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UDC 616.314.714.1-007.272
DOI – <https://doi.org/10.14300/mnnc.2022.17042>
ISSN – 2073-8137

VARIABILITY OF MORPHOMETRIC INDICATORS OF THE CRANIOFACIAL COMPLEX IN PATIENTS WITH DISTAL OCCLUSION ACCORDING TO 3D CEPHALOMETRY DATA

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ВАРИАБЕЛЬНОСТЬ МОРФОМЕТРИЧЕСКИХ ПОКАЗАТЕЛЕЙ КРАНИОФАЦИАЛЬНОГО КОМПЛЕКСА У ПАЦИЕНТОВ С ДИСТАЛЬНОЙ ОККЛЮЗИЕЙ ЗУБНЫХ РЯДОВ ПО ДАННЫМ 3D-ЦЕФАЛОМЕТРИИ

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According to the results of a digital study of 3D cephalometry and cone beam computed tomography of the skull (panoramic and axial images of the teeth and temporomandibular joints with measured points and measurements in the vertical and sagittal planes). Diagnostic plaster models of the lower jaw of 52 adult patients with distal occlusion, and morphometric features of the craniofacial complex were determined. Anthropometric, odontometric and biometric methods for studying the indicators of the craniofacial complex have been improved. A method for determining the sagittal occlusal curve Spee is proposed. Thus, the obtained results effectively treat adult patients with occlusive pathology with partial or complete loss of teeth.

Keywords: 3D cephalometry, CT scan, distal occlusion, Spee sagittal curve, anthropometry, biometry, temporomandibular joint

По результатам цифрового изучения 3D-цефалометрии, реформатов конусно-лучевой компьютерной томографии черепа (панорамного, аксиального скрининга зубов и височно-нижнечелюстных суставов с нанесенными реперными точками и измерениями в вертикальной и сагиттальной плоскостях), а также реформатов диагностических гипсовых моделей нижней челюсти 52 взрослых пациентов с дистальной окклюзией определены морфометрические особенности краниофациального комплекса. Усовершенствованы антропометрические, одонто- и биометрические методики изучения показателей краниофациального комплекса. Предложен способ определения сагиттальной окклюзионной кривой Spee. В результате исследования установлено, что полученные данные результативны при лечении взрослых пациентов с окклюзионной патологией, с частичной или полной потерей зубов.

Ключевые слова: 3D-цефалометрия, конусно-лучевая компьютерная томография, дистальная окклюзия, сагиттальная кривая Spee, антропометрия, биометрия, височно-нижнечелюстной сустав

For citation: Grigorenko M. P., Bragin E. A., Vakushina E. A., Karakov K. G., Dmitrienko S. V., Bragin A. E., Grigorenko P. A., Khadzhaeva P. G. VARIABILITY OF MORPHOMETRIC INDICATORS OF THE CRANIOFACIAL COMPLEX IN PATIENTS WITH DISTAL OCCLUSION ACCORDING TO 3D CEPHALOMETRY DATA. *Medical News of North Caucasus*. 2022;17(2):174-178. DOI – <https://doi.org/10.14300/mnnc.2022.17042>

Для цитирования: Григоренко М. П., Брагин Е. А., Вакушина Е. А., Караков К. Г., Дмитриенко С. В., Брагин А. Е., Григоренко П. А., Хаджаева П. Г. ВАРИАБЕЛЬНОСТЬ МОРФОМЕТРИЧЕСКИХ ПОКАЗАТЕЛЕЙ КРАНИОФАЦИАЛЬНОГО КОМПЛЕКСА У ПАЦИЕНТОВ С ДИСТАЛЬНОЙ ОККЛЮЗИЕЙ ЗУБНЫХ РЯДОВ ПО ДАННЫМ 3D-ЦЕФАЛОМЕТРИИ. *Медицинский вестник Северного Кавказа*. 2022;17(2):174-178. DOI – <https://doi.org/10.14300/mnnc.2022.17042>

At the present stage of development of digital radiology and clinical dentistry the problem of optimization of diagnostic and prognostic approaches in planning rational treatment is one of the fundamental [1–4].

The mathematical relationships between the linear dimensions of the face, tooth rows, teeth, the linear and angular indexes of the tooth and articular triangles of the lower jaw are one of the cornerstones of the anthropo – and odontometry. They are constantly improving their registration [5–8].

