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Space management required after unsuccessful root canal therapy of a mandibular second primary molar: case report

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Abstract

Root canal therapy for primary molars is not always successful. This report illustrates that the consequences of treatment can be significant in terms of patient discomfort, loss of arch circumference, expense to the parent, the amount of time needed to accomplish the clinical objective, and the commitment to long term follow-up care.

Introduction

Retention of a nonvital second primary molar before and during the eruption of the permanent first molar has been advocated for a long time. If, however, the second primary molar is extracted, severe space loss probably would occur (Forrester et al. 1981; Stewart et al. 1982; Goerig and Camp 1983; Mathewson et al. 1987; McDonald and Avery 1987; Pinkham 1988). Even when the prognosis is in doubt, root canal treatment of the infected primary second molar allows the first permanent molar to erupt fully into its normal position after which the second molar can be removed and an appropriate space management technique initiated.

Literature Review

Little is mentioned in published reports about the unsuccessful root canal treatments of nonvital primary molars and the long term effects on the developing occlusion (Allen 1979; Wright and Widmer 1979; Camp 1984).

Coll et al. (1985) described 41 nonvital root canal treatments of primary molars in 37 children and reported success to be 80%. He followed 29 root canal treated nonvital primary molars from five to six years until the premolars erupted. Zinc oxide paste was still visible in the radiographs of one-half of the cases after six years. With the eruption of the premolars in two of the eight cases the zinc oxide paste was removed. Spedding (1985) cautions that cases in which zinc oxide paste was used as a root canal, the filling must be monitored. He reported a case followed for approximately nine years where remnants of the root canal filling were still visible in a radiograph even after the maxillary second primary molar had exfoliated.

Case Report

Pulp Therapy

A healthy 3-year 10-month-old Caucasian male was examined by a dental student on an emergency basis. The child complained of pain in the mandibular left quadrant of about one month duration. Two weeks prior, another dentist prescribed an antibiotic for the child but provided no dental treatment. There were no significant medical findings. No swellings or mobility of any teeth were noted and no discomfort was reported. When the radiograph of the area was examined (Fig 1) the second primary molar appeared to have a carious pulp exposure but no periapical pathosis was noted. However there was some slight buccal marginal gingival inflammation present. Under a local anesthetic and with a rubber dam in place, the pulp chamber was opened and cleaned. A cotton pellet containing formocresol then was sealed in with IRM® (Intermediate Restorative Material: LD Caulk Division, Milford, DE). The child returned for other extensive and urgent restorative needs before the planned root canal treatment was completed three months after the emergency appointment.

The root canals were instrumented to a size 40 endodontic file and a pressure syringe was used to insert a zinc oxide-eugenol-formocresol paste into the root canals. An orthodontic band was cemented to the tooth and then the banded tooth was filled with a ZnOE cement. About 10 days later the band became loose and was recemented on the tooth. At this time a periapical radiograph was made and it revealed a less than adequate root canal fill (Fig 2). No effort was made to refill the tooth. One month later a stainless steel crown was placed. Periodic post-treatment bite-wing radiographs were made and approximately 1-1/2 years later the first permanent molar was noted to be erupting and the roots

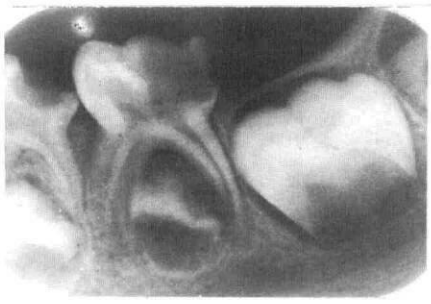

Fig 1. Initial radiograph taken at the emergency appointment (3 years 10 months). Note some space loss because of the large carious lesion involving the distal surface of the first primary molar and the two distinct mesial roots.

