STUDY OF DENTAL AND SKELETAL DISORDERS IN MONO- AND DIZYGOTIC TWINS

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STUDY OF DENTAL AND SKELETAL DISORDERS IN MONO- AND DIZYGOTIC TWINS (Abstract): The aim of this study was to analyze and to compare the dental and skeletal morphology of mono- and dizygotic twins (MZ and BZ). Material and methods: 10 sets of monozygotic (mean age: 18.5 years) and 10 sets of dizygotic (mean age: 19.7 years) twins were examined, cast analysis, ortopantomography and lateral cephalometric films were analyzed. Results: The upper frontal teeth dimension and shape is the same in 99.69% of MZ and 93.91% of the DZ twins. In MZ twins we found different values for transversal arch width and upper intercanine distance. The dental malpositions were different in the DZ sets, especially in transversal and sagital plan. The same differences were seen in the arch forms. The skeletal pattern was also different between the components of DZ twins. The cephalometric values showed slight differences of the interincisal angle both in MZ and DZ twins.
Conclusions: Genetically influenced patterns can be explained by the results of our study.
Keywords: MOMOZYGOTIC TWINS, DIZYGOTIC TWINS, MALOCCLUSIONS

A twin is one of two offspring produced in the same pregnancy. Twins can either be monozygotic ("identical"), meaning that they develop from one zygote that splits and forms two embryos, or dizygotic ("fraternal") meaning that they develop from two eggs, each fertilized by separate sperm cells.

The twin method is one of the most effective methods available for investigating genetically determined variables in orthodontics, as well as in other medical fields, depending on the variance in the shape and the size of skull and teeth, both on genetic and environmental influences. In the meantime, the results of these studies cannot be always transposed to the singleton population, unless extensive analysis of the parents and nutritional, functional habits is made (1).

The purpose of this study was to analyze the dental and skeletal pattern, the type of malocclusion in the components of
MZ and DZ sets. 10 MZ (5 boys and 5 girls, mean age: 18.5 years) and 10 DZ (same sex, 7 boys and 3 girls, mean age: 19.7 years) consisted the analyzed sample. In each case dental casts, panoramic X-ray and lateral cephalograms were studied.

At the dental cast analysis we examined every tooth’s position in all of the three planes, the position of the frontal and lateral dental groups, the shape of the arches, the symmetry of the arches (symmetry-scropy), the transversal, sagittal and vertical development of the dental arches (Pont and Korkhaus index, intercanine width), we studied the static occlusion in all of the three planes (2, 3, 4).

On the panoramic X-rays we followed the presence of all teeth, the shape and the development stage of the roots, agenesis or supernumerary teeth (fig. 1).

The lateral cephalogram were interpreted using the Tweed analysis technique. Cephalograms were traced according the mentioned technique with different colored pencils in case of a twin set. Frankfort-mandibular incisal angle (FMIA), Frankfort-mandibular plane angle (FMA), incisor-mandibular plane angle (IMPA), sella-nasion-point A (SNA), sella-nasion-point B (SNB), point A-nasion-point B (ANB), sella-gnasion-Frankfort (SGn-F) and inter-incisal angles were measured. We superimposed each pair of cephalogram on sella-nasion plane in S (6,7) (fig. 2).
Study of dental and skeletal disorders in mono- and dizygotic twins

RESULTS

The upper anterior teeth dimension and shape were similar in 99.69% of MZ and 93.91% of DZ sets. Upper arch transversal width was found different in MZ sets, especially in intermolar region. Intercanine width was slightly dissimilar in the upper arch in the MZ sets (fig. 3, 4). We found difference in the static occlusion analysis, 4 sets of DZ twins presented different sagital relationship in molar and canine region.

As far as dental malpositions are concerned, only 50% of both MZ and DZ sets presented symmetrical dental positions, in 5 MZ twins we found a so called “mirror image”: left ectopic or retained canine in one, right ectopic or retained canine in the other component of the twin set or different way of mandibular shift at the two components (fig. 5).

