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MEDICINE
Research article

THE INFLUENCE OF THE LOWER THIRD MOLAR ON MANDIBULAR SKELETAL DEVELOPMENT

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Accepted April 3, 2015

Most studies in the literature that have investigated the correlations between the skeletal growth pattern and lower third molar evolution explored the influence of / disturbance produced by the facial growth pattern on the space corresponding to the third molar and its eruption path.
The present study aims an opposite analysis of the third molar's influence on the development of the corresponding dento-alveolar and skeletal mandibular region, on a group of 25 patients presenting unilateral third molar agenesis. Comparative measurements were performed on panoramic radiographs (OPT). For some subjects investigations were also conducted using 3D CBCT information.
Although several retromolar space length differences were found between the area with third molar agenesis and that with existing third molar, the comparative statistical analysis revealed no statistical significance of these differences.

Key words: Retromolar space, third molar, mandibular development, panoramic radiograph measurement, third molar agenesis.

INTRODUCTION

Regardless of the field of dental medicine in which the doctor works, the assessment of the lower third molar evolution during jaw growth and development remains, in most cases, difficult and uncertain. At least for orthodontists, skeletal mandibular growth features should favor these estimations.

There are many authors claiming that skeletal growth is mainly responsible for the third molar evolution, especially for the lower one.

In 1956, Bjork *et al.*[1] observed that 90% of third molar impaction cases are being associated with reduced alveolar space, distal to the second permanent molar. They also outlined 3 other skeletal development factors, which can be correlated with reduced retromolar space:

– The vertical growth of the condyle;
– The mandibular length deficit;
– The distal teeth eruption path.

In 1973, Silling[2] found that the third molars were precociously erupting in the correct position in Class III malocclusions with excessive mandibular growth, while richardson[3], in 1977, referred to the skeletal retrognathia as an important factor in the etiology of third molar impaction.

Olive and Basford's[4] study confirms the importance of prognathic or retrognathic skeletal relationships in the etiology of third molar impaction.

Bertrand *et al*.[5] synthesize Olive and Basford[4]'s study, stating: "the diagnosis of impaction on a lateral cephalogram could be denied on a posteroanteriorcephalogram."

This study confirms the importance of intermaxillary relationships (prognathic or retrognathic) in the etiology of the third molar impaction, as mentioned by Bjork *et al.*[1] and Silling[2].

Thus, individuals with erupted third molars, but with a reduced retromolar space tend to develop prognathic skeletal relationships (Class III intermaxillary relationships). At the same time, individuals with a retromolar space that should allow development of third molars, but with impacted third molarstend to develop a retrognathic skeletal pattern (brachycephalic).

Hellman[6] demonstrates a predisposition for teeth impaction in patients with small cranial size.

The present study aims to conduct a reverse analysis of the mandibular skeletal development in relation with the lower third molar, trying to determine whether the presence/absence of the third molar has an influence on the maxillo-mandibular skeletal base and alveolar process growth and development.

MATERIALS AND METHODS

For this purpose we have assembled a group of 25 patients with unilateral lower third molar agenesis, with an average age of 13.6 years, therefore being in the final growth stage.

The corresponding space for the lower third molar was assessed by the Niedzielska[7] measurement method on panoramic radiographs, at the occlusal plane level (the occlusal plane was built from the tip of the highest cusp of the first premolar to the mesio-buccal cusp tip of the second permanent molar). The measurements were carried out as follows (Figure 1):

– distance from the distal surface of the first permanent molar to the anterior border of the mandibular ramus along the occlusal plane (M1 – ramus);

– distance from the distal surface of the second permanent molar to the anterior border of the mandibular ramus along the occlusal plane (M2 – ramus). The distances were measured on both sides (right and left).

