НАУЧНЫЙ ОБЗОР

COMPARISON OF ACCURACY OF 2D- AND 3D-DIAGNOSTIC METHODS IN ANALYSIS OF MAXILLOFACIAL REGION FOR CEPHALOMETRY IN ORTHDONTIC PRACTICE BASED ON LITERATURE.

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Purpose. To determine the orthodontic treatment relevance on the base of meta-analysis of the prevalence of dentoalveolar anomalies, and to compare the accuracy of 2D and 3D cephalometry to detect them.

Materials and methods. Comprehensive literature search on the prevalence of dentoalveolar anomalies and comparison of 2D - and 3D-cephalometry results was carried out using two databases. After the selection of the selected criteria, 46 articles on prevalence and 20 articles containing studies on the comparison of teleroentgenogram and CBCT were taken for the analysis. The prevalence was estimated in two groups: analysis of the situation in different regions of the Russian Federation (RF) and prevalence in the world.

Results. The analysis of statistical data showed a high prevalence of dentoalveolar anomalies, the highest figures were recorded in Colombia (88%) and Nigeria (88.2%), the lowest figure was recorded in Iran (29%). Among the RF subjects the highest value was found in Tyumen (89%), the lowest - in the Republic of North Ossetia-Alania (42.25%). The analysis of comparison of accuracy of teleroentgenogram and CBCT showed discrepancy in results of the carried-out works at different authors.

Conclusion. Need for orthodontic treatment is quite high due to the high prevalence of dentoalveolar anomalies among the population. The advantages and disadvantages of 2D and 3D cephalometry are analyzed. For the final result in comparison to the accuracy requires further clinical and morphological studies..

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Keywords: teleroentgenogram, cone-beam computed tomography, CBCT, cephalometry, 3D cephalometry, orthodontics, orthodontic treatment.

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СРАВНЕНИЕ ТОЧНОСТИ 2D- И 3D-МЕТОДОВ ИССЛЕДОВАНИЯ ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ ДЛЯ ПРОВЕДЕНИЯ ЦЕФАЛОМЕТРИИ В ПРАКТИКЕ ВРАЧА-ОРТОДОНТА НА ОСНОВЕ АНАЛИЗА МЕДИЦИНСКОЙ ЛИТЕРАТУРЫ

Куликова А.А., Хабадзе З.С., Абдулкеримова С.М., Бакаев Ю.А., Мохамед Эль-Халаф Рамиз, Багдасарова И.В.

Цель исследования. Определение актуальности ортодонтического лечения на основе мета-анализа распространённости зубочелюстных аномалий, и (II) сравнение точности 2D- и 3D-цефалометрии для их выявления.

Материалы и методы. Всесторонний поиск литературы о распространенности зубочелюстных аномалий и о сравнении результатов 2D- и 3D-цефалометрии проводился с использованием двух баз данных. После отбора по выбранным критериям для анализа было взято 46 статей о распространенности и 20 статей, содержащих исследования о сравнении ТРГ и КЛКТ. Распространенность оценивалась по двум группам:

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анализ ситуации в различных регионах Российской Федерации и распространенность в мире.

Результаты. Анализ статистических данных показал высокую распространенность зубочелюстных аномалий, наибольшие показатели были зафиксированы в Колумбии (88%) и Нигерии (88,2%), наименьший показатель был отмечен в Иране (29%). Среди субъектов РФ наибольшее значение выявлено в городе Тюмени (89%), наименьшее - в республике Северная Осетия-Алания (42,25%). Анализ сравнения точности ТРГ и КЛКТ показал расхождение в результатах проведенных работ у разных авторов.

Выводы. Потребность в ортодонтическом лечении достаточно высока за счет большой распространенности зубочелюстных аномалий среди населения. Проанализированы достоинства и недостатки 2D- и 3D-цефалометрия. Для окончательного результата в сравнении по точности требуются дальнейшие клинико-морфологические исследования.

Ключевые слова: телентгенограмма, ТРГ, конусно-лучевая компьютерная томография, КЛКТ, цефалометрия, 3D-цефалометрия, ортодонтия, ортодонтическое лечение, сравнение ТРГ и КЛКТ, распространенность, зубочелюстные аномалии.

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Introduction.

