ORIGINAL ARTICLE

CONTENTS

Criteria of a smile in twins

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ABSTRACT

Aim: The purpose of the work was study of the influence of genetic and environmental factors on the formation of classic smile parameters.

Materials and Methods: Research was conducted on 12 people (6 pairs of (MZ) twins): 4 pairs of females and 2 pairs of males. The age of the patients was 17-28 years.

Results: In (MZ) twins, the criteria for an ideal smile coincide in 51.6% of cases, do not coincide in 26.6% of cases, there are no criteria in 21.8% of cases. Genetic factors have a significant influence on the morphological features of the teeth, because more than 50% of the parameters of an ideal smile in (MZ) twins are coincided.

Conclusions: Signs of external similarity in (MZ) twins, taking into account such morphological characteristics as the set of the eyes, the shape of the nose, lips and teeth are confirmed by photo documentation and biometric research methods. However, the ratio between lips, teeth and gums when forming a smile in (MZ) twins is the same in 51.6% of cases. Based on the results of this study, we cannot confirm the primary role of genetics in dental features such as the ideal smile criteria. Environmental factors (nature of nutrition, bad habits, sucking, tooth extraction, sleeping on the stomach, etc.) and traumas have a significant influence on the features of dental smile parameters.

KEY WORDS: monozygotic twins, criteria, smile, teeth, lips

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INTRODUCTION

When people are happy, they smile. Among all variants of emotional expression on the human face, a smile functionally is the most positive but also the most complex option. However, not many people can boast of a naturally perfect smile. The attractiveness of a smile largely depends on the correct proportions and relationship of three elements: teeth, gums and lips.

Numerous studies indicate that the criteria for a smile are multifactorial in nature, and both genetic and environmental factors are involved in their formation.

Examining the state of dentition in twins, taking into account the influence of genetic and environmental factors, allows to determine the influence of these factors on many physical and behavioral features or anomalies [1-13]. This is possible because monozygotic twins are two independent organisms with absolutely identical genetic features, the difference between them can be explained by environmental factors [8, 13].

The idea of the twin method was formulated by F. Galton in 1865, but its final modification is associated with the name of H. Siemens. It was he who in 1924 justified the using of the twin method in genetics.

The character and a smile feature depend on the growth and development of the craniofacial complex, which is influenced by genetic and environmental factors and determines its morphological and functional features [11].

The results of scientific studies have shown a significant genetic influence on the length of the base of the skull, the body of the upper jaw and the length of the lower jaw. Environmental factors are mainly involved in determining the characteristics of the teeth (for example, the inclination of the incisors). Research on twins is a unique method of assessing the influence of genetic and environmental factors on personality formation [12]. (MZ) twins are the result of fertilization of one egg-cell, which at an early stage of embryogenesis is divided into two identical embryos. Each embryo has the same number and distribution of genes - the genotype, which is manifested by the same morphological features - the phenotype. Variations in (MZ) pairs are the result of the influence of various environmental factors, as well as the interaction of genetic and environmental factors. The model of (MZ) twins is used in dental practice, which makes it possible to study the differences in orofacial structures between (MZ) twins [2, 4, 6, 7].

Genetic modeling showed that additive genetic and unique environmental factors explained the variation in all measured occlusal characteristics to the best extent, except of width between mandibular canine. High heritability was observed for most intra-arch occlusal variables (0.61–0.85), including canine width and maxillary and mandibular molar width, dental arch depth and perimeter [10]. Environmental factors such as food, habits (sucking, etc.) and injuries strongly influence the characteristics of teeth [1, 5, 9, 14]. During the comparative analysis of bite anomalies in (MZ) and dizygotic (DZ) twins and determining the role of genetics and the environment, a high frequency of intrapair similarity of bite anomalies was determined (from 80 to 94%). The frequency of intrapair similarity in (MZ) twins was 100%, and in (DZ) twins - only 57%. This study found that environmental factors are responsible for a greater number of malocclusions.

Pairs of (MZ) twins show a higher level of correlation than pairs of (DZ) twins, which provides convincing evidence that genes play a significant role in the etiology of dental caries, periodontal diseases, and malocclusion [2,4]. The lack of data in the literature on the dynamics of the interaction of genetic and environmental factors in the formation of the main indicators of the ideal smile criteria made it necessary to carry out this study.

