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Unilateral chronological compromise in development of permanent molars: Report of two cases

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Introduction

Several morphological anomalies of teeth have been reported along with associated problems of eruption, alignment and susceptibility to dental caries.[1-3] Possible chronological effects of tooth development associated with position on the dental lamina have not been discussed. This paper reports two cases each with maxillary molars developing chronologically midway between the times anticipated for three molars on the opposite side.

Case Reports

Both cases are of Caucasian males with no genetic anomalies nor other dental abnormalities. A genetic causality could not be established definitely due to the uncertain histories from the parents regarding this relatively benign anomaly. It was established that neither family had serious dental-oral disturbances such as multiple congenitally missing teeth nor cleft lip or palate.

Case 1

At age five, a panoramic radiograph revealed one crown in each of the areas expected for the maxillary first permanent molars. At age eight years, a second panoramic radiograph showed on one side the fully erupted maxillary first permanent molar (Figure 1-A). On the opposite side was a single molar which had begun root formation. This tooth emerged and approached functional occlusion between ages nine years and nine years, nine months. Crown morphology was atypical of a first permanent molar and different from the first molar on the opposite side. The main feature was reduction of the distolingual cusp. At nine years, eight months, a panoramic radiograph revealed crown formation in the area of the maxillary second permanent molar. Development was behind the other three second molars. No third molars could be detected in the remaining three quadrants. From stages of tooth development, dental age was found to be almost identical to chronological age.[4]

Case 2

At age nine years, nine months, a panoramic radiograph revealed a situation similar to Case 1 (Figure 2). On one side, the maxillary first permanent molar had erupted into occlusion and the crown of the second permanent molar was completed. Furcation development and root formation had begun. Eight months later, the tooth had emerged and approached functional occlusion. Unlike Case 1, the molar in question resembled neither the first nor the second molar (Figure 2). The molar in question was approximately the same size as the first permanent molar on the opposite side. A "Y-shaped" groove extended from the lingual surface between the mesiolingual and distolingual cusps, divided on the occlusal surface and continued to the anterior and posterior occlusal fossae. The distolingual cusps appeared to be partially divided. At age 14 years, seven months, a panoramic radiograph revealed a small crown developing in the second or third molar area. In the remaining three quadrants, the second molars had erupted into functional occlusion with no third molars in evidence. At the chronological age of nine years, nine months, dental age was 8.5 and at chronological age 14 years, seven months, dental age was 14.4.[4]

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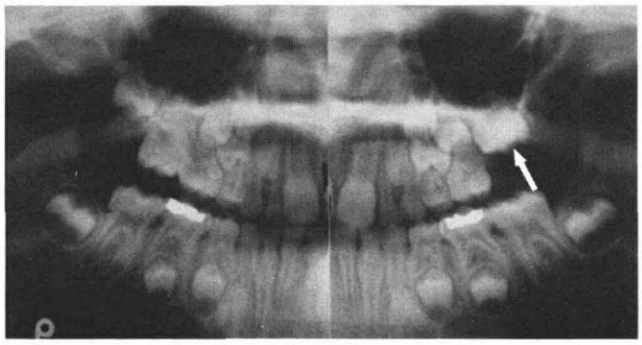

