http://dx.doi.org/10.35630/2199-885X/2020/10/4.35

DEVIATIONS IN THE POSITION OF THE THIRD MOLARS

Received 16 October 2020;
Received in revised form 19 November 2020; Accepted 22 November 2020

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ABSTRACT — Timely teething is one of the most important indicators of the harmonious development of the dentoalveolar system, which is determined by the correct (physiological) position of the teeth in the dentition, ensuring the optimal shape and function of the temporomandibular joint, the work of the chewing muscles, the height of the lower part of the face, and aesthetics of a smile. Retention of individual teeth is often the reason for the formation of anomalies in the dentition, their closure, functional and aesthetic disorders. An urgent problem in modern dentistry is the problem associated with the development of third molars. According to the results of the analysis of 3000 orthopantomograms of the jaws of patients 7–25 years old with dentoalveolar anomalies, the spatial arrangement of the primordial of the third molars relative to the buttresses of the upper and lower jaws was studied. It was found that the buttresses on the upper jaw are vertical and do not interfere with the correct eruption of the third molars. The buttresses located near the primordial of the third molars on the lower jaw contribute to the retention of the third molars due to the change in inclination during the formation stage.

KEYWORDS — third molar, eruption pathology, dystopia, retention, wisdom tooth, lower jaw, retromolar space.

INTRODUCTION

Currently, the prevalence of retention of lower third molars ranges from 35 to 50% [4, 20, 23].

Anomalies in the development and eruption of these teeth lead to the formation of bone pockets, destruction of hard tissues of the adjacent tooth, the formation of follicular cysts, the development of neuralgic pain, osteomyelitis, phlegmon, sepsis [1, 7, 12, 15, 18, 22, 25, 32, 38, 40].

Complications of obstructed eruption of the lower wisdom tooth proceed according to the type of inflammatory reactions and depend on the anatomical and physiological characteristics of the retromolar region [3, 16, 28, 33, 39, 41]. The increase in the prevalence of retention of third molars is due to the general reduction of the dentition in the process of phylogenesis [6, 31, 35].

For many years, question of the influence of third molars on the occurrence of maxillofacial anomalies has been intensively studied by both Russian and foreign specialists [5, 8–10, 14, 21, 26, 29, 30, 36].

According to the literature, the formation of the upper and lower jaws, various groups of teeth is in direct proportion to the growth and development of wisdom teeth. This indicates that the eruption of third molars has a direct effect on the structure of the entire dentoalveolar system [2, 11, 17, 19, 24, 27, 34, 37].

There is no consensus about the influence of abnormally located third molars on the occurrence of maxillofacial anomalies or their recurrence after the orthodontic treatment. According to S.P. Atkinson (1950), the excessive pressure exerted by third molars on the anterior teeth leads to excessive eruption of the second molars. In some cases, it can cause an *open bite* and traumatic occlusion of the second molars. S. Mueg (1992) assigns a decisive role to the influence of growth of these teeth on the development of crowding of teeth in the anterior segment, while Schwarz (1975) and Ades (1990), on the contrary, and do not consider this factor to be significant.

Problems with third molars attract the attention of dentists in many countries around the world. In 1998, a national congress in Great Britain summarized the experience of working on this issue in the largest clinics in the country for 10 years. Particular attention was paid to partially or completely impacted third molars. The issue of their removal is recognized as not a preventive measure, but considered as a method of treatment. In 1999, at the National Institutes of Health conference in the USA, the role of third molars in the growth and development of the dentition, indications for extraction and the most appropriate age for removing the germs of these teeth was discussed. It is recognized that in order to prevent the development of crowding of teeth, the removal of the germs of the third molars should be considered very appropriate, and the most suitable age for this is over 10 years, i.e.

until the period of complete formation of the roots of these teeth.

