

Evaluation of the mesio-distal positioning of the maxillary first permanent molar in individuals with ectopic eruption

Avaliação do posicionamento mesiodistal do primeiro molar maxilar permanente em indivíduos com erupção ectópica

Evaluación del posicionamiento mesiodistal del primer molar permanente maxilar en individuos con erupción ectópica

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Abstract

Objective: To evaluate the mesial-distal positioning of the maxillary first permanent molar in children who present with ectopic eruption of the maxillary first permanent molar (PFMEE). *Methods:* panoramic radiographs and lateral cephalometric radiographs 12 children of both genders were evaluated. The study group was composed of 12 children with PFMEE and the control group was composed of 12 children with normal occlusion with the first upper permanent molar in occlusion. After selecting the exams from both groups and performing the anatomical tracings, linear and angular measurements were performed. In the lateral cephalometric radiographs the following angles were evaluated: SNGo.GN, SN.GN, SNA, SNB, ANB, 6mx.Palatal Plane and the 6mx.PTV distance. In the panoramic radiograph the angles 6mx.Infraorbital Plane and 6mx.Occlusal Plane were evaluated. *Results:* PFMEE can occur in individuals regardless of their skeletal pattern. The control group showed much greater angular measurements 6mx.Palatal Plane and 6mx.Infraorbital Plane. *Conclusion:* There is no relationship between PFMEE and craniofacial growth pattern, there is no direct relationship with the anteroposterior relationship of the apical bases and in cases of PFMEE the mesial angulation is reduced, representing lack of space for eruption of the first permanent molars.

Keywords: Tooth eruption ectopic; Molar; Cephalometry.

Resumo

Objetivo: Avaliar o posicionamento mesiodistal do primeiro molar permanente superior em crianças que apresentam erupção ectópica do primeiro molar permanente superior (EEPMS). *Métodos:* foram avaliadas radiografias panorâmicas e cefalométricas laterais de 12 crianças de ambos os sexos. O grupo de estudo foi composto por 12 crianças com EEPMS e o grupo controle foi composto por 12 crianças com oclusão normal com o primeiro molar permanente superior em oclusão. Após a seleção dos exames de ambos os grupos e a realização dos traçados anatômicos, foram realizadas medidas lineares e angulares. Nas radiografias cefalométricas laterais, foram avaliados os seguintes ângulos: SNGo.GN, SN.GN, SNA, SNB, ANB, 6mx.Plano palatino e a distância 6mx.PTV. Na radiografia panorâmica foram avaliados os ângulos 6mx.Plano Infraorbital e 6mx.Plano Oclusal. *Resultados:* O EEPMS pode ocorrer em indivíduos, independentemente de seu padrão esquelético. O grupo de controle mostrou medidas angulares muito maiores 6mx.Plano palatino e 6mx.Plano Infraorbital. *Conclusão:* Não há relação entre EEPMS e padrão de crescimento craniofacial, não há relação direta com a relação anteroposterior das bases apicais e nos casos de EEPMS a angulação mesial é reduzida, representando falta de espaço para a erupção dos primeiros molares permanentes.

Palavras-chave: Erupção ectópica de dente; Molar; Cefalometria.

Resumen

Objetivo: Evaluar el posicionamiento mesial-distal del primer molar permanente maxilar en niños que presentan erupción ectópica del primer molar permanente maxilar (PFMEE). *Métodos:* Se evaluaron radiografías panorámicas y cefalométricas laterales de 12 niños de ambos sexos. El grupo de estudio estaba compuesto por 12 niños con PFMEE y

el grupo de control por 12 niños con oclusión normal con el primer molar permanente superior en oclusión. Tras seleccionar los exámenes de ambos grupos y realizar los trazados anatómicos, se realizaron mediciones lineales y angulares. En las radiografías cefalométricas laterales se evaluaron los siguientes ángulos: SNGo.GN, SN.GN, SNA, SNB, ANB, 6mx.Plano Palatino y la distancia 6mx.PTV. En la radiografía panorámica se evaluaron los ángulos 6mx.Plano Infraorbital y 6mx.Plano Oclusal. *Resultados:* La PFMEE puede ocurrir en individuos independientemente de su patrón esquelético. El grupo de control mostró medidas angulares mucho mayores 6mx.Plano Palatino y 6mx.Plano Infraorbitario. *Conclusiones:* No hay relación entre el PFMEE y el patrón de crecimiento craneofacial, no hay relación directa con la relación anteroposterior de las bases apicales y en los casos de PFMEE la angulación mesial está reducida, lo que representa falta de espacio para la erupción de los primeros molares permanentes.

