Annotation. The construction of a correct orthodontic intervention that will satisfy the aesthetic and functional needs of the patient requires the perception of the craniofacial region as a single complex. At the same time, it is necessary to understand the relationship of each component of this complex and its influence on each other in order to better predict the expected result of treatment and its planning. The purpose of this study is to review modern scientific sources devoted to the study of the relationship between odontometric and cephalometric indicators. For this, a search for literary sources related to the research topic in the period 2012-2022 was performed on the basis of Google Scholar using keywords and inclusion/exclusion criteria, in particular, the presence of previous review of articles, the representativeness of the sample, and the presence of statistical analysis of the obtained data. The analysis of selected literary sources showed that the vast majority of publications are devoted to the topic of studying the relationship of odontometric and cephalometric indicators under the conditions of pathology of the dental and jaw system. Also, in most sources, researchers do not prefer the use of one or two methods of cephalometric analysis of lateral teleradiograms, but use complex analysis methods. At the same time, scientists pay attention to its ethnicity, gender and age when drawing up a sample. Thus, taking into account the relevance of this research topic and at the same time the lack of studies aimed at determining the relationship of cephalometric and odontometric indicators under the conditions of orthognathic bite, there is a need to conduct this kind of clinical experimental study on the Ukrainian population using several of the most common methods of cephalometric analysis.

Keywords: odontometric indicators; cephalometric indicators; craniofacial morphology; teleradiography.

Introduction

Abnormalities of the maxillofacial system are not an isolated phenomenon in orthodontics, as it may seem at first glance. If you look at the data from different parts of the planet, it becomes obvious that this is an equally widespread pathology that affects different peoples. In Brazil, the prevalence of dental abnormalities is 56.90 % among people who have ever sought dental care. The most common is taurodontia, which occurred in 27.2 % of the examined. Among the groups of diseases, the pathology of the shape of the teeth was the most common, occurring in 47.3 % of people, and in second place was the pathology of the number and size of the teeth, which was noted in 19.3 % of patients [10].

Among the children of India, at least one dental anomaly was found in 25.8 % of people, and in 13.4 %, the presence of two or more anomalies of the dental system was noted. The most common pathology was tooth wedging, less common pathologies such as duplication of teeth, micro and macrodontia [17].

In Australia, an analysis of the overall prevalence of dental and jaw pathology in persons under the age of 16 was carried out. Pathology from the teeth was the most common, noted in 24.4 % of people, followed by odontogenic cysts, which were found in 18.5 % of patients, and pathology from the mucous membrane was less common - found in 17.0 %. The most widespread pathology in general was a dental cyst - found in 9.4 % of the examined [12].

This prevalence of orthodontic pathology has led to the widespread introduction of new treatment methods, and in particular, intervention planning carried out by orthodontists. One of such methods that became widespread was the cephalometric analysis of lateral teleradiograms [3, 9, 19].

Experimental studies conducted with the use of its numerous modifications made it possible to confirm the assumptions of scientists regarding such theories as the presence of age, ethnic and gender characteristics of development and, in general, normative indicators of cephalometric indicators, which in turn made it possible to improve the quality of orthodontic treatment and improve the individual approach to the patient [5, 8, 11, 12, 30].

The results of the study by Kim D. K. and others [18], conducted on the Korean population, are interesting, which showed high rates of heritability of the shape and position of the lower jaw, the anterior-posterior position of the upper jaw, the intermaxillary ratio, vertical angular variables, the shape and length of the base of the skull, the inclination of the incisors upper and lower jaw.

However, for the further development of the field of orthodontics and a better understanding of the interrelationships of the craniofacial structures of a person, an in-depth study of the interrelationships of each of the structures involved in the formation of a person’s face and smile is necessary. Thus, there is a need to study the relationship between cephalometric and odontometric indicators. Research has been carried out in this direction for a long time, but it requires a certain systematization in
order to identify the main trends, directions of experiments and, as a result, search for topics that have not been researched much or at all.

The purpose of the study is to conduct a review of current literary sources related to the revealed relationships of odontometric and cephalometric indicators in domestic and international scientific publications.

Materials and methods

In order to achieve the goal, a review of scientific literary sources was carried out with a search depth of 10 years using the scientometric database of Google Scholar. The search was carried out using keywords both individually and in combination: "odontological pathology", "cephalometric analysis", "odontometry", "position of teeth", "size of teeth", "craniofacial morphology". Criteria for including an article in the review: review of an article in a journal, a representative sample of the study, statistical processing of the obtained results (except for publications devoted to epidemiology). Thus, out of 86 publications that were found, 33 were included in the review.

Results. Discussion.

Studies of relationships between odontometric and cephalometric parameters among practically healthy populations (as far as bite is concerned) are quite few, but they are still found in modern scientific literature. The analysis of lateral teleroentgenograms of Moroccan adults proved the existence of a relationship between the upper-posterior alveolar height with the frontal height of the face, the posterior height of the face. Lower anterior alveolar height is negatively correlated with the facial height index, positively with FMA and AFH. Superior anterior alveolar height has an inverse correlation with FHI and a positive correlation with FMA [1].

