IJIMM, Volume 3, Issue 8, 2025
ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM

INTERNATIONAL JOURNAL OF
INTEGRATIVE AND
MODERN MEDICINE

Assessment of Morphometric and Functional Parameters of the Facial Part of the Upper jaw in Children During the Period of Replacement Bite

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Abstract: This study focuses on the assessment of morphometric and functional parameters of the facial part of the upper jaw in children aged 7–9 during the mixed dentition period. Using H.G. Gerlach's method, the length of the lateral segment, the mesiodistal and buccolingual dimensions of tooth crowns, and the modulus of the first permanent molars were measured. Comparative analyses were carried out among children with normodont, microdont, and macrodont dental systems. The findings revealed a direct correlation between lateral segment length and tooth size, and for the first time, a method was proposed for determining the dental system type based on the average modulus of the first four molars. The results have practical significance for orthodontic diagnostics, prediction of chewing segment pathologies, and selection of treatment strategies.

Keywords: *dental system types, normodontia, microdontia, macrodontia, lateral segment, Gerlach method.*

Introduction

The researchers propose to characterize the morphology of teeth in combination with their jaw segments, including the bone tissue of the alveolar bone, the distribution features in the segments of compact and spongy matter, the structure of the periosteum and periodontal tissues. The majority of orthodontic diagnostic methods are based on the odontometric parameters of this group. The size of the upper incisors is the starting point of textbook methods of biometric diagnosis of dental arch anomalies in various periods of ontogenesis. The sum of the width of the crown parts determines the width of the dental arches between the premolars and the first molars of the permanent bite. The difference in the numerical values of the coefficients proposed by the authors determines their limited use, taking into account the typological features of the upper dental arches, even with physiological occlusion. A comparative analysis of these parameters with the antagonizing mandible shows that its dimensions correlate with the total width of the crown parts of the upper incisors. In addition, the depth of the anterior sector of the dental arch according to G. Korkhaus was noted for both jaws, depending on the size of the anterior teeth.

The same period is characterized by the presence of the first additional teeth of permanent bite, in particular the first permanent molars, which, according to A.H. Engle, are the key to occlusal relationships. The sizes of permanent incisors and first permanent molars are variable and, according to most researchers, determine the dental type of the dental system, namely: macro-, micro- or normodontism. At the same time, the authors recommend comparing the size of the incisors with the transversal zygomatic size of the face. According to the

authors, this technique makes it possible to determine the correspondence of tooth sizes to jawbone sizes and to propose modern research methods. It is recommended to evaluate the type of dental system both by the sum of the four upper incisors and by the modulus of the first permanent molars, calculated as a half-sum of the mesial-distal and vestibular-lingual diameters. There are many methods for determining the dental type in the literature, but most of them relate to the period of permanent bite formation. In this case, experts noted not only the variability of face size in representatives of both sexes, but also showed that the size of teeth is less determined by gender differences and, as a rule, depends on the diagonal and latitudinal (transversal) dimensions of the facial region of the head.

The proportionality of the head, face, dental arches and groups of teeth is indicated by researchers when analyzing the graphic shape of dental arches. Information on the relationship of tooth sizes and typological variants of dental arches with the features of articular elements is presented. The authors note that the shape and size of the articular pits correlate with the peculiarities of the inclination of the anterior teeth in the sagittal direction, characterizing the protrusion, retrosion and mesotrusion variants of the dental arches.

To assess the normal values of the lateral segments, Gerlach proposed a method for measuring and comparing it with the size of the upper incisors, as well as comparing the lateral segments of the dental arch, both with each other and with antagonists. However, Gerlach recommended measuring the segment from the medial surface of the permanent canine, which is possible during the period of permanent teeth bite. In the period of replacement bite, dental arches are represented by teeth of both generations, which determines the treatment methods with effects on periodontal tissues of both milk and permanent teeth, with varying degrees of formation and resorption of their roots.

At the same time, it is noted that biometric diagnostics of dental arch anomalies and deformities determines not only treatment methods, but also is a critical indicator of its effectiveness. Replacement bite, according to the researchers, is the most variable of all periods of dental ontogenesis. In this case, not only does the teeth change, but almost all the parameters of the dental arches change, which aims at an individual approach to diagnostic and therapeutic measures. A comparative assessment of the functional state of the dental and maxillary system was carried out and the features of metabolism in anomalies of occlusal relationships were presented, which is also recommended to be evaluated in clinical orthodontics. The estimate of the length of the lateral segment is comparable to the size of the teeth located in this segment, which are represented by premolars in a permanent bite. At the same time, the size of the milk molars differs from the size of the teeth replacing them, which determines the relevance of the study and determines its purpose. The aim of the study was to conduct a comparative analysis of the size of the Gerlach lateral segment with the size of teeth during the period of replacement bite in children with different dental types of dental systems. Materials and methods of research. A retrospective stratified study of models of dental arches in children aged 7-9 years was carried out after changing the milk incisors of both jaws with optimal functional occlusion and a neutral ratio of the first permanent molars. On plaster models of the jaws, the mesial-distal width of the crowns of the teeth of both generations was measured to determine the length of the dental arch and the vestibular-lingual size of the first permanent molar to assess the modulus of the first permanent molars and the total modulus of the molars of the upper and lower jaw.