Palabras clave: Erupción Ectópica de Dientes; Diente molar; Cefalometría.

1. Introduction

Permanent first molar ectopic eruption (PFMEE) is an eruptive anomaly characterized by the impaction of the permanent first molar crown on the distal surface of the deciduous second molar. Its prevalence ranges from 0.75% to 6% in normal populations, which can be considered as low. In children with clefts, palatine or labial, the prevalence of this anomaly varies between 19.6% and 26.3% (Decker *et al.*, 2008; Kim *et al.*, 2020).

According to Young (1957), two types of ectopic eruption are recognized: the reversible, occurs when the first permanent molar leaves the impaction situation and reaches the occlusal plane properly, and the irreversible type, when the impaction does not present self-correction, and with clinical progression that presents consequences such as the early loss of the second deciduous molar, mesial inclination and lingual rotation of the first permanent molar, which causes a decrease in the dental arch perimeter and consequently a deficiency of space for the second premolar (Kuroil & Bjerklin, 1982; YOUNG, 1957).

Regarding the etiologic factors, the literature presents factors which can influence in a isolated or combined ways: the small maxilla, maxilla in retruded position in relation to the cranial base, permanent first molar eruption pattern, permanent first molar with increased mesio-distal diameter, asynchrony between the eruption of the upper first permanent molar and the growth of the maxillary tuberosity. Genetic factors are also considered, since the prevalence among siblings is 19.8%, thus much higher than in the general population (Harrison & Michal, 1984).

The diagnosis of PFMEE is based on the association between clinical examination and radiographic analysis. The routine clinical examination performed in the early stage of the mixed dentition is the ideal moment for the detection of PFMEE. It can be observed a partial eruption of the permanent first molar crown with exposure of distal cusps and part of the occlusal surface and absence of mesial cusps (Güven, 2018). The complementary radiographic examination by periapical radiographs or panoramic radiographs shows an invasion of the mesial portion of the permanent first molar crown into the distal surface of the deciduous second molar root with a typically radiolucent image of root resorption due to the eruption with a very pronounced mesial-angular inclination in relation to the normal pattern (Pulver & Croft, 1983; Suri, Gagari & Vastardis, 2004). The occurrence of pain is not a primary factor for the detection of this anomaly, but it can be reported in some cases, due to pulp exposure of the deciduous second molar (Marañón-Vásquez *et al.*, 2019; Salbach *et al.*, 2012). The percentage of deficient diagnosis cases is relatively high, which often makes it difficult to respond adequately to the established therapy. Early and accurate diagnosis associated with timely treatment can prevent the occurrence of a more complicated malocclusion (Dabbagh *et al.*, 2017; Yaseen, Naik & Uloopi, 2011).

Considering that PFMEE is a very important etiologic factor for malocclusions, and that the axial inclination axis of these teeth can determine this eruption anomaly, it is necessary to have a detailed knowledge of the several aspects which are related to this eruption anomaly, among which the mesial-distal positioning of the first molar should be emphasized, in order to present to the general practitioner information which can help him to obtain an accurate diagnosis and to elaborate an effective treatment plan.

The aim of this research was to evaluate the mesial-distal position of the maxillary first permanent molar in children who present with ectopic eruption of the maxillary first permanent molar.

