Risk factors associated with atypical root resorption of the maxillary primary central incisors

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Abstract

Maxillary occlusal radiographs of 233 children between 42 and 60 months old were examined for the presence or absence of atypical root resorption (ARR). In addition, the dental records of these children were examined to determine if an association existed between ARR, oral habits, documented trauma and overjet. Thirty-three (14.2%) of the patients had radiographic evidence of ARR of either maxillary primary incisor. Children with a positive history of both trauma to the incisors and oral habits had a statistically higher prevalence of ARR than those without either finding (P = .03). ARR was more prevalent as overjet increased, independent of trauma, and oral habits (P = .03). Furthermore, as the number of risk factors (large overjet, documented trauma, and oral habits) increased, the likelihood of developing ARR also increased (P = .03). (Pediatr Dent 13:273–77, 1991)

Introduction

Atypical root resorption (ARR) of the maxillary primary incisors is characterized by superficial root resorption along the lateral and/or apical aspects of the roots of these teeth. Proposed etiologic factors include trauma (mechanical or chemical), caries, pulpal necrosis, orthodontic movement, tumors, and traumatic occlusion (Pindborg 1970; Herd 1971; McDonald and Avery 1983).

In 1983, Taylor and Peterson reported on atypical root resorption of the maxillary primary incisors and distinguished it from normal root resorption because of a distinct peripheral circumferential resorptive pattern. They also reported that digit sucking appears to contribute to the development of atypical resorption of the maxillary primary central incisors. Rubel (1986) confirmed this finding, and, in addition, identified and categorized various patterns of atypical root resorption (Fig 1).

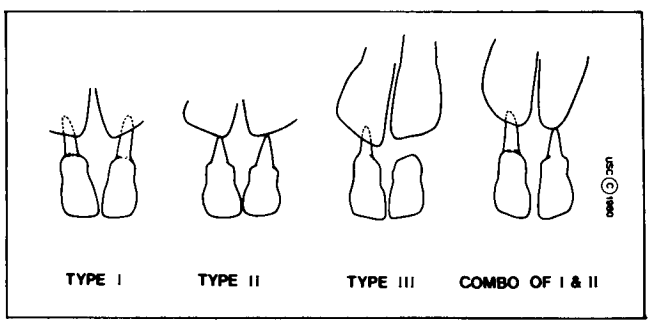

Fig 1. Types of Atypical Root Resorption as described by Rubel 1986
Type I — circumferential without loss of total root length
Type II — conically shaped apical reduction ("ice cream cone")
Type III — rounded or capped reduction of apical half of root(s)
Type IV — combination of Types I and II.

It is unclear from these studies whether digit sucking is directly responsible for root resorption, or whether other variables are involved. Oral habits may contribute indirectly to resorption by increasing the protrusion of the maxillary incisors (Andrews 1961; deRudder 1961; Popovich and Thompson 1973; Ripa and Barenie 1975; Gellin 1978), thus rendering them more prone to trauma (McEwen 1967; Gutz 1971, O'Mullane 1973; García-Godoy et al. 1982; Dearing 1984). Taylor and Peterson (1983) and Rubel (1986) specifically eliminated subjects who had a history of trauma to the involved teeth from their studies, but their samples may have contained patients whose incisors had been traumatized without parental knowledge.

Possible causes of ARR of the maxillary primary central incisors in patients with digit sucking, and in the absence of pulpal pathosis, may include excessive, constant orthodontic forces due to the oral habit, trauma, or a combination of both.

The purpose of this study was to investigate the influence of oral habits, trauma and overjet on the development of atypical root resorption of maxillary primary central incisors in a sample of healthy children.

Materials and Methods

The sample consisted of 335 children, 42 to 60 months old, from a private pediatric dental practice for whom a maxillary anterior occlusal radiograph had been exposed at the initial screening. Forty-two months was chosen as the lower age limit for selection, since only a small percentage of children younger than 42 months had satisfactory diagnostic information. All subjects' records contained a complete medical/dental history, an occlusal examination, and a satisfactory maxillary anterior occlusal radiograph using the bisecting angle

technique. Only maxillary primary central incisors with clearly visible apices on radiographs were included. Maxillary primary central incisors that had radiographic evidence of caries, restorations, calcific degeneration, or pulpal pathosis/therapy were eliminated from the study. Two examiners evaluated the maxillary anterior occlusal radiographs for the presence or absence of ARR. Reliability of the rating assessment of ARR was previously performed by both authors to insure accurate and consistent ratings. Root resorption was considered ARR if it appeared as one of the three types described by Rubel (1986, Fig 1).