AIM

Clinical study of the influence of genetic and environmental factors on the formation of an ideal smile criteria.

MATERIALS AND METHODS

The research was conducted in 12 people: 6 pairs of (MZ) twins: 4 pairs of females and 2 pairs of males. The age of the patients was 17-28 years. Homozygosity of twins was confirmed by the coincidence of phenotypic traits, which are determined by numerous loci and have full penetrance under any external conditions. We noted signs of external similarity, taking into account morphological characteristics: color and shape of hair, eyebrows, color of the skin and iris of the eyes, cut of the eyes, shape of the nose, lips, outline and shape of the ears. A subjective examination of the patients was carried out, taking into account the place of birth and residence, transferred and concomitant diseases, psycho-emotional state of the twins, occupation and objective examination of the patients using photo documentation and biometric research methods.

Evaluation of patients' smiles was carried out according to the following parameters: 1. Parallelism of horizontal landmarks. 2. Smile line. 3. Gum level. 4. Vertical symmetry and the middle line. 5. "Golden ratio". 6. Proportions of teeth. 7. Interincisal angles. 8. Zenith of gingival contours. 9. Cutting edges position. 10. Interdental gingival papillae.

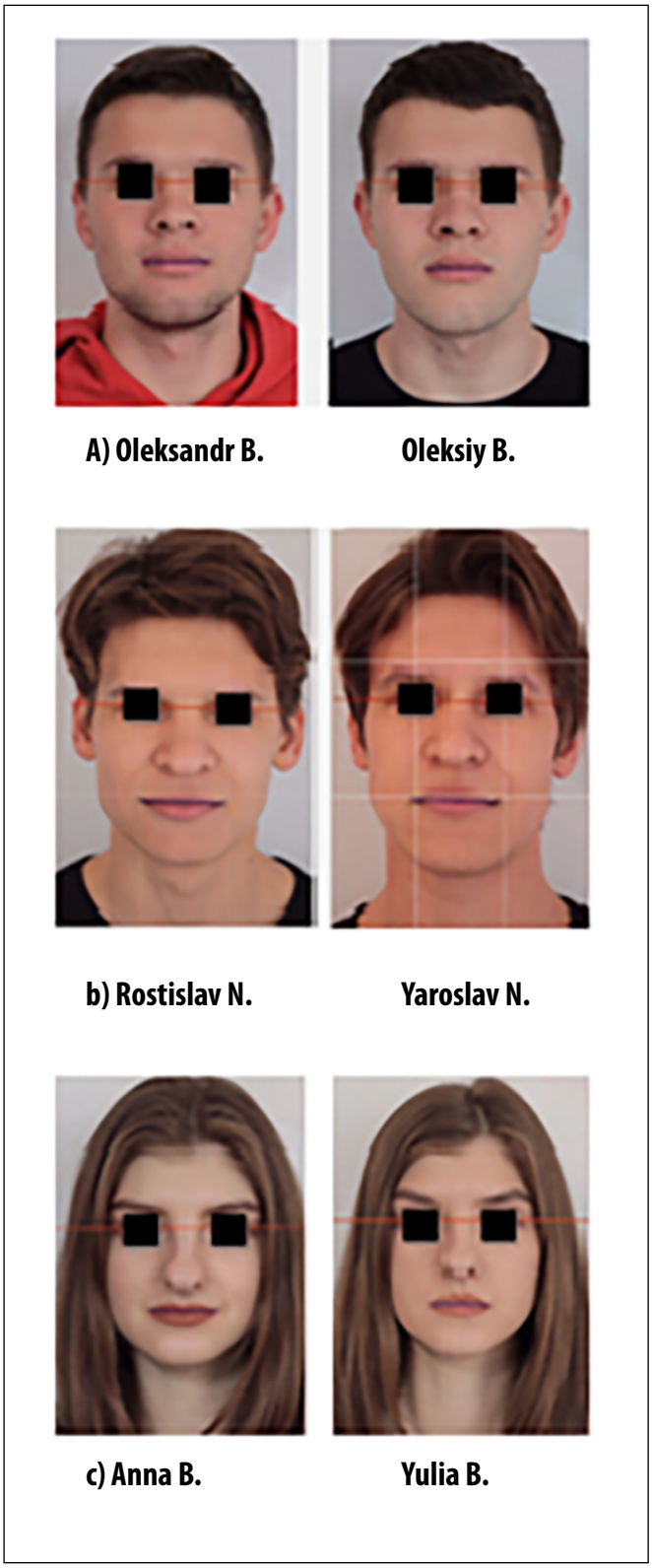