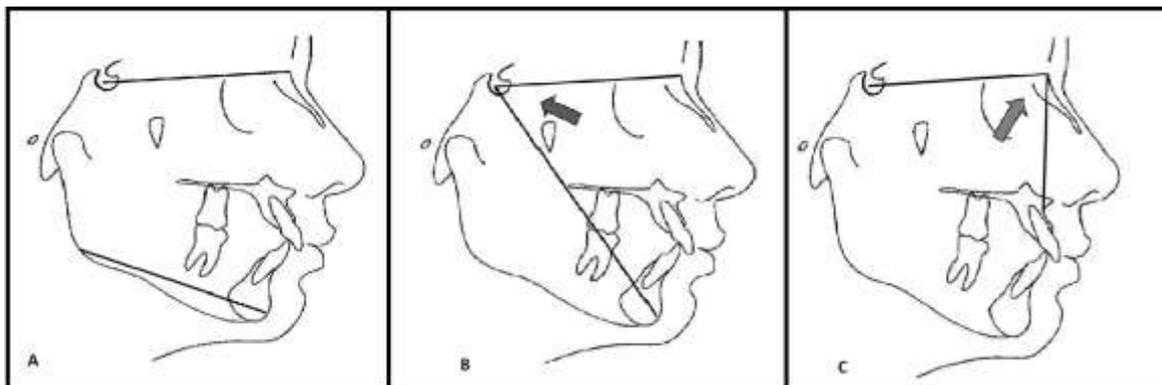
2. Methods

To perform this qualitative study, we used panoramic radiographs (orthopantomographic) and lateral cephalometric radiographs of 12 children of both genders, aged between 6 and 8 years, who presented ectopic eruption of the first upper permanent molar. For the composition of the Control Group, panoramic radiographs and lateral cephalometric radiographs were used of children with the same gender and age, but with normal occlusion, and mainly with maxillary first permanent molars in occlusion. The radiographs were obtained after collecting patients from the archive of the Orthodontics Department of the Araçatuba Dental School, São Paulo State University - UNESP.

After selecting the panoramic and lateral cephalometric radiographs of both groups, the anatomical tracings of the skull base, maxilla, mandible, upper and lower teeth were performed. Both linear and angular measurements were made on the anatomical tracings (Chintakanon & Boonpinon, 1998; Mooney *et al.*, 2007).

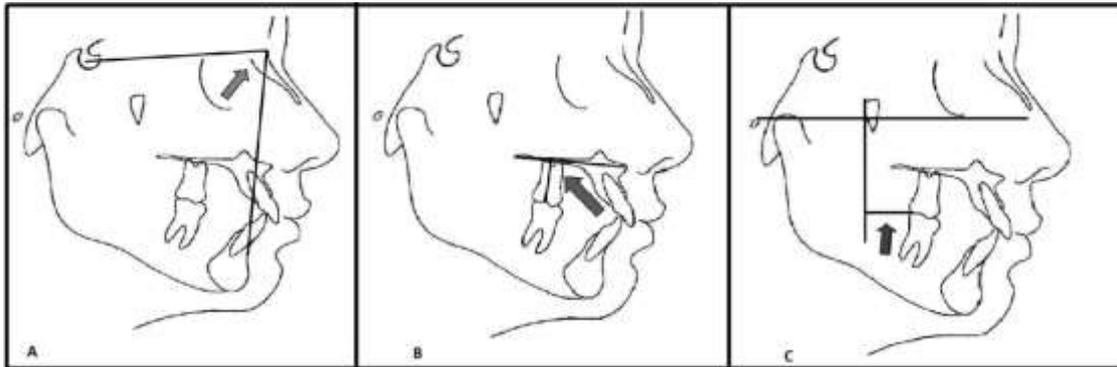
In the lateral cephalometric radiograph, the following measurements were obtained: 1 - SN.GoGN angle, formed between the skull base and the mandibular plane (Figure 1A); 2 - SN. Gn angle, formed between the cranial base and the most anterior and most inferior portion of the mandible (Figure 1B); 3 - SNA angle, formed between the cranial base and the maxilla (Figure 1C); 4 - SNB angle, formed between the cranial base and the mandible (Figure 2A); 5 - ANB angle, formed by the difference between SNA and SNB angles; 6 - 6mx.Palatal Plane, formed by the long axis of the maxillary first permanent molar and the palatal plane (ENA-ENP) (Figure 2B); 7 – Linear distance 6mx-PTV, distance from the distal surface of the permanent maxillary first molar crown and a perpendicular to the Frankfurt Horizontal Plane passing through the Pterigomaxillary point (Figure 2C).

Figure 1 – Representation of the: A - SN.GoGN angle; B - SN.GN angle; C - SNA angle.



Source: Author.

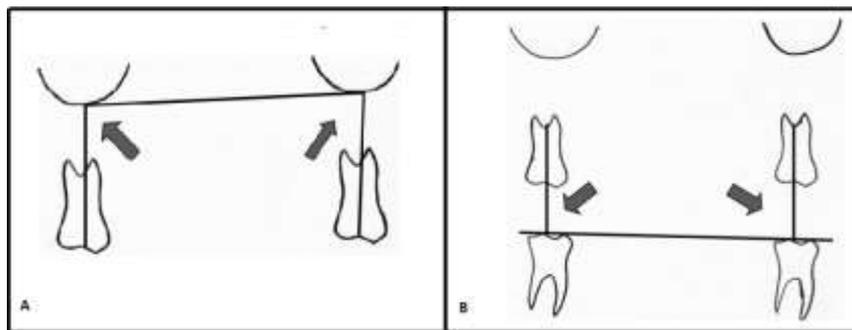
Figure 2 – Representation of the: A - SNB angle; B - 6mx.ENA-ENP angle; C - PTV(Perp)-6mx distance.