N.P. Stadnitskaya (2009) found that the beginning of the formation of the germs of third molars should be considered the age from 6 to 16 years. In 22.4% of cases, the germs of third molars in the same patient may begin to form at different times. Differences in the stage of formation are noted in the first half of the formation of the coronal part of the rudiment. By the end of the formation of roots, the differences are leveled. Also, author noted that anomalies of the germs of third molars (position, shape and size, macroscopic structure) occur in 18.7% of cases, and just as anomalies of eruption are complicated by inflammatory diseases (0.3%), destruction of the surrounding bone tissue and hard tissues of the second molars (0.9%), partial or complete impaction of the second molars (1.2%), the development of crowding of the teeth in the frontal parts of the jaws (17%) or its recurrence at the end of orthodontic treatment (12%). At the same time N.P. Stadnitskaya (2009), on the basis of an X-ray examination, identified four main types of position of the impacted third molars: medial (47%), horizontal (29%), vertical (21%), distal (3%), which cause complications characteristic of each type of position

Salakh S.M. Temeza, A.P. Romanovskaya (2010) in the course of a study found that a lack of space for the eruption of third molars over 3 mm and angulation of more than 69 degrees are an indication for their removal. The optimal period for the removal of third molars is 13–15 years old. After removal of the third molars, a significant decrease in the terms of orthodontic treatment and stable results in the retention period are observed.

S.S. Almurat, B.B. Aimukhanbetov (2015) conducted a study and found that the frequency of tooth impaction in childhood was 27%, the most common impaction of third molars was 44%, of which in a horizontal position - 48%. In the majority of clinical observations, bilateral impaction of the third mandibular molar was observed — 18.7%.

I.N. Skapkareva, O.A. Zhigalsky (2014) did not reveal the influence of gender on the eruption of the third molar. Shift in the timing of the eruption of the third molars to later ones was noted. In a modern person, a gradual rudimentation of the third molar occurs, in 76.7% of people, the eighth teeth do not erupt.

I.A. Ganiev (1993), S.B. Fishchev et al. (2008), G.A. Bonetti (2008) discussed the effect of third permanent molars on crowding and recurrence after orthodontic treatment. E.A. Bragin (2006) noted that one of the informative methods for diagnosing anomalies is orthopantomography of the jaws and A.P. Kibkalo (2008) proposed methods for analyzing orthopantomograms based on standard morphometric symmetrically located points.

S.B. Fishchev et al. (2012) proposed a technique for examination of orthopantomograms, which makes it possible to determine the position of the third permanent molars: on the image, according to the criterion of information content, lines are drawn along the coordinate points. The main horizontal plane was a line connecting the lower edges of the slopes of the articular tubercles (T). From the middle of the T-T line, a perpendicular was lowered and a median vertical line was drawn, which was designated as the line of the aesthetic center, which passed between the medial incisors of the upper and lower jaw and through the *Me* point on the chin. Tangent lines were drawn on both sides along the lower edge of the lower jaw body and along the outer edge of the lower jaw branch. The point of intersection of the bisector of the angle formed by the tangent lines to the angle and body of the mandible with the inner angle of the mandible is designated as the retromolar point (RM), and the bisector itself was regarded as the *stress axis*. The position of the third molar beyond the retromolar point or *stress axis* was regarded as critical for the normal eruption of wisdom teeth.

N.V. Pankratova et al. (2014) studying the frequency of spreading and position of third molars at the stages of their formation in 866 OPTG of patients 7–18 years old. The presence or absence of germs of 3 molars was recorded in 4 age groups: 7–9 years, 10–12 years, 13–15 years and 16–18 years. On the panoramic image, the position of the 3 molars was assessed by the size of the internal angles formed by the perpendicular from the line connecting the apexes of the distal and mesial cusps of the 3 molars: for the upper — to the infraorbital line, for the lower ones — to the plane of the base of the lower jaw. The largest number of panoramic images with 3 molars was found in patients aged 10—15 years. The magnitude of the angles characterizing the position of the 3 upper molars decreases with age, and the lower ones increase.

During comparative characteristics of the position of the third molars in various occlusion anomalies in patients from 7 to 25 years old with a narrowing of the dentition N.V. Pankratova et al., (2016) found that the angles of inclination of the third molars change their magnitude: on the upper jaw, the indicators decrease, on the lower jaw, they increase with varying degrees of reliability. Third molars tend to take a vertical position even with anomalies of size of the dentition, and the stages of formation of third molars increase with age with a high coefficient of reliability between the corresponding indicators in age groups.

The magnitude of the angles characterizing the position of the third molars in patients 15–18 and 18–25 years old significantly differs from their values in the initial state, in patients aged 7–12 years. At the age of 15 to 25, teeth are actively formed and, as a result, the third molars change their position. Active changes in the position of the teeth occur before the age of 18, and from 18 to 25 years, the position of the third molars changes, but the magnitude of the angles confirming these changes is unreliable.