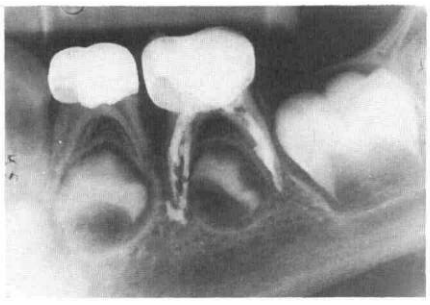

Fig 2. Root canal-treated tooth three months later. Orthodontic band cemented. Note less than adequate fill and some material in the periapical area of the mesial canals and distal inclination of the developing second premolar. An open contact exists between the crowns.

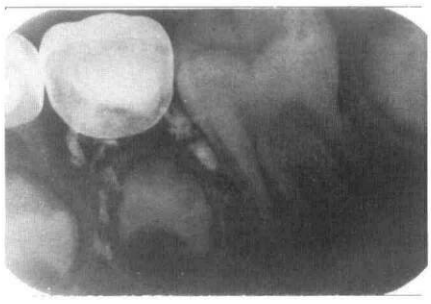

Fig 3. Postoperative 1-1/2 years. Note resorption of roots, a radiolucency, retained ZOE-FC, first permanent molar not fully erupted, and enamel defect on the disto-occlusal of the developing second premolar. Contact between crowns now closed as the first permanent molar erupts.

of the second primary molar were seen to be resorbed (Fig. 3). Incomplete resorption of the root canal filling was noted and particles of material were seen in close proximity to the follicle of the developing second premolar. At that time, the treated second primary molar was extracted.

Space Maintenance

A reverse band and loop space maintainer was indicated because the first permanent molar was partially erupted. Nine days after the extraction the maintainer was inserted (Fig. 4). Seven weeks after it was inserted the parent reported that the space maintainer had broken and was "sticking into the cheek of the patient." It had been removed by a local dentist. Within two weeks a new maintainer was made at the dental school and inserted. This maintainer was used for one year and four months because it took that long for the first permanent molar to erupt completely. The maintainer was removed and replaced with a band and loop space maintainer cemented on the first permanent molar (Fig. 5).

First Space Regaining Appliance

The band and loop space maintainer was worn for about two years, or until the first primary molar abutment was about to exfoliate. At that time, it was discovered that there was inadequate space for the unerupted second premolar.

A fixed mandibular 2x4 regaining appliance (banding first molars and four incisors) with a passive 0.019 x 0.025" arch wire was tied in with an open coil compressed between the buccal tube of the left molar and a soldered stop placed on the arch wire approximately 10 mm anterior to the buccal tube. Two months later the first permanent molar was judged to be in good position. It was anticipated that the reciprocal effect of the open coil would flare the incisors. A lingual arch was

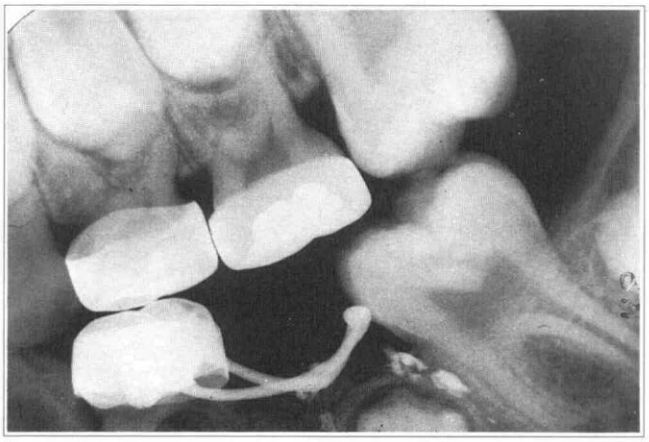

Fig 4. Reverse band and loop. Premolar orthodontic band adapted over steel crown. Worn for one year, four months.

