period from 2018 to 2022. 570 patients aged 20–55 years with established diagnosis of generalized periodontitis of the initial, I, II and III stages were examined. The size of the patient sample was determined by the design of the previous studies.[2, 8]

Determination of blood groups according to the AB0 system was performed using gel technology on an immunohematological analyzer (IH-1000, BIORAD, USA).[23] The material for the study was venous blood.

The diagnosis of generalized periodontitis was established in accordance with generally accepted clinical criteria and data obtained during paraclinical examination.[21] Diagnostic approach dictated by Classification EFP & AAP World Workshop, 2017 was used to establish the final diagnosis.[25]

Anthropometric parameters of the maxillary central incisor considering its' association with periodontal biotype were measured with the use of high-precision intraoral caliper and expressed in millimeters (mm). Crown length/width (CL/CW) ratio according to the procedure described by Olsson and Lindhe.[7, 9] The length of the crown was measured between the cutting edge of the crown and the free gingival margin or, considering position of enamel-cementum border, if such was visible. The length of the crown was divided into three parts of equal height. The width of the crown, i.e., the distance between the proximal surfaces of the tooth, was measured at the border between the middle and cervical regions.

The gingival height was measured using a periodontal probe, and it was defined as the distance from the free gingival margin to the mucogingival junction. The height of the gingival papilla was assessed using a periodontal probe on the medial and distal sides of the central incisors. This parameter was defined by Olsson et al. as the distance from the top of the papilla to the line connecting the midfacial soft tissues of the adjacent teeth.[9]

The periodontal phenotype was determined using Hu-Friedy Colourvue Biotype Probe. The use of these instruments allows to classify the biotype into thin (Cluster A1: thin – scalloped gingival biotype, ThinS), medium (Cluster A2: thick – scalloped gingival biotype, TS) and thick (Cluster B – flat gingival biotype, TF).[7] If all three probes are visible through the soft gingival tissues, the phenotype is thin; if no white color is seen, but green and blue are present, the phenotype is medium; and if none of the probes can be seen through the gums, the phenotype is thick. [17]

Statistical analysis: The statistical analysis of the results was carried out using the computer programs «Excel» (Microsoft Office 2019, Microsoft Corp., USA) and «Statistica. Version 8» (StatSoft, Inc., Tulsa, OK, USA). Descriptive statistics included the calculation of relative and mean values. Categorical parameters were presented in the form of relative indicators (percentage of patients with the presence of a sign in the group, %). Quantitative indicators were presented in the form M ± m, where M is the arithmetic mean, m is the standard error of the mean. Student's criteria and the $\chi 2$ test (chi-square test) were used to test the significance of the difference between groups of categorical (qualitative) attributes. Two-sided Student's t-test was used to test the significance of the difference between the mean values. Differences were considered significant at a value of $p < 0.05$, which is generally accepted for biomedical research.[26]

Ethical aspects: Design of present research and its correspondence with all ethical norms was approved by the Bioethics Committee of the I. Gorbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine (protocol №6 approved on March 26th 2023), while present study represent part of complex scientific research work of the Department of Pediatric Dentistry at I. Gorbachevsky Ternopil National Medical University (Ukraine) dedicated to the improving the treatment and prevention of

dental and periodontal diseases in people of different ages and physical conditions

Results

Study sample distribution considering different blood types demonstrated the following pattern: 0 (I) – 184 patients (32.28%), A (II) – 169 patients (29.65%), B (III) – 120 patients (21.05%), AB (IV) blood group – 97 patients (17.02%).

Provided analysis revealed that cluster A1-ThinS (thin scalloped gingival phenotype with a thin tooth shape) was present in 39.30% patients (224 persons), cluster A2-TS (thick scalloped gingival phenotype with a thin tooth shape (or medium)) was detected in 28.77% patients (164 persons) and cluster B-TF (thick flat gingival phenotype with a square tooth shape) – in 31.93 % patients (182 persons) of the total number of patients with generalized periodontitis (GP) (570 patients) (Figure 1).