Dentoalveolar anomalies are one of the main dental diseases and are characterized by high prevalence [1]. The study of occurrence of maxillofacial pathology has a great scientific interest. Accordingly, the growth in the number of anomalies is steadily increasing and the need for orthodontic treatment. The tasks of modern orthodontics are timely qualitative diagnosis of various disorders of the maxillofacial area, their treatment and prevention [2].

There are many methods for the diagnosis of dentoalveolar anomalies, including the use of x-rays. Among them, teleroentgenogram has one of the leading places. Since its first Use in Broadbent in 1931 and to the present moment teleroentgenogram is a mandatory study in the planning of treatment orthodontist [3]. Over the years, this type of research has repeatedly confirmed the reliability of the data obtained in the analysis of successful treatment results and is leading in the conduct of differential diagnosis and planning orthodontic treatment of dentoalveolar anomalies [4]. However, like any other branch of medicine, orthodontics does not stand still. Doctors and scientists together every time try to open more and more new horizons in the prevention, treatment and rehabilitation of patients.

Improvement of x-ray diagnostic technologies and, as a result, the appearance of cone – beam computed tomography (CBCT) led to the creation of a new type of dental unit study in orthodontics called 3D-cephalometry. The calculations are carried out on a three-dimensional model of the skull obtained as a result of scanning. In addition, cone-beam computer tomography it is possible to extract the digital equivalent of teleroentgenogram and perform a standard cephalometric calculation. The emergence of new methods with caution always found the doctors, as a required validation of the results obtained. It is for this reason that most orthodontists now prefer to use proven years of teleroentgenogram.

Thus, the objectives of this study were: 1 – to determine the relevance of the orthodontic treatment on the basis of meta-analysis of the prevalence of dentoalveolar anomalies; 2 – to compare the accuracy of 2D and 3D cephalometry based on the results of scientific publications.

Materials and methods.

We decided to conduct a comprehensive literature search. For analysis was taken of scientific publications in two databases: Pubmed and Google Scholar. Requests were made using the following terms: "prevalence of dentoalveolar anomalies", "dentoalveolar anomalies", "comparison of teleroentgenogram and CBCT ", "comparison of 2D and 3D cephalometry".

Table №1. Prevalence of dentoalveolar anomalies among the subjects of the Russian Federation.

Year	Author	City	Age (years)	Sample size (n)	Males (n)	Females (n)	Prevalence (%)
2003	Anokhina A.V. [5]	Kazan	3-16	5509	2489	3020	52.63%
2005	Khetagurova L.K. et al [6]	Republic of North Ossetia-Alania	3-19	1593	-	-	54.40%
2006	Romanov D.O. [7]	Krasnodar	-	474	-	-	85.65%
2007	Smolina E.S. [8]	Moscow	7-19	866	-	-	65.80%
2008	Fanakin V.A. [9]	Chelyabinsk	3-6	1562	-	-	13.20%
2008	Voloshina I.M. et al. [10]	Omsk	12-15	1073	-	-	63.70%
2008	Lavrikov V.G. et al. [11]	Belgorod	3-15	865	-	-	77.90%
2008	Averyanov S.V. [12]	Beloretsk	6-15	1185	-	-	68.10%
2009	Vasiliev V.G. et al. [13]	Chita	6-11	829	400	429	60.57%
2009	Chuikin, S.V. et al. [14]	Sterlitamak	6-16	1170	-	-	57.86%
2011	Gontarev S.N. et al. [15]	Belgorod	3-15	2940	-	-	62.48%
2011	Sirac S.V. et al. [16]	Grozny	3-15	1627	-	-	75.90%
2012	Shamov S.M. [17]	Dagestan	11-17	1258	-	-	56.12%
2013	Popova E.S. et al. [18]	Chita	12-15	1060	-	-	60.30%
2015	Bagnenko N.M. et al. [19]	Kirishsky district, Leningrad region	6-9	734	-	-	88.80%
2015	Averyanov S.V. et al. [20]	Ufa	16-22	1398	-	-	83.12%
2015	Matveyev R.S. et al. [21]	Tyumen	6-16	5743	2945	2798	89,.00%
2016	Averyanov S.V. et al. [22]	Ufa	6-15	625	-	-	69.92%
2016	Soldatova L.N. et al. [23]	St. Petersburg	17-21	2854	2854	0	72.20%
2016	Strukova V.S. et al. [24]	Kursk	21-40	160	71	89	77.00%
2016	Markin A.S. [25]	Samara	16-25	100	-	-	70.00%
2016	Alikova Z.R. et al. [26]	Republic of North Ossetia-Alania	35-44	1258	-	-	42.25%
2017	Tikhonov V.E. et al. [27]	Ryazan	7-10	1066	-	-	49.40%
2017	Tikhonov V.E. et al. [28]	Ryazan	7-16	663	-	-	80.00%

Table №2. Prevalence of dentoalveolar anomalies among the countries of the world.