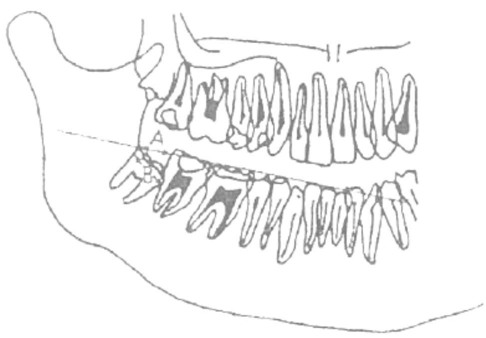

Fig. 1. The M1 – ramus, M2 – ramus distances measurements at the occlusal plane level on the panoramic radiographs (according to Niedzielska[7]).

In order to remove the error factor the panoramic radiograph may trigger, a coefficient of error (fM1, fM2) was calculated for each arch for the two distances measured: the ratio between the maximum mesio-distal diameter of the first molar / the maximum mesio-distal diameter of the second molar measured on plaster casts and respectively the maximum mesio-distal diameter of the first molar/maximum mesio-distal diameter of the second molar measured on the panoramic radiograph:

f_{M1}= ó max M_1cast/ ó max M_{1OPT}

f_{M2}= ó max M_2cast/ ó max M_{2OPT} .

Each of the right/left M1 – ramus, M2 – ramus distances measured on the panoramic radiograph was multiplied by the corresponding coefficient of error, yielding the respective distances. Subsequently we compared the left and right M1 – ramus, M2 – ramus distances on the panoramic radiograph to evaluate if there are differences between the retromolar area where the third molar is congenitally missing and the retromolar area where the third molar does exist. For most subjects, taking into account the application of the coefficient of error obtained by the ratio between the actual size of the first and second permanent molars, measured on the plaster casts, and their size on the panoramic radiograph, we have obtained several differences between the side with congenital missing third molar and the other side where the lower third molar is present.

RESULTS AND DISCUSSION

The ANOVA, Kruskal Wallis and Mann Whitney statistical tests for the comparative analysis of the M1 – ramus M2 – ramus parameters, on the side of the dental arch with third molar agenesis (A) versus the side of the dental arch where the third molar does exist (b) do not show any statistical significance for these values (Table 1). So there are no statistically significant differences. This lack of statistical significance may also be a result of the fact that the panoramic radiograph might incorporate interpretation errors by possible radiological differences on the right side *versus* left side.

The lateral cephalogram in classic incidence is not useful for a comparative analysis of these areas due to the overlapping images. In order to accomplish a general investigation of dental morphology in patients with unilateral third molaragenesis, the ideal way is three-dimensional examination, which offers the possibility of a comprehensive analysis of the skeletal mandibular morphology, but with the disadvantage of a relatively high cost. This type ofexamination confirmed the differences between the retro-molarspace in the lower third molar agenesis side compared to the opposite side, where the third molar does exist, differences that illustrate a larger retromolar space where the third molar existed.

Table 1
Comparative statistical analysis of the retromolar space in the area with / without agenesis in patients with unilateral third molar agenesis

Parameters	ANOVA test		Kruskal Wallis test		Mann Whitney test	
	Test value	Significance	Test value	Significance	Test value	Significance
M_1-ramus (A/B)	p = 0.30	p > 0.05	p = 0.24	p > 0.05	p = 0.27	p > 0.05
M_2-ramus (A/B)	p = 0.88	p > 0.05	p = 0.87	p > 0.05	p = 0.91	p > 0.05

A noteworthy on the side of dental arch asymmetry at the level of the retromolar space was not recorded in any of the patients who presented mandibular developmental asymmetry and were supplementally investigated by CBCT, consequently the mandibular asymmetry could not be related to the presence or absence of the third molar.

CLINICAL CASES

To illustrate our investigation on the size of retromolar space in cases with unilateral third molar agenesis, we present two cases in which the measurements made on the panoramic radiograph, as well as the CT section measurements, showed differences in the retromolar space length between the right and the left side of the dental arch, accordingly between the areas where the third molar does and does not exist. In contrast, it was not possible to determine any correlation between the third molar evolution and the mandibular skeletal growth features.

