

Alveolar bone height in infraoccluded primary teeth

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The purpose of this research is to describe the distance from the cemento enamel junction (CEJ) to the alveolar bone crest (ABC) of infra occluded primary molars and the adjacent and opposing teeth. Bitewing radiographs from 29 children (mean age 98.8 months; SD 21.2), who had infra occluded molars, were scanned and measured. The results of these measurements found that the means of the CEJ-ABC distances of the mesial and distal aspects of the infra occluded teeth were 0.78 mm (SD 0.3) and 0.94 mm (SD 0.32) respectively. Pearson correlation coefficient analysis revealed no significant correlation between the different measurements, except when comparing the measurements in the infra occluded tooth and those of the opposing tooth. It was concluded that the CEJ-ABC values for infra occluded primary molars are shorter than normal values. The CEJ-ABC distances of the opposing and adjacent teeth to the infra occluded tooth are within normal limits.

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INTRODUCTION

An infraoccluded tooth is a condition frequently found in primary teeth, with a prevalence ranging from 1.3% to 8.9%.¹ The etiology of this condition is commonly attributed to ankylosis or fusion of the roots of the infraoccluded tooth to the supporting bone, thus preventing the affected tooth from further eruption. Consequently, the involved tooth fails to maintain a proper relative position to the adjacent teeth and assumes an inferior position appearing to be infra occluded; the terms of ankylosed or submerged are also used to describe this situation. Other possible etiologies include: disturbed local metabolism, gaps in the periodontal membrane, local mechanical trauma, localized infection, chem-

ical or thermal irritation, local failure of bone growth, and abnormal pressure from the tongue.¹ Previous studies indicate that there is no variation in growth activity of the alveolar crest structures of infra-occluded teeth as compared to control teeth.^{2,3} These findings suggest that ankylosis is a local disturbance, and that the cause is related to the dental or periodontal tissues rather than in the bone.

It is clear in the literature that children are not immune to periodontal diseases in the primary teeth, that the first primary molar is most prone to bone loss, and that the early diagnosis of these diseases is crucial for the success of the treatment and the prognosis.^{4,12} Moreover, children with early signs of alveolar bone loss should be considered as periodontitis-risk patients and should be included in a preventive program as early as possible.^{8,13}

One of the parameters that are utilized for the early diagnosis of periodontal diseases is the distance from the cemento enamel junction (CEJ) to the alveolar bone crest (ABC).^{14,15} However, the clinician must take in consideration that this distance may increase as the result of eruption related to attrition and facial growth.¹⁶ Infra occluded primary teeth are no longer in eruption, and therefore, not subjected to eruption changes related to facial growth and attrition. For this reason, one could expect that in infra occluded teeth, the CEJ-ABC distance would be smaller than normal. In addition, it may be possible that the CEJ-ABC distances of the opposing teeth, if over erupted, would be larger than normal. Therefore, the purpose of this study was to describe the CEJ-ABC distances of infra occluded teeth and the adjacent and opposing teeth. These values may provide information on the effect of ankylosis on the alveolar bone height in primary molars, and allow the clinician to take them into consideration, while diagnosing periodontal diseases in primary teeth.

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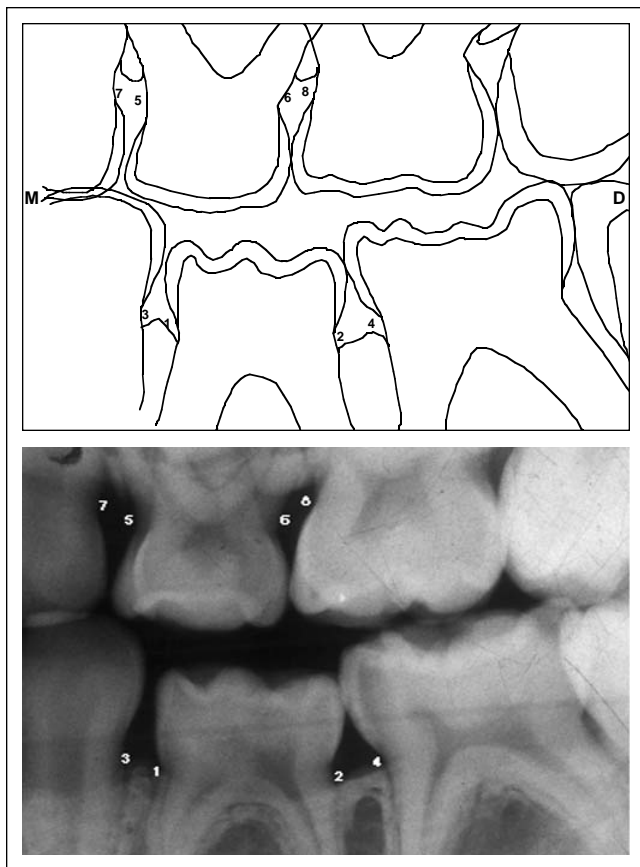