Year	Author	Country	Age (years)	Sample size (n)	Males (n)	Females (n)	Prevalence (%)
2000	Tristen K.S. et al. [29]	Belarus	2-14	1692	860	832	45.45%
2001	Esa R et al. [30]	Malaysia	12-13	1512	770	742	37.40%
2001	Birgit Thilander et al. [31]	Colombia	5-17	4724	2371	2353	88.00%
2004	Adela Baca-Garcia et al. [32]	Spain	14-20	744	-	-	41.40%
2005	Fabio Ciuffolo et al. [33]	Italy	11-14	810	434	376	63.00%
2006	Katalin Gabris et al. [34]	Hungary	16-18	483	194	289	70.40%
2009	Saurabh K et al. [35]	India	-	1123	572	551	34.28%
2009	Matilda Mtaya et al. [36]	Tanzania	12-14	1601	632	969	63.80%
2012	Tokarevich I.V. [37]	Belarus	5-12	1039	-	-	81.14%
2012	Bourzgui F et al. [38]	Morocco	8-12	1000	-	-	84.20%
2013	Mitesh D Kathariya et al. [39]	India	-	600	293	275	39.20%
2013	Kaur H. et al. [40]	India	13-17	2400	1192	1208	87.79%
2014	Panahov, N.A. [41]	Republic of Azerbaijan	12-17	6785	-	-	63.09%
2014	Abbas Shokri et al. [42]	Iran	7-35	1649	624	1025	29.00%
2014	Aikins EA et al. [43]	Nigeria	13-20	620	297	323	88.20%
2015	Zharmagambetova A.G. et al. [44]	Kazakhstan	6-17	1600	785	815	83.00%
2015	Lillemor Dimberg et al. [45]	Sweden	3-11,5	277	128	149	71.00%
2015	Rekha P. Shenoy et al. [46]	India	11-18	1340	773	567	38,50%
2016	Terekhova T.V. [47]	Belarus	7-15	431	-	-	75.79%
2016	Moskaleva I.V. et al. [48]	Belarus	6-16	381	-	-	77.69%
2016	Usmanjanov R.Y. et al. [49]	Republic of Kyrgyzstan	15-18	734	362	372	44.45%
2016	Khandogiy, D.V. et al. [50]	Belarus	7-15	600	-	-	78.50%

Table №3. Research Results compared to 2D and 3D cephalometry.