The purpose of the study is to study the variability of morphometric indicators of the craniofacial complex in respondents with distal occlusion at holistic tooth rows according to 3D cephalometry.

Material and Methods. Conducted cone beam computed tomography (CBCT) of the elements of the craniofacial complex. The study was carried out using the digital X-ray system «ORTHOPANTOMOGRAPH» OP 300 (KAVO, Germany) in 52 (100 %) adult patients aged 18–35 years with distal occlusion at integral tooth rows (K07.20 according to ICD 10) with various gnathic and dental types [14] in the position of usual occlusive

contacts with subsequent 3D cephalometric analysis. On the reforms of the bones of the facial section of the skull, directly in the viewer program, rather than on the soft facial tissues, as traditionally done, anthropometric measurements of the linear indicators of the width between the points (zy-zy) (skin projections of the point (tt)), and linear indicators both diagonals of the skull between the points (zy-zy) and point A (skin projection of the point (t-sn)) (Fig. 1).

The GFI was calculated, which is equal to the ratio of the sum of the two diagonals of the face (t-sn) to the width of the face (t-t). Gnathic face types (dolichognathia, mesognathia, brachyognathia) and dental types (microdontia, normodontics, macrodontia) were determined using the classification of variability according to D. A. Domenyuku et al. (2017) [14]. They were successfully applied later by S. V. Dmitrienko et al. (2019) [8] when examining respondents with physiological occlusion of the dentition on the soft tissues of the face and V. V. Seleskeridi (2020) [6]. The spread of GFI values from 1.7 to 1.8 was interpreted as mesognathia, above and below dolichognathia and brachygnathia, respectively.

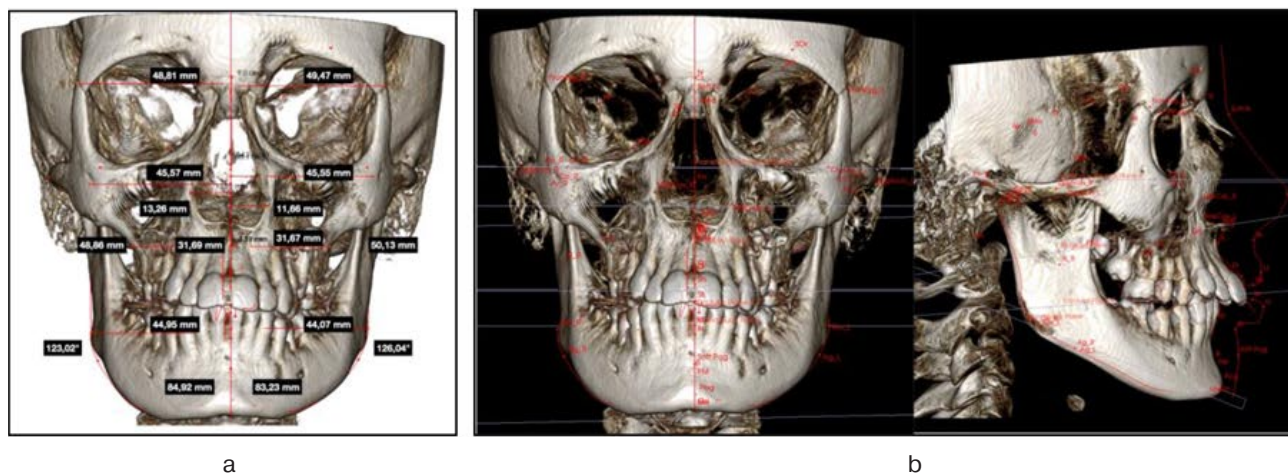


Fig. 1. A series of panoramic CBCT of the skull with applied bone guidelines for the width and diagonals of the face (a) and calculated linear indicators of the width and diagonals of the face in the 3D cephalometry program (b)

At the reforms of the CBCT, directly in the viewer program in digital format and not on jaw models, as was traditionally done, linear odontometric parameters were measured. Microdontia was diagnosed in 4 (8 ± 3.76 %) patients, normodontics in 32 (61.33 ± 6.75 %) patients, and macrodontia in 16 (30.67 ± 6.39 %) patients with distal occlusion with intact teeth ranks.