However, in all of the literature sources we studied, issues of impaction of third molars and methods of studying their position are discussed. Recommendations are given on the methods and timing of removal of third molars. At the same time, there is no indication of the reason for the incorrect position of the third molars during their formation and eruption.

The purpose of this study is to try to find the reason for the change in the position of third molars during their formation and eruption.

MATERIALS AND METHODS

During the study of this problem, we analyzed more than 3000 orthopantomograms of the jaws of patients from 7 to 25 years old with various anomalies of the maxillofacial system (crowded position of the teeth, malocclusions class II and III, transversal occlusion). The position of the molars was assessed by the size of the internal angles (1, 2, 3 and 4) formed by the line connecting the tops of the cusps of the third molars and perpendicular to the infraorbital line for the teeth of the upper jaw and to the plane of the base of the lower jaw for the teeth of the lower jaw (Fig. 1).

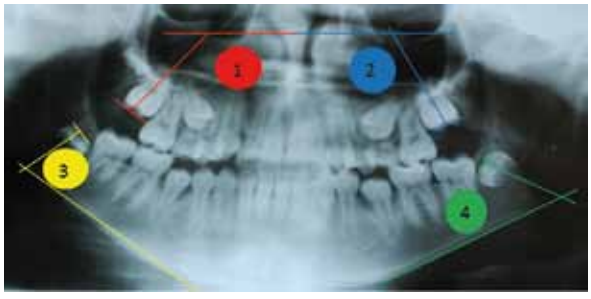

Fig. 1. *Determination of the angles characterizing the position of the third molars of the upper (1 and 2) and lower (3 and 4) jaws*

Were selected 105 orthopantomograms of the jaws of patients for a long time under dispensary observation up to 12 years, who had from 2 to 8 X-ray images. Studying the dynamics of the formation of third molars in the same patient, we drew attention to the severity of the buttresses of the upper and lower jaws.

There are 4 buttresses on the upper jaw: frontal-nasal; alveolar-zygomatic; pterygoid palatine; palatine. ***The frontal-nasal buttress*** rests at the bottom on the alveolar eminences in the canine region, at the top it continues in the form of a reinforced plate of the frontal process of the upper jaw, reaching the nasal part of the frontal bone. Balances the upward pressure exerted by the canines. ***The alveolar-zygomatic buttress*** goes from the alveolar eminence of the 1st and 2nd molars, goes up the zygomatic ridge to the zygomatic bone, which redistributes the pressure. ***The pterygo-palatine buttress*** starts from the alveolar eminence of the molars and the tubercle of the upper jaw, goes up, where it is reinforced by the pterygoid process of the sphenoid bone and the perpendicular plate of the palatine bone. Balances the force exerted by molars from bottom to top and back to front. ***The palatine buttress*** is formed by the palatine processes of the upper jaw and the horizontal plates of the palatine bone, connecting the right and left alveolar arches in the transverse direction. There are 2 main buttresses on the lower jaw: 1 — ***alveolar***; 2 — ***ascending*** (along the branch of the lower jaw) (Fig. 2).

Thus, the buttresses of the upper jaw, in particular the alveolar-zygomatic buttress, goes from the alveolar eminence of the 1st and 2nd molars, goes up the zygomatic ridge to the zygomatic bone, which redistributes the pressure and the pterygo-palatine buttress starts from the alveolar and tubercle of the molar of the upper jaw, goes up, where it is reinforced by the pterygoid process of the sphenoid bone and the perpendicular plate of the palatine bone. As indicated by T.S. Guseinov, M.A. Azizov (2016) the biomechanism of the temporomandibular joint and the thin histotopographic structure of the lower jaw make it possible to identify 7 thickenings of the lower jaw or directions of the bone beams (buttresses). The following thickenings are distinguished:1 — from the recess behind the last molar to the corner of the lower jaw; 2 — from the corner of the lower jaw along the posterior edge of the branch of the jaw to the temporal process; 3 — from the place of attachment of the masticatory muscles to the processes: temporal and alveolar and articular; 4 — between the chin tubercles; 5 — from the base of the lower jaw to the temporal and articular processes; 6 — along the posterior edge of the lower jaw branch; 7 — between the temporal and articular processes [13].

