Comparative characteristic of the upper jaws structure with normal cutting of the wisdom teeth, retention, and absence of their germs

Alexander A. Ponomarev¹, Alexander V. Tscymbalystov¹, Ivan V. Gayvoronsky²³, Maria G. Gayvoronskaya²⁴, Dmitry V. Emelyanov¹

INTRODUCTION

According to the data of modern literary sources, the retention of the third molars is most common among the eruption anomalies of permanent teeth.¹⁻³
According to some authors, up to 35% of dental patients seek surgical and orthodontic care for this disease.⁴
Whereas the formation of occlusion anomalies and deformation of the dentition occupy a special place among the complications of wisdom tooth retention, a sufficient number of works are devoted to the study of its etiology and pathogenesis.⁵

The Aim of the Study

This study aims to study the morphometric features of the upper jaw and to identify the regularities of its structure with full teeth eruption, various types of retention, and the absence of wisdom tooth buds.

MATERIALS AND METHODS

Cranio metric studies were conducted according to the Martin Method, in compliance with the relevant requirements and rules, and included the measurement of basic dimensions both between standard cranio metric points and non-standard points.

All skulls were systematized by gender and the shape of the facial skull. According to the peculiarities of eruption of the third molars, four groups were distinguished: Group I – with the presence of completely erupted third molars, Group II – with

ABSTRACT

The article presents information about the structural features of the upper jaw of an adult with the normal eruption of third molars, retention, and the absence of the rudiments of these teeth. It has been established that during the retention of the upper third molars and their absence, significant changes in the morphometric characteristics of the alveolar process of maxilla, the bone palate, as well as the shape of its alveolar arch and tuber are occurred. In terms of their morphometric parameters, the upper jaw with bilateral retention is as close as possible to the upper jaw with missing rudiments of wisdom teeth and the upper jaw with one-sided retention to the upper jaw with fully erupted third molars. According to its morphometric parameters, the upper jaw with bilateral retention is as close as possible to the upper jaw with missing rudiments of wisdom teeth and the upper jaw with unilateral retention – to the upper jaw with fully erupted third molars. Difficult eruption of the upper third molars is accompanied by changes in the angular parameters of the upper jaw and features of the horizontal and vertical facial profiling.

KEY WORDS: Alveolar process of maxilla, Facial profiling, Retention, Third molars, Upper jaw
no wisdom teeth buds, Group III – with unilateral retention of the third molars, and Group IV – with bilateral retention of the third molars.

Heron’s formula was used to study the areas of the palatine process of maxilla and the triangle of the face. To determine the vertical proportions of the face, the sides and angles of the facial triangle proposed in the work of Roginsky and Levin were studied.\cite{8} To calculate the values of angles in this triangle, the law of cosines was used. In the cranioscope part of the study, we used our classification developed for the forms of maxillary tuberosity.

Statistical processing of the obtained data was carried out using the Statistica 7.0 application package. For each characteristic, the arithmetic mean and standard error were determined. To identify the significance of the difference between averages from the contralateral sides, the Student’s t-distribution was determined.

**EXPERIMENTAL AND RESULTS**

As a result of the study, it was found that the width of the alveolar process of maxilla at the level of canines, first premolars, and first molars reaches maximum values in the group with fully erupted third molars and varies from 39.5 to 62.5 mm depending on the level of measurement. In the group with the absence of wisdom tooth buds, these parameters ranged from 35 to 56 mm, in the group with unilateral retention – from 38.3 to 61.7 mm, and in the group with bilateral retention – from 35 to 54 mm.

The length of the palatine process of maxilla is on average 4.4 mm longer in the group with completely erupted third molars as compared to the group with the absence of wisdom tooth buds and is on average 4.7 mm longer than in the group with bilateral retention. However, in the group with unilateral retention, the values of this parameter are comparable to those in the group with a full set of teeth.

The length values of the alveolar process of maxilla in the group with the absence and retention of third molars averaged 59.7 ± 1.2 on the right and 60.4 ± 0.8 mm on the left and 60.8 ± 1.1 mm on the right and 62.7 ± 1.2 mm on the left, respectively, and in the group with the presence of wisdom teeth – already 66.4 ± 0.8 mm on the right and 69.7 ± 0.9 mm on the left. No significant differences were found on the contralateral sides (P < 0.05), except for the group with unilateral retention of these teeth.

Tuberal distance, which has an important predictive value for calculating the possibility of wisdom tooth eruption, in groups with bilateral retention or the absence of wisdom teeth primordia, is on average 3.5–4 mm smaller as compared to other studied groups.

At the same time, as in the case with the length of the alveolar process of maxilla, no significant differences were found for this parameter by the contralateral sides; however, in the group with unilateral retention, the values of this indicator differed significantly (P < 0.05) and on the side of the retention were only 8.7 ± 0.5 mm, while on the opposite side – 12.0 ± 0.6 mm.

