DIAGNOSTIC AND TREATMENT METHODS

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COMPARATIVE EVALUATION OF THE LOCATION OF OCCLUSAL LANDMARKS ON THE ORTHOPANTOMOGRAM AND TELEROENTGENOGRAM

A comparative analysis of the location of occlusal landmarks on orthopantomogram and teleradiogram in normal and occlusive pathology was carried out, which has a high level of information value in planning orthopedic treatment in patients with defects of dental arches and dental-alveolar anomalies of occlusion. In the course of comparative analysis of orthopantomogram and teleradiogram data, it was determined that the infradental-occlusal horizontal, as a rule, was parallel to the gnathic horizontal. The ratio of the size of the alveolar-articular line (Cond-A) to the size of the segment crossed by the articular circle line on the teleradiogram was 1.50±0.09. At the OPG, when analyzing linear parameters, it was noted that the ratio of the distance from the "Cond" point to the intersection with the aesthetic median vertical to the segment of the articular circle intersected by the line was 1.61±0.1, which was close in value to the Fibonacci number. This circumstance allowed the use of the principle of the "golden section" in determining the radius of the circle in anomalies of the position of the molars in the vertical direction. A comparative analysis of the location of occlusal landmarks on the orthopantomogram and teleradiogram in normal and occlusion pathology showed that both methods of X-ray examination can be used in the clinic of prosthetic dentistry in the diagnosis of dental-alveolar forms of occlusal anomalies and for the selection of treatment methods for patients with defects of dental arches that are not limited on the distal side of the arch. In addition, the intersection point of the occlusal lines and infradental-occlusal horizontals, which are located in the same way on both types of X-rays, which makes both methods of X-ray examination acceptable in the clinical practice of dental prosthetics.

The results obtained reveal that when constructing the occlusal line, it is most appropriate to use its parallelism with the gnathic horizontal, connecting the supramental point Downs with the lower diameter of the articular circle. At the same time, the use of parallelism of the infradental-occlusal horizontal with the gnathic line of the lower jaw in the clinic of prosthetic dentistry makes it possible to use them in determining the position of the distal occlusal point.

Keywords: orthopantomography; teleradiography; occlusal line; articular horizontal; distally unlimited defects of dental arches

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Introduction. Methods for assessing the condition of the maxillofacial region based on X-ray data are widely used in the clinical practice of dentists [8,11]. In the presented works, the authors carried out a detailed comparison of the X-ray and morphometry data of native skull specimens with a complete set of teeth of permanent occlusion. Data on the ratio of the sizes of the upper and lower jaws, taking into account odontometric indicators, were noted.

In the clinical examination of patients, teleradiography is an irreplaceable method of examination, in which the position of the structures of the maxillofacial region in relation to linear landmarks is assessed. The most significant and controversial issues of orthodontics and prosthetic dentistry are the methods of constructing and analyzing the occlusal plane [1]. In the presented scientific study, recommendations are given to focus on the position of the mandibular plane when constructing the alveolar-occlusal horizontal of the lower jaw. The author used the obtained landmark for further construction of the occlusal horizontal and determined their stable position regardless of the type of jaw growth and the size of the mandibular angle.

The works of researchers comparing the position of the mandibular plane on orthopantomograms and teleroentgenograms of the same patients deserve attention [10]. In this study, the author showed various options of constructing the mandibular plane and revealed certain regularities when comparing the marked horizontal on different types of roentgenograms. However, this study was limited only to the position of the mandibular horizontal, and the starting point of the orthopantomograms was the constructive point of the angle of the mandible, without taking into account the proportionality of the branch and the body of the organ under study. At the same time, the study was carried out in people with a physiological occlusal norm.

Specialists draw attention to the need for a comprehensive examination of patients with various dental pathologies, including X-ray, functional and laboratory methods. The effectiveness of such studies was demonstrated by the authors using the examples of diagnosis and treatment of dental patients in combina-

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tion with somatic pathology, in particular, diabetes mellitus and connective tissue dysplasia [3,5].

The analysis of the position of the occlusal plane is significantly complicated by numerous variants of anomalies of the maxillofacial region, in which the position of key teeth of different classes changes, which in its turn affects the condition of hard tissues and the periodontal complex [6,14].