Dental arches were considered normodont, where the longitudinal length varied from 114 to 118 mm, microdont and macrodont – lower and higher, respectively. Calculated indicators of the longitudinal length of the dental arch, equal to the sum of the mesio-distal dimensions of 14 teeth.

Linear transversal and sagittal measurements of the dental arch were also consistently carried out at the jaw model reforms of CBCT.

For the first time, the results of sagittal occlusion curve See on the reforms of CBCT lower diagnostic gypsum models on the method of determination of sagittal occlusal curve See at anomalies and deformations of tooth arcs, proposed by E. A. Vakushina with co-authors (Fig. 2).

The CBCT study extended from the lower edge of the model base to the occlusal surface of the teeth of the lower

jaw. It was scanning at a single layer speed of 2 to 6 seconds with instant black and white image playback. On the resulting CBCT reforms at the interface, the tops of the cutting edges of 3.1, 4.1, and the tops of the distal buccal tubercles of teeth 3.7 and 4.7 were connected sequentially on the left and right by a horizontal line. The resulting plane was connected perpendicularly to the tops of the mesial buccal tubercles of teeth 3.6 and 4.7 successively on the left and right to determine the deepest point of the Speesagittal curve from both sides. The computer software of the viewer program made it possible to simplify the study, obtain high-precision calculated data without additional manual measurements, reduce the time of the study and significantly increase its objectivity.

The sagittal occlusal curve was interpreted as flat, with the obtained values from 1.5 to 2 mm; a slightly concave curve, with the accepted indicators from 1.8 to 2.5 mm and a sharply concave curve, with the obtained indicators from 2.4 to 3.5 mm.

On axial CBCT reforms, the TMJ was successively constructed and calculated in 3D digital format:

1. Angular indices of the inter-incisal angle, the range of indices from 124.7° to 144.39° were taken as the norm.

An angular index below 124.7° was interpreted as retrusion of the incisors in 21 patients ($40.38 \pm 6.8\%$), and values of the index above 144.39° corresponded to the protrusion in 31 patients ($59.62 \pm 6.8\%$).

2. Linear indices of the sagittal fissure in the anterior section.

3. Indicators of the lower dental triangle.

4. Indicators of the articular triangle.

5. The angle of convergence of the articular heads of the lower jaw (Fig. 3).

The results were statistically processed using Statistica 10.0 (StatSoft Inc, USA). A comparative assessment of microcirculatory parameters was carried out using the Wilcoxon t-test. Differences were considered significant at $p < 0.05$.

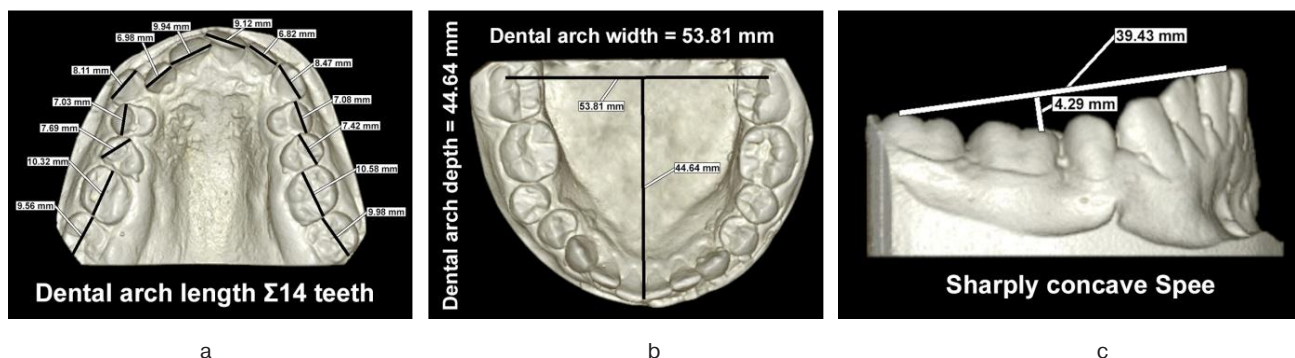


Fig. 2. A series of panoramic CBCT diagnostic plaster models of the jaws with applied measuring points and calculated linear indicators of the mesio-distal dimensions of the teeth and the length of the upper dental arch (a), the width and depth of the lower dental arch (b), the depth of the Spee occlusal curve in the 3D cephalometry program (c)