The formation and development of buttresses begins at 4–5 years and reaches its development in adulthood (20–65 years) and their thinning begins at 65–70 years in connection with age-related and senile atrophy of the jaw bone plates.

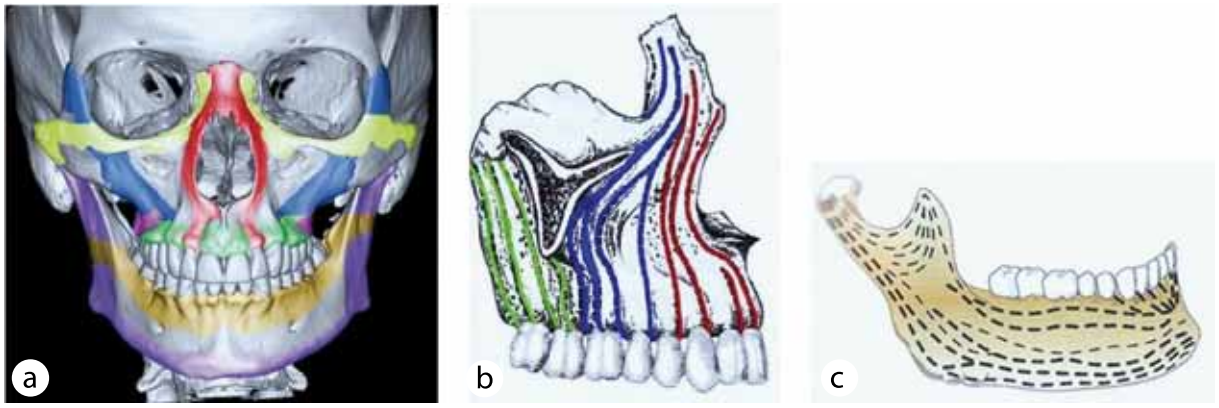

Fig. 2. *a — buttresses of the skull, b — buttresses of the upper jaw, c — buttresses of the lower jaw*

RESULTS AND DISCUSSION

As already mentioned, we divided the orthopantomograms of the jaws into groups according to the location of the roots of the third molars of the lower jaw: with a distance from the buttresses (Fig. 3) and without a distance (Fig. 4). It is noted that the third molars, located with a distance from the buttresses, increase the angle characterizing the position of the teeth with age (Table 1).

As follows from Table 1, the presented values of the angles characterizing the position of the third lower molars, depending on the location of their roots relative to the buttresses, indicate a decrease in the angle of inclination of the molars in the case of a close passage of the buttresses and an increase in the presence of a distance between them.

In confirmation of the above noted feature, the graphs in Fig. 5 and 6 are presented.

In the course of visual examination of the orthopantomograms of the jaws, a difference in the position of the third molars of the lower jaw was noted (Fig. 7).

The results of X-ray studies formed the basis for an in-depth study of the morphology of the skull buttresses, which was described earlier. The data obtained logically explains the minimum number of problems with the position and eruption of the third molars of the upper jaw. The buttresses of the upper jaw are positioned vertically, creating favorable conditions for the formation of the correct direction and position of the third molars during eruption. This cannot be asserted when evaluating information about the lower molars, including a significant amount of their retention. The close location of the roots of the third molars of the lower jaw to the buttresses worsens their position with age (changes in the angles of inclination), prevents their eruption, contributing to retention.

CONCLUSION

1. The results of clinical and radiation studies based on the anatomical and topographic features of the upper and lower jaw, allow us predicting the possibility of complications during the eruption of third molars.

2. During the study, the location of the buttresses of the skull including the upper and lower jaw was studied.

3. It has been established that the location of the primordial of third molars related to the buttresses is important for their position and eruption.

4. The buttresses on the upper jaw are vertical and do not interfere with proper eruption.

5. Buttresses on the lower jaw can pass near the primordial of third molars, depending on the distance between them, their retention is possible due to a change in their inclination during formation.