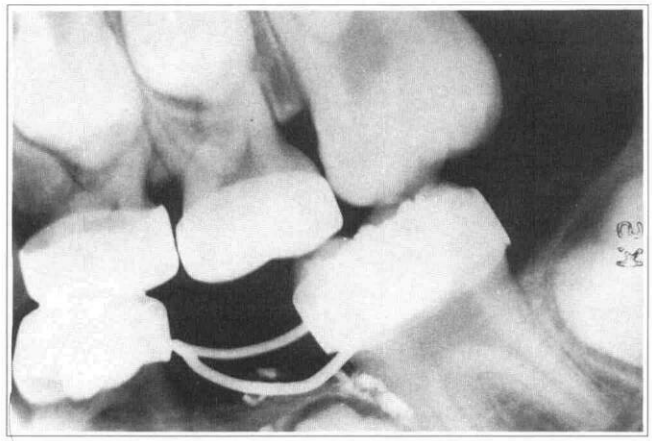

Fig 5. Band and loop. Worn for two years. Space available for unerupted second premolar apparently adequate.

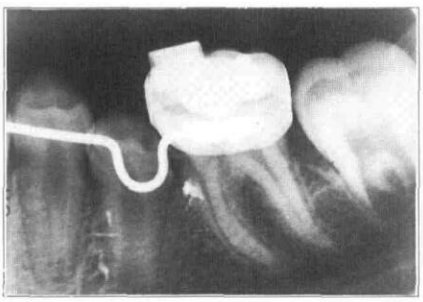

Fig 6. (left) Inadequate space available for the second premolar. Note the presence of a hypoplastic defect on the disto-occlusal surface of the second premolar.

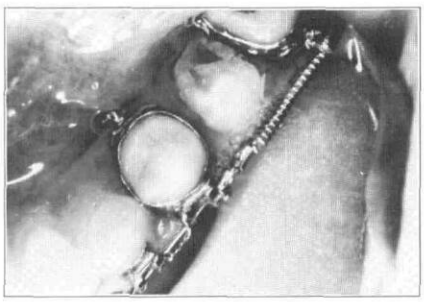

Fig 7. (right) Adequate space regained for the second premolar.

inserted to maintain the permanent molar in its correct position. The anterior portion of the wire was purposely made shy of the cingula of the four incisors to allow the incisors to become upright. The lingual arch was worn for one year, two months.

Midtreatment Summary

The following is a chronological summary of the treatment over 4-3/4 years.

1. A reverse band and loop space maintainer was worn for one year and four months.
2. A band and loop space maintainer was cemented to the first permanent molar and was worn for two years.
3. A fixed active appliance was used to distalize the first permanent molar and was worn for two months.
4. A lingual arch was worn for one year and two months.

Second Space-Regaining Appliance

Even after four years and eight months of treatment the amount of space regained to accommodate the second premolar proved to be deficient by 2 millimeters (Fig 6). Therefore, bands with preattached buccal tubes for the first molars and brackets for the premolars (except for the left second premolar) were placed on the mandibular posterior teeth. The anterior teeth were bonded with brackets. A series of three leveling cinched and stopped round arch wires up to an 0.018" were inserted. An open coil (.009 x .030") was used to translate the first permanent molar. To preserve the midline, a single ligature wire was twisted and tied to brackets on the right first permanent molar, both premolars, the six anterior teeth, and the left first premolar. Further activation of the coil required two visits four weeks apart at which time sufficient space was found to have been regained (Fig 7).

A portion of the occlusal surface of the left second premolar was hypoplastic. This tooth was lingual in position and not completely in occlusion. To align the second premolar, a bracket was direct bonded to its buccal surface. The open coil was removed and the bracket was ligated to the arch wire. Within four weeks the second premolar was found to be in an acceptable alignment. A sealant was applied on the occlusal surface. The total treatment time for these second space-regaining procedures was approximately six months (Fig 8).

