THE INFLUENCE OF impacted WISDOM TEETH ON THE STRENGTH OF THE BONE TISSUE IN THE ANGLE OF THE LOWER JAW

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Summary.
Objective:study the effect of impaction of the lower third molars on the strength of the bone tissue of the lower jaw in the area of its angle. **Materials and methods.** On 150 preparations and 120 sagittal cuts of the lower jaws, the features of its strength in the corner area were studied. All jaws were divided into four groups: Group I - with fully erupted lower third molars, Group II - with no primordia of lower wisdom teeth, Group III - with unilateral impaction of lower third molars, and IV - with bilateral impaction of lower third molars. The results of X-ray examination of 190 patients of the first period of adulthood with fractures of the mandible were also studied. **Results of the study.** It was established that the growth of the lower jaw in the area of its angle in the presence of the primordia of wisdom teeth proceeds in the same way, regardless of the peculiarities of its eruption. In the absence of primordia, this growth slows down significantly. In the presence of impacted wisdom teeth in the area adjacent to these teeth, in 42% of cases there is III and 32% of cases IV class of bone tissue architectonics according to U. Lekholm and G. Zarb (1985), characterized by a low density of trabeculae of the spongy substance and a large diameter its cells. It is proved that fractures in the area of the mandibular angle most often occur with the second degree of impaction (in 65.3% of cases) and mesial inclination of the impacted third molar, most rarely - in the case of partially erupted wisdom teeth (in 12.6%). **Conclusions.** The presence of impacted wisdom teeth significantly increases the risk of fractures in the area of the lower jaw angle due to a decrease in the strength of its bone tissue, and the greater the degree of impaction and the greater the angle of inclination of the impacted wisdom tooth, the higher the likelihood of fractures of this localization.
Keywords: fractures of the lower jaw, impaction, lower third molars, bone tissue architectonics, angular triangle, and lower jaw angle.

Introduction

Impaction of the lower third molars occurs most frequently among the anomalies in the eruption of permanent teeth (Shah & Parekh, 2014; Skapkareva & Zhigalskii, 2014). In the general structure of wisdom teeth diseases in adolescents and the first period of adulthood, the prevalence of impaction ranges from 17 to 22.1% of observations (Ponomarev, 2017).

A sufficient number of works by national and foreign authors are devoted to the study of the etiology, pathogenesis and treatment of difficult eruption of third molars (Druzhinin, 2015; Juodzbalys & Daugela, 2013; Malkawi, Al-Omiri, & Khraisat, 2011). For many years, the influence of third molars on the growth of the jaws and features of its morphometric characteristics has remained debatable.

The annual increase in the prevalence of lower jaw fractures, as well as the severity of the nature of injuries, the increase in the number of multiple and associated injuries make the problem of improving the treatment of patients of the

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corresponding profile quite urgent (Idashkina, 2019; Urgunaliev & Boronchaev, 2016). In this case, the localization of damage is fundamental for the choice of approaches to the treatment of fractures of the bones of the facial skull (Efimov, Stomatov, Efimova, Dolgova, & Stomatova, 2018; Trubina, Trubin, & Merkulova, 2016; Tulkumbayev, 2018; Zhang, Petruk, & Medvedev, 2017).
The objective of this study was to study the effect of impaction of the lower third molars on the occurrence of fractures in the area of its angle.

Materials and Methods

The study of the structural features of the lower jaw was performed on 150 preparations of the lower jaws and 120 of their sagittal cuts. All jaws were divided into four groups: Group I - with fully erupted lower third molars, Group II - with no primordia of lower wisdom teeth, Group III - with unilateral impaction of lower third molars, and IV - with bilateral impaction of lower third molars.
To study structural features of the lower jaw in the area of its angle and, accordingly "growth zones of the lower jaw" we have introduced a new concept of "angular triangle", the sides thereof are: AB - retromolar distance (McCoy, 2012); BC - distance from the opening of the lower jaw to its angle; AC is the distance from the angle of the lower jaw to the distal edge of the second lower molar (Fig. 1).