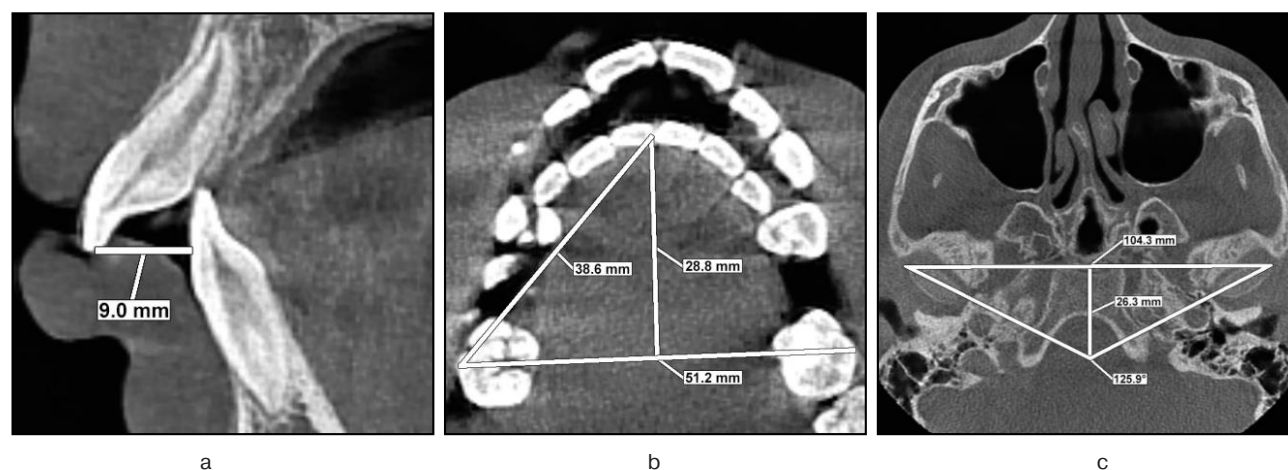


Fig. 3. A series of axial CBCT scans of the maxillofacial area with calculated linear parameters of the sagittal fissure in the anterior region (a), the lower dental triangle (b), the articular triangle and the angle of convergence of the articular heads of the mandible in the 3D cephalometry program (c)

Results and Discussion. During the digital X-ray studies of the skull in the computer program 3D cephalometry in patients with distal occlusion with intact dentition, normodontics was visualized in 32 ($61.33 \pm 6.75\%$), macro- and microdontia – in 16 ($30.67 \pm 6.39\%$) and 4 ($8 \pm 3.76\%$) patients. Mesognathic type of face and dental arches was diagnosed in 33 ($63.47 \pm 6.67\%$), brachygnathic type of face and dental arches – in 11 ($21.15 \pm 5.66\%$) and dolichognathic type of face and dental arches and 8 ($15.38 \pm 5\%$) of patients, which confirmed the data of anthropo-, odonto- and biometric studies conducted by the authors using traditional methods on the skin of the face and diagnostic plaster models of the jaws [5, 6, 8, 10, 12, 13, 17].

According to the author's method, a flat occlusal curve Spee was determined in 33 patients ($63.47 \pm 6.67\%$) with three possible variants of dental arches in mesognathia with retrusion of the incisors in 14 patients ($26.92 \pm 6.15\%$) and with protrusion of the incisors in 19 patients ($36.54 \pm 6.67\%$). Slightly concave Spee occlusal curve in 11 patients ($21.15 \pm 5.66\%$)

with three possible variants of dental arches in brachygnathia with retrusion of the incisors in 4 patients ($7.69 \pm 3.69\%$) and with protrusion of the incisors in 7 patients ($13.46 \pm 4.73\%$). A sharply concave Spee occlusal curve in 8 patients ($15.38 \pm 5\%$) with three possible variants of dental arches in dolichognathia with retrusion of the incisors in 3 patients ($5.77 \pm 3.23\%$) and with protrusion of the incisors in 5 patients ($9.61 \pm 4.08\%$). The proposed method made it possible to quickly, with low labor costs and a high degree of accuracy, quantitatively determine the depth of the Spee occlusal curve and thereby confirmed the theoretical research [1, 4, 6, 9, 11, 15] devoted to the problems of increasing the aesthetic and functional efficiency of constructing artificial dentitions in dental prosthetics with a different ratio of the jaws.

In the process of carrying out the study in digital format, with a high degree of confidence, detailed the deeply incised occlusion with the presence of cutting-tubercle contact against the background of distal occlusion in the lateral sections of the dental row in 21 patients

(40.39±6.8 %). Deep incisor disocclusion with varying extensions of the sagittal slit in the anterior area against the background of distal occlusion in the lateral sections of the tooth row in 31 patients (59.61±6.8 %).

With a high degree of certainty, it was determined that for long and narrow dental arches (dolichognathia), the convergence angles of the joint heads of the lower jaw were smaller, and for short and broad dental arches (brachygnathia), correspondingly larger. In 44 patients (84.62±5 %) with mesognathia visualized the joint heads of the lower jaw on the left and right. The angle of convergence of the mandibular joint heads on the left and right of 5 patients (9.62±4.08 %) with brachygnathia was visualized from 146 to 155°. The angle of convergence of the lower jaw joint heads on the left and right of 3 patients (5.76±3.23 %) with the dolichognathia visualized 120 to 129°. The obtained results were confirmed in the work of dentists-orthopaedists and orthodontists [2, 6, 8, 18], which this is due to the characteristics of the gnathic type of dental arches.

At the moment, digital 3D technologies are leading positions in the application of orthopedic dentistry and orthodontics in creating diagnostic protocols. Dentists of this profile use these technologies to research the relationships between deviations in the balance of occlusion, posture, disorders in the TMJ and problems with the muscles of the maxillary fossa [9, 16].

Conclusions. Thus, the analysis of the obtained results of the morphometric parameters of the craniofacial complex according to 3D cephalometric (anthropological, odonto- and biometric) studies in patients with distal occlusion with intact dentition shows their pronounced variability. The calculated correlations are highly informative data. The obtained results are effective for creating occlusion in orthodontic and (or) orthopedic rehabilitation of adult patients with occlusion pathology, Partial or complete loss of teeth using articulators of various designs, taking into account the individual configuration of the maxillofacial region of the individual.

Disclosures. The authors declare no conflict of interest.

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UDC 615.015:615.035:615.036

DOI – <https://doi.org/10.14300/mnnc.2022.17043>

ISSN – 2073-8137

INFLUENCE OF CHRONIC ADMINISTRATION OF ANTIPARKINSON DRUGS ON LEVELS OF SERUM AUTOANTIBODIES TO DOPAMINE AND NMDA RECEPTORS

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ВЛИЯНИЕ ХРОНИЧЕСКОГО ВВЕДЕНИЯ АНТИПАРКИНСОНОВСКИХ СРЕДСТВ НА УРОВНИ СЫВОРОТОЧНЫХ АУТОАНТИТЕЛ К ДОФАМИНОВЫМ И NMDA РЕЦЕПТОРАМ

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In experiments on 108 rats, changes in the level of serum autoantibodies to NMDA receptors (subunits NR1, NR2A, NR2B) and dopamine receptors of the first and second types (DR1 and DR2) were studied during chronic intraperitoneal administration of antipsychotics, antiparkinsonian drugs and their combination. The highest values of autoantibodies to NR1 and NR2A subunits were revealed when bromocriptine was used and to NR2B – when amantadine was administered. Chronic administration of haloperidol at a dose of 0.5 mg/kg increased serum levels of autoantibodies to NMDA receptors, especially in the NR2A subunit. At a dose of 0.1 mg/kg, haloperidol increased the content of autoantibodies to DR1 dopamine receptors. The use of an antipsychotic in combination with antiparkinsonian drugs led to an even more significant increase in the levels of autoantibodies to NR1, NR2A, DR1 and DR2, especially with the combined administration of bromocriptine and haloperidol. At the same time, haloperidol prevented the increase in autoantibodies to NR2B caused by antiparkinsonian drugs. The isolated use of haloperidol or bromocriptine, as well as their joint administration, increased the level of autoantibodies to the S100B protein in the blood serum, and amantadine eliminated this increase in autoantibodies. An increase in the concentration of autoantibodies to the S100B protein correlated with a high content of autoantibodies to NR1 and NR2A, as well as low content of NR2B.

Keywords: autoantibodies, dopamine receptors, NMDA receptors, S100B protein, haloperidol, bromocriptine, amantadine, L-DOPA