The greatest difference was noted when comparing the values of the prostion-basion distance, which forms one of the sides of the facial triangle proposed by Roginskii and Levin.\cite{8} Thus, in the group with bilateral retention of the third molars, as well as in the group with no absence of these teeth primordia, the values of this indicator were on average 10–11 mm lower than in the group with fully erupted wisdom teeth, which indicates of the different position of the upper jaw in the selected groups.

The calculation of the area of the palatine process of maxilla showed that its maximum values are typical for a group with wisdom teeth cutting through and minimum values are for a group with the absence of these teeth primordia. In the group with bilateral retention, the area value of this geometric figure is slightly higher than in the group with the absence of the third molars (46 mm²) but at the same time is on average 66 mm² less as compared with the group with their full eruption.

In addition to the significant difference in size, characterizing the sides of the facial triangle, among the studied groups of skulls, is a presence of a statistical difference in the values of the angles of this geometric figure.

Thus, the α values (the angle with the top at the nasion point) are significantly larger in the group with completely erupted third molars, and in the group with bilateral retention, they have minimal values. The angle β (the angle with the top at the prostion point), on the contrary, is minimal with the full penetration of the third molars. In the absence of the third molars primordia, the values of angle α (the angle with the top at the nasion point) are comparable to those in bilateral retention, while the values of the angle β (the angle with the top at the prostion point) are with the group with fully cut wisdom teeth [Table 1].

When studying the features of the vertical and horizontal facial profiling, it was found that statistically significant differences between the selected groups of skulls exist in the angle of the alveolar part, as well as in the zygomatic angles [Table 2]. At the same time, the angle of the alveolar part is significantly greater with the full eruption of the third molars, which does not cause contradictions with the lack of a significant difference in the total angle value of the facial profile between the selected
Alexander A. Ponomarev, et al.

Table 1: The average values of the angles of the facial triangle in the studied groups of skulls

<table>
<thead>
<tr>
<th>Angle</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle α</td>
<td>69.7±1.1***</td>
<td>62.5±1.3</td>
<td>67.1±1.2***</td>
<td>59.2±1.3</td>
</tr>
<tr>
<td>Angle β</td>
<td>70.2±0.4**</td>
<td>73.8±1.8**</td>
<td>72.6±2.1**</td>
<td>80.7±1.6*</td>
</tr>
<tr>
<td>Angle γ</td>
<td>40.1±1.2</td>
<td>43.7±1.5</td>
<td>40.4±1.3</td>
<td>40.1±0.9</td>
</tr>
</tbody>
</table>

Group I – with the erupted third molars; Group II – without the absence of wisdom teeth primordia; Group III – with unilateral retention; Group IV – with bilateral retention; *the presence of statistically significant differences with Group II \( P < 0.05 \); **presence of statistically significant differences with Group IV \( P < 0.05 \).

Table 2: The average values of the angles characterizing the vertical and horizontal profiling of the face in the studied groups

<table>
<thead>
<tr>
<th>Angle, °</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>The total angle of the front profile (f)</td>
<td>84.8±0.6</td>
<td>83.5±1.2</td>
<td>81.7±1.3</td>
<td>82.5±1.1</td>
</tr>
<tr>
<td>The angle of the alveolar part of the face (al)</td>
<td>73.5±1.2**</td>
<td>66.3±1.1</td>
<td>72.8±0.9***</td>
<td>64.8±1.2</td>
</tr>
<tr>
<td>Nasomalar angle (nm)</td>
<td>156.8±1.5</td>
<td>154.2±1.5</td>
<td>155.6±1.5</td>
<td>155.8±1.8</td>
</tr>
<tr>
<td>Zygomaxillary angle (zmx)</td>
<td>161.2±2.3***</td>
<td>168.7±1.7</td>
<td>160.3±1.3***</td>
<td>173.3±2.1</td>
</tr>
</tbody>
</table>

Group I – with the erupted third molars; Group II – without the absence of wisdom teeth; Group III – with unilateral retention; Group IV – with bilateral retention; *the presence of statistically significant differences with Group II \( P < 0.05 \); **presence of statistically significant differences with Group IV \( P < 0.05 \).

When studying the features of the cranioscopic parameters of the upper jaw, we found that between the selected groups, there are statistical differences in the shape of the upper jaw tuber. Thus, it was found that with the full eruption of the upper wisdom teeth, in the overwhelming majority of cases, a direct form of the upper jaw tuber is observed when the angle of the transition of the alveolar process to the tuber is on averages 90°. In the absence of the upper third molars primordia, the values of this angle are on average 108°, and during retention, the angle of transition of the alveolar process of the upper jaw into its tuber is on average 20° larger than in the case of full eruption of the upper wisdom teeth, which gives the tuber a slanted appearance.