When assessing the position of the occlusal plane when it deviates from the azimuth of the pupillary horizontal, the researchers recommend evaluating teleroentgenogram in direct projection and orthopantomography data [9]. This type of anomaly is recommended by the authors to be defined by the term "transversal occlusion". This study was carried out taking into account the growth of the jaws. However, relatively stable landmarks for the construction of the occlusal line are not shown, and the features of the temporomandibular joint, which determines the biomechanics of the mandible, are not taken into account.

This feature was noted by specialists studying the spatial arrangement of the bone elements of the mandibular joint, taking into account the trusal types of dental arches and the location of anterior teeth in the gnathic complex [2]. In the presented material, experts noted the effect of occlusal balance of the anterior teeth on the shape of the articular fossa and the location of the mandibular head in it.

The issues of proportionality of dental arches and the size of the craniofacial complex are presented in the classifications of specialists in the analysis of the physiological occlusal status [4,7,12]. However, in the course of the study, the authors compared the biometrics of the dental arches with the morphometry of the head and face, which did not allow assessing the position of the teeth relative to the occlusal horizontal in the structure of the gnathic complex. Nevertheless, a comparative analysis of the parameters of the head and dental arches determines the algorithm for predicting the size of dental arches in anomalies [13].

Data on the position of the structures of the maxillofacial region of the head relative to the location of stable anatomical landmarks were shown by the specialists and the features of different periods of ontogenesis were noted [15]. Information is presented on the variability of the position of the teeth relative to the occlusal plane in various anomalies and variants of bite height reduction [16].

Nevertheless, we did not find information about the position of the teeth relative to the occlusal plane, built considering the location of the elements of the mandibular joint, on teleroentgenograms and orthopantomograms at the same time, which determined the purpose of the work.

Research objective: To conduct a comparative analysis of the location of occlusal landmarks on orthopantomogram and teleroentgenogram in normal conditions and malocclusion.

Material and methods of research. In the course of the retrospective study, the analysis of teleroentgenograms (TRG) and orthopantomograms (OPG) of the same young people with physiological occlusion, necessary for the development of a method of comparative analysis, was carried out. For this purpose, 38 clinical cases were analyzed. At the second stage, similar data were analyzed in 23 individuals with distally unlimited defects of the dental arches, in whom vertical occlusion anomalies were identified, in particular, the protrusion of antagonists. This study made it possible to clarify the diagnosis and determine the tactics of therapeutic measures.

For the convenience of analysis, scaled (1:1) photographs of X-ray images were placed in the Power Point program, after which point landmarks were placed, among which the main ones were those that were placed on the TRG and OPG. The main points on the TRG and OPG, in accordance with the purpose of the work, were articular ones (Cond), installed in the upper part of the jaw head. The infradental point (Id) was located on the TRG in the upper part of the alveolar part on the vestibular side near the incisor neck. On the OPG, the indicated landmark was located along the midline between the incisors-anthemers in their cervical part. Of the chin points, the most rational was considered to be the setting of the "gnation" (Gn) point. On the OPG, the point was located in the lower part of the jaw body along the midline. On the TRG, this landmark was projected on the lower point of the chin, protruding anteriorly. On the second lower molar in the distal part of the occlusal surface, an occlusal point "hPOcP" was installed on both TRG and OPG.

The auxiliary points on the TRG in our study were landmarks for the construction of the skull base line (N-Se), the nasal vertical of the face (n-sn), the Dreyfus line, and the occlusal line (hPOcP-vPOcP). Besides, the points of the apical bases ("A" and "B") and the supramental point (sm) on the skin of the chin were marked (Fig. 1).

The use of Microsoft PowerPoint allowed the construction and combination of lines and shapes to enable comparative analysis.

The analysis of the location of occlusal landmarks is based on the construction of an articular circle, the radius of which was the distance from the apex of the articular head to the occlusal point of the distal odontomer of the second molar (Cond-hPOcP) and the construction of the circle was carried out both on the TRG and on the OPG on both sides. The occlusal line on the TRG connected the anterior and distal occusal points. On the OPG, the distal points were connected by a straight line. An infradental-occlusal line connected the "Id" point with the distal molar points "hPOcP". The lower gnathic horizontal was drawn from the gnathion point (Gn) to the position point of the lower diameter of the circle on one side of the TP and on both sides of the OPG (Fig. 1).