Fig. 1. Determination of the horizontal landmarks parallelism: a), b), c).

Fig. 2. Definition of the smile line: a), b), c).

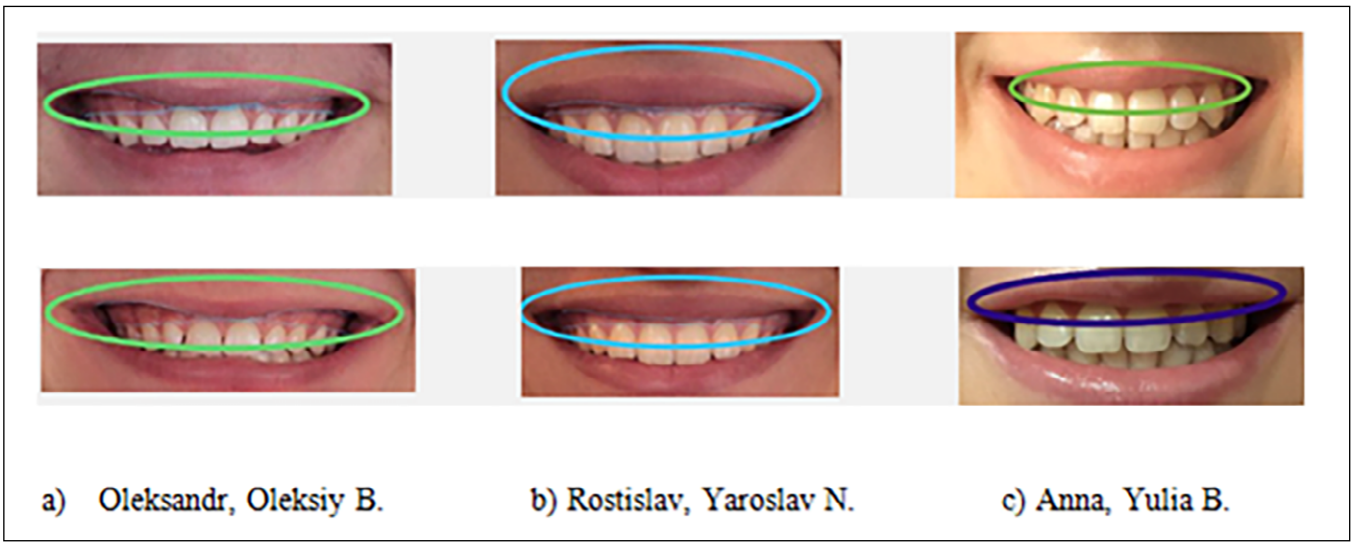

Fig. 3. Determination of the gum level criterion: a), b), c).

RESULTS

When studying the parallelism of horizontal landmarks, we determined the parallelism of imaginary lines: between the pupils and the line of the lips. Both of them should be parallel to the lines connecting the edges of the central incisors and the cutting tubercles of the canines.

Parallelism of horizontal landmarks is equally expressed in four pairs of monozygotic twins, does not coincide in one pair, and is not expressed in one pair (Fig. 1). The smile line runs along the cutting edges of the upper front teeth and should ideally repeat the curve of the upper edge of the lower lip, that is, be convex.

The smile line is equally expressed in three pairs of (MZ) twins, it does not coincide in one pair, it is not expressed in two pairs (Fig. 2). A smile looks attractive and more aesthetically pleasing if the line connecting the necks of the teeth repeats the line of the upper lip. At the same time, with a maximally open smile, only the gingival triangles between the teeth and a small strip of gums above them (no more than 2-3 mm wide) should be visible. The gingival level criterion is equally expressed in two pairs of (MZ) twins, does not coincide in two pairs, is not expressed in two pairs (Fig. 3).

