Orthodontic Treatment of Hypodontia and Delayed Development of a Maxillary Second Premolar

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It can be difficult to formulate a definitive diagnosis and treatment plan for patients with hypodontia while dental development is still in progress. Proper radiographs should be used periodically to check for the possibility of delayed tooth development to reduce the potential of misdiagnosis and improper treatment. This article presents a case with orthodontic treatment of hypodontia and delayed development of a maxillary second premolar.

Keywords: *Hypodontia, delayed dental development, orthodontic treatment, children.*

INTRODUCTION

Hypodontia is a common dental anomaly which involves developmental absence of at least 1 permanent tooth or tooth germ.[1,2] Depending on the actual population being studied, the reported prevalence of hypodontia in the permanent dentition, not including third molars, has been reported to range from 0.3% to 10.1%, regardless of gender.[3,4] In addition to genetic factors, the congenital absence of teeth may result from disturbances during the initial stages of tooth development such as ectodermal dysplasia, localized trauma or infections and systemic conditions.[5]

When planning orthodontic treatment of hypodontia, early diagnosis and effective clinical management are important.[6] The management of hypodontia works best with a multidisciplinary approach.[7] The number, shape, size, and formation of the remaining teeth are significant factors in long-term treatment planning.[8]

Sometimes a definitive diagnosis of developmental hypodontia is difficult before dental development is complete. Since there is a significant variation in the timing of dental development from one person to another, differential diagnosis should be included.[9] Radiographic evidence of second premolar mineralization is usually visible by 5 years of age. Although it is rare, these teeth can develop late, especially in the maxilla.[10] As a result, the unexpected late mineralization of a second premolar may complicate the initial treatment plan or if appropriate follow-up radiographs are not taken, it could go undiagnosed.

This case report presents the late dental development of a maxillary right second premolar in a skeletal Class III patient who presented with hypodontia and anterior open bite.

Case Report

An 11 year 2 month old female presented with the chief complaint of protrusive lips and an anterior open bite (Figure 1). Facial examination indicated protrusive upper and lower lips and a flattened mentolabial sulcus. Her maxillary dental midline was 4.2 mm to the left of her facial midline; her mandibular dental midline was coincident with her facial midline. When smiling, the patient showed 10% of her maxillary incisors. In a temporomandibular joint evaluation, she did not show muscle or joint pain or other symptoms associated with temporomandibular dysfunction .

Intraoral examination showed a Class III molar relationship. She had an anterior open bite and -0.9 mm overjet. Her maxillary right first molar was tilted mesiolingually and showed a posterior crossbite. She was clinically observed to have a tongue thrust habit with forced opening of her lips when she swallowed.

Lateral cephalometric analysis indicated a skeletal Class III (ANB= -0.5°, Wits= -11.8 mm) with a hyperdivergent growth pattern (SN-MP: 42.6°). Her maxillary and mandibular incisors were proclined (U1-SN: 112.2°, IMPA: 104.5°). A panoramic radiograph showed agenesis of her maxillary left first premolar and mandibular left second premolar. There was evidence of a very early odontogenesis of her maxillary right second premolar (Figure 2 and Table).

The treatment objective was to correct her anterior open bite, obtain a normal overjet and overbite, establish a Class I canine and molar relationship, correct her midline, and improve facial esthetics. The treatment plan was to extract her primary teeth and mandibular right second premolar and close the extraction sites. Since it was expected that her maxillary right second premolar would be developing abnormally late,

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Figure 1. Pretreatment facial and intraoral photographs.