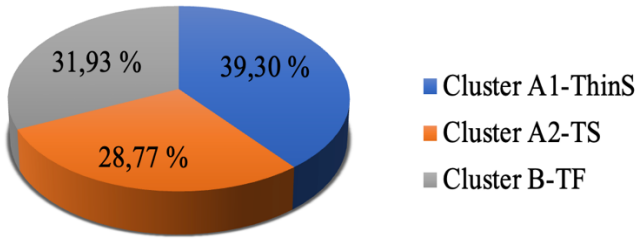

Figure 1. Distribution of patients with generalized periodontitis considering periodontal phenotype.

According to the obtained data it was found that in patients with GP and blood type 0 (I) the A1-ThinS cluster was found in 44.02% cases, which was analogical to the patients with GP and blood type A (II) (46.15%) ($p > 0.05$). At the same time, periodontal phenotype A1-ThinS was significantly less common in patients with GP and B (III) and AB (IV) blood types (26.67% and 24.74%, respectively).

The A2-TS periodontal phenotype in carriers of blood type 0 (I) was found in 28.80%, which did not differ from the data of the other groups of subjects with GP ($p > 0.05$). At the same time, it was noted that among patients with GP and B (III) and AB (IV) blood types, the B-TF cluster was identified significantly more often (40.00% and 41.24%, respectively) than in patients with GP and 0 (I) and A (II) blood types (27.18% and 26.04%, respectively) (Table 1).

Phenotype of periodontal	Patients with GP (n=570)							
	0 (I) blood type, (n=184)		A (II) blood type, (n=169)		B (III) blood type, (n=120)		AB (IV) blood type, (n=97)	
	abs. num.	%	abs. num.	%	abs. num.	%	abs. num.	%
Cluster A1-Thin S	81	44,02	78	46,15	32	26,67 *, †	24	24,74 *,†
Cluster A2-TS	53	28,80	47	27,81	40	33,33	33	34,02
Cluster B-TF	50	27,18	44	26,04	48	40,00 **,††	40	41,24 **,††

Note 1. *p<0,01; **p<0,05 – significant difference compared to patients with GP and blood type 0 (I).
Note 2. †p₁<0,01; ††p<0,05 – significant difference compared to patients with GP with blood type A (II).

Table 1. Variations of periodontal phenotypes depending on blood type among patients with generalized periodontitis.

It was found that patients with 0 (I) and A (II) blood types, who had A1-ThinS periodontal cluster, demonstrated the lowest detection frequency of generalized periodontitis of initial stage and I stage, which corresponded to 13.58% and 17.98%, respectively ($p > 0.05$). At the same time, carriers of B (III) and AB (IV) blood types with above-mentioned cluster affiliation, were diagnosed with initial stage of GP more often (59.38% and 66.67%, respectively).

In representatives of blood type 0 (I) with A2-TS cluster the summed prevalence of initial stage and I stage generalized periodontitis was 28.30%, and it was 2.0 times higher than in patients with the A1-ThinS cluster ($p < 0.05$). In patients with blood type A (II), who were the carriers of the A2-TS cluster, the summed incidence of initial stage and I stage generalized periodontitis was not statistically different from the people with blood type 0 (I), and equaled to 38.30% ($p > 0.05$), but at the same time it was 2.0 times higher than in carriers of blood type A (II) with the A1-ThinS cluster ($p < 0.05$).

Frequency of initial and I stage GP identification among carriers of B (III) and AB (IV) blood groups with A1-ThinS and A2-TS clusters was the same ($p > 0.05$). Also, prevalence of initial and I stage GP among patients of all study groups with the B-TF cluster was the same ($p > 0.05$).

It was noteworthy that the frequency of detection for II stage GP among the examined patients did not depend on the periodontal phenotype and was determined with the same level of incidence among carriers of different blood types ($p > 0.05$). The prevalence of III

stage GP was the highest in patients with blood type 0 (I) and A (II) with periodontal phenotype A1-ThinS (54.32% and 47.40 %, p > 0.05, respectively). At the same time in carriers of B (III) and AB (IV) blood types with this periodontal phenotype the lowest frequency of III stage GP was determined (18.75±6.89% and 12.50±6.75%, respectively). Carriers of blood types 0 (I) and A (II) with B-TF cluster was diagnosed with III stage GP less frequently (in 16.00% and 18.19%, respectively) compared to the patients with A1-ThinS cluster (p < 0.01). In patients with B (III) and AB (IV) blood type, the prevalence of III stage GP in the B-TF cluster did not differ from that in the A1-ThinS periodontal phenotype (p > 0.05). It should be noted that in the periodontal phenotype A2-TS the frequency of III stage GP detection was lower in carriers of B (III) and AB (IV) blood types compared to those with blood type 0 (I) (p < 0.01) (Table 2).