To determine vertical symmetry and the middle line, we conventionally drew a line through the center of the face, which passes between the central incisors of the upper jaw and should coincide with the middle line of the face.

We determined the rule of the "golden proportion" by calculating the ratio of the width of the central incisors and canines to the width of the lateral incisor of the upper jaw in the projection on the frontal plane from the calculation - 0.618:1:1.618. This criterion is equally

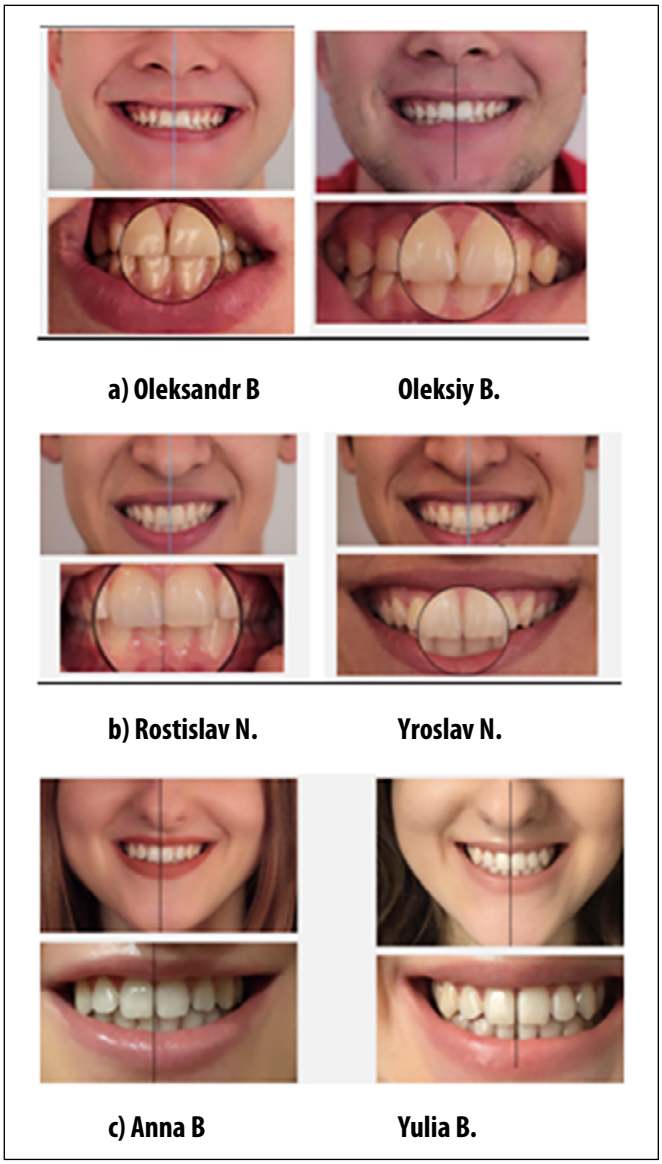

Fig. 4. Determination of vertical symmetry and the middle line of the face: a), b), c).

expressed in three pairs of (MZ) twins, does not coincide in one pair, is not expressed in two pairs (Fig. 5).

For the central incisors of the upper jaw, there is a rule according to which teeth with a ratio of tooth width to tooth length of approximately 0.7-0.8 to 1 look most harmonious (Fig. 6). This criterion is equally expressed in three pairs (MZ) of twins, does not coincide in two pairs, is not expressed in one pair of (MZ) twins. When determining the "interincisal angles" parameter, the gaps between the cutting edges of the front group of teeth were examined. These angles should gradually increase from the center to the periphery. In (MZ) female twins, the corners of the incisors are rounded, in (MZ) male twins, the corners of the incisors are straighter (Fig. 7).

The "interincisal angles" criterion is equally expressed in one pair of (MZ) twins (female), it does not coincide - in five pairs of twins.