Discussion

From the time of the first emergency appointment at 3-1/2 years of age until the mandibular left second premolar was brought into alignment at 11 years, 4 months of age, 31 appointments (seven years and six months) were needed to obtain acceptable alignment of the permanent teeth. If managed ideally, this alignment would have been achieved with a decrease in the total number of appointments from 31 to approximately 18, but the overall time frame would have been the same.

In hindsight, questions can be asked about the treatment procedures used to manage this case. At the emergency (first) appointment a pulpotomy was performed and then an IRM® restoration was inserted. By the time a treatment plan was made and the remaining carious teeth were restored (three months), leakage of this restoration may have allowed the ingress of fluids and microorganisms that caused the eventual resorp-

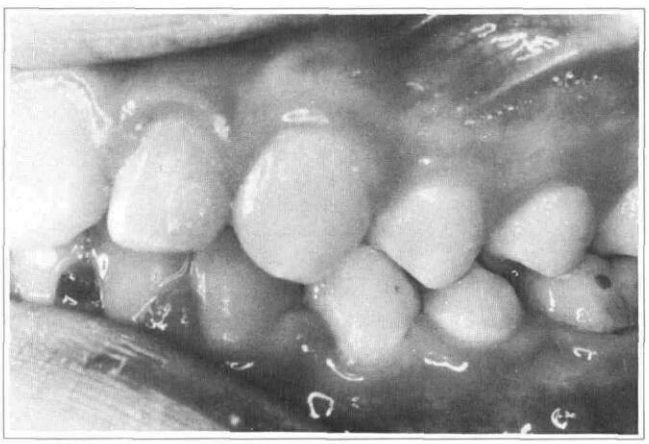

Fig 8. Second premolar erupted into occlusion at 11 years, 4 months.

tion of the roots of this treated molar.

Why was the first space regainer needed? Close scrutiny of the patient record shows that nine days lapsed after the second primary molar was removed and before the reverse band and loop space maintainer was inserted. An immediate space maintainer should have been inserted because space loss can occur immediately after the premature loss of a mandibular second primary molar (Northway et al. 1984). Seven weeks after the space maintainer was inserted it broke and it was removed by a local dentist. Then there was an additional two-week delay until the child returned to the dental school clinic to obtain a new space maintainer. This two-week time interval also may have contributed to space closure.

One alternative treatment might have been to delay extraction of the tooth with the unsuccessful root canal treatment long enough to allow the first permanent molar to erupt sufficiently so that its crown could be banded. The reverse band and loop space maintainer could have been eliminated. Some would judge this alternative as a poor one based on the presence of a noted radiolucency. This is a matter of conjecture.

Another alternative would have been to extract the second primary molar and to immediately insert a distal shoe space maintainer. Contraindications to this approach are: 1) possible penetration of the crypt of the developing second premolar by the metallic intra-alveolar extension; 2) accelerated root resorption of the primary first molar; 3) mesial tipping of the erupting first permanent molar over the distal extension if not carefully monitored; and 4) additional different kinds of space maintainers to manage the space over time (Hicks 1973; Kapala 1980; Barber 1982; Mathewson et al. 1982; McDonald et al. 1987).

A third alternative would have been to extract the mandibular primary second molar and do nothing else. Because this extraction would occur before the eruption of the permanent first molar severe space loss probably would occur.

As previously noted, the retention of a nonvital second primary molar is advocated before and during the eruption of the first permanent molars. Even when the prognosis is in doubt, the objective is to allow the first permanent molar to erupt fully using the distal surface of the crowned second primary molar as a guide, then to extract the second primary molar and use appropriate space management procedures. However, if this alternative is not selected and the second primary molar is extracted at a young age, severe loss of mandibular arch circumference might require complex orthodontic treatment. The fact that some clinical procedures can fail, as noted in this report, emphasizes the need to inform parents about treatment sequence and to impress on them that even if they are compliant treatment can fail. Therefore, alternative methods of treatment may be indicated at an additional cost.

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