Table. Cephalometric measurements

Measurement	Norm	Pretreatment	Posttreatment	1 y Posttreatment
SNA (°)	82.0	76.6	76.8	76.7
SNB (°)	80.0	77.1	75.4	75.1
ANB (°)	2.0	-0.5	1.4	1.6
Wits (mm)	1.1	-11.8	-4.8	-5.1
SN - MP (°)	34.0	42.6	43.2	43.4
FH - MP (°)	28.2	31.2	32.1	32.4
LFH(ANS-Me/N-Me)(%)	55.0	55.3	56.3	56.5
U1 - SN (°)	104.0	112.2	101.9	101.7
U1 - NA (°)	22.0	35.7	25.1	24.9
IMPA (°)	90.0	104.5	82.8	82.5
L1 - NB (°)	25.0	44.2	20.9	20.6
U1/L1 (°)	124.0	100.6	132.5	132.9
Upper lip (mm)	1.2	2.1	-0.5	-0.7
Lower lip (mm)	2.0	5.3	-0.1	0.2

her maxillary right deciduous second molar was retained and monitored until her permanent tooth had erupted.

Treatment began with the extraction of her primary teeth (except for the right primary second molar) to encourage earlier establishment of her permanent dentition.[7] The patient wore a facemask and a W-Arch fixed expander to correct anterior and posterior crossbites. Preadjusted appliances with .022 X .028-in slots (3M Unitek, Monrovia, CA) were bonded on her maxillary and mandibular arch. After leveling and alignment, slight wire expansion was performed to correct the posterior crossbite. Her open bite was corrected after 8 months by habit control and up-and-down anterior elastics. At age 13, progress radiographs showed delayed initial crown formation of the maxillary right second premolar. Cone-beam computed tomography (CBCT) showed the tooth bud to be located palatally with adequate distances between adjacent teeth (Figure 3). Based on this information, it was recommended that the patient have her primary tooth and the permanent tooth bud removed, but she and her mother declined to have the permanent tooth bud removed, opting rather to have just the primary tooth removed. Because of this, the position of her tooth bud was carefully monitored while the space was closed (Figure 4).

Posttreatment records reveal that the treatment objectives were achieved. Facial esthetic harmony was achieved by retracting maxillary anterior teeth and closing an anterior open bite. Class I canine and molar relationship was established, and an acceptable overbite and overjet were achieved (Figure 5).

Posttreatment lateral cephalometric analysis and superimposition revealed positive skeletal changes (ANB= 1.4°, Wits= -4.8 mm). The proclination of the maxillary and mandibular incisors was reduced (U1-SN: 101.9°, IMPA: 82.8°). A post treatment panoramic radiograph showed proper space closure and acceptable root parallelism with no significant root resorption. The maxillary right second premolar showed slow development and the patient was reminded to have her tooth extracted (Figures 6, 7 and Table).

At the 1-year follow-up, she had a stable occlusion and the results of the orthodontic treatment were maintained (Figure 8). Radiographic examination showed fairly stable results with the

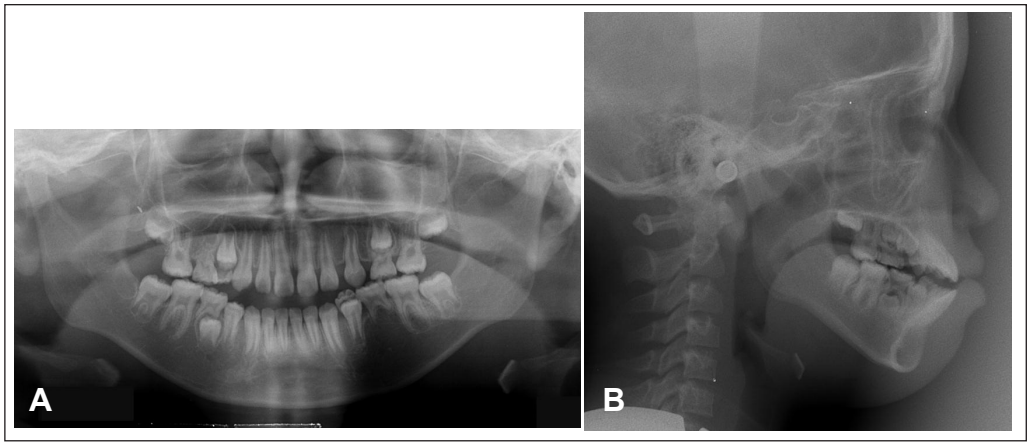

Figure 2. Pretreatment radiographs; A, panoramic radiograph; B, lateral cephalogram.