To determine the zenith of the gingival contour, the most concave part of the gums around the neck of the tooth was evaluated. The level of zeniths near different teeth in the smile area should be at different levels. The central incisors and canines are approximately at the same level, the lateral incisors are somewhat lower than both. At the same time, it is important that the zeniths on symmetrical teeth are at the same level. This criterion is equally expressed in four pairs (MZ) of twins, does not coincide in one pair, is not expressed in one pair (Fig. 8).

To determine the position of the cutting edges, the teeth of the central group were evaluated. The cutting edges of the central group of teeth are located at different levels. This criterion is equally expressed in five pairs of (MZ) twins, not expressed in one pair (Fig. 9).

Assessment of the condition of gingival papillae was carried out by examination. In all patients, all gingival papillae have a healthy appearance - triangular shape with a sharp top, pink color, no swelling. Between the central incisors, the gingival papilla is the longest, and its length gradually decreases toward the periphery. This criterion is equally expressed in three pairs of (MZ) twins, does not coincide in one pair, is not expressed in two pairs (Fig. 10).

According to the obtained results, the maximum number of matches of ideal smile parameters in (MZ) twins concerns criterion 9 (position of cutting edges) - in five pairs and criterion 1 (parallelism of horizontal landmarks) - in four pairs. There are no matches in 5 pairs of (MZ) twins according to the 7th criterion (interincisal angles) (Fig. 11). Thus, in (MZ) twins, the smile criteria match in 51.6% of cases, do not match in 26.6% of cases, and are absent in 21.8% of cases. So, genetic factors have a significant influence on the morphological features of the teeth, more than 50% of the parameters of an ideal smile in twins are coincided (Fig.12).

DISCUSSION

Most of the monozygotic twins are alike. In general it is expected that the monozygotic twin pairs are the same within the congenital defects, chromosomal abnormalities and Mendelian disorders. However, more and more often non-compliances of monozygotic twin pairs are reported. It is quite a unique occurrence that two genetically identical individuals can exhibit a variety of phenotypes due to the impact of environmental factors and epigenetic variances.

One of the main methods of genetics for assessing the influence of genetics and the environment is the twin method. It is undeniable that genetic factors control the size and morphology of teeth, gums, and lips, which are components of a smile. Since MZ twins

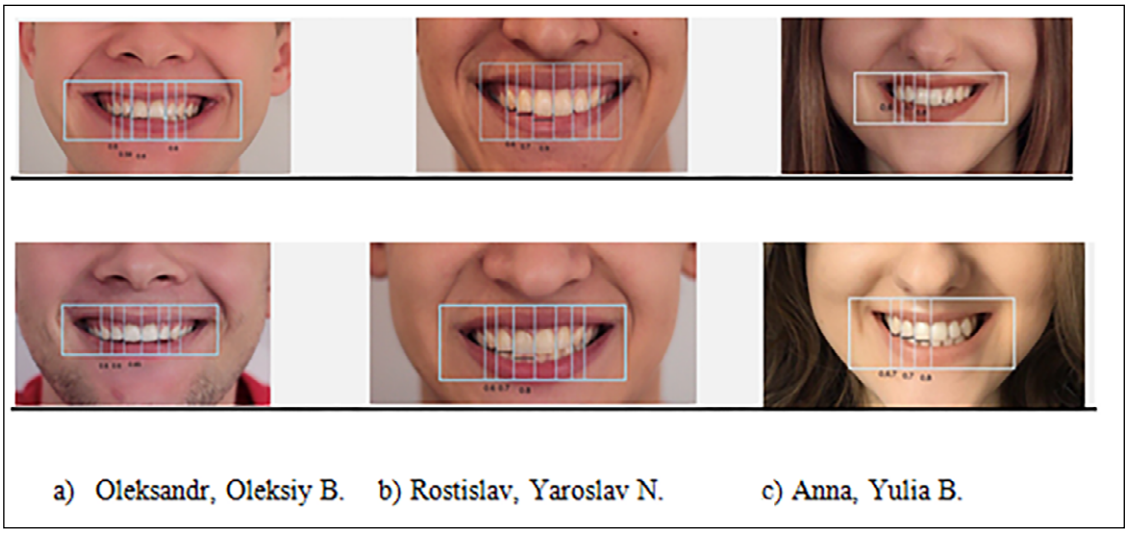

Fig. 5. Definition of the "golden ratio" rule: a), b), c).