A pronounced correlation was established between the Condylion-Gonion-Menton angle and all alveolar heights (p<0.001). Superior anterior height correlated with CoGoMe\(^\alpha\) (r=0.183; p=0.003) and SN\(^\beta\)GoGn (B=0.08; 95 % CI: 0.014-0.144; p=0.017). A negative correlation was found between CoGoMe\(^\alpha\) and lower back height (B=-0.098; 95 % CI: -0.161-0.035; p=0.003) [31].

Analysis of a sample of 103 normal-occlusal Koreans who underwent a cephalometric study showed that posterior-calibrated data correlated strongly with the vertical position of the maxillary first molar. The conducted multiple linear regression analysis generated models with the highest R\(^2\) value of 0.880 [13].

A. Jan et al. (2020) revealed a reliable relationship between the molar ratio of Engle and the curve of Spee (COS), a significant linear positive relationship of COS with the Jarabak coefficient and the distance of L7 to MP [15].

During the analysis of 108 cephalograms of people who had no history of orthodontic intervention and orthognathic bite, the following correlations were established: a significant positive correlation between sagittal parameters and indicators of arch width between SNA and upper intercanine width, as well as between lower intercanine width and length lower arch Upper and lower intercanine widths were significantly correlated, the relationship between upper and lower intermolar widths and between upper arch length and lower arch length was significant. Among sagittal measurements, both upper and lower arch lengths were correlated with the ANB angle [26].

Most of the studies are aimed at identifying the relationships between dental and cephalometric characteristics in the presence of dental and jaw pathology. Peculiarities of the position of the lower incisor with different types of bite and facial types were studied by a team of scientists led by E. Hernandez-Sayago et al. (2013) [14]. Taking into account the cephalometric data of the front base of the skull, IMPA, Frankfurt plane, McGorris analysis and occlusal plane, the lower proclination of the incisors is characteristic for class II bite pathology, the indicators of which are higher in dolichocephalics; with Class III retroclination of the lower incisor, which is more pronounced in brachycephalics. Differences in incisor position were established for McGorris, Holdaway, and Ricketts analyses.

Using the analyzes of Steiner and Eastman, the peculiarities of cephalometric and odontometric characteristics for the adult population of the UAE were established [2].

A similar type of study was performed on the Javanese population [4, 5]. As a result of the analysis of the obtained data, a correlation between skeletal class II models and odontometric indicators was revealed - SNA was positively correlated with the interpremolar width of the upper jaw, and SNB was negatively correlated with the interpremolar height of the lower jaw.

With different classes of occlusion but vertical type of face, significant differences in the ratio of the facial axis to the nasion-basion (NBa) and the growth axis to the NBa were established (p<0.001). In the group of the sagittal type of facial growth, the ratio of the growth axis to the NBa was significantly different only between the groups with class II and III occlusion pathology [6].

Intergroup differences were found in individuals with class II occlusion pathology using cephalometric analysis, which can be used to predict dental and skeletal parameters related to the inclination of the front teeth. As the proclination of the incisors decreased, the gonial angle significantly decreased (0.04<\(p\)<0.002), while the incisor angle, the total length of the lower jaw, and the nasolabial angle increased (0.04<\(p\)<0.001) [19].

Peculiarities of the characteristics of the skull and teeth were studied in persons with ankyloglossia. The mean width of maxillary and mandibular intercanine tooth dimensions and maxillary intermolar teeth were statistically significant (p<0.01) in different skeletal pathology groups. At different degrees of ankyloglossia, Tukey HS, Go-Gn- Kut SN indicators were statistically significant (p<0.05) [29].

Peculiarities of cephalometric and maxillofacial indicators in Iranian residents with Class III pathology were studied by
B. Ramezanzadeh et al. (2017) [25]. The SNA angle, the distance from point A to the Nasion perpendicular, and the effective length of the maxilla were significantly lower in the study group of individuals, while the SNB and SN-Pog angles were significantly higher compared to the control group of individuals.

In another study on Indian populations, the authors found 14 parameters that distinguish two classes of disorders, namely SNB, SND, FMA, IMPA, MeGoOcP, Mand 1-MeGo, NSAr, ArGoMe, NGOme and SNPog angles, Ao-Bo and 1u distances -NPog, Holdaway and AFH coefficients and 3 parameters for class III age ranges, among which the NGoAr angle, the Ls-NsPog’ distance and the S-Ar:Ar-Go ratio (p<0.05 in all cases) were noted [33].

S. Singh & G. Shivaprakash (2017) performed a similar type of study, also on the Indian population and on individuals with class II pathology [27]. Among all parameters, only the effective length of the lower jaw had a statistically significant difference between the study and control groups.

Individuals with class I skeletal pathology have such features of the dento-maxillofacial system indicators as: retroclination of the central incisors of the upper jaw, obtuse interincisor angle, low values of the gonial angle, low height of the lower front part of the face [7].