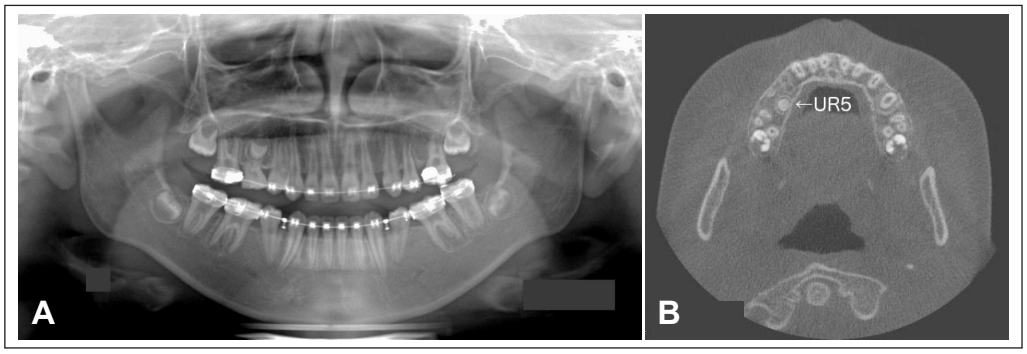

Figure 3. Progress radiographs after 9 months of treatment showing late development of the maxillary right second premolar; A, panoramic radiograph; B, CBCT image.

extraction of the maxillary right second premolar. The mandibular third molars were developing but the maxillary third molars were missing (Figures 9 and 10).

DISCUSSION

Delayed tooth development may affect the accuracy of an orthodontic diagnosis and treatment plan, and could delay overall treatment. As a result, delayed tooth development is a critical clinical issue which can significantly affect the proper orthodontic care of a patient. Although the period can vary greatly, mineralization of the second premolars begins at the age 3 to 5 years with most children. Some second premolars begin to develop after a child is 5 or 6, but this is rare.[10] With orthodontic treatment planning, it is also important to know when the late developing teeth have erupted.

When a tooth emerges into the oral cavity significantly late compared with the established norms considering gender and

Figure 4. Progress intraoral photographs after 14 months of treatment.

Figure 5. Posttreatment facial and intraoral photographs.