Figure 1. Angled triangle ABC of the lower jaw.

To assess the quality of the bone tissue of the body of the lower jaw, the classification of bone quality according to Friberg, Sennerby, Roos, and Lekholm (1995) was used, according to which there are four types of its structure: class I - the bone tissue of the jaw is represented by a homogeneous compact layer; class II - a thick compact layer surrounds a highly developed spongy layer; class III - a thin compact layer surrounds a highly developed spongy layer; class IV - a thin compact layer surrounds a spongy layer with a low density of trabeculae.
The value of the lower jaw angle was measured separately in each group.
The clinical part of the study was performed on the basis of Vsevolozhsk Interdistrict Clinical Hospital. The results of X-ray examination of 190 patients of the first period of adulthood with fractures of the lower jaw were analyzed (X-ray in frontal and lateral projections, orthopantomography, and computed tomography). All the fractures studied were classified according to Taub, Patel, Buchman, and Cohen (2019) with regard to their localization.
The following was determined for every feature: arithmetic mean, and error of arithmetic mean. In order to determine the presence of significant differences between the average values of the parameters, the criterion of the Student's significance (t) was determined. With a sufficient total number of observations in the compared groups, statistical significance of the difference between their mean values was recognized at t>2.
To assess the statistical significance of the incidence of various types of fractures in adults, we used the criterion χ^2 Pearson.

Results and Discussion

It was established that average values of BC side of an angular triangle (distance from the opening of the lower jaw to its angle) did not differ significantly in the studied groups and varied on average from 24.2 to 26.1 mm. This was probably due to the fact that, in general, topography of the opening of the lower jaw is quite constant and, as was shown by Klemetti (2008), does not depend on sex, age and degree of preservation of the dentition.
However, with regard to AC side of this triangle, equal to the distance from the angle of the lower jaw to the distal edge of the second lower molar, then between the studied groups there were significant differences in this parameter ($p<0.05$). Thus, in the group with fully erupted third molars, the values of this indicator were 33.9±0.6 mm on the right and 35.1±0.6 mm on the left; in the group with the absence of the primordia of these teeth - 27.4±0.4 mm and 28.9±0.6 mm; in a group with unilateral impaction - 28.1±0.8 mm and 35.3±0.7 mm; in a group with bilateral impaction - 28.9±0.6 mm and 27.4±0.4 mm, respectively.
Substituting the obtained data on the value of the lengths of the sides of the angular triangle into Heron formula, $S=\sqrt{p\times(p-a)\times(p-b)\times(p-c)}$, having previously rounded up the values to integers, we get:
1) the area of an angular triangle in a group with fully erupted lower third molars is
$S = \sqrt{43x\ (43-28)\ (43-24)\ (43-34)} = 332.1\ mm^2$
2) area of an angular triangle in a group with no wisdom tooth buds:
$S = \sqrt{38x\ (38-24)\ (38-24)\ (38-29)} = 258.9\ mm^2$
3) area of an angular triangle in a group with bilateral impaction of wisdom teeth:
$S = \sqrt{42x\ (42-24)\ (42-26)\ (42-33)} = 289.2\ mm^2$

Due to the fact that the area of the studied angular triangle in the group with the absence of primordia of third molars was significantly less than in the groups with full eruption of third molars and their bilateral impaction, it can be assumed that the growth of the lower jaw in the area of its angle in the presence of tooth buds wisdom proceeds in the same way, regardless of whether the patient will have impaction in the future or not. And only in the absence of a primordia, this growth slows down significantly.