The line connecting the articular points was an auxiliary landmark on the OPG. On TRG, the nasal vertical and the Dreyfus line were used to clarify the position of the points of the apical bases of the jaws when the projection of the tips of the incisor roots on the alveolar bone was not clear. At the same time, the subspinal point Downs ("A") was located at the intersection of the perpendicular to the Dreyfus line coming out of the subnasal cutaneous point "sn". When determining point “B”, a perpendicular was constructed to the nasal vertical, which passed through the supramental point “sm” to the junction with the alveolar part of the jaw. In the TRG, point "A" was used to build the alveolar-articular radial line, and point "B" was connected to the lower diameter of the circle, obtaining the lower alveolar line.

After drawing the X-ray images, linear and angular parameters were evaluated. The distance from the "Cond" point to the point of intersection with the articular circle line was measured on the OPG. The angles formed by the median aesthetic vertical and the infradental-occlusal horizontal, as well as the angle of inclination of the gnathic line to the specified vertical, were measured. The parallelism of the articular and occlusal lines was assessed.

On TRG, the ratio of the alveolar-articular radial line with the segment crossed by the articular circle was determined. The angles of deviation of the horizontal lines of the TRG from the Dreyfus vertical were determined and the parallelism

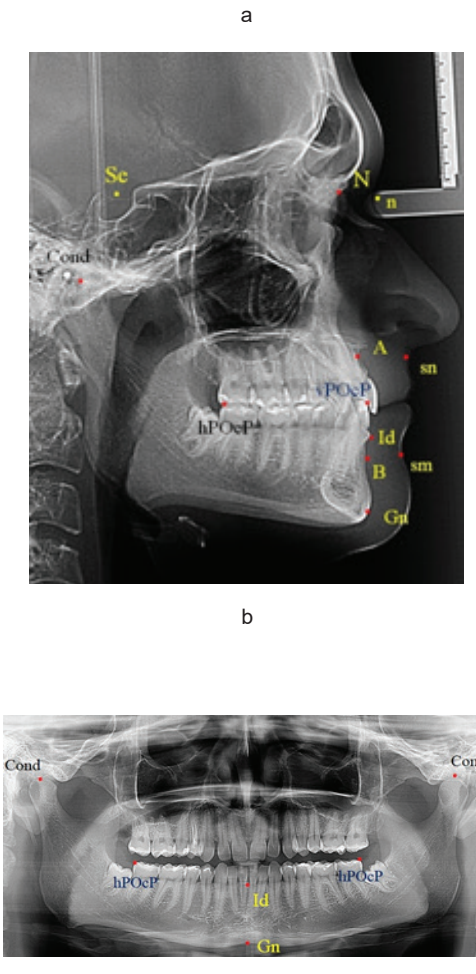

Fig. 1. Location of the main points on the TRG (a) and OPG (b)

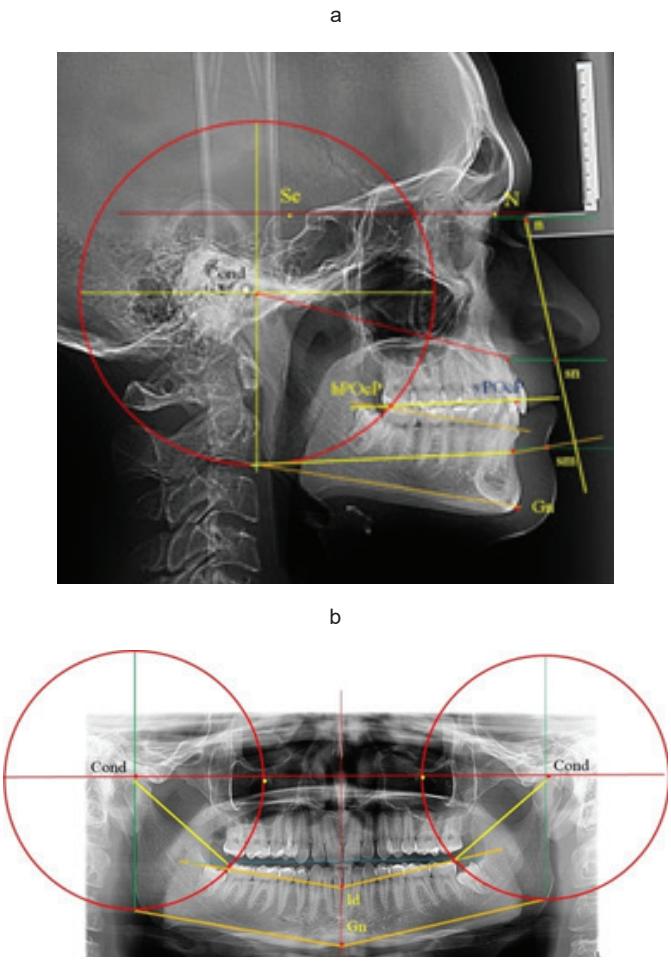

Fig. 2. Methodology of comparative analysis of the location of occlusal landmarks on the TRG (a) and OPG (b)