Age, gender, history of trauma, overjet (OJ, as measured in millimeters from the facial surface of the maxillary anterior tooth to the facial surface of the mandibular anterior tooth), and history of any oral habit were recorded. All patients were included in the sample regardless of the anterior occlusion. Trauma was defined as an injury to the primary maxillary central incisor as documented by parental history, documented on the chart by the dentist of record, or evidenced by internal discoloration.

Eleven additional children (nine males, two females) 42 to 60 months old who were identified with atypical root resorption in the same pediatric dental practice, were included in the analysis that examined risk factors, but were not included in calculating the prevalence of ARR. These additional children with ARR were included to increase the sample numbers for statistical analysis of the risk factors. The relationship between oral habits, overjet, history of trauma, and ARR were examined using Chi-square tests and Chi-square tests for trend.

Results

The records of 233 of the 335 children, 42 to 60 months old contained adequate diagnostic information to be used. Females accounted for 55.4% (129/233) of the sample and males 44.6% (104/233). Only 14.2% (33/233) of the patients had radiographic evidence of ARR of either maxillary primary incisor. ARR was present in 12.5% (13/104) of the males and 15.5% (20/129) of the females, however this difference was not statistically significant ($P \leq .05$).

Table 1 presents the prevalence of oral habits and types of documented trauma sustained by the maxillary primary incisors in the sample. At least one oral habit (i.e. finger, thumb, pacifier, or other) was found in 37.3% (87/233) of the children. The most common type of oral habit was thumbsucking, accounting for 58.6% (51/87) of the habits followed by pacifier, 31.0% (27/87); finger, 8.0% (7/87); and other types, 2.2% (2/87). Documented trauma to the primary maxillary central incisors occurred in 15.4% (36/233) of the patients.

Table 1. Prevalence of oral habits and types of trauma to maxillary primary incisors for 233 children

	Frequency	*Per cent*
Habit		
Thumb	51	21.9
Pacifier	27	11.6
Finger	7	3.0
Other	2	0.9
None	146	62.7
Trauma		
Fracture	14	6.0
Intrusion	2	0.9
Luxation	1	0.4
Subluxation	7	3.0
Trauma, not otherwise specified	12	5.1
None	197	84.5

Fractures were the single most common type of documented trauma, accounting for 38.9% (14/36) of the documented trauma and occurring in 6.0% (14/233) of all patients reviewed.

Of the patients with habits, 22.3% (21/94) exhibited ARR, compared with 15.3% (23/150) of the nonhabit group. However, this difference was not statistically significant ($P = 0.17$). Table 2 illustrates the breakdown of types of habits and their relationship to ARR. Of those patients with oral habits, pacifiers were associated with the highest prevalence of ARR, 25.0% (7/28), followed by thumb habits, 22.8% (13/57) and finger habits, 14/3% (1/7). Insufficient numbers of subjects

Table 2. Prevalence of atypical root resorption in 244 children as a function of oral habits

Habit	*Resorption* *Yes*	*No*	*Total*
Thumb	13 5.3%	44 18.0%	57 23.3%
Pacifier	7 2.9%	21 8.6%	28 11.4%
Finger	1 0.4%	6 2.5%	7 2.9%
Other	0 0.0%	2 0.8%	2 0.8%
None	23 9.4%	127 52.1%	150 61.5%
Total	44 18.0%	200 82.0%	244 100%

Table 3. Prevalence of atypical root resorption in 244 children as a function of documented trauma

Trauma	Resorption Yes	No	Total
Fracture	1 0.4%	13 5.3%	14 5.7%
Intrusion	0 0.0%	2 0.8%	2 0.8%
Luxation	1 0.4%	0 0.0%	1 0.4%
Subluxation	1 0.4%	6 2.5%	7 2.9%
Trauma, not otherwise specified	6 2.5%	9 3.7%	15 6.1%
None	35 14.3%	170 69.7%	205 84.0%
Total	44 18.0%	200 82.0%	244 100%

within each category precluded statistical analysis to determine any significant differences in the prevalence rates of ARR between the different types of habits.

Of the patients with history of trauma, 23.4% (9/39) exhibited ARR, compared with 17.1% (35/205) of those without such a history. This difference was not statistically significant ($P = 0.37$). When trauma was categorized by type (Table 3), the number of subjects in each category was not large enough to allow for statistical analysis.

Table 4 presents an analysis of the relationship between trauma and ARR with and without the presence of oral habits. This trivariate analysis indicates that children with documented trauma had a statistically significant ($P = .03$) higher prevalence of ARR when oral habits also were present, 40.0% (8/20), compared to those patients without oral habits, 5.3% (1/19). When no trauma had occurred, the prevalence of ARR was similar between the nonhabit group, 16.8% (22/131); and the habit group 17.6% (13/74).