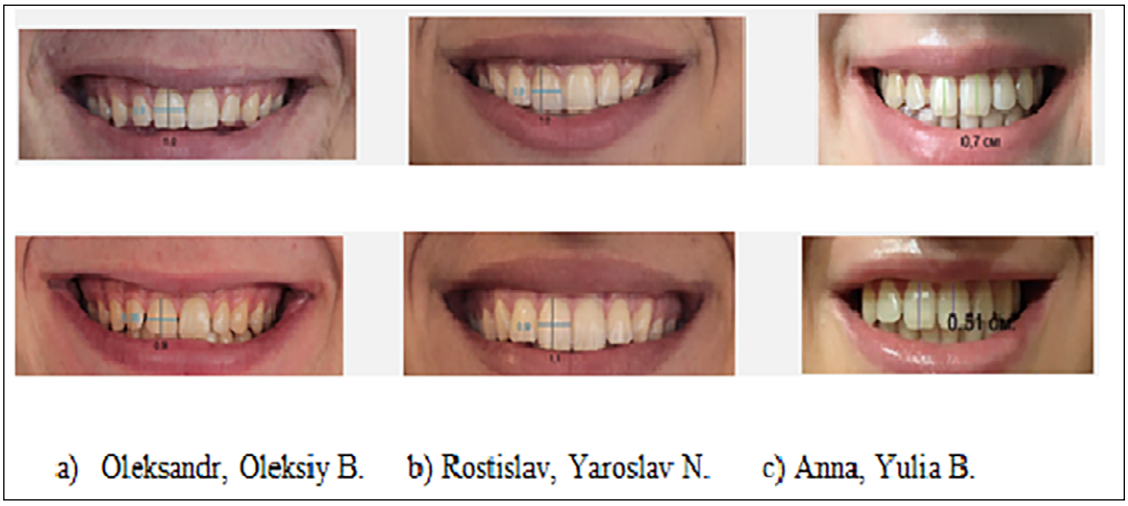

Fig. 6. Determination of tooth proportions: a), b), c).

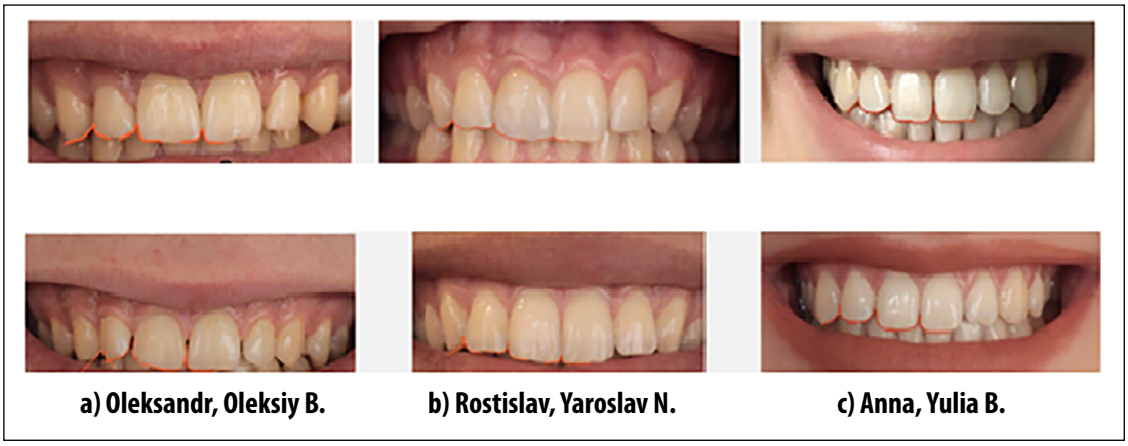

Fig. 7. Determination "intercutting angles" parameter: a), b), c).