**DISCUSSION**

Analyzing the data obtained in our work, it should be noted that most of the morphometric parameters of the upper jaw are statistically significantly more pronounced in the group with fully erupted third molars compared to groups with the absence of these teeth primordia or their bilateral retention.

At the same time, depending on the characteristics of the eruption of the upper wisdom tooth not only individual morphometric parameters of the upper jaw change but also the lengths of the sides of the facial triangle, whose tops are the nasion, prostion, and basion points, which allow analyzing its parameters to estimate about the position of the upper jaw regarding the skull, as well as the area of the palatine process of maxilla, which characterizes not only the upper jaw but also the whole bone palate.

According to Roginskii and Levin,[9] in the front triangle, the angle value with the top at the nasion point increases with prognathism increasing and the angle with the top at the prostion point is characterized by the inverse ratio. We found that during the retention of the third molars, the values of α (the angle with the top at the nasion point) are minimal and the angles of β (the angle with the top at the prostion point), on the contrary, are maximum compared to other groups, which indicate that the upper jaws with obstructed eruption of the third molars are located more distally than in other studied groups. The obtained data are confirmed in the work of G.V. Bevezstnyi,[9] in which it is shown that during the eruption of the upper third molars not only the distal parts of the upper jaw are developing but also its spatial position is changing. In our study, we proved that with the difficult eruption of the third molars, the lack of a galvanizing effect from those teeth on the alveolar process of the upper jaw leads to the fact that the distance between the prostion and basion points does not increase, and the upper jaw occupies a more distal position in comparison with the full teething wisdom teeth.

As noted by Volkov,[5] as the upper third molars erupt, the upper incisors deflect mesially. Probably, this also causes a change in the angle β of the facial triangle in the selected groups of skulls, as well as the angle of the alveolar part. The same circumstance can explain the change in the horizontal profiling of the face during the retention of the third molars. Hence, we have shown that the zygomatic angle, the sides of which pass through the junction points of the upper jaw and the zygomatic bone, in the case of this disease is significantly larger than in the case of full eruption of the upper wisdom teeth.

Some authors argue that the difficulty of eruption of the third molars is accompanied by a decrease only in the length of the upper jaw.[10] We have shown that along...
with changes in the morphometric characteristics of
the upper jaw directly, with difficulty in eruption of
the third molars, the parameters of the bone palate
are reduced, and the differences in the structure of
the genetic part of the face associated with the more
distal position of the upper jaw retention are noted.
We found that the widths of the alveolar process of
maxilla at the level of different groups of teeth have
statistically significant differences only with the group
of the absence of the third molars primordia and do
not differ significantly in groups with the presence
of wisdom teeth, regardless of the characteristics of their
eruption.

Based on this, we can conclude that the formative
effect of the primordia of the upper wisdom teeth on
the growth of the upper jaw, due to which at this stage
of the development of the dental-maxillary system,
there is no complete reduction of the upper third molar.

CONCLUSIONS

1. With the retention of the upper third molars and their
absence, significant changes in the morphometric
characteristics of the alveolar process of the upper
jaw, the bone palate, as well as in the shape of its
alveolar arch and tuber are occurred.

2. According to its morphometric parameters, the
upper jaw with bilateral retention is as close as
possible to the upper jaw with the absence of
wisdom teeth primordia, and the upper jaw with
one-sided retention – to the upper jaw with fully
erupted third molars.

3. Difficult eruption of the upper third molars is
accompanied by changes in the angular parameters
of the upper jaw and features of the horizontal and
vertical profiling of the face.

REFERENCES

1. Skapkareva VO, Zhigalskii OA. The evolution of the eighth
2. Jasinevicius TR, Pyle MA, Kohrs KJ. Prophylactic third molar
extractions: US dental school departments' recommendations
3. Shah AP, Parekh PA. An evaluation of genesis and impaction of
4. Stepanov GV. Diagnosis and treatment of the retention of
5. Volkov IG, Andreichev AR. Algorithm of medical tactics in
6. Gaivoronskii IV, Iordanishvili AK, Vasilchenko GA,
Gaivoronskaia MG, Ponomarev AA. Retention of Wisdom
7. Alekseev VP, Debets GF. Craniometry: Methods of
Anthropological Studies. USSR Academy of Sciences, Institute
of Ethnography Named by N.N. Miklouho-Maclay. Moscow:
Nauka; 1964. p. 128.
8. Roginskii YY, Levin MG. Anthropology. Moscow: High
School; 1978. p. 528.
10. Ganiev IA. The Role of The Lower Third Molars in the
Occurrence of Dental-anomalies and Deformities. St.

Source of support: Nil; Conflict of interest: None Declared