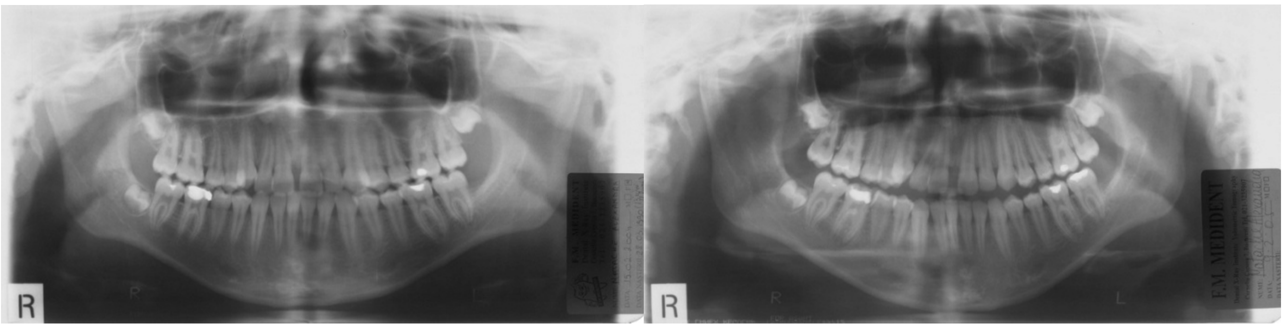

Fig. 2. M.A., female, panoramic radiograph at 14 years and 15 years of age (measurements were performed on the second OPT).

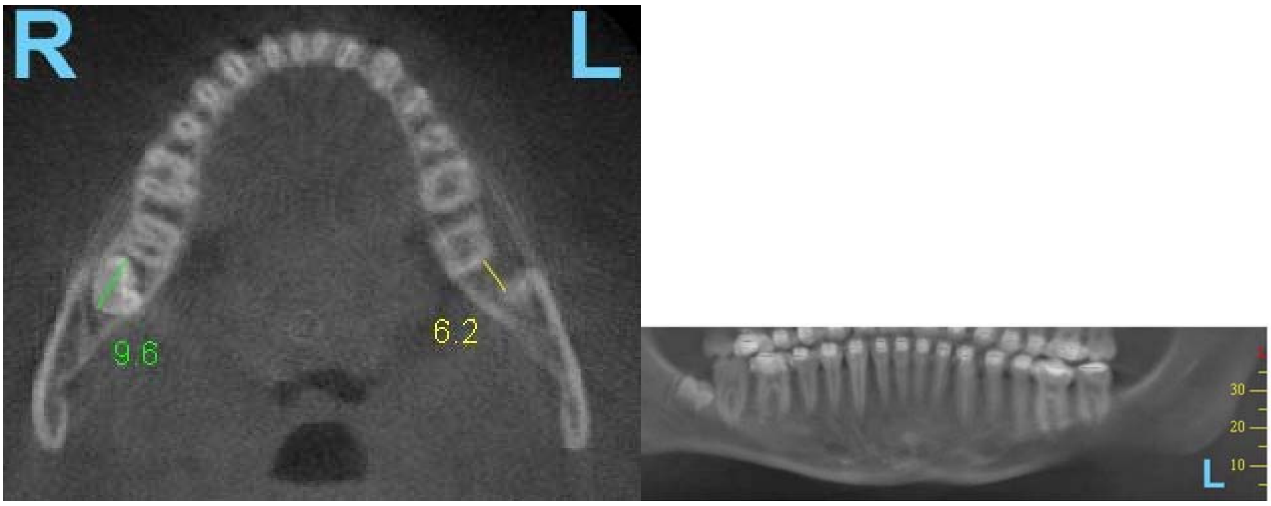

Fig. 3. M. A., female, 15 years old – images used from the CBCT investigation.