have identical genetic material, the differences between them in determining smile criteria can be explained by environmental factors [2-4]. Environmental factors such as food, habits and injuries strongly influence the features of the teeth. The monozygotic (MZ) twin model is one particularly valuable method, given that examining the smile criteria of only one pair of MZ twins provides insight into the underlying causes of the observed variation. Scientific studies of monozygotic twins have proven a significant genetic influence on the length of the skull base, the body of the maxilla, and the length of the mandible, since an identical genotype (number

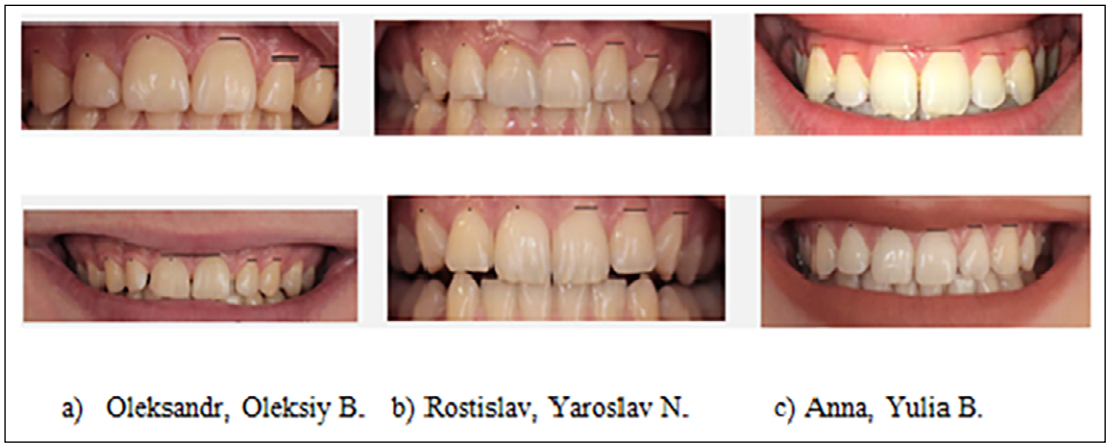

Fig. 8. Determination of the zenith of the gingival contour: a), b), c).

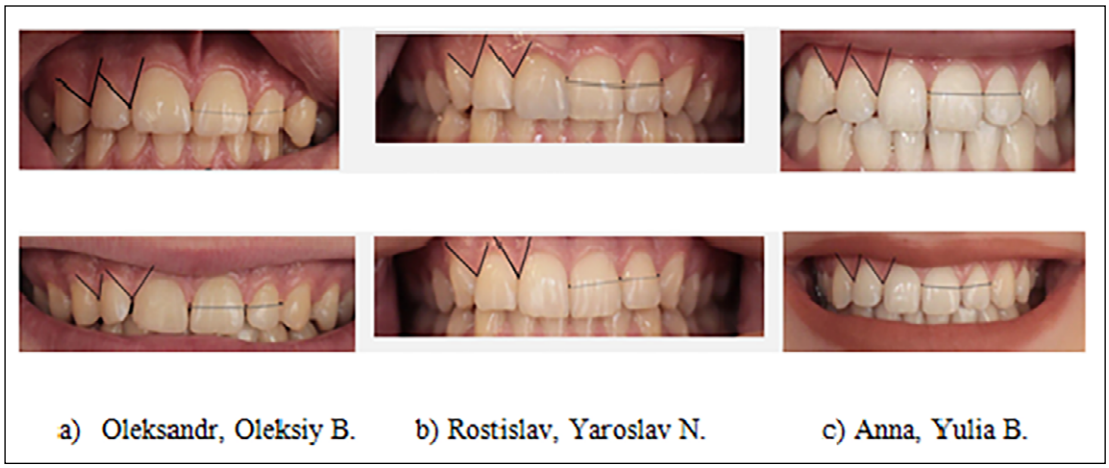

Fig. 9. Determination of the position of the cutting edges: a), b), c).

Fig. 10. Assessment of the condition of gingival papillae: a), b), c).

and distribution of genes) is manifested by the same morphological features - the phenotype. High heritability is characteristic of most intracranial occlusal ratios, including the width of the canine and the width of the maxillary and mandibular molars, the depth and perimeter of the dental arch [12]. The intrapair similarity of malocclusion anomalies in monozygotic twins reaches 100%, while in dizygotic pairs it is only 57%. Environmental factors such as nutrition, habits (sucking, etc.) and trauma strongly influence dental characteristics, such as incisor inclination, depth of incisal overlap, and are responsible for many physical and behavioral features or anomalies that lead to the formation of malocclusion.