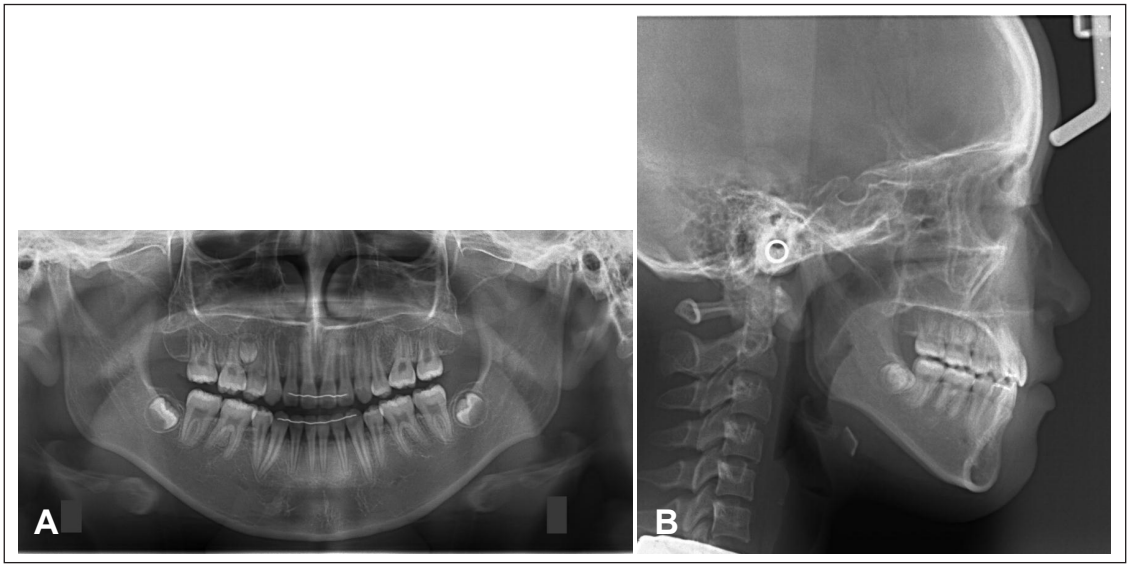

Figure 6. Posttreatment radiographs; A, panoramic radiograph; B, lateral cephalogram.

ethnic background, it is considered to be a delayed tooth eruption (DTE).[14] DTE has been associated with genetic, local, and systemic factors.[14-22] Clinically, DTE is present when any of the following four conditions exist: 1) a tooth is absent in the dental arch and shows no potential for eruption; 2) an unerupted tooth shows complete root formation; 3) the normal time for eruption has passed; 4) a contralateral tooth has been erupted for at least 6 months.[23] It is unlikely that a permanent tooth will erupt without orthodontic intervention if the timing of eruption is delayed in terms of both dental and chronological age (mean ± 2 SD).[14,15]

Ranta stated that the etiology of delayed and asymmetrically developed second premolars is related with the etiology of hypodontia.[24] For instance, the severe delay in mineralization associated with hypoplasia of one or more of the second premolars occurred in 30% of a group of 95 children with cleft palate, but only in 4% of a group of 60 children with cleft palate without a congenital absence of some premolars.[2]

When a second premolar is diagnosed as missing, there are two potential solutions to the problem. One would be to wait until the primary tooth is lost by exfoliation or is extracted due to caries, root resorption or ankylosis. An attempt could be made to preserve the infraoccluded primary tooth until patient growth has ceased by treating it with a coronal build-up. After growth ceases, exfoliation or extraction would then usually be followed by prosthetic

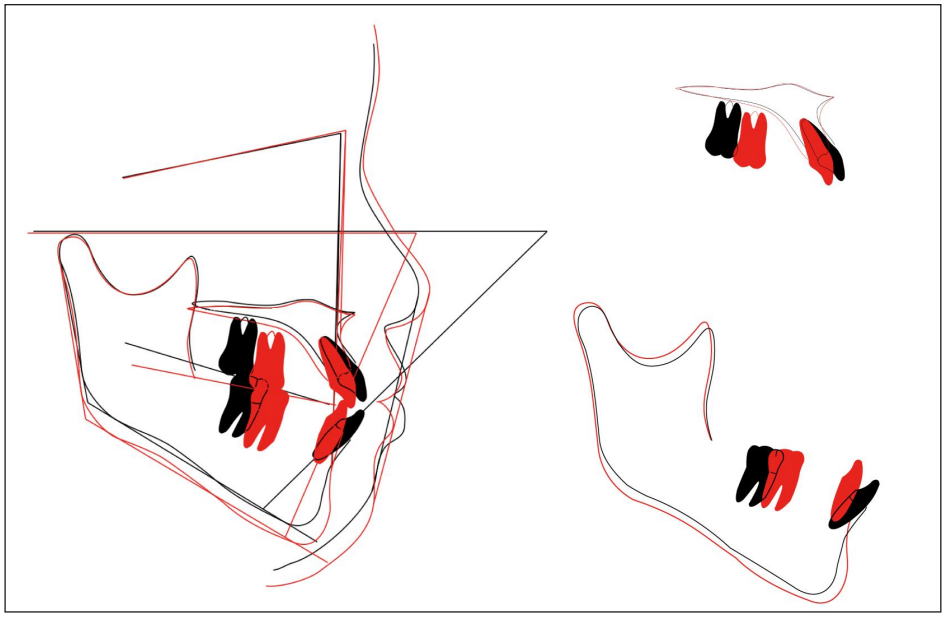

Figure 7. Lateral cephalometric superimposition. Black, pretreatment; red, posttreatment.

