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Longitudinal changes in the molar relationship from primary to permanent dentition

André Luiz Tannus Dutra[1]; Patrícia Medeiros Berto[2]; Letícia Diniz Santos Vieira[3]; Orlando Ayrton de Toledo[4]

[1] PhD in Health Science – Unb;
[2] General practitioner – Unb;
[3] Postgraduated in Health Science – Faciplac;
[4] Professor of the Department of Dentistry – UnB.

Postal adress
Orlando Ayrton de Toledo
SHIS QI 17, conjunto 15, casa 03
71645-150 Brasília, DF [Brazil]
ayrtontoledo@gmail.com

Abstract

Preschool children (n=721) aged between 4 and 5 years were examined and 60 were selected. Two pairs of dental casts were obtained for each child. The first pair was from primary dentition before eruption of permanent first molars; the second pair had the permanent first molars in occlusion. The sample was divided into 3 groups, according to the terminal plane. The findings indicate that 55% of the group with flush terminal plane developed into Class I, 40% into Class II, and 5% into Class III molar relationship in the permanent dentition. The group with mesial step, 70% progressed to Class I, 25% to Class II, and 5% to Class III molar relationship in the permanent dentition. Finally, the group with distal step developed into Class II in the permanent dentition. It can be concluded that the terminal relationship of deciduous second molars was associated with the permanent first molars occlusion.

Key words: Molar relationship; Occlusion; Primary dentition.

Introduction

The establishment of normal occlusion depends on normal morphogenetic and functional patterns and adequate craniofacial growth and development[1]. Analysis of the occlusion in the primary dentition should consider both the arrangement of deciduous teeth and permanent buds and the occlusal relationship of the anterior and posterior segments of both arches[2]. The recognition of normal occlusion patterns in the primary dentition as well as the identification of morphologic changes during permanent teeth eruption are essential for treatment planning in pediatric dentistry.

Understanding the association between morphologic aspects in the primary dentition and its transition to the permanent dentition provides the possibility of predicting the final permanent occlusion. However, the occlusal pattern does not remain constant during growth period. It presents both beneficial changes and changes that predispose development of a malocclusion[3-5].

It is generally agreed that, at the time of eruption of permanent first molars, the relationship of maxillary and mandibular deciduous second molars constitutes an important factor of occlusal development. However, there is a certain controversy regarding the stability of terminal relationship of deciduous teeth before eruption of permanent molars[3, 6-9].

The anteroposterior relationship of maxillary and mandibular permanent first molars is an important criterion for recognition of malocclusions. This determines the necessity of interceptive orthodontic treatment. The final permanent molar occlusion depends on various factors. Besides the terminal plane relationship, it also includes the mesial shift of mandible with no evident tooth movement and the closure of the present spaces in dental arches. However, it is agreed that the permanent first molars are guided into position by distal surfaces of the deciduous second molars[10-13].

The prevalence of flush terminal plane decreases with age, whereas the mesial step demonstrates a corresponding increase in frequency. Therefore, around six years of age, the mesial step predominates at flush terminal plane, providing a favorable molar relationship in the primary dentition for a direct intercuspation of the erupting permanent molars. As skeletal growth pattern overcomes any dental adjustment mechanisms, a distal step in the primary dentition probably reflects a skeletal imbalance, and typically results in a Class II malocclusion in the permanent dentition[14-18].

According to Ngan and Fields[12], in cases with a flush terminal plane, 56% will develop into a Class I, and 44% into a Class II molar relationship in the permanent dentition. A total of 76% of cases with a mesial step will result in a Class I, 23% in Class II and 1% in Class III molar relationship. Cases with distal step do not self-correct with growth and early orthodontic treatment will be necessary.

This study was based on clinical exams of children aged between 4 and 5 years and study casts analysis. The purpose was to evaluate the deciduous second molars terminal plane in the primary dentition and its association with molar relationship in the permanent dentition.

Material and methods

A total of 721 preschool children aged between 4 and 5 years, 300 males and 421 females, had a triage dental exam. Children were recruited from public schools in the city of Brasilia, Brazil. Their first dental examination was performed by one researcher only. The exam was performed in a well lighted room where the children seated with their occlusal plane perpendicular to the floor. The children occluded in intercuspal position, as instructed. The researcher classified the terminal planes for each side of the arches using disposable wood spatulas. This exam was performed twice to verify the real relation of terminal plane. Only chil-

dren with bilateral symmetrical terminal plane were included in the study.

Sixty children with complete primary dentition prior to permanent first molars eruption were selected for the study. The inclusion criteria were the following:

1. Complete primary dentition
2. Absence of caries or proximal restorations
3. Absence of deleterious habits
4. Absence of open bites or crossbites
5. Absence of excessive overbite or overjet
6. Absence of orthodontic treatment
7. Symmetry of Arches

Once selected, the sample was divided into 3 groups of 20 children each, 10 male and 10 female, based on the terminal plane classification proposed by Baume[8]:

Group 1 – Flush terminal plane – in which the most distal points of maxillary and mandibular deciduous second molars are in the same vertical plane.

Group 2 – Mesial step – in which the most distal point of mandibular deciduous second molar is mesial to the most distal point of maxillary deciduous second molar, with arches in occlusion.

Group 3 – Distal step – in which the most distal point of mandibular deciduous second molar is distal to the most distal point of maxillary deciduous second molar, with arches in occlusion.

The source materials for data collection were plaster dental study casts (HEROSTONE – Rio de Janeiro) made from alginate impressions (ZHERMACK HIDROGUM – Italy) of each child selected. The first impression was accomplished before permanent first molar eruption at the second dental visit. The selected children were then re-examined monthly in their schools until the occlusion of permanent first molars on both sides, at which time the second impression was obtained (children aged between 6 and 8 years).

The deciduous second molars terminal plane in the primary dentition and the permanent first molars relationship were then compared among the same children.

Descriptive statistics were performed for the analyzed variables. Qui-Square tests were used to assess differences between genders in the three groups, and to test the hypothesis of null differences in final first molar relationship among groups. A significance level of 0.01 was used.

The present study was approved by the ethics committee of Universidade de Brasilia, Faculty of Medicine. (Project register number: 003/00).

Results

There was no difference between genders within the three groups.

The classification of permanent first molar relationship in the primary and permanent dentitions from groups 1, 2 and 3 are summarized in Table 1. There was a significant difference in final permanent molar relationship among the three terminal plane groups ($p<0.001$).

Discussion

Although the distal surfaces of deciduous second molars serve as a guide during the permanent first molars eruption, their initial occlusion is not entirely influenced by the terminal plane of the primary dentition[2, 4]. In many situations, the terminal plane is asymmetric, which can be related to differences in either of the arch forms, differences in space distribution between the teeth on both sides of the arches, and the rotation or tipping of molars on one side of the arches[17].

Sucking habits can reduce the maxillary width and influence the deciduous terminal plane. The deleterious effects are dependent on this habit's duration and intensity, however its elimination before 5 years of age improves the terminal plane.[12] A distal step, according to Clinch[16], is present in 55% of children with suck-

Table 1: Terminal plane of deciduous second molars and permanent first molars relationship*

Group	Primary Dentition		Permanent first molars relationship					
	Terminal Plane	N	Class I		Class II		Class III	
			N	%	n	%	n	%
1	Flush	20	11	55	8	40	1	5
2	Mesial	20	14	70	5	25	1	5
3	Distal	20	0	0	20	100	0	0

*p<0.001

ing habit, while 11% exhibit a mesial step and 34% a flush terminal plane.

Since some variables are present, the results interpretation becomes difficult. Thus, this study selected a sample with similar characteristics such as gender, age and bilateral terminal plane classification. As many factors as possible that could worsen the anteroposterior relation of deciduous dental arches were excluded.

Considering the results of group I (Table 1), of the 20 children with a flush terminal plane, 11 (55%) progressed to a Class I, 8 (40%) to Class II and 1 (5%) to Class III relationship in the permanent dentition. Of those children who progressed to Class I, 60% were female and 40% male, and of those in Class II, 80% were female and 20% male. The child with Class III was male. However, no statically significant difference was found for gender. These results are in agreement with the findings of Johannsdottir et al.[19], who reported that the Class I molar relationship during the transition from primary to permanent dentition was prevalent in females, although the difference was not statically significant.

In similar studies, a flush terminal plane on deciduous second molars was found in association with either a Class I or a Class II molar relationship, almost equally distributed with little modification (around 8%) to distal relationship[4, 12, 19-21].

Arya et al.[22] concluded that the occlusal pattern of permanent first molars that initially erupted into cusp-to-cusp relationship tend to change with 70% developing into a Class I molar relationship, while the remainder develop into a Class II relationship in the permanent dentition.