CONCLUSIONS

Research on (MZ) twins is a unique method of assessing the influence of genetic and environmental factors on the formation and development of the cra-

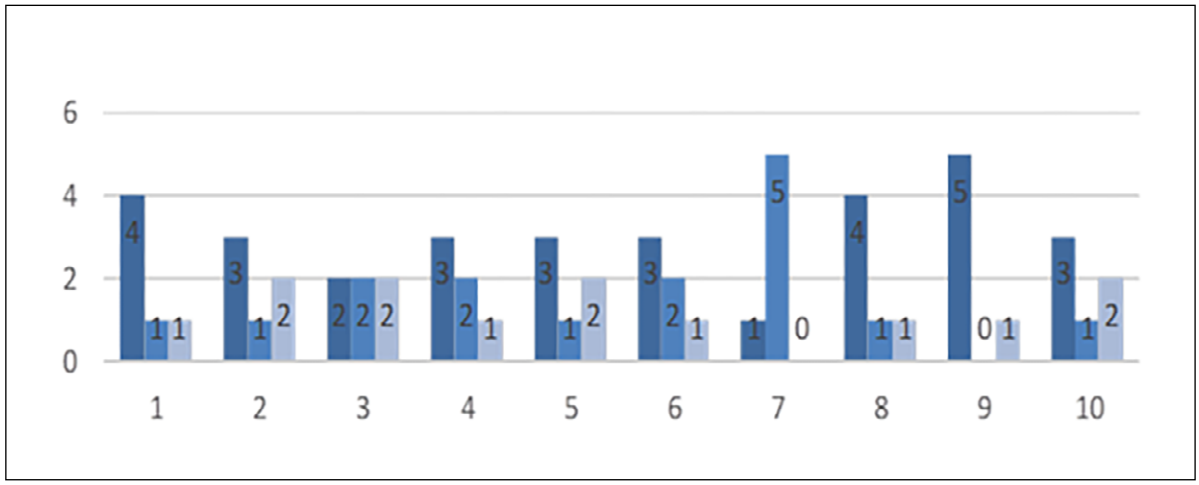

Fig. 11. The number of coincidences of smile criteria in (MZ) twins

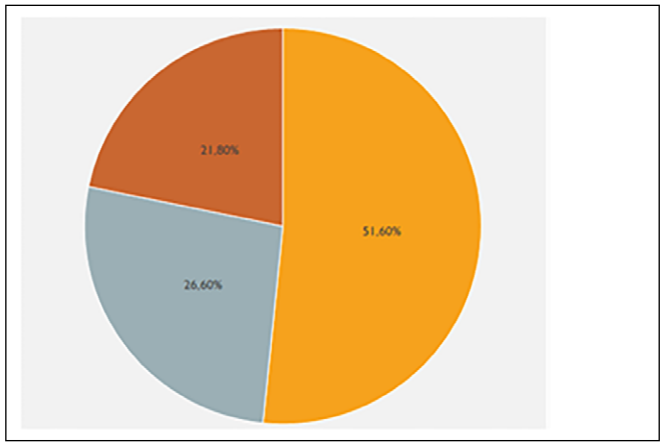

Fig. 12. The number of matches of ideal smile parameters in (MZ) twins (%).

niofacial complex. Signs of external similarity in (MZ) twins, taking into account morphological characteristics: the shape of the eyes, the shape of the nose, lips, and teeth, is confirmed by photo documentation and biometric research methods. However, the ratio between lips, teeth and gums when forming a smile in (MZ) twins is the same in 51.6% of cases. Based on the results of this study, we were unable to confirm a primary role of genetics in dental features such as criteria for a perfect smile. Environmental factors (nature of nutrition, bad habits, sucking, tooth extraction, sleeping on the stomach, etc.) and injuries have a significant influence on the features of dental smile parameters.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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