of the lower alveolar horizontal and the occlusal line was estimated. The location of the infradental-occlusal horizontal in relation to the gnathic line was also compared.

Numerical indicators were evaluated in Microsoft Excel, calculating mean values with a representativeness error index (M±m) to determine reliability according to Student.

Results and discussion. In the course of a comparative analysis of the TRG and OPG data, it was determined that the infradental-occlusal horizontal, as a rule, was parallel to the gnathic horizontal, both on the TRG and OPG. Parallelism of the TRG occlusal line with the inferior alveolar line was also noted. On the OPG, the articular horizontal at physiological occlusion was parallel to the occlusal intermolar horizontal (Fig. 3).

When analyzing the linear parameters on the TRG, it was noted that the ratio of the size of the alveolar-articular line (Cond-A) to the size of the segment crossed by the articular circle line was 1.50±0.09. This coefficient can be used to determine the radius of the articular circle in case of abnormal deviation of the distal occlusal point in people with occlusal anomalies and in the presence of dental arch defects in the distal region.

When measuring angular parameters, a significant variability of indicators was revealed. However, a comparative analysis revealed certain patterns.

At the OPG, when analyzing linear parameters, it was noted that the ratio of the distance from the "Cond" point to the intersection with the aesthetic median vertical to the segment of the articular circle crossed by the line was 1.61±0.1, which was close in value to the Fibonacci number. This circumstance allowed the use of the principle of the "golden section" in determining the radius of the circle in anomalies of the position of the molars in the vertical direction.

The differences in the value of the angle formed by the median aesthetic vertical and the infradental-occlusal horizontal, as well as with the angle of inclination of the gnathic line to the specified vertical, did not exceed one and a half degrees, and the difference in the indicators for the group accounted for 0.87±0.62 degrees. The result proved the parallelism of these lines and the possibility of using the gnathic horizontal as a reference point for the construction of the infradental-occlusal line in occlusal anomalies.

A similar situation was observed on the TRG when analyzing the slope of these contours with the Dreyfus vertical. In addition, the differences in the value of the angles formed by the Dreyfus vertical with the occlusal line and the lower alveolar horizontal accounted for 1.04±0.91 degrees. Thus, the lower alveolar horizontal can be used to predict the location of the occlusal line in malocclusion.

It is noteworthy that the point of intersection of the occlusal line with the infradental-occlusal horizontal was located on the distal occlusal point of the second molar, which will make it possible to determine the position of the distal occlusal point in case of dental-alveolar deformity of antagonists.

A comparative analysis of the results of the study of roentgenograms of patients with distally unrestricted defects of the dentofacial arches showed correspondence in the location of the occlusal