Table 4. Prevalence of atypical root resorption in 244 children as a function of oral habits and/or documented trauma

Trauma	Resorption Yes	No	Total
No trauma or habit	22 9.0%	109 44.7%	131 53.7%
Only trauma	1 0.4%	18 7.4%	19 7.8%
Only habit	13 5.3%	61 25.0%	74 30.3%
Trauma and habit	8 3.3%	12 4.9%	20 8.2%
Total	44 18.0%	200 82.0%	244 100%

Of the children with oral habits and a large OJ (defined as greater than 5 mm), 26.5% (13/49) exhibited ARR compared with 17.8% (8/45) of those with a smaller OJ. Similarly, in the absence of a habit, 33.3% (3/9) patients with a large OJ demonstrated ARR, compared with 14.2% (20/141) of those with a smaller OJ. These differences were not statistically significant ($P = 0.16$).

Of the children with documented trauma and a large OJ, 37.5% (6/16) exhibited ARR, compared with 13.0% (3/23) of those with a smaller OJ. Similarly, in the absence of documented trauma, 23.8% (10/42) of the patients with a large OJ demonstrated ARR compared with 15.3% (25/163) of those with a smaller OJ. These differences were not statistically significant ($P = 0.10$).

Of the 58 patients with a large OJ, 27.6% (16/58) exhibited ARR compared with only 15.1% (28/186) of those patients with a small OJ. This difference was statistically significant ($P = 0.03$). Fig 2 (see next page) illustrates the effect that various magnitudes of OJ have on the prevalence of ARR, irrespective of trauma and/or habit. Only 241 patients were used in this analysis, since the OJ measurements were unavailable for three records. The bivariate analysis of this trend also indicates with statistical significance ($P = 0.03$) that as OJ increased from < 1 mm to 5 mm, the chance of having ARR increased from 0% (0/6) with < 1 mm OJ to 41.7% (10/24) with an OJ > 5 mm. Only 19.4% (6/31) of patients with an OJ > 5 mm, however, demonstrated ARR. This finding reduced the overall significance of the relationship between OJ and ARR ($P = 0.06$).

Three risk factors (large OJ, oral habits, and documented trauma) were added to create a new variable that represents the number of risk factors for developing ARR. Fig 3 (see next page) illustrates the relationship between the number of risk factors and the development of ARR. As the number of risk factors increased, the percentage of ARR observed also increases. If no risk variables were present, ARR occurred in 15.5% of the children. However, if all three were present, the occurrence of ARR was 40.0%. A Chi-square test for trend indicated that this finding is significant ($P = 0.03$). The relative risk of developing ARR when all three risk factors are present is 3.4, 95% confidence intervals (0.98–11.38).

Discussion

ARR of the maxillary primary central incisors is a common radiographic finding in the pediatric dental

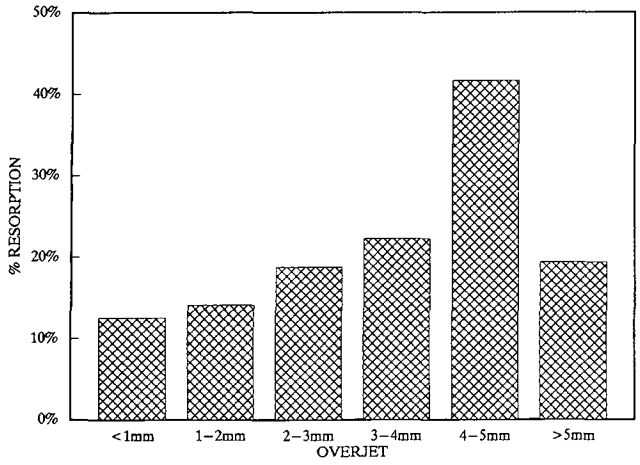

Fig 2. Prevalence of atypical root resorption as a function of overjet.