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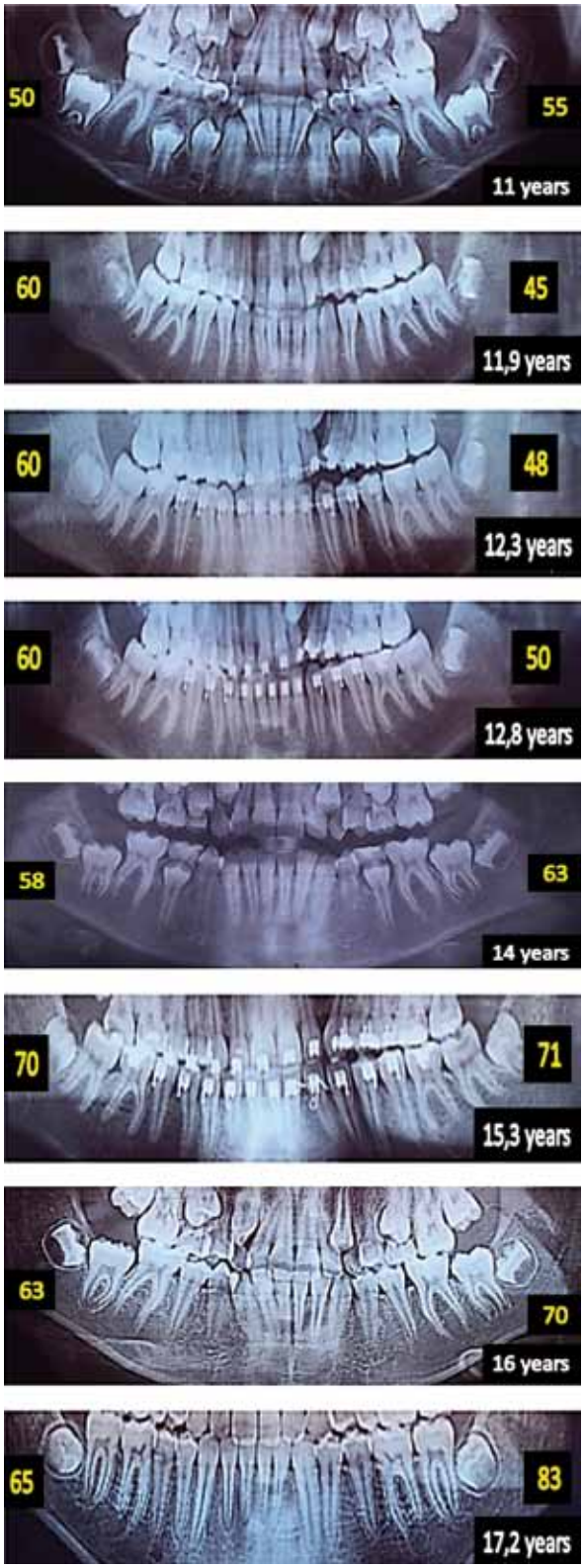

Fig. 3. A selection of orthopantomograms of the jaws, with the location of the roots of the third molars with a distance from the buttresses (the angles of the 3 molars are shown in yellow, the age of the patient is indicated in white)

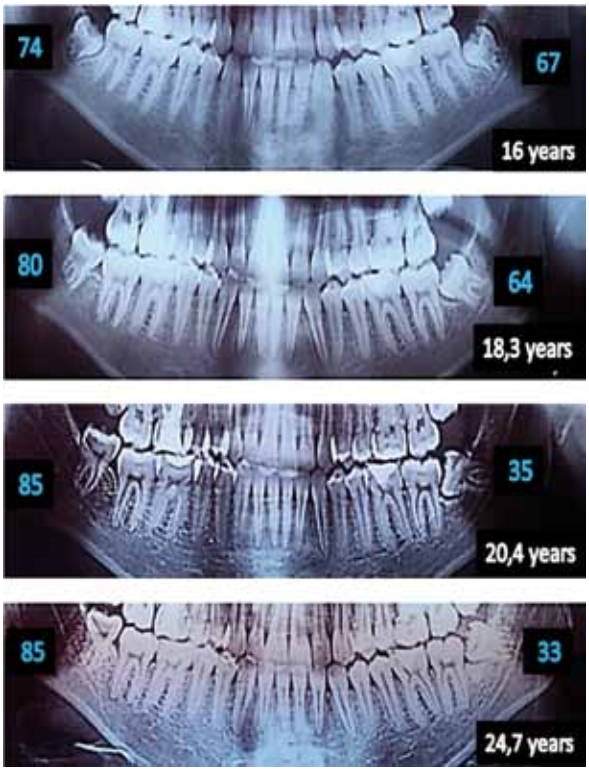

Fig. 4. A selection of orthopantomograms of the jaws, with the location of the roots of the third molars without distance from the buttresses (the angles of the 3 molars are indicated in blue, the age of the patient is indicated in white)