Blood type	Periodontal phenotype (cluster)	GP initial – I stage, (n=214)		GP II stage, (n=188)		GP III stage, (n=168)	
		abs. num.	%	abs. num.	%	abs. num.	%
0 (I)	A1-Thin S	11	13,58	26	32,10	44	54,32
	A2-TS	15	28,30‡	17	32,08	21	39,62
	B-TF	22	44,00‡‡	20	40,00	8	16,00‡‡
A (II)	A1-Thin S	14	17,98	27	34,62	37	47,40
	A2-TS	18	38,30‡	18	38,30	11	23,40‡
	B-TF	16	36,36‡	20	45,45	8	18,19‡‡
B (III)	A1-Thin S	19	59,38*,†	7	21,87	6	18,75*,†
	A2-TS	24	60,00*,††	9	22,50	7	17,50**
	B-TF	22	45,83	16	33,33	10	20,84
AB (IV)	A1-Thin S	16	66,67*,†	5	20,83	3	12,50*,†
	A2-TS	17	51,52**	11	33,33	5	15,15**
	B-TF	20	50,00	12	30,00	8	20,00

Note 1. *p<0,01; **p<0,05 − significant difference compared to the patients with blood type 0 (I).
Note 2. †p_1<0,01; ††p_1<0,05 − significant difference compared to the patients with blood type A (II).
Note 3. ‡p_2<0,05; ‡p_2<0,01 − significant difference compared to patients with the A1-ThinS cluster.

Table 2. Prevalence of generalized periodontitis in patients with different blood types depending on periodontal phenotype.

The results of the anthropometric analysis provided for maxillary central incisor crown revealed no statistically significant difference in the length of the central incisor crown depending on the blood type and cluster affiliation of the subjects (p > 0.05). However, in all subjects, regardless of blood type, the width of the central incisor crown in the presence of the A1-ThinS cluster was smaller than in the B-TF cluster (p < 0.05). It was noteworthy that the CW/CL ratio in patients with GP belonging to the B-TF cluster was significantly higher than in patients with the A1-ThinS cluster (p < 0.05) and did not depend on the blood type (p > 0.05). The height of the gingival papilla (PH) was the highest in representatives of blood type 0 (I) in the presence of the A1-Thin S cluster (4.95±0.22 mm) and exceeded the value in patients with B (III) and AB (IV) blood types (4.35±0.19 mm and 4.15±0.20 mm, respectively). It should be noted that in patients with GP, who were carriers of blood type 0 (I), the height of the gingival papilla, in the presence of cluster A2, was greater than in patients with GP B (III) and AB (IV) blood types (4.70±0.34 mm versus 3.90±0.18 mm (p<0.05), and 4.70±0.34 mm versus 3.85±0.17 mm, respectively, (p > 0.05)).

Blood type	Periodontal phenotype (cluster)	Crown width (CW), mm	Crown length (CL), mm	Ratio CW / CL	Height, mm	
					papilla, (PH)	gingiva, (GW)
0 (I) (n=184)	A1-Thin S	6,95±0,45	9,26±1,55	0,75±0,04	4,95±0,22	4,60±0,51
	A2-TS	7,58±0,90	9,54±0,93	0,79±0,03	4,70±0,34	4,50±0,50
	B-TF	8,00±0,24†	9,15±0,72	0,87±0,03	4,55±0,26†	5,35±0,65
A (II) (n=169)	A1-Thin S	7,15±0,35	9,35±0,83	0,76±0,01	4,60±0,52	4,55±0,58
	A2-TS	7,77±0,92	9,60±0,92	0,81±0,03	4,34±0,63	4,60±0,55
	B-TF	8,10±0,26†	9,10±0,69	0,89±0,02†	3,10±0,36*,†	5,30±0,62
B (III) (n=120)	A1-Thin S	7,26±0,37	9,20±0,91	0,79±0,02	4,35±0,19*	4,40±0,59
	A2-TS	7,85±0,94	9,35±0,94	0,84±0,01	3,90±0,18*	4,54±0,60
	B-TF	8,20±0,29†	9,00±0,68	0,91±0,02†	3,05±0,32*,†	5,38±0,61
AB (IV) (n=97)	A1-Thin S	7,32±0,38	9,15±0,93	0,80±0,04	4,15±0,20*	4,36±0,58
	A2-TS	7,90±0,93	9,30±0,67	0,85±0,03	3,85±0,17*	4,42±0,52
	B-TF	8,30±0,22*,†	9,00±0,83	0,92±0,04†	3,00±0,19*,†	5,46±0,67