It is important to emphasise that the disagreement between the results of the previous and the current study is due to the different methods used in each one. In the referred studies, the occlusal symmetry in the primary dentition was not an inclusion criterion, and the children's observation period finished before the complete permanent first molars occlusion. With the increasing of age, the terminal plane changes can be due to mesial migration of the permanent mandibular molars. Therefore, the greater the observation period, the greater the probability of changes in occlusal patterns. Another important factor in this investigation is the choice of the occlusal pattern that was considered the definitive result in the permanent dentition. When the analysed characteristics were not symmetric, that is, with different occlusal patterns on each side of the arch, the Class II or the Class III relation was chosen to the detriment of Class I.

In group 2 (Table 1), out of the 20 cases that started with a mesial step in the primary dentition, 14 (70%) proceeded to develop into a Class I molar relationship, 5 (25%) into a Class II e 1 (5%) into a Class III relationship in the permanent dentition. A total of 60% of the children with Class I were female and the remaining 40% were male. In contrast, of those who resulted in a Class II, 40% were female and 60% male, while the child with Class III was male. These gender differences were not statically significant.

Bishara et al.[20] found that in cases with a mesial step of 2 mm or more in the primary dentition, 68% became Class I, 13% Class II and 19% Class III relationship, whereas Ravn[23] verified that 73% of children with a mesial step in the

primary dentition persisted with this relationship in the mixed dentition.

Nevertheless, Johannsdottir et al.[19] stated that a mesial step on deciduous teeth was found in associtation with a Class I (91%), a Class II (1%) or a Class III (8%) relationship. According to Nanda et al.[17], who emphasised that a mesial step is desirable because it would permit a normal occlusion of permanent molars. Barrow and White[24] describe that in the transition from the primary dentition to the permanent dentition the prevalence of normal occlusion relationships decreased to two-thirds of its original value, while the Class II relationships doubled. The conclusion was that the cases classified as normal in the primary dentition demonstrated least change during this transition period. Clinch[16] stated that the flush terminal plane was considered normal for deciduous teeth until permanent first molar eruption. Baume[25] and Nanda et al.[17] reported that the mesial step could also be considered normal.

Group 3 (Table 1) consists of 20 children with a distal step in the primary dentition. All of them (100%) progressed to a Class II molar relationship in the permanent dentition. Like the other groups, there was no statically significant difference between genders. Similar results were found by Nanda et al.[17] who established that the prevalence of Class II had no significant change while the Class I decreased and the Class III increased. In addition, Ravn[23] reported that 76% of children with a distal step on deciduous teeth retained the same occlusal pattern in permanent teeth. On the other hand, Clinch[16] pointed out that a normal occlusion of permanent first molars was achieved in 36% of the sample with a distal step in the primary dentition.

Johannsdottir et al.[19] stated that when the terminal plane ended in a distal step, the molar relationship was almost always Class II, according to Bishara et al.[20] and Carlsen and Meredith[4], who verified that all terminal planes with distal step became a Class II even with an inversion in the sequence of permanent teeth eruption. Varella[26] pointed out that growing children with a Class II relationship already exhibited an unfavourable relationship at the age of 3 years, and the relationship became more distal by the time the permanent first molars erupted. Both in primary and mixed dentitions, this distal occlusion is not self-correcting with growth, and orthodontic treatment needs to be initiated as soon as possible. The features of this malocclusion such as distal molar relationship, Class II canine relationship and excessive overjet are typically the same in the primary and permanent dentitions[12-13, 20].

The results of this study confirm previous findings by Arya et al.[22] on the influence of deciduous second molar terminal relationship in the permanent first molars occlusal pattern. This conclusion is valid only for this study, for this sample and for the observed period.

Moorees[27] related that the distal surfaces of the deciduous second molars generally form one plane resulting in an eruption of the permanent first molars into a cusp-to-cusp relationship that remains during the transitional phase until the deciduous second molars are lost. When a discrepancy between maxillary and mandibular molars occurs with a distal step, a Class II would be established, while a mesial step would develop into a Class III relation[5, 26, 28].

The modifications in terminal relationship of deciduous second molars and in permanent first molar occlusion are an outcome of two mechanisms. The first one is an anterior shift of mandible. The second is a mesial migration of deciduous molars enabled by the spaces present in dental arches functioning as a biologic mechanism that ensures normal occlusal relation. Finally, the greater anterior growth and the greater space in the mandible compared with the maxilla result in a greater mesial position of the mandibular permanent molars[17, 20, 29].

Conclusion

Considering the studied sample, it can be concluded that the terminal relationship of de-

ciduous second molars was associated with the occlusion of the permanent first molars.

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