Table 1. *Average values of the angles of inclination of the third molars of the lower jaw, with different positions of the roots of the teeth from the buttresses, (°)*

Age of the patient, (years)	The angle of inclination of the lower third molars, (°)	
	With distance	Without distance
12	52,5	60,5
13	54,5	75,5
14	57,5	65,5
15	60,5	68,1
16	67,5	70,7
17	67,7	63,3
18	73,0	56,0
19	74,0	44,6
20	75,1	44,3
21	83,1	41,7
22	83,7	39,0
23	84,0	40,1
24	83,1	39,5
25	84,0	39,8

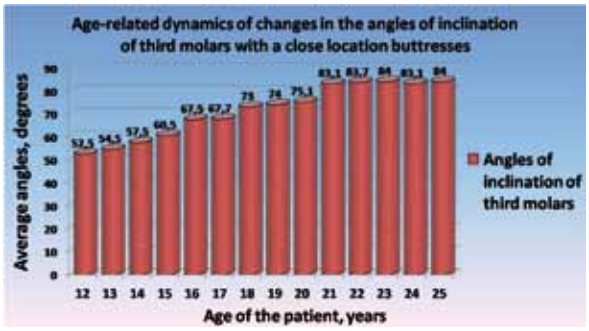

Fig. 5. Graphical representation of age-related dynamics of changes in the angles of inclination of the third molars of the lower jaw with a close location to the buttresses

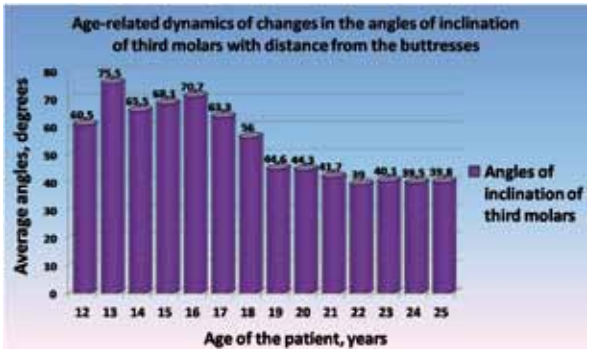

Fig. 6. Graphic representation of age-related dynamics of changes in the angles of inclination of the third molars of the lower jaw with a distance from the buttresses

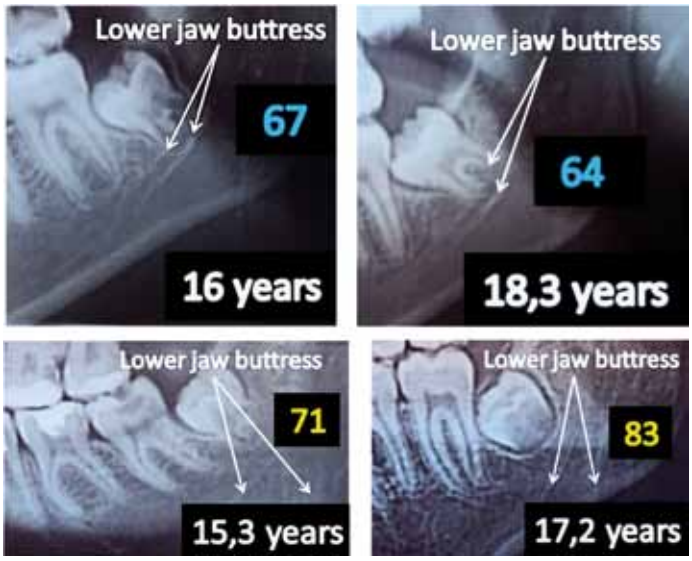

Fig. 7. A selection of orthopantomograms of the jaws with the location of the roots of the third molars and the values of their angles without distance (a, b) and with distance (c, d) from the buttresses (white color — patient's age)

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