Figure 1. Bitewing radiograph

1. Mesial surface of the infraoccluded tooth.
 2. Distal surface of the infraoccluded tooth.
 3. Mesial surface of the tooth located distal to the infraoccluded tooth.
 4. Distal surface of the tooth located mesial to the infraoccluded tooth.
 5. Mesial surface of the antagonist tooth.
 6. Distal surface of the antagonist tooth.
 7. Mesial surface of the tooth located distal to the antagonist tooth.
 8. Distal surface of the tooth located mesial to the antagonist tooth.
- In addition, the gender and age of the patient were recorded.

MATERIALS AND METHODS

Infra occluded teeth were clinically identified when the tooth was >1mm below occlusal plane, had no normal mobility, and had a characteristic metallic sound during percussion indicative of the presence of ankylosis. Diagnostic bitewing radiographs that were taken as part of the routine examination of the child, in which the infra occluded teeth were present, were selected for the present study based on the following criteria:

- a) Minimal evidence of distortion;
- b) Minimal overlapping between the proximal surfaces;
- c) Clear image of the CEJ;
- d) No evidence of periodontal pathosis, as determined by the presence of an intact lamina dura at the interdental crest.

Table 1. Measurements of the CEJ-ABC distances of infraoccluded first and second primary molars and their adjacent and opposing teeth.

Tooth (n=29)	Mean (mm)	SD
Infraoccluded tooth mesial	0.78	0.30
Infraoccluded tooth distal	0.94	0.32
Adjacent tooth mesial	1.11	0.35
Adjacent tooth distal	1.74	0.62
Opposing tooth mesial	1.62	0.39
Opposing tooth distal	1.55	0.42
Opposing adjacent mesial	1.05	0.47
Opposing adjacent distal	1.52	0.55

The selected radiographs were scanned into a computer by a HP-S20 Photosmart scanner (Hewlett Packard, Singapore) in 1200 DPI resolution, including the margins of the radiographs (size no. 1 for pediatric patients). Distances from the CEJ to the ABC were measured in pixels utilizing Microsoft Photo Editor software®. The amount of pixels was transformed to millimeters by calculating the relative amount of pixels and size of the whole radiograph. The CEJ-ABC distances of the primary teeth were measured at (Figure 1):

Bitewing radiograph

1. Mesial surface of the infraoccluded tooth.
2. Distal surface of the infraoccluded tooth.
3. Mesial surface of the tooth located distal to the infraoccluded tooth.
4. Distal surface of the tooth located mesial to the infraoccluded tooth.
5. Mesial surface of the antagonist tooth.
6. Distal surface of the antagonist tooth.
7. Mesial surface of the tooth located distal to the antagonist tooth
8. Distal surface of the tooth located mesial to the antagonist tooth. In addition, the gender and age of the patient were recorded.

Data Analysis

The statistical analysis utilized a standard statistical computer program (JMP, version 5, 1989-2002, SAS Institute Inc. Cary NC, USA) and included: 1) *t*-test to analyze the significance of the difference between measurements, 2) Pearson correlation to analyze the significance of the correlation between measurements and between measurements and age. A 0.05 level of significance was chosen.