The first group included models in which the total component of the medial-distal crown width ranged from 30 to 32 mm. A value of less than 29 mm characterized microdontism, and more than 33 mm characterized the macrodontal type of the system. In addition, the magnitude of the modulus of permanent molars was determined as the average semi-total length and width of the crowns of the teeth under study. The length of the dental arch was determined by the Nance method using a flexible wire, which was installed along the vestibular surface of the teeth from the distal point of the first molar of one of the sides to a similar landmark on the antimeter. The length of the lateral segment was determined according to H.G. Gerlach (1966). Due to the absence of permanent canines, the distal contact point of the permanent lateral incisor was used as an anterior measuring landmark. On the distal side, the Gerlach point, located on the distal side of the first permanent molar, served as a guideline. Taking into account the variability in the size of baby teeth and differences in the timing of eruption of premolars and permanent canines, the sum of the crown widths of both baby and permanent teeth located between the lateral incisors and the first permanent molars on both sides of the jaw was estimated and the resulting size was compared with the length of the lateral segment. When determining the correspondence of odontometric

parameters to antagonizing teeth, the classical methods of P. Tonn (1937) for the front teeth and W.A. Bolton (1962) for the entire dental arch were used. In the period of replacement bite in children with a normodont type of dental system, the sum of the medial-distal width of the upper incisors was 30.71±1.12 mm, in antagonists this parameter was 22.90±1.09 mm. The calculated Tone value was 1.34±0.01 and indicated the proportionality of the antagonists to the physiological norm. The odontometric parameters of the first permanent molars were also close to the physiological parameters of the normal dental system and were comparable with the results of other researchers. In the upper jaw in this group, the mesial-distal dimensions of the crowns of the first permanent molars were 10.10±0.12 mm, the vestibular-lingual diameter was 11.19±0.08 mm, and the modulus of the upper molars was 10.64±0.09 mm.

The mesial-distal dimensions of the crowns of the lower first permanent molars were 10.89±0.14 mm, and the vestibular-lingual diameter was 10.61±0.09 mm, and the modulus of the lower molars was 10.75±0.11 mm. The average modulus of the four permanent molars is 10.69±0.08 mm, which can be used in clinical orthodontics to determine the dental type of the dental system. The total component of the mesial-distal dimensions of the milk teeth (canine and two molars on each side) averaged 21.34±0.53 mm, and on the lower dental arch – 20.59±0.47 mm. At the same time, the length of the Gerlach lateral segment on the upper and lower jaws was 31.66±1.24 mm and 32.02±1.31 mm, respectively, and was close to the sum of the width of the crowns of the upper permanent incisors. In the replacement bite, the length of the upper normodont arch was 93.59±1.05 mm. The lower arch was 86.86±1.11 mm long.

The mesial-distal dimensions of the crowns of the lower first permanent molars were 10.20±0.12 mm, and the vestibular-lingual diameter was 10.36±0.11 mm, and the modulus of the lower molars was 10.28±0.11 mm. The average modulus of the first four permanent molars was 10.32±0.11 mm, which determined the microdental type of the dental system. The total component of the mesial-distal dimensions of the milk teeth (canine and two molars on each side) averaged 19.87±0.57 mm. The size of the antagonizing group of teeth was 19.45±0.44 mm. The length of the upper lateral segment according to Gerlach was 29.88±1.21 mm. On the lower arch, the index was 29.68±1.18 mm, respectively, and was close to the sum of the crown widths of the upper permanent incisors. In the replacement bite, the length of the upper microdibular arch was 88.26±1.02 mm. The lower arch was 80.58±1.01 mm long. The Bolton ratio of these sizes was 91.29±0.02% and corresponded to the parameters of permanent bite. Thus, it was found that the size of the lateral segment according to Gerlach is determined by the odontometric parameters of the milk and permanent teeth, which can be used in the diagnosis of pathology in the chewing segment and in predicting the size of permanent teeth. For the first time, a method was proposed for determining the dental type by the average modulus of the first four molars of both jaws. Conclusion During the period of replacement bite, it is recommended to measure the length of the lateral segment from the distal contact point of the permanent lateral incisor to the first molar (distal surface)

Conclusions

In people with macrodontinal variants of dental systems, the size of the upper incisors in the total value was 33.16±1.14 mm, while the length of the lateral segment according to Gerlach was 34.42±1.29 mm (upper segment) and 33.76±1.34 mm (lower segment). For microdental variants of dental arches, the sum of the width of the upper incisors averaged 28.76±1.06 mm, and the lateral upper segment was 29.88±1.21 mm, the value of the antagonizing group was 29.68±1.18 mm.

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