In cefalometric analysis we found slight difference in the IMPA and interincisal angle both in MZ and DZ sets.
DISCUSSION
Since Francis Galton's classic paper (8) of 1875, twin studies have been viewed as an ideal way to evaluate the interaction between genetic (nature) and environmental (nurture) influences on a particular phenotype, including dentofacial variations (9). Biologically, twinning results from a single fertilized ovum; so MZ twins are identical genetically. The chance that both MZ twins would express the same uncommon abnormality or condition as a random happening is highly unlikely (10).
The study of craniofacial relationships in twins has provided much useful information concerning the role of heredity in malocclusion. The procedure is based on the underlying principle that observed differences within a pair of monozygotic twins (whose genotype is identical) are due to environment and that differences within a pair of dizygotic twins (who share 50 per cent of their total gene complement) are due to both environment and genotype. A comparison of the observed within-pair differences for twins in the two categories should provide a measure of the degree to which monozygotic twins are more alike than dizygotic twins. The larger this difference between the two twin categories, the greater the genetic effect on variability of the trait. This model implies that zygosity is accurately determined and that environmental effects are equal in the two twin categories. At the present time, accurate zygosity classification is seldom a problem due to the ability to identify the large number of available polymorphic blood group and enzyme markers. (11).

The dentitions and faces of twins provide a good opportunity to study the fascinating phenomenon of mirror-imaging, in which one twin mirrors the other for one or more features (fig. 6). As Mosey (11) has pointed out, ‘the key to the determination of the etiology of malocclusion, and its treatability, lies in the ability to differentiate the effect of genes and environment on the craniofacial skeleton in a particular individual’. Twin studies have confirmed that genetic influences contribute to variation in occlusal traits to varying degrees, with tooth size and arch shape displaying relatively high heritability, whereas heritability estimates for inter-arch variables such as overbite and overjet are considerably lower (12). However, these findings have not led to major changes in the clinical management of malocclusions (13).

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OSTEOPOROSIS AND PERIODONTAL DISEASE

Osteoporosis (OP) is a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in fragility and susceptibility to fracture of bones. In the past, OP was considered a physiological process associated with ageing, but today it is recognized as a multifactorial chronic systemic disease. OP may affect also the jawbones, whose structure may be impaired by other conditions resulting in bone loss. One of these, is periodontitis (PD), a chronic infection-mediated condition modulated by different genetic and environmental factors, characterized, in advanced forms, by loss of the soft tissue attachment to teeth and resorption of alveolar bone. PD is the prototype of a low grade local infection (bacteria of the oral plaque) associated with local (within the periodontal tissues) immune-inflammatory response causing periodontal tissue damages/destruction and a mild individual systemic inflammatory response contributing to the global inflammatory burden and to its related dangerous effects. It might be expected that the alveolar bone destruction seen in periodontitis could be magnified in the presence of generalized skeletal disturbances such as OP. Thus, a relationship between OP and PD might be probable, but further prospective and sensitive studies are required in order to provide definitive evidence. By now, available data underline the primary importance of dentists in the early diagnosis of OP, because of the opportunity to assess the health of the entire skeleton of the patient through dental radiography. This is of considerable clinical interest, considering that such dental radiological investigations are routinely performed for diagnosis and treatment of dental and periodontal diseases, which are particularly frequent in the same population affected by OP. This may also provide clues for new preventive strategies and/or early therapeutic approach resulting in a potential reduction of bone resorption and contributing to maintain bone biomechanical characteristics (e.g. architecture, remodelling, quality of matrix collagen and its mineralization). In fact, the prevention of OP is the most rational and modern approach to defeat the disease, and early diagnosis is one of the foundations of modern medicine; the dentist seems to have an important role not only in monitoring/maintaining the oral and periodontal health and its relationships with systemic health, including OP, but also in drafting diagnostic/therapeutic paths and participating in counselling for OP in collaboration with general practitioners and other specialists (Rosario Guiglia, Olga Di-Fede, Lucio Lo Russo. Osteoporosis, jawbones and periodontal disease. Med Oral Patol Oral Cir Bucal. 2013 Jan 1;18 (1):e93-9).

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