Figure 8. 1-year posttreatment facial and intraoral photographs.

replacement or orthodontic space closure. The second solution is planned extraction of the primary molars during the developmental phase to facilitate space closure, combined, if necessary, with orthodontic appliance therapy.[9,25]

In the treatment of hypodontia, accurate prediction of tooth maturation and eruption is important. Several methods have been reported for determining the dental development stages using radiographs.[26-29] Panoramic radiographs and CBCT are useful for recognizing hypodontia, because the entire dentition can be counted and missing teeth could be identified.[7,30,31] The absence of second premolars cannot be diagnosed as early as or to the same level of confidence as the agenesis of anterior teeth.[32] To prevent a false-positive diagnosis of the congenital absence of teeth, one must remember that a tooth germ's visibility in a radiograph depends on its stage of calcification.[4]

Hypodontia does not affect lip position or facial esthetics,[33] and it seems to have little effect on the general growth pattern, even though some studies report that the maxilla is more retrognathic in cases of hypodontia.[34] With a congenital absence of primary dentition, it has been reported that the permanent successors will also be missing in a bit more than 60% of all such cases.[35,36] A connection between developmental absence of third molars and delayed mineralization of posterior teeth has been reported.[37] Interestingly, such a correlation was found in this case study because only 2 third molars were developing.

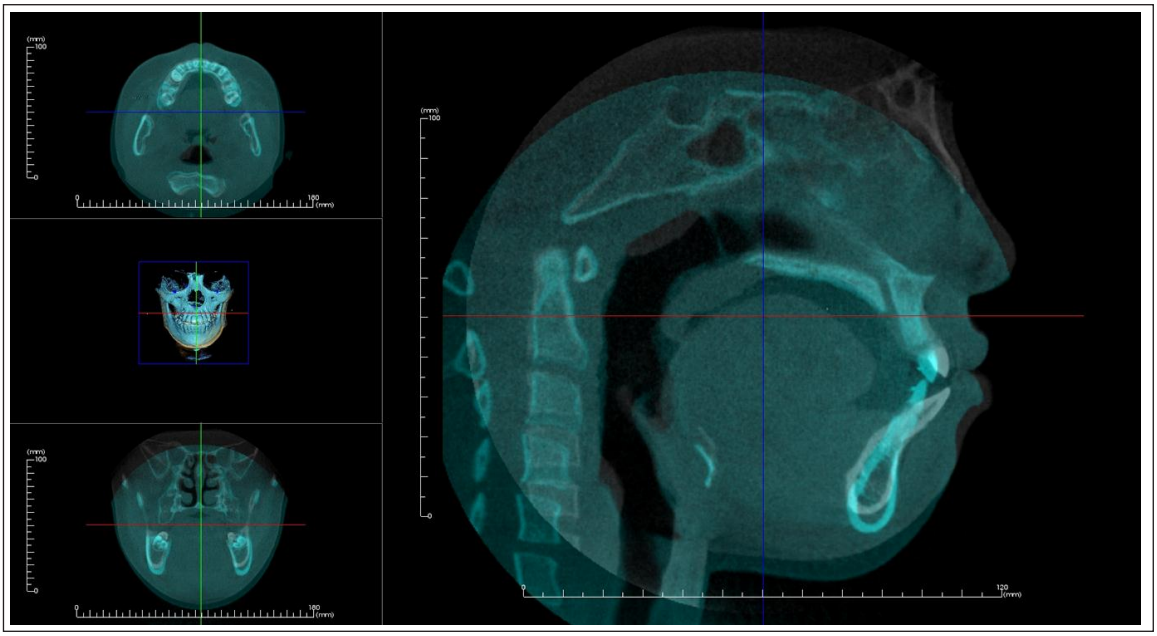

Figure 9. Postretention multiplanar reconstruction (MPR) images were superimposed with pretreatment MPR iimages.[11-13]