However, when studying the features of the architectonics of the bone tissue in the area of the lower jaw angle, we found that, despite the full development of the growth zone of the lower jaw, corresponding to the angular triangle, in the presence of impacted wisdom teeth in the area adjacent to these teeth, in 42% of cases III and in 32% of cases, the IV class of bone tissue architectonics according to Friberg et al. (1995), characterized by a low density of trabeculae of the spongy substance and a large diameter of its cells, which means insignificant strength. Meanwhile, in the area of fully erupted third molars in the studied sample, in 65% of cases, there was mainly the second class of bone structure with a highly developed spongy bone (Fig. 2).

a

b

Figure 2. Features of the architectonics of bone tissue in the area of the lower jaw angle: a) with full eruption of the lower wisdom tooth - class II of the bone quality according to Friberg et al. (1995) with impaction of the lower wisdom tooth, class III of the bone quality according to Friberg et al. (1995).

It was established that in the group with fully erupted third molars, the values of the lower jaw angle ranged from 123.1 to 124.7°, in the group with the absence of these primordia, they varied from 122.7° to 125.6°; in the group with bilateral impaction they were already 135.2-136.3°. Thus, there was a significant increase in the value of the angle of the lower jaw with impaction of the lower third molars.

Analyzing the information presented in the work of Burdi, Huelke, Snyder, and Lowrey (1969) it should be noted that an increase in the angle of the lower jaw significantly increases the risk of fractures of the lower jaw in this area due to the peculiarities structuring bone trabeculae of spongy substance and, accordingly, distribution of forces of chewing tension.

In the clinical part of the work, it was found that among 190 patients of the first period of adulthood with fractures of the lower jaw in the angle, the presence of impacted 3 molars was observed in 167 (in 87.9% of cases).

According to Taub et al. (2019), we have classified all options of impaction of 3 molars into the following groups: I degree - thickness of the bone tissue from the crown of the impacted tooth to the alveolar edge of the jaw did not exceed 1 mm; II degree - thickness of the bone tissue over the impacted tooth varied from 1 to 3 mm; III degree - thickness of the bone above the tooth exceeded 3 mm (Table 1).

Table 1: Correlation between degree of impaction of the 3rd molar and type of fracture of the lower jaw

Degree of impaction	Fractures in the area of the angle of the lower jaw	
	abs.	%
I	24	12.6
II	124	65.3
III	42	22.1
Total	190	100

Analysis of Table 1 showed that most often fractures in the area of the lower jaw angle occur with the second degree of impaction (in 65.3% of cases), most rarely - in the case of partially erupted wisdom teeth (in 12.6%), which is comparable with the information given in work of (Safdar & Meechan, 1995). Whereas Tevepaugh and Dodson (1995) argue that fractures of the lower jaw in the area of its angle do not correlate in any way with the degree of eruption of the lower wisdom tooth or its impaction.

To systematize the obtained material by the angle of inclination of the lower wisdom tooth, the Winter classification was used. According to it, the following groups are distinguished: 1. vertical position of the wisdom tooth (angle of inclination from 10° to -10°); 2. mesial tilt of the crown (angle of inclination 10-79°); 3. horizontal position of the

3rd molar (angle of inclination 80-100°); 4. distal tilt (angle of inclination from -11 to - 79°).

The prevalence of fractures in the area of the lower jaw angle with different positions of the impacted lower wisdom tooth is shown in Table 2.

Table 2: The incidence of fractures in the angle of the lower jaw with different positions of the impacted third molar

Position of the 3rd molar	The incidence of fractures in the angle	
	abs.	%
Vertical position	19	10
Mesial tilt	108	56.8
Horizontal position	21	11.1
Distal tilt	42	22.1
Total	190	100

Cho, Lee, and Kim (2006) argue that the most common cause of a fracture in the angle is the horizontal location of the impacted third molar, however, analyzing the information we have received, it has been established that with fractures of this localization most common mesial position of the lower 3rd molar, when angle of inclination is from 10 to 79° (in 56.8% of cases).

Conclusion

Anatomical studies prove that with impaction of the lower third molars, the features of the architectonics of the bone tissue of the lower jaw in the area of its angle change significantly. Clinical data confirm that the presence of impacted third molars significantly increases the risk of fractures in the area of the lower jaw angle, and the greater the degree of impaction and the greater the angle of inclination of the impacted wisdom tooth, the higher the likelihood of fractures of this localization.

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