



Case report

An approach of preserving a mandibular primary second molar by a hemisection procedure: A case report with 36-month follow up



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ABSTRACT

Primary teeth play a crucial role in functional, aesthetic and speech tasks. They are also responsible for maintaining the jaw space for successor permanent teeth. Thus, dentists should understand that extraction might be the easiest decision but not always the correct one, especially, in the case of multiple loss of primary molars. On the other hand, endodontic treatments should be accurately diagnosed - necrotic and irreversibly inflamed teeth - and performed with suitable dental tools and materials. Then it is important to provide a good sealing with a suitable final restoration. This case report discusses an approach for preserving a mandibular primary second molar which had a radiographic lesion in the mesial root and the furcation area with multiple loss of primary molars (before eruption of first permanent molar). This treatment was done by performing a root canal treatment (pulpectomy) just for the distal root and a hemisection procedure by extracting the mesial root, followed by applying SSC crown and space maintainer (band and loop). To conclude, this type of treatment should be temporary until the eruption of the first permanent molar and then changed to be a lingual arch appliance. Moreover, hemisection was a suitable alternative approach to extraction over 36 months of following up.

1. Introduction

Early childhood caries (ECC) is a common oral health problem. ECC affects infants and preschool children around the world. The rate of ECC cases differs according to the group examined, and a percentage of up to 85% has been reported for poor groups. ECC is the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of 6 (72 months). It starts with white-spot lesions in the upper primary incisors gingival third or cervical third. If the disease continues, caries can progress to destruct the crown completely [1, 2]. The main risk factors in the development of ECC can be classified as microbiological, dietary, and environmental risk factors. The main contