ABSTRACT

Introduction: Anteroposterior relationships of the deciduous second molars in children with clinically acceptable occlusion were assessed. Methods: The sample comprised 268 children of both sexes, aged 3-6 years, with complete deciduous dentition, attending preschools in São Paulo City. Clinical examinations were performed by one dentist, while the children were occluding in maximal intercuspation, who classified the terminal relationships as: flush, mesial step and distal step. The frequencies of the occlusal patterns were compared according to age, sex and ethnic group, using the chi-square test (p<0.05). Results: Flush was diagnosed in approximately 59% of the children in the three studied age groups (3-4, 5, and 6 years). The prevalence of mesial step ranged from 24.5% to 31.1%, and that of distal step, from 10.2% to 16.3%. There were no significant differences between age groups in the total sample. Analysis of sexual dimorphism demonstrated that, in the age group of 5 years, the prevalence of flush was higher for boys (69%) than girls (49%), p=0.004. However, there was a great frequency of mesial step among girls, compared to boys (34.4% versus 15%), p=0.002. Flush was diagnosed in 66.2% of the black children and 53.7% of the white children (p=0.006). Among white children, mesial step was more frequent (35%) in comparison to the black ones (21.8%), p=0.002. Conclusion: flush is the most prevalent terminal relationship of the deciduous second molars. Nevertheless, it may be observed some differences by sex and ethnic group due to an increase in the frequency of mesial step.

DESCRIPTORS: Dental occlusion – Molar – Dentition, primary

RESUMO

Introdução: Nesta pesquisa foram avaliados os relacionamentos ântero-posteriores dos segundos molares decíduos em crianças com oclusão clinicamente aceitável. Métodos: Foram incluídas na amostra 268 crianças de ambos os sexos, na faixa etária dos 3 aos 6 anos, com dentição decidua completa, matriculadas em pré-escolas da cidade de São Paulo. Um cirurgião-dentista realizou os exames clínicos nas crianças em máxima intercuspidação habitual e classificou as relações em: plano terminal reto, degrau mesial e degrau distal. As frequências das características observadas foram comparadas, segundo idade, sexo e grupo étnico, pelo teste Qui-Quadrado (p<0,05). Resultados: O plano terminal reto foi observado em aproximadamente 59% das crianças nos três grupos etários estudados (3-4, 5 e 6 anos). A prevalência do degrau mesial variou de 24,5% a 31,1%, e do degrau distal, de 10,2% a 16,3%. Não houve diferenças significativas entre grupos etários, na amostra total. A análise do dimorfismo sexual demonstrou que, na idade de 5 anos, a prevalência de plano terminal reto foi mais elevada em meninos (69%) do que em meninas (49%), p=0,004. Contudo, as meninas apresentaram alta frequência de degrau mesial em comparação aos meninos (34,4% versus 15%), p=0,002. O plano terminal reto ocorreu em 66,2% dos melanodermas e 53,7% dos leucodermas (p=0,006). Para leucodermas, o degrau mesial foi mais frequente (35%) em relação aos melanodermas (21,8%), p=0,002. Conclusão: A relação dos segundos molares deciduos em plano terminal reto é a mais prevalente. Entretanto, pode haver diferenças quanto ao sexo e grupo étnico por aumento na frequência de degrau mesial.

DESCRITORES: Oclusão dentária – Molar – Dentição decidua
INTRODUCTION

Knowledge about the variations in terminal relationships of the deciduous second molars and their influence on the occlusal pattern of permanent dentition is important for prevention and interception of malocclusions (Baume\(^4\), 1950; Dutra and Toledo\(^\text{5}\), 2004; Ferreira et al.\(^1\), 2001; Santos\(^1\), 2005).

In a study using pairs of plaster models of the dental arches from 27 children, aged 4 to 6 years (15 boys and 12 girls), Barbosa, Di Nicoló and Ursi\(^1\) (2000) found that mesial step (61.2\%) was the most prevalent terminal relationship, followed by flush (29.6\%) and distal step (9.2\%). There was no sexual dimorphism. On the other hand, Gimenez, Siqueira and Negreiros\(^1\) (2000), by assessing 50 children aged 3 to 5 years, of both sexes, found that 18\% presented distal step; 24\%, mesial step and 12\%, flush. The authors emphasized that the deciduous dentition should be followed-up during the period of transition to the permanent dentition, with the goal of properly conducting interceptive Orthodontics in the early treatment of Angle's Class II and III malocclusions.

Carvalho and Valença\(^3\) (2004) assessed the normal occlusal features of the deciduous dentition in children aged 2 to 6 years, attending public day-care centers in João Pessoa – PB, Brazil. The sample consisted of 223 children (55.6\% were boys and 44.4\% were girls). Regarding the terminal relationships of the deciduous second molars in children with symmetry, 46.4\% presented flush; 41.6\%, mesial step and 12\%, distal step. Flush was the most frequent terminal relationship according to the age groups, from 2 to 4 years and from 4 to 6 years, in symmetric children. The authors concluded that flush was the most prevalent terminal relationship, followed by mesial and distal steps. Furthermore, the type of terminal relationship of the deciduous second molars was not associated with the children's sex or age.

In a study conducted by Sadakyio et al.\(^2\) (2004), who examined 263 children aged 3 to 6 years, from 12 schools run by the municipality in Piracicaba – SP, Brazil, it was observed that 71.6\% of the sample presented malocclusion. Notably, bilateral distal step (n=178) was more prevalent in comparison to flush (n=43).

Anderson\(^2\) (2006) carried out an investigation to compare the anteroposterior relationships of deciduous second molars in plaster models of Afro-American and European children. The sample comprised 189 Afro-American children (103 boys and 86 girls), from a day-care center in the city of Washington (USA), as well as 61 European children (39 boys and 22 girls). The children's ages ranged from 2 to 5 years for Europeans, and from 3 to 6 years for Afro-Americans. Mesial step was the most prevalent relationship in the two studied populations, corresponding to the percentages of 89\% in Afro-Americans and 63\% in Europeans. Distal step, however, was the least frequent relationship: 5\% in Afro-Americans (5\% for boys and 7\% for girls) and 16\% in Europeans (14\% for boys and 20\% for girls). In both sample populations, the terminal relationships of the deciduous second molars presented the decreasing order of prevalence: mesial step, flush and distal step.

In a sample of 205 Turkish children aged 3 to 6 years (115 boys and 90 girls), Yilmaz et al.\(^3\) (2006) diagnosed flush in 88\% of the subjects. The frequencies of distal and mesial steps corresponded to 7\% and 4\%, respectively. No mesial step was observed in 3 and 4-year-old children.

Considering the variety of information relative to the prevalence of terminal relationships of the deciduous second molars, the present cross-sectional study aimed at evaluating these anteroposterior occlusal features in a sample of preschool children from the eastern region of São Paulo City, Brazil. In addition, the frequencies of terminal relationships of the deciduous second molars were compared according to age, sex and ethnicity.

METHODS

This cross-sectional study is in agreement with Resolution 196/96 from the National Health Council/Health Department (Brazil).

In order to conduct the research, 561 presumably healthy children aged 3 to 6 years, of both sexes, were initially examined. All children were regularly enrolled at three public preschools run by the municipality in the eastern region of São Paulo City, Brazil. Information on the children's name, sex and date of birth was collected from questionnaires filled out by their parents/guardians.

After obtaining parents/guardians' authorization by means of a signed informed consent form, clinical examinations of the occlusal relationships were performed. Visual inspection of occlusion was accomplished in the school environment, with the child comfortably seated, facing a suitable source of abundant artificial lighting...
and occluding in maximal intercuspation. The clinical examinations were performed by one previously calibrated dentist (κ: 0.87-1.00), who wore disposable masks and gloves. Data relative to the diagnosis of the anteroposterior relationships of the deciduous second molars were registered on clinical forms specially prepared for this investigation.

During the assessment of the relationships between the distal surfaces of the deciduous second molars, the oral soft-tissues were maintained apart from the teeth by disposable wooden swabs. To classify these relationships, the criteria proposed by Baume (1950) were applied:

1. **Flush**: the distal surfaces of the maxillary and mandibular deciduous second molars coincided in the same vertical plane. The terminal plane of the arches was found to be straight;
2. **Mesial step**: the distal surface of the mandibular deciduous second molar was positioned mesially to the distal surface of the maxillary deciduous second molar;
3. **Distal step**: the distal surface of the mandibular deciduous second molar was positioned distally to the maxillary one.

The study sample consisted of 268 children (138 girls and 130 boys), selected using the criteria established on the basis of information obtained by the questionnaires and clinical examinations. Therefore, to select the study subjects, the following inclusion criteria were considered:

1. No history of traumatisms, deficiencies, syndromes or orofacial clefts;
2. No history of previous orthodontic and/or phonoaudiological treatments;
3. Clinically acceptable occlusion, without anterior open bite, anterior and/or posterior crossbites;
4. Complete deciduous dentition, without permanent teeth erupted or in the eruption process;
5. All deciduous teeth, without approximal restorations, cavitated carious lesions or loss of coronal structure that could result in decreased arch length, in order to avoid the influence of this factor on the development of occlusion;

The collected data were submitted to descriptive statistics, with distribution of the frequencies relative to the characteristics of the anteroposterior relationship of the deciduous second molars in the total sample, as well as by age group (3-4 years, 5 years and 6 years) and ethnic group (white and black children). Tables 1 and 2 present the sample distribution according to the age and ethnic groups.

The 3-year-old children were included in the same group as the 4-year-olds, as they constituted the less populous subgroup. Hence, the age groups became more homogeneously distributed.

The studied ethnic groups were established considering the skin color classification of the children by the examiner. It should be explained that, for assessing the occlusal characteristics according to ethnicity, only white and black children were selected, since they constituted the greater groups of subjects under study (Table 2).

The frequencies of the occlusal patterns were compared according to age, sex and ethnic group, using the chi-square test. The level of significance was set at 5%.

**RESULTS**

Flush was very frequently diagnosed, occurring in approximately 59% of the children,

in the three studied age groups. On the other hand, a decreased prevalence of distal step was found in this sample, with frequencies varying from 10.2% to 16.3% (Figure 1).

According to the graphs shown in Figures 2 and 3, and the comparisons presented in Table 3, for the 5-year-old age group, the prevalence of flush was significantly higher among boys (69% versus 49%, p=0.004). However, it was observed that girls had a greater frequency of mesial step in comparison to boys (34.4% versus 15%, p=0.002). Sexual dimorphism was demonstrated for the two abovementioned types of

Table 1 – Sample distribution by age range

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Girls</th>
<th>Boys</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>3-4 years</td>
<td>48</td>
<td>34.78</td>
<td>40</td>
</tr>
<tr>
<td>5 years</td>
<td>48</td>
<td>34.78</td>
<td>50</td>
</tr>
<tr>
<td>6 years</td>
<td>42</td>
<td>30.43</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>138</td>
<td>100</td>
<td>130</td>
</tr>
</tbody>
</table>

Table 2 – Sample characterization according to skin color

<table>
<thead>
<tr>
<th>Skin color</th>
<th>Girls</th>
<th>%</th>
<th>Boys</th>
<th>%</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>5</td>
<td>3.62</td>
<td>6</td>
<td>4.62</td>
<td>11</td>
</tr>
<tr>
<td>White</td>
<td>60</td>
<td>43.48</td>
<td>63</td>
<td>48.46</td>
<td>123</td>
</tr>
<tr>
<td>Black</td>
<td>62</td>
<td>44.93</td>
<td>46</td>
<td>35.38</td>
<td>108</td>
</tr>
<tr>
<td>Brown (Mullato/Caboclo)</td>
<td>11</td>
<td>7.97</td>
<td>15</td>
<td>11.54</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>138</td>
<td>100</td>
<td>130</td>
<td>100</td>
<td>268</td>
</tr>
</tbody>
</table>

Table 3 – Analysis of sexual dimorphism

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Terminal relationships of the deciduous second molars</th>
<th>Girls versus Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flush</td>
<td>p</td>
</tr>
<tr>
<td>3-4 years</td>
<td>3.6079</td>
<td>0.058</td>
</tr>
<tr>
<td>5 years</td>
<td>8.1442</td>
<td>0.004</td>
</tr>
<tr>
<td>6 years</td>
<td>0.2861</td>
<td>0.593</td>
</tr>
</tbody>
</table>

Figure 2 – Frequency of terminal relationships of the deciduous second molars in girls, by age group

Figure 3 – Frequency of terminal relationships of the deciduous second molars in boys, by age group
terminal relationship of the deciduous second molars.