Note 1. *p<0,05 − a significant difference in values compared to the data for people with blood type 0 (I).
Note 2. †p_1<0,05 − a significant difference in values between the A1-ThinS and B-TF clusters.

Table 3. Dimensions of maxillary central incisor and gingival parameters in different periodontal phenotypes depending on blood type.

Maximum PH values were found in carriers of blood type 0 (I) (4.55±0.26) mm, and the minimum – in representatives of B (III) and AB (IV) blood types (3.05±0.32 mm and 3.00±0.19 mm, respectively). It should be noted that the results of the study revealed no significant differences in the length of the gingival papilla between patients with GP with blood type 0 (I) and A (II), regardless of cluster affiliation. At the same time, in patients with GP of blood type A (II), the PH in all types of clusters did not differ from the data in patients with blood type B (III) and AB (IV) (p > 0.05). There were no statistical differences in terms of gingival height data both depending on blood type and periodontal cluster affiliation (p > 0.05).

Discussion

The scientific interest in the periodontal phenotype is guided by the abundance of

literature evidences regarding the impact of the individual's anatomy on the clinical treatment outcomes, tissue response to trauma or healing. The evaluation of the periodontal phenotype in modern dental practice is a crucial factor in the treatment planning and long-term clinical success prognosis.[15]

Data obtained in present research allows to conclude that carriers of 0 (I) and A (II) blood types demonstrate morphological predisposition to the occurrence and intensification of dystrophic-inflammatory changes within the periodontium, due to the prevalence of periodontal A1-ThinS and A2-TS clusters among them. At the same time, carriers of B (III) and AB (IV) blood types demonstrated greater prevalence of B-TF cluster, which may be interpret as protective factor that lowering susceptibility to generalized periodontal tissue diseases.[8] Provided study also revealed that carriers of B (III) and AB (IV) blood types, in which the thick type of periodontium prevailed, characterized with more common signs of the initial stage compared to GP of II and II stages. At the same time, representatives of 0 (I) and A (II) blood groups, in which the thin type of periodontium was more often determined, developed more severe forms of dystrophic-inflammatory changes within the periodontium with a higher frequency. Recent research demonstrated that patients with A (II) and 0 (I) blood types demonstrated second greatest prevalence of aggressive forms of periodontitis, while AB (IV) blood type patients were characterized with only 7.5% prevalence distribution of aggressive periodontitis.[27] Kouki A. et al. also categorized A (II) and 0 (I) blood types as potential risk factors for periodontal diseases, while authors also mentioned that tissue response on scaling and root planning did not depend on the patients adherence to some specific blood group.[28] Cross-sectional studies provided by Mostafa D. et al. revealed that 0 (I) blood type patients characterized with greater risk of developing generalized form of chronic periodontitis, while patients with A (II) blood type were the second one regarding associated risk increase.[29] Recent systematic review highlighted that AB blood group demonstrated protective effect to periodontitis based on provided fixed effect analysis, and such results are in correspondence to data obtained in our study.[30]

On the other hand Mortazavi and colleagues demonstrated that B (III) blood type associated with greater risk of gingivitis development, but there was no statistically argumented correspondences between blood type and periodontitis development.[31] Number of studies demonstrated that B (III) blood type is of important risk factors for chronic periodontitis development.[31, 32, 33] Controversies between above-mentioned studies and results obtained in our research could be explained by the differences in the studied population, impact of epigenetic factor regarding predisposition to the periodontitis development, role of confounders that were not properly analyzed in the studies, while also by the usage of different approaches for establishing and quantifying the links between periodontitis and blood groups. In present research the main focus was oriented on establishing associations between periodontitis and blood groups through different prevalence patters of periodontal phenotypes identified among study group. Relevant systematic review also highlighted that no unequivocal conclusion could be made regarding influence of A, B and 0 blood groups on the periodontitis development while using fixed effect analysis approach during the processing of available evidences.[30]