Figure 1.A

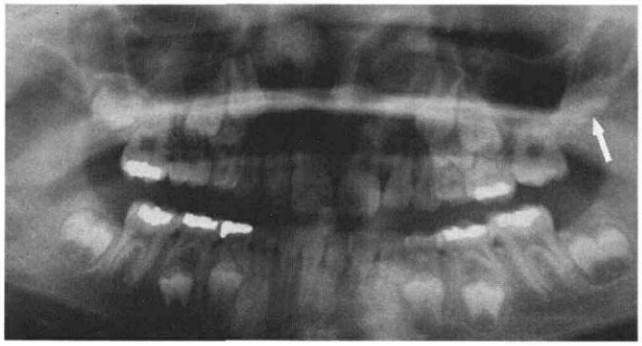

Figure 1.B

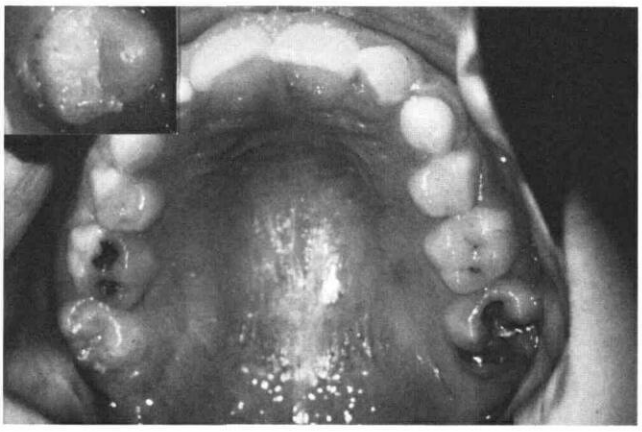

Figure 1.C

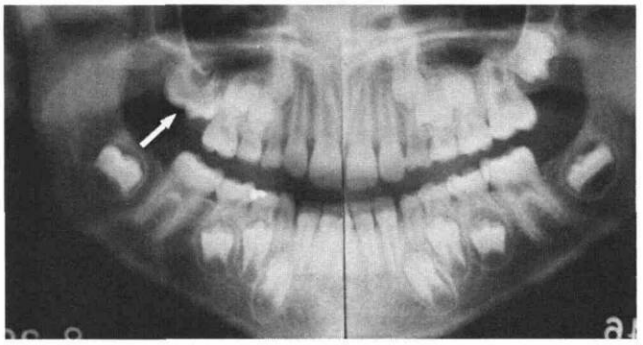

Figure 2.A

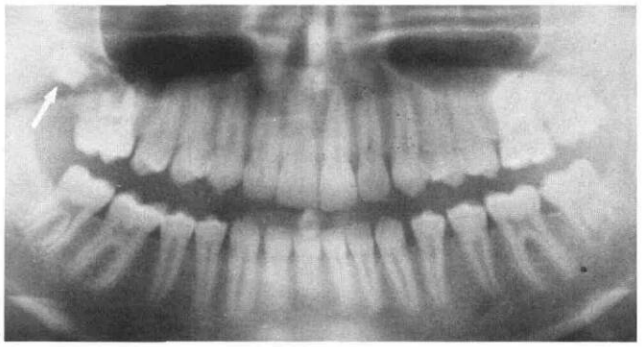

Figure 2.B

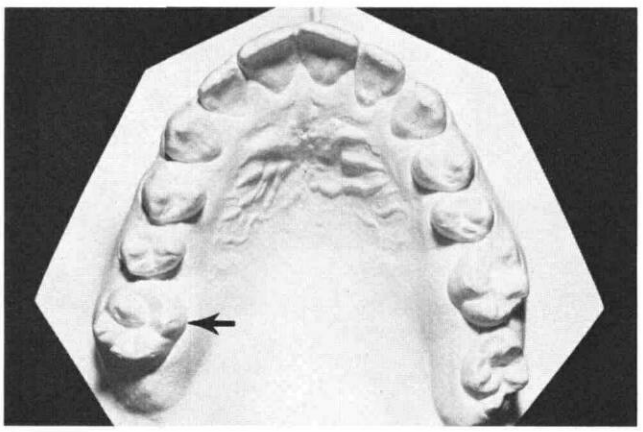

Figure 2.C

Figure 1. Panoramic radiographs and photograph from Case 1. 1-A is at age eight years. One first permanent molar (arrow) is in development behind the first molars in the remaining three quadrants. 1-B is at age nine years, eight months. The first molar indicated in Figure 1-A has emerged and reached functional occlusion. A second molar has begun formation (arrow) ahead of any third molars in the remaining quadrants, but behind the development of the remaining second molars. 1-C. The first permanent molar in question has a single lingual cusp and differs from the more normal first permanent molar on the opposite side.

Figure 2. Panoramic radiographs and photograph from Case 2. 2-A is at age nine years, zero months. The first permanent molar in question is indicated by an arrow. 2-B is at age fourteen years, seven months. Third molars are absent. A second molar (arrow), apparently smaller than any of the other molars has begun to form. 2-C. The first permanent molar in question has an irregular morphology involving either division of the mesiolingual cusp or enlargement and partial division of the distolingual cusp.

Discussion

These cases are primarily of interest from the standpoint of mechanisms controlling timing of tooth development. The morphologic considerations are secondary. It is evident that a chronologic compromise has been reached when a single permanent molar develops instead of the normal situation of two or, as appears to the case here, where two molars develop instead of three.

Two factors—the stage of dental lamina extension and a defect in epitheliomesenchymal tissue interaction—may partly explain the observations. Calcification and eruption progresses from mesial to distal for the primary teeth and for the permanent molars (the primary canine is the exception).[5-8] With normal development, the three permanent molars in a quadrant develop consecutively in a posterior sequence as the dental lamina extends distally.[9] Studies of tissue interactions at the site of tooth formation have suggested a dominant role of the mesoderm in initiation and structural organization.[10, 11] A localized defect in the mesodermal tissue would contribute to the structural as well as chronological alterations. The defect could be either in the biochemical structure of individual cell components or in the abnormal localization of cells capable of tooth bud formation.

In the two cases reported here, the teeth may have developed when the distal point of the dental lamina was between the sites normally anticipated for the first and second molars. The result was a single irregularly formed tooth with chronological development approximately half way between the normal pattern with two teeth. Development of an additional molar distal to the teeth in question strengthens the hypothesis. Development in each case was behind the remaining second molars but ahead of any third molars, if they were destined to form at all. Perhaps development of the initial permanent molar in a quadrant inhibits tooth bud initiation for a certain distance as the dental lamina extends distally. This inhibition may be a function of mesenchymal activity with establishment of one area (in which a tooth forms) influencing the boundaries of succeeding adjacent areas.

In Case 2, it is unlikely that third molar development will occur. The small crown forming after the three second molars indicates that development arose from the distal-most aspect of the dental lamina and contained only a part of the cells normally available for the second molar.

An explanation of atypical morphology of the teeth in question is not as clear since the cases differ in this regard. In Case 1, loss of the distolingual cusp is probably associated with positioning of tooth formation toward the site of the second molar. The distolingual cusp (the most recent phylogenetically) is often reduced in maxillary second and third molars.[12, 13] In Case 2, crown morphology is atypical of any normal molar and suggests a defect in organization as well as positioning of cells involved in tooth formation.

The permanent molar area is unique in studying this phenomenon. The sequence of development for this tooth type proceeds from anterior to posterior spaced over a period of several years. In the incisor area, the above hypothesis would be difficult to formulate. The possibility of fusion of two tooth buds seems less likely. Fusion would not explain development of an additional tooth intermediate in time between the second and expected third molar.

Clinically, one differential diagnosis with a different prognosis as far as eventual eruption is ankylosis of the tooth. With radiographic and visual examination, the two could be easily distinguished.

Conclusion

In each of two cases, two permanent molars developed in one quadrant instead of three. Timing of development for the two molars is chronologically between the anticipated times for the three contralateral molars. Position on the dental lamina or a defect in epitheliomesenchymal interactions at the time of initiation may influence timing of tooth development. Formation of one molar may be a determinant in timing of the adjacent molar.

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