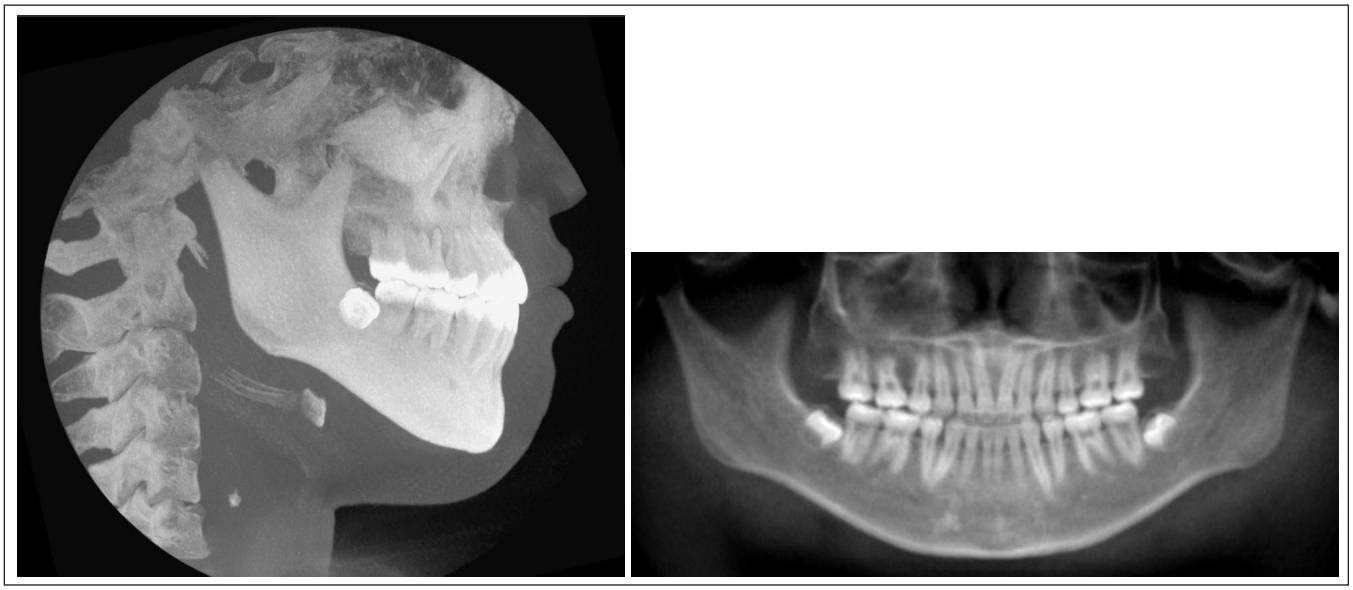

Figure 10. 1-year posttreatment CBCT images; A, lateral maximum intensity projection (MIP) images; B, panoramic rendering.

It is not usual to monitor the late development of teeth during orthodontic treatment.[34,38] The presence of hypodontia, in conjunction with slowly developing second premolars, should alert the orthodontist to the possible presence of a not yet visible uncalcified tooth germ. In this situation, follow-up radiographs should be considered before orthodontic space closure or after interceptive extractions.[9]

CONCLUSION

When planning orthodontic treatment of hypodontia, early diagnosis and a through treatment plan is important, but sometimes a definitive diagnosis of developmental hypodontia is difficult while dental development is still in progress. To reduce the potential of a misdiagnosis, proper radiographs should be periodically examined to check for the presence of a tooth germ before mineralization and the possibility of delayed tooth development.

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