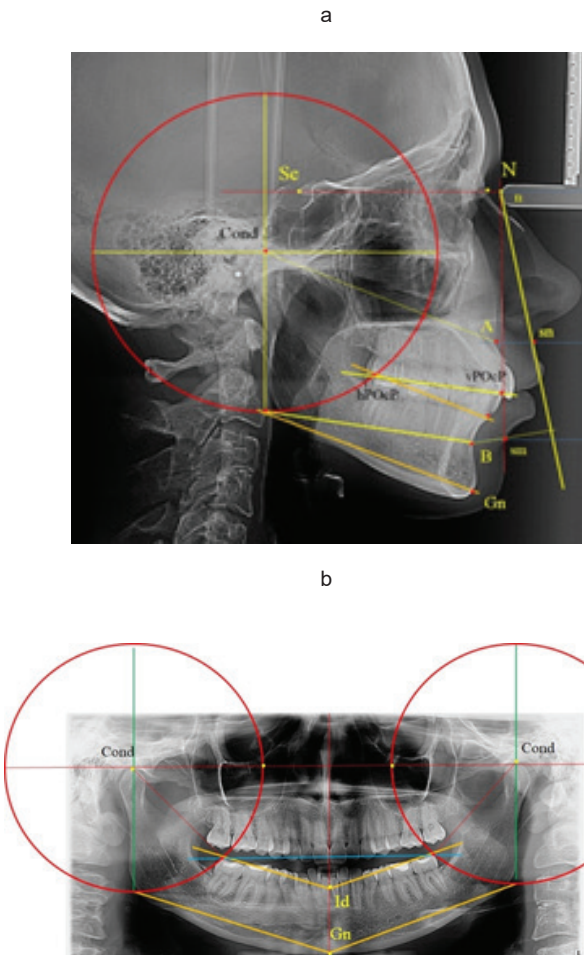

Fig. 3. Comparative analysis of the location of occlusal landmarks on TRG (a) and OPG (b) in physiological occlusion

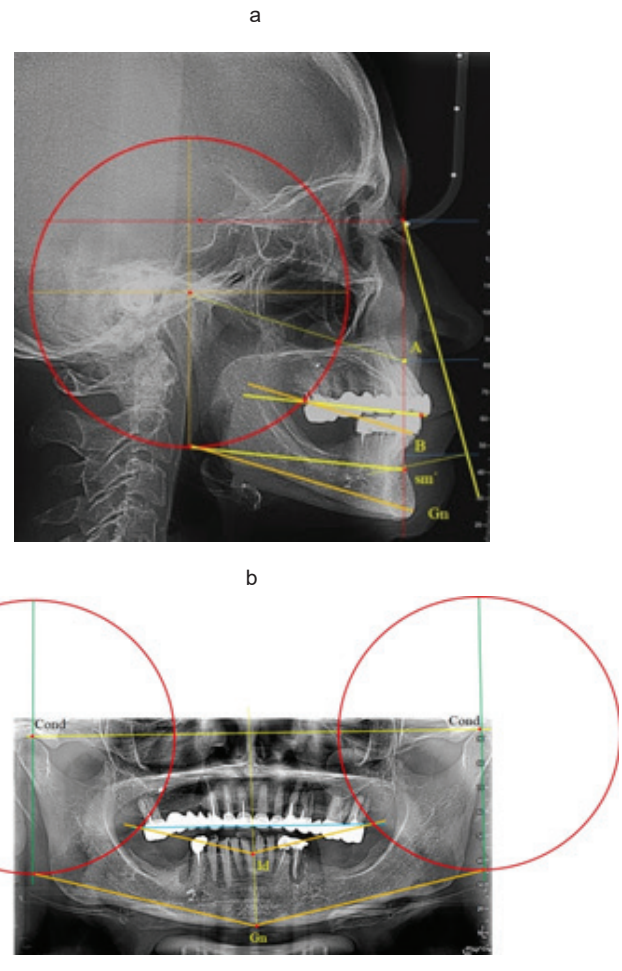

Fig. 4. Comparative analysis of the location of occlusal landmarks on TRG (a) and OPG (b) in pathological occlusion

landmarks of the TRG with the data of the analysis of orthopantomograms.

In the course of the study, the same algorithm for constructing diagnostic lines and figures was used as in people with the physiology of bite ratios. The radius of the articular circle on the TRG was determined by the ratio of the "Cond-A" size to the coefficient of 1.5. But the OPG radius was calculated through the ratio of half the value of the interarticular distance to the Fibonacci number (1.618). Infradental-occlusal horizontals were drawn in parallel with the gnathic lines in both images (Fig. 4).

Attention is drawn to the point of intersection of occlusal lines and infradental-occlusal horizontals, which were located in the same way on both types of X-rays, which makes both methods of X-ray examination acceptable in the clinical practice of dental prosthetics.

Conclusion. Thus, a comparative analysis of the location of occlusal landmarks on the orthopantomogram and teleradiogram in normal and occlusion pathology showed that both methods of X-ray examination can be used in the clinic of orthopedic dentistry in the diagnosis of dental-alveolar forms of occlusion anomalies and for the selection of treatment methods for patients with dental arch defects not limited on the distal side of the arch. When constructing the occlusal line, it is most expedient to use its parallelism with the gnathic horizontal, connecting the supramental point Downs with the lower diameter of the articular circle. The parallelism of the infradental-occlusal horizontal with the gnathic line of the mandible allows their use in determining the position of the distal occlusal point.

The authors declare that there is no conflict of interest.

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