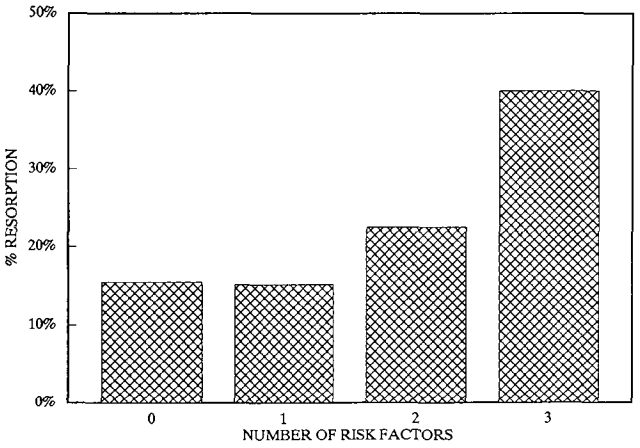

Fig 3. Prevalence of atypical root resorption as a function of risk factors (risk factors: overjet > 5 mm; presence of oral habit; documented trauma).

population. Two recently published studies associated digit habits with the development of ARR (Taylor and Peterson 1983; Rubel 1986). This study attempted to determine if oral habits and/or trauma are related to the development of ARR using a more comprehensive study design and statistical analysis.

The prevalence of ARR in the population studied was 14.2%. This is approximately half the prevalence rate of 29.8% reported by Taylor and Peterson (1983). (It is important to note that they defined ARR as "indenting along the lateral aspect of the root.") The present study identified ARR according to criteria set forth by Rubel (1986) which are more specific; this probably accounts for our lower prevalence rate. Rubel (1986) presented no prevalence data for ARR. The prevalence of 14.2% for ARR in our study is based on a sample of 42 to 60-month-old children from a private practice of high-level socioeconomic families. These children were evaluated at initial "routine" examinations; however, their families may have been more likely to seek professional care for the child because of factors such as large overjet, history of trauma, or prolonged oral habits. Therefore, extrapolation of the 14.2% prevalence rate must be done with caution.

The prevalence of habits in the population studies was 37.3%, which is consistent with data from previous studies (Gellin 1978; Popovich and Thompson 1973). The prevalence of documented trauma in the population studies was 15.5%, which also falls within the range of 4–30% as reported in similar studies (Andreasen and Ravn 1972; Andreasen 1981). The prevalence of documented trauma in our study was based only on a positive history and signs of trauma to the incisors. The number of patients who actually sustained trauma in this study is probably larger, since children frequently sustain minor injuries to the maxillary primary incisors which may not be diagnosed, treated, or reported.

The role of documented trauma and oral habits in the etiology of ARR was investigated. The bivariant analyses show that there is no statistically significant association between oral habits or documented trauma when each is analyzed individually relative to the development of ARR. There are, however trends indicating an increase in the prevalence of ARR when either an oral habit or documented trauma is present. A larger sample size may have resulted in these trends becoming statistically significant.

The trivariant analysis that separates the variables of habit and trauma also failed to reveal a statistically significant association between oral habits alone, and documented trauma alone relative to the development of ARR. Another trivariant analysis, however, indicates that ARR occurs more frequently with statistical significance when both habit and trauma are present in the same individual in comparison with the children who have neither oral habits nor documented trauma.

Overjet of the maxillary primary central incisors was analyzed as an additional variable relative to the development of ARR. Both bi- and trivariant analyses indicate with statistical significance that as OJ increases, the prevalence of ARR increases irrespective of the presence or absence of oral habits or documented trauma. A large OJ cannot independently cause ARR, but may put children at higher risk for developing ARR, either because they are more often traumatized, or because the large OJ is the result of a previous or ongoing oral habit.

When OJ, oral habits, and documented trauma were considered as separate risk factors for ARR, both bivariant analysis and Chi-square test for trend indicate with statistical significance that as the number of these risk factors increased, the risk of developing ARR increased. When all three risk variables were present, a

child is 3.4 times more likely to develop ARR than a child without any of these risk factor variables.

Some of the difficulties encountered in this study were those inherent in any retrospective analysis. This current study depended upon parents' recall and reporting of their children's oral habits and history of trauma. In addition, neither the nature of the oral habits (i.e., duration, intensity, frequency), nor the severity of trauma was able to be documented and analyzed.

This study was unable to statistically associate trauma or oral habits individually with development of ARR. When both these factors were present, however, ARR was more likely to occur. OJ was identified as a significant risk factor for the development of ARR. Independent of habits and trauma, it was noted that as the amount of OJ increased, the prevalence of ARR increased significantly.

Conclusions

1. The prevalence of ARR in 233 healthy children from a private practice between the ages of 42 and 60 months was 14.2%.
2. Although trends were identified, there was no statistically significant association for either documented trauma or oral habits when analyzed individually with the development of ARR.
3. Patients with a history of both documented trauma and an oral habit had a significantly higher prevalence of ARR (40.0%) than those without both these variables (15.5%).
4. ARR was more prevalent as OJ increased, independent of trauma and oral habits.
5. ARR was more likely to develop as the number of risk factors (large overjet, documented trauma, oral habit) increased.

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