The relationship between gingival and periodontal phenotypes and crown forms have been assessed in number of studies.[34,35,36,37]

However, these studies reported inconsistent findings regarding the crown form as a predictor factor for gingival and periodontal phenotypes.[34, 35, 36, 37, 38, 39, 40]

In present study no statistically significant difference in the length of the maxillary central incisor crown was found considering potential impact of blood type and cluster affiliation of the subjects. It was noteworthy that the CW/CL ratio in patients with GP belonging to the B-TF cluster was significantly higher than in those with the A1-ThinS cluster and did not depend on the blood group.

Similar findings have been reported earlier by Anand *et al.* who correlated the prevalence of thick and thin biotype with gender and tooth morphology.[39] Results shown that different periodontal phenotype clusters associated with various parameters of CW/CL, especially prominent between clusters A and B.[39] In the study of Yin et al. it was found that even though anterior teeth parameters are correlated

with periodontal biotype, but mostly gingival angle and papilla width could be used as independent predictors of periodontal biotype.[40]

On the other hand Zhong and colleagues approved statistically significant correlations between gingival phenotype and CW/CL, faciolingual thickness of papilla base, and papillary heigh.[41] Within the limits of the investigation Malhotra R. et al. also confirmed the existence and correlation between different gingival biotypes and dentopapillary complex dimensions.[42] The results of discriminant function analysis has shown that average crown length was the best single determinant of biotype and area of papilla was the next best choice. The result of the study provided by Malhotra R. et al. demonstrated that there was highly significant correlation between gingival biotype and crown length and area of papilla.[42] However, one of the previous study has shown that crown parameters did not fit the model of periodontal phenotype categorization, which highlights the problem of choosing validated clinical criteria for correct periodontal phenotype differentiation.[43]

Considering the growing attention paid to anterior esthetics by both patients and clinicians, findings on correspondence between periodontal phenotype and maxillary teeth anthropometric parameters could enhance clinical guidance in achieving optimal soft-tissue esthetics.[44] A thorough understanding of the biotype form of the gingival tissue is mandatory for the clinician to predict the tissue response to various pathologies and to various treatment procedures, which will help to optimize the final outcome of the periodontal therapy.[44]

The limitation of this study related with the fact that its' objective did not considered parameters of buccolingual tooth position during complex analysis of periodontal biotype, while such may impact various biotype's parameters. On the other hand adequate buccolingual tooth position analysis may be provided only based on CBCT data, which may be obtained through roentgenological examination, causing additional radiation load on the patients. Due to the established protocol of present study and its approval by bioethical committee X-ray examinations were not included into complex of patient assessment procedures to avoid any harmful effect occurring during patient's participation in the study. Another limitation is related to the fact that data analysis was provided while not taking into account patients distribution over different age groups. Potentially age of the patient may impact anthropometric parameters of the maxillary central incisor and some periodontal parameters, and to overcome such limitation further research on the same study sample would be held in the future.

Conclusions

Carriers of 0 (I) and A (II) blood types with generalized periodontitis demonstrated morphological predisposition to the occurrence and intensification of dystrophic-inflammatory alterations within the periodontium due to the higher prevalence of periodontal A1-ThinS and A2-TS clusters among them. On the other hand carriers of B (III) and AB (IV) blood types, among which the thick type of periodontium prevailed, characterized with greater prevalence of the initial forms of generalized periodontitis, and less prevalence of II and III stages of periodontitis. No statistically significant difference in the length of the maxillary central incisor crown was found considering potential impact of blood type and periodontal cluster affiliation of the subjects. It was noteworthy that the CW/CL ratio in patients with generalized periodontitis belonging to the B-TF cluster was significantly higher than in those with the A1-ThinS cluster and did not depend on the blood group.

Declaration of interest

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