Source: Author

In the panoramic radiographs the following variables were measured: 1 - 6mx.Infraorbital plane angle, formed by the long axis of the first upper molar and the infraorbital plane (Figure 1C), and 2 - 6mx.occlusal plane angle, formed by the long axis of the maxillary first molar and the occlusal plane (Figure 2A).

Figure 3 – Representation of the: A - 6mx.Infraorbital plane angle; B - 6mx.Occlusal plane angle.



Source: Author.

The radiographs were analyzed under negatoscopes in darkened rooms to improve the evidence of the structures analyzed. After obtaining the anatomical tracings, the measurements were taken by two previously calibrated examiners. Five measurements were taken for each magnitude, and after adjusting the values to eliminate discrepancies, this mean was used for statistical analysis.

3. Results and Discussion

The data obtained were grouped as means, submitted to an analysis of variance and the Tukey test to evaluate the significance of the difference found between the means using a significance level of 5%.

Table 1 - Values found for the Control Group (Normal Occlusion), in panoramic radiographs and lateral cephalometric radiographs.

VARIABLE	N	x	d.p.
6mx. PI I.Orb.	12	99,17°	1,63
6mx. PI Ocl.	12	81,87°	1,25
SNA	12	82,36°	2,12
SNB	12	78,31°	1,86
ANB	12	4,02°	1,38
SN.Gn	12	32,46°	2,29
SN.Go.Gn	12	67,25°	1,48
6mx- PTV	12	11,25mm	1,23
6mx- PL. Palat.	12	106,5°	3,4

Source: Author.

Table 2 - Values found for the Ectopic Eruption Group, in panoramic radiographs and lateral cephalometric radiographs.

VARIABLE	N	X	d.p.
6mx. PI I.Orb.	12	89,8°	1,23
6mx. PI Ocl.	12	91°	3,2
SNA	12	79,33°	1,89
SNB	12	79°	1,45
ANB	12	4°	2,6
SN.Gn	12	34,66°	3,23
SN.Go.Gn	12	69,3°	1,76
6mx- PTV	12	7,6mm	1,35
6mx- PL. Palat.	12	96°	2,3

Source: Author.

For the diagnosis of PFMEE, clinical and radiographic examination are considered fundamental factors. For the radiographic evaluation, numerical interpretation has been used to quantify dental, skeletal and even facial profile anomalies. With these considerations in mind, this study aimed at obtaining comparison values to aid in the diagnosis of this eruptive anomaly.

By examining the lateral cephalometric radiograph, we sought to study measurements that represent the different areas already standardized in radiographic cephalometry. By grouping the magnitudes SN.GoGN and SN.GN, we tried to characterize the cephalic skeleton pattern of the individuals in both groups. Thus, it can be inferred that ectopic eruptions can occur in individuals regardless of their facial growth pattern. These results were also found by Salbach when they concluded that there is no predilection between ectopic eruptions and skeletal patterns (Barberia-Leache *et al.*, 2005; Lin, 1996).

Another group of measurements used, SNA, SNB and ANB, represent the positioning of the maxilla and mandible relative to the skull base, respectively, and ANB represents the relationship between maxilla and mandible and sagittal plane. Since among the etiologic factors of ectopic eruption were the retrusion of the maxilla in relation to the skull base, this verification is rationale (Bondemark & Tsiopa, 2007; Pulver, 1968). In the sample of the present study, this relationship was not verified

because the positioning of the maxilla was adequate in both groups. These results can be interpreted as a tendency for PFMEE to occur more frequently in individuals with a adequate skeletal anteroposterior relationship between maxilla and mandible, which can be supported by the results of the present study (Ambriss, Moukarzel & Noueri, 2019; Frazier-Bowers *et al.*, 2010).

When the group of measurements representing tooth positioning was evaluated, significant differences began to emerge. Individuals in the Control Group presented angular measurements 6mx.Palatal Plane angle and 6mx.Infraorbital Plane angle with mean values much higher than the respective measurements in the Experimental Group subjects. The reduced values found in the experimental group subjects composed of patients with PFMEE represent data that can be used as an aid to diagnosis, since the differences between the groups were statistically significant and also have an important clinical significance.

4. Conclusion

In view of the results obtained, it can be concluded that:

- 1 - the PFMEE does not present a direct relationship with the craniofacial growth pattern;
- 2 - the PFMEE is not directly related to the anteroposterior relationship of the maxilla and mandible;
- 3 - in cases where the PFMEE is present, the mesial angulation is significantly reduced, which may represent lack of space for eruption of the first permanent molars.

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