Regarding the comparisons by ethnic group (Figure 4), flush occurred in 66.2% of the black children and 53.7% of the white ones, p=0.006. The mesial step was more frequent in white children (35%), compared to black children (21.8%), p=0.002.

DISCUSSION

The assessment of the relationship between the distal surfaces of the deciduous second molars is relevant, because this would be one of the parameters during the establishment of the permanent first molars occlusion (Baume4, 1950; Di Nicolò et al8, 2001; Prado et al13, 1983; Sadakyio et al14, 2004; Santos15, 2005; Shimizu et al16, 2003; van der Linden17, 1986). Di Nicolò et al8 (2001) mentioned that the terminal relationship of the deciduous second molars seems to be the first factor that can substantially determine or influence the future relationship between the permanent first molars, in the subsequent stages of occlusion development.

The terminal relationship of the deciduous second molars characterized as flush was diagnosed in approximately 59% of the children, in the three studied age groups (Figure 1). In a comparative evaluation with other studies (Carvalho and Valença5, 2004; Costa et al6, 1999; Di Nicolò et al8, 2001; Gimenez, Siqueira and Negreiros11, 2000; Santos15, 2005; Shimizu et al16, 2003; Yilmaz et al18, 2006), it can be observed that flush was the most prevalent relationship, corroborating the findings of this research. Interestingly, in dental arches that maintain this kind of anteroposterior relationship, the permanent first molars would present a cuspto-cusp occlusion right after the eruption, and later, attain stability in Class I occlusion (van der Linden17, 1986).

Based on the percentage values relative to the prevalence of the three types of terminal relationship between the deciduous second molars, it was found that there were no remarkable alterations among the age groups (Figure 1). Carvalho and Valença5 (2004) explained that the type of terminal relationship of the deciduous second molars is not related to the children’s age. However, the frequency of mesial step in children aged 3-4 years was higher in comparison to the value obtained for the 5-year-old age group (31.1% versus 24.5%), though

Figure 4 – Prevalence of terminal relationships of the deciduous second molars in white and black childrens
not statistically significant. In the latter age group, a higher prevalence of distal step (16.3%) was observed.

Humphreys and Leighton (1950) reported that pacifier use was associated with the establishment of abnormal occlusion, classified as distal step. The authors attributed this occlusal abnormality to a more intense anteroposterior load in pacifier users. Prado et al. (1983) and Adair et al. (1995) also suggested that prolonged non-nutritive sucking habits were associated with the development of distal step. Special attention should be given to this information, since the distal step is considered a malocclusion in the deciduous dentition, and generally determines the Class II relationship between the permanent first molars.

Although some authors (Barbosa, Di Nicoló and Ursi, 2000; Carvalho and Valença, 2004; Ferreira et al., 2001) have mentioned that sexual dimorphism for the terminal relationships of the deciduous second molars is not significant, differences between sexes were demonstrated in this sample (Figures 2 and 3, Table 3). In the 5-year-old age group, female children had a twofold higher frequency of mesial step than boys.

The results of the present study also demonstrated statistically significant differences between ethnic groups. The mesial step was more prevalent in white children. On the other hand, flush was more frequently diagnosed in black children. Few studies have investigated the ethnic differences for the terminal relationships of deciduous second molars. Anderson (2006) found that mesial step was the most prevalent type of terminal relationship between the deciduous second molars, both in Afro-American and European children. Nevertheless, European children presented distal step more frequently in comparison to Afro-Americans (16% versus 5%).

Theoretically, the two most favorable types of terminal relationship of the deciduous second molars would be flush and mesial step (van der Linden, 1986). According to the study by Di Nicoló et al. (2001), the majority of the relationships diagnosed as flush (75%) and mesial step (82%) developed into Class I relationship of the permanent first molars, after eruption of the permanent second molars. However, it should be highlighted that other factors may influence the occlusion of the permanent first molars, such as the presence or absence of diastemas in the deciduous dentition, size discrepancies between the deciduous and permanent teeth, and early loss of the deciduous first molars (Cuoghi et al., 1998; Di Nicoló et al., 2001).

CONCLUSION

It may be concluded that flush is the most prevalent terminal relationship of the deciduous second molars in children having clinically acceptable occlusion. Nevertheless, it was possible to observe some differences according to sex and ethnic group due to an increase in the frequency of mesial step.
REFERENCES


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