Year	Author	Sample size (n)	Males (n)	Females (n)	Results
Patients					
2010	Nalçaci R et al. [51]	10	5	5	Comparison of traditional teleroentgenogram and 2D sagittal reconstruction from CBCT by angular measurements confirmed the reliability of the 3D method for use in planning orthodontic treatment. 3D technologies have the potential to be used in treatment planning in patients with complex orthodontic indications.
2011	Kamal Bajaj et al. [52]	9	5	4	CBCT is a more reliable method than teleroentgenogram, but because of the high cost of using orthodontists is limited.
2011	U Oz et al. [53]	11	5	6	When comparing the 2D image and reconstructing the image in the sagittal plane, no clinically important differences were revealed from the CBCT, both images have difficulties in finding certain points, the use of a three-dimensional reconstruction of the skull from CBCT solves this problem, but at the moment there are no fully clinically confirmed data on the truthfulness of the obtained with 3D reconstruction of measurements and the possibility of using them for planning treatment. Conducting CBCT only for the purpose of obtaining a picture in the sagittal plane is not justified. the patient will receive a greater radiation load, in comparison with the traditional teleroentgenogram.
2012	Ghoneima A et al. [54]	30	-	-	There were no significant statistical differences in the measurements made with the help of manual analysis and computer cephalometric calculation of CBCT. These differences are small, but due to the individual characteristics of patients, they can have significant clinical significance.
2014	Oh S et al. [55]	20	12	8	There were no statistically significant differences in the measurement of angular and linear values, as well as differences in the location of the major planes when comparing the teleroentgenogram and the 2D extracted image from CBCT, but the 3D method has significant advantages: compared with CBCT, teleroentgenogram has a low accuracy of the results of the analysis in patients with asymmetry. 3D visualization minimizes the overlap of the right side to the left and vice versa. Thus, an orthodontist using 3D technology can diagnose all patients including those with asymmetry.
2015	Pil-Kio Jung et al. [56]	50	12	38	The results of the study showed that there was no clinically significant difference between 3D and 2D cephalometry.
2016	Arvind Hariharan et al. [57]	30	-	-	As a result of the comparison of the 2D snapshot obtained with the standard teleroentgenogram, the 2D snapshot extracted from the CBCT and the 3D 3D skull reconstruction, it was found that the 2D images do not differ greatly, which confirms the possibility of using the images taken from the CBCT for orthodontic treatment planning. The possibility of using 3D skull reconstruction for the same purposes requires further study, but there were no strong differences with 2D images.
2016	Zecca P.A. et al. [58]	321	155	157	The analysis of orientations on soft tissues when comparing teleroentgenogram and CBCT showed that the latter has high reliability and reproducibility, but still requires further research.
2017	Na Li et al. [59]	40	18	22	According to the results of the study 3D cephalometry gives more accurate results in comparison with 2D, but the reliability of the obtained data from 3D reconstruction requires further confirmation by clinical data.
2017	Wen J et al. [60]	60	-	-	As a result of the study, it was found that in the calculations carried out for the standard TWG and the 2D image taken by their CBCT, there are no significant discrepancies in the values obtained. 3D reconstruction from CBCT had significant discrepancies with 2D images, which casts doubt on the use of this method by orthodontists.

Skulls					
2008	Danielle R. et al. [61]	23	-	-	Most of the cephalometric measurements obtained on volumetric skull models reconstructed from CBCT can be considered sufficiently accurate for craniofacial analysis.
2010	Olivier J. C. et al. [62]	40	-	-	There were statistically significant and clinically significant differences in some measurements between the 3D reconstruction of the same skull constructed from two different CBCT devices. Care should be taken when interpreting the measurements performed on 3D models obtained from different CBCT devices.
2011	Oded Yitschaky et a.l [63]	10	-	-	The accuracy of most orthodontic cephalometric measurements on the 3D skull model was proven.
2014	Pittayapat P et al. [64]	21	-	-	When comparing analog teleroentgenogram, digital teleroentgenogram and CBCT, the highest accuracy was observed with the use of 3D technologies. Due to the absence of soft tissues, the results should be interpreted with caution. they do not fully reflect the clinical conditions.
2014	Abbas Shokri et al. [65]	6	-	-	Calculations obtained using CBCT compared with the calculated values of teleroentgenogram are much closer to the actual distance between anthropometric landmarks.

The selection of articles was carried out according to the certain criteria that meets the objectives of the study. Books and articles containing supporting information on the teleroentgenogram and the CBCT were also included in the list of references for additional data.

All publications that do not meet the selection criteria, are not fully accessible, and contain insufficient information have been deleted. The results obtained in the analysis of the literature were presented in tables.

Results.

In the selection of publications for the evaluation of the prevalence on the request "prevalence of dentofacial anomalies (CFA)" about 7 320 results were obtained. The Selection criteria were defined: indication of the country in which the study was conducted, the number of samples of at least 100 people, indication of the total percentage of occurrence of all dentoalveolar anomalies detected in patients. Publications containing data on dentoalveolar anomalies in patients undergoing or having undergone orthodontic treatment, concomitant somatic diseases published earlier than 2000, as well as articles that do not have full access and do not contain the necessary statistics, were excluded from the study. The age of patients was not taken into account, as orthodontic treatment is carried out for both children and adult patients. As a result, 46 articles that fully meet the selection criteria were selected for analysis. The obtained data were divided into 2 groups: the prevalence of dentofacial anomalies in various regions of the Russian Federation and prevalence of anomalies in other countries of the world.