RESULTS

Twenty-nine bitewing radiographs from 13 males and 16 females met the requested criteria for the study. The mean age of the children was 98.8 months (standard deviation: 21.17, range: 46-167). No statistically signifi-

Table 2. Comparisons of the measurements of the CEJ-AB distances of the first primary molars by right and left quadrants.

Tooth	Left, n=12		Right, n=14		Probability
	Mean (mm)	Standard error	Mean (mm)	Standard error	
Infraoccluded tooth mesial	0.67	0.09	0.81	0.08	>0.05
Infraoccluded tooth distal	1.06	0.09	0.83	0.08	>0.05
Adjacent tooth mesial	1.07	0.09	1.19	0.09	>0.05
Adjacent tooth distal	1.62	0.18	1.98	0.17	>0.05
Opposing tooth mesial	1.53	0.11	1.71	0.10	>0.05
Opposing tooth distal	1.51	0.12	1.56	0.11	>0.05
Opposing adjacent mesial	0.97	0.13	1.21	0.12	>0.05
Opposing adjacent distal	1.30	0.15	1.74	0.14	<0.05

cant difference in age (in months) was found between females and males (mean 104.2, SE=5.7 and mean 95.5, SE=6.6 respectively, *t*-Test, $p>0.05$). The infra occluded teeth included 3 mandibular second primary molars and 26 mandibular first primary molars. The mean CEJ-AB measurements are presented in Table 1. When comparing the measurements by right and left quadrants, in mandibular first primary molars, only the difference of the measurements between opposing adjacent distal measurements was found to be statistically significant (Table 2). Analysis of the significance of the differences in the measurements between males and females (*t*-Test) indicated a statistically significant difference only for the measurement in the distal surface of the opposing tooth (mean=1.3, S.E.=0.14 and mean=1.7, S.E.=0.12 respectively). Analysis of the correlation (Pearson correlation) between age and the different measurements indicated statistically significant correlation only between age and the distal opposing tooth measurement ($r=0.43$, $p=0.01$), and the mesial of the opposing tooth ($r=0.61$, $p=0.000$).

DISCUSSION

Data relating to the alveolar bone level of ankylosed primary teeth is of scientific interest by itself, and also is of clinical significance and application in providing the clinician with the ability to diagnose alveolar bone loss in children with infra occluded primary molars. A decreased alveolar bone height level at the site of an infraoccluded primary molar could be indicative of a risk of future periodontal damage to the first permanent molars. However, at least one study has shown that ankylosis of primary molars does not constitute a general risk of future alveolar bone loss mesial to the first permanent molars.¹⁷

The hypothesis of the present study was that since the alveolar bone level follows the eruption of the

tooth, infraoccluded teeth would have smaller than the average CEJ-ABC values, whereas, the adjacent teeth and opposing teeth would have larger than normal measurements. The present sample did not allow for comparison with contra lateral non-ankylosed teeth since in most cases the infraoccluded tooth was bilateral. Due to this limitation, the results of this study were compared previous reported values.^{15,18-20}

This comparison indicates that the CEJ-ABC measurements of the infra occluded teeth (mesial 0.78 and distal 0.94 mm) in the present study are smaller than those previously reported for normal teeth. On the other hand, the measurements for the adjacent teeth (mesial 1.11 and distal 1.74 mm) were within normal limits and not larger as was hypothesized. A possible explanation for this is the fact that teeth adjacent to infra occluded teeth were found to drift towards the infraoccluded tooth,²¹⁻²³ a fact that was not taken into consideration when formulating the hypothesis of the study.

The measurements of the opposing teeth were within normal limits, a finding, which was also in contradiction with what was postulated in the hypothesis of the study. This may be attributed to the fact that not all the opposing teeth were over erupted. Further analysis of the alveolar bone height of primary over erupted teeth is needed to delineate the characteristics.

CONCLUSIONS

Comparison of the present findings with previous studies suggests that the CEJ-ABC values for infra occluded teeth are smaller than normal values.

The CEJ-ABC distances of adjacent and opposing tooth to the infra occluded teeth are within normal limits.

The clinician, when diagnosing periodontal disease in children and assessing marginal bone loss, should take the present findings into consideration.

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