The existence of a direct moderate correlation (r=0.45; p=0.002) between the crowding of the upper and lower jaws, a direct strong correlation (r=0.68; p=0.000) between the length of the base of the upper jaw (Co-A) and the length of the base was proved of the lower jaw (Co-Gn) and also between the SNA angle and the SNB angle (r=0.74; p=0.000).

An inverse correlation of moderate strength was found between maxillary incisor position and vertical facial size as measured by the MP to SN angle. A direct and moderately strong correlation was found between the position of the mandibular incisor and the anterior-posterior jaw ratio, measured by the ANB angle [22].

Peculiarities of the type of facial growth in class I bite pathology were investigated by a team of Nepalese scientists. The most common type of growth was the hypodivergent type (71.2 %), followed by the normodivergent type (18.3 %) and the hyperdivergent type (10.6 %).

Correlations were established between AFH and PFH in the hyperdivergent (r=0.821) and normodivergent groups (r=0.978), in the hypodivergent group between AFH and PFH (r=0.743) and between PFH and the Jarabak coefficient (r=0.643) [3].

M. Maddalone et al. (2019) established that tissue thickness has an effect on the modification of the aesthetic profile in relation to the position of the incisors [21]. Namely: pronounced correlations between SU, ULA and LS were noted, and the values of LS, SU, ULA and NLA as dependent variables were significant with respect to treatment prognosis at p<0.05.

The analysis of 35 teleroentgenograms revealed a statistically significant positive correlation of moderate strength for GT and WITS, as well as the length of the mandibular symphysis. WKT was positively correlated with ANB, WITS and mandibular symphysis length with a moderate strength of correlation. GRW, GRH and CAL were not correlated with any cephalometric parameters [16].

The age-related characteristics of the relationship between the studied parameters of the head and teeth are also often the subject of research. Thus, when comparing the examination data at the age of 17 and 62 years, an increase with age of the upper and lower jaw from the front, the height of the face and the branch of the lower jaw was noted. The vertical nature of the development of the molars of both the upper and lower jaws was revealed. The analysis of the indicators of the soft tissues of the face revealed a decrease in the nasolabial angle, retraction of the upper and lower lips, a decrease in the thickness of the upper lip, and an increase in the thickness of the lower lip and soft chin. The exposure of maxillary incisors near the upper lip decreased by 3.6 mm during the indicated period of examination [8].

In the Netherlands, a comparison of dental and cephalometric examination data of children aged 8 and 11 years was carried out. Dental development was positively associated with growth in both jaws (β=0.04; 95 % CI 0.01 to 0.08). Children with above-average dental development tended to have a Class II jaw ratio (β=-0.08; 95 % CI -0.13 to -0.04) [32].

In Ukraine, several groups of researchers were engaged in the study of this topic. For example, Y. A. Nesterenko et al. (2022), when analyzing indicators of Ukrainian boys and girls using the COGS method, taking into account different types of faces, found reliable or trends in differences in linear and angular indicators that characterize the position of individual teeth relative to cranial structures [23]. In addition, the authors established the existence of gender differences - in boys, larger values of most linear dimensions were found, and in girls, larger values of the OP-HP angle.

For girls with a very wide face type, residents of Ukraine and a normal bite, 18 reliable models (with a coefficient of determination from 0.863 to 0.962) of linear computer tomography sizes were built for building the correct shape of the dental arches of the teeth of the upper and lower jaws depending on the features of odontometric and cephalometric indicators [24].

In another study, Ukrainian scientists conducted a quantitative analysis to identify reliable correlations between the computed tomography dimensions of molars and the dimensions of the face. The authors found numerous connections between cephalometric indicators and the height of teeth, their crowns, and the length of roots [28].

The existence of relationships between odontometric indicators of large canine teeth and cephalometric indicators in healthy men living in the western regions of Ukraine was established. The largest number of reliable connections was found between the indicators of the cerebral skull and the lingual-lingual and mesio-distal dimensions of the teeth [11].

ISSN 1917-7883
eISSN 2522-9354
“Вісник Вінницького національного медичного університету”, 2022, Т. 26, №4
Also, for men, residents of western Ukraine, with a correct bite, reliable models of computer-tomographic dimensions of the large angular teeth of the upper and lower jaws were built. These models most often included such cephalometric indicators as: sagittal arc, external eye width, nose depth, distance between nasion and interincisor point, length of the body of the lower jaw on the left, the largest head circumference and the largest head length [20].

Conclusions and prospects for further development.
1. The performed analysis of literary sources proves the high interest of scientists both from Ukraine and abroad in the study of relationships between odontometric and cephalometric indicators. The revealed numerous interrelationships between the investigated parameters indicate the prospects of further research that can be carried out in this area. At the same time, the performed search did not reveal practically any publication related to studies of the interdependence of odontometric and cephalometric indicators in the absence of concomitant pathologies of the dento-maxillary system, especially with the use of separate methods of cephalometric analysis.

It would be promising to conduct an appropriate clinical experimental study in the future on a sample of individuals of a certain age group with an orthognathic bite using one or more methods of cephalometric analysis.

References