The same search bases were used to analyze publications on the comparison of 2D and 3D cephalometry. Received the order of 1025 results. Was chosen as selection criteria: availability of data on the comparison of 2D and 3D cephalometry or teleroentgenogram and CBCT, the group of patients not less than 5 people. Articles containing data only on the application of teleroentgenogram or CBCT, not including a review of the comparison of 2D and 3D methods, as well as not having full access were excluded. Thus, 20 articles were selected for analysis, which fully met the specified criteria. It is important to note, that in the sample were included articles, containing description of research not only on patients, but and on human turtles, so as recent have an important diagnostic information.

Data interpretation.

In assessing the prevalence of dentoalveolar anomalies in the Russian Federation were identified quite high rates. (table. 1) the largest percentage of pathologies was determined in the city of Tyumen and amounted to 89%, the lowest rate was observed in the Republic of North Ossetia-Alania - 42.25%. The average rate in Russia was 66.37%.

The analysis of the prevalence of dentoalveolar anomalies among the countries of the world also showed a high percentage of occurrence. (table.2) the Highest value was obtained in Nigeria – 88.2%, the lowest recorded in Iran – 29%. When comparing the world indicators, the average value was 62.21%.

The total number of patients who participated in the studies compared to 2D and 3D cephalometry was 602. In the course of studying the selected material, both the coincidence of the re-

sults among a number of authors and a significant divergence of opinions were revealed. Below is a summary table of studies (Table 3). In each work, the authors conducted two types of research: lateral teleroentgenogram and cone-beam computed tomography, calculations were made on the obtained images and based on comparison of the obtained results, the conclusion was made about the accuracy of each of the methods.

One of the significant problems of the standard teleroentgenogram is the difficulty of posing certain points, especially in the area of the base of the skull. The three-dimensional model used for 3D cephalometry can solve this problem. However, immediately the question arises about the reliability obtained in the calculation of data. It is not possible to compare the scans obtained and the anatomical bone reference points in a living patient, so Pittayapat P., Bornstein M.M. and co-authors performed a study using dry human skulls. On 21 skull, teleradiography and CBCT were performed [64]. Then, the results obtained after calculations on the standard teleroentgenogram, digital teleroentgenogram and 3D model were compared. The highest accuracy was observed when using 3D technologies.

Similar scientific studies were conducted on 6 (Shokri A., Khajeh S., Khavid A.), 23 (Danielle R. Periago, William C. Scarfe), 10 (Oded Yitschaky, Meir Redlich, Yossi Abed) human turtles, where the authors also confirmed the higher accuracy of the analysis using the 3D method [62, 63, 65].

In studies it was noted that an important aspect of the application of three-dimensional cephalometry is the choice of a tomograph for scanning [62]. So Olivier, J.C. van Vlijmen conducted a study of the results of CBCT of 40 human skulls and found a significant difference in the values obtained between tomograms that were performed on different devices. Proceeding from the fact that different results were obtained when scanning the same skulls, the reliability of such information obtained with the use of three-dimensional cephalometry is questioned. It should be noted that the study was conducted by the same specialists, which eliminates the factor of non-calibrated staff.

In a number of studies, despite the findings, the authors caution that due to the lack of visualization of soft tissues on the CBCT of skulls, the results should be interpreted with caution. they do not fully reflect the clinical conditions [64]. In turn, when evaluating the accuracy of orientations on soft tissues, when comparing teleroentgenogram and CBCT, it was found that the latter possesses high reliability and reproducibility [59]. Thus, proceeding from the foregoing, it can be concluded that 3D cephalometry could replace the standard teleroentgenogram in the practice of an orthodontist.

During the analysis of publications, it was also noted that most authors consider a significant disadvantage of teleroentgenogram to be the imposition of the right side of the head on the left side when taking a picture [53, 55]. This leads to the formation of double contours, making it difficult to establish points with cephalometry and, accordingly, worsening the quality of treatment.

The accuracy of calculations in orthodontics is an indisputable requirement in the planning of treatment. Especially the problem of overlapping is manifested in patients with asymmetry of the face. The use of three-dimensional cephalometry avoids imposing and, accordingly, simplifies the setting of anthropometric points. A number of studies conducted on patients from this group, when comparing the results obtained by standard calculation of teleroentgenogram and 3D cephalometry, showed no significant differences, which guarantees the accuracy of calculations [55]. Thus, the introduction of this method could significantly facilitate the conduct of cephalometry, and that it is less important to improve the quality of planning and orthodontic treatment and its result in patients with maxillofacial anomalies.