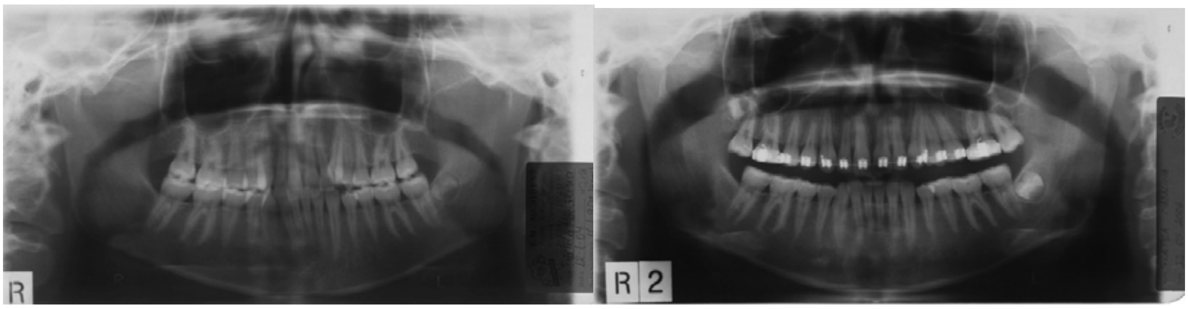

Fig. 4. F. M., female – Panoramic radiographs at the ages of 13 years and 15 years (measurements were performed on the second radiograph).

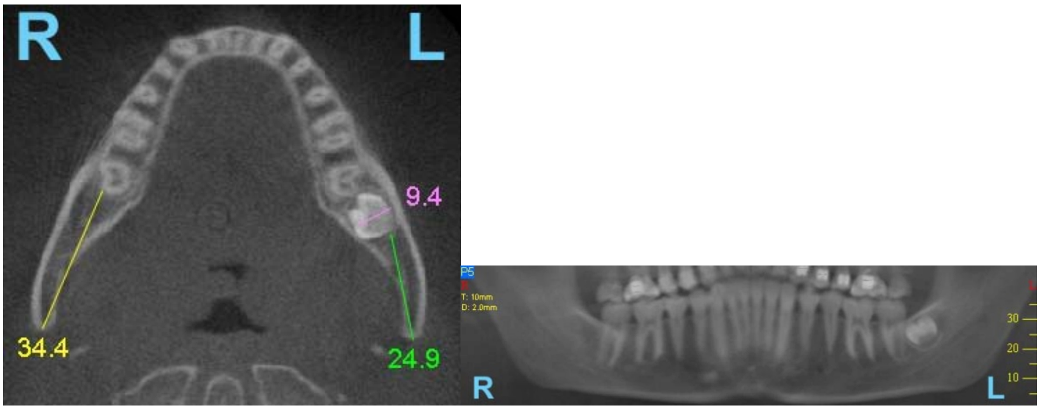

Fig. 5. F. M., female, 15 years old – images used from the CBCT investigation.

CONCLUSIONS

The measurements carried out on the panoramic radiographs and 3D investigations in the lower retromolar area reveal dentoalveolar development features at this level. Although incases there were dimensional differences between the segment with congenitally missing third molar and the one where the third molar was present, comparative statistical analysis revealed no statistical significance of these differences with regard of the dentoalveolar and skeletal development of the whole region. This is probably due to the fact that the third molar, the last developing tooth in the dental series, evolves in the final period of skeletal growth when the maxillo-mandibular structures are already configured (the average age when the third molar begin its development is 9 years old and the average age for its eruption is 17 years old).

A rationale for the lack of statistical significance of the differences might be provided by the fact that the third molar, unlike all other teeth, develops into an anatomical region (the ramus – base junction) where the basal skeletal segment of the mandible is predominant in relation to the alveolar process.

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