Another way to solve the problem of imposing anatomical formations of one side on another on a standard teleroentgenogram can be the extraction of a two-dimensional image from CBCT [58, 60]. It becomes possible to obtain an image of the right and left halves of the patient's head separately, which eliminates the appearance of double contours. Investigating the publication material, it was established that the results were similar in comparison to the standard teleroentgenogram and synthesized from CT. This gives the right to assert about the reliability of the data obtained and the possibility of their use in planning orthodontic treatment.

Conclusion.

Every year the number of requests for medical assistance to a doctor - orthodontist - is steadily growing. As you know, the treatment of dental disorders is impossible without prior planning, which in turn is based on the results of diagnosis. The need to conduct the best quality treatment makes one think about the fact that most often patients of an orthodontist become children.

As a consequence, the issue of radiation loading is important. Unfortunately, of all the publications studied, it was covered only in two works [52, 53]. The importance of this aspect is certainly very great, because most of the patients of the orthodontist are children. According to the norm, the patient should not receive radiation exposure exceeding 1000 microsievert (μSv) per year for the purpose of prophylaxis and prophylaxis [68]. When carrying out the standard teleroentgenogram, the load is 15-40 μSv, and with CBCT up to 120 μSv [66, 67]. It would seem that aban-

don the appointment of CBCT patients due to a significant difference in the dose received. However, it is necessary to take into account the fact that when planning treatment, the physician will additionally need an orthopantomogram - up to 35 μSv, perhaps several sighting images - each at 5 μSv, as well as a frontal (in direct projection) teleroentgenogram - 76 μSv [66]. All these images, the total value of the radiation load is on the average 156 μSv, which exceeds the load with CBCT. It is important to note that cone-beam computed tomography with a scanning zone of 15 * 15 cm and more allows one to obtain any of these images, and in the best quality, and also provides the opportunity to use several calculation methods for cephalometry simultaneously. Another advantage is that the obtained tomogram can be used by doctors of other specialties without conducting a re-examination, and hence without additional radiation dose. Thus, in a detailed analysis of all the advantages and disadvantages, it can be concluded that 3D technologies have a clear advantage over standard versions of radiation diagnostics.

According to the study, the prevalence of pathologies requiring orthodontic treatment in children in different regions of the Russian Federation is quite high: Moscow – 65,80%, St. Petersburg – 72,20%, Tyumen – 89,00%, Kazan – 63%, Omsk – 63,7%, Krasnodar – 85,65% , Ufa - 83.12% [5, 7, 8, 10, 20, 22, 24]. In other countries of the world, high rates of anomalies in the maxillofacial area were also found in the population: Hungary - 70.4%, Sweden - 66%, Tanzania - 63.8%, India 87.79%, Nigeria 88.2 %, Morocco - 84.2% [35, 37, 39, 41, 44, 45]. The need to reduce the increase in the prevalence of dentoalveolar anomalies by preventing and, most importantly, rehabilitating patients already having certain pathologies, is the most urgent issue in modern orthodontics.

As a result of the study, it was not possible to establish the most accurate diagnostic method. The use of 3D-research expands the possibilities of the orthodontist in conducting diagnostics, and also has many advantages. First, the possibility of extracting a 2D snapshot in the sagittal plane from the CBCT of the right and left sides of the skull separately; a significant disadvantage of the traditional teleroentgenogram is the overlapping of one side of the skull on the other, which results in fuzzy outlines of the image, which leads to a decrease in the accuracy of the analysis. Secondly, when using 3D reconstruction from the CBCT, the problem with the complexity of setting points, which is available for manual calculation, is solved. Thirdly, the doctor, using CBCT, reduces the number of ongoing studies. From the scan results, various kinds of images can be synthesized (teleroentgenogram in different projections, orthopantomogram, sighting areas).

But despite all the advantages of 3D-technologies, they have a number of shortcomings. The possibility of using 3D reconstructions as an analogue of traditional teleroentgenogram remains questionable due to discrepancies in the studies and insufficient data confirming the reliability of the values obtained in the analysis. The second significant disadvantage is the cost of this study, which is often the decisive factor for the patient.

Thus, this study reflects the high prevalence of dentoalveolar anomalies, and hence the need for orthodontic treatment which can not do without diagnostic methods. The question of the advisability of replacing traditional teleroentgenogram with CBCT for all patients of an orthodontist remains open, and the reliability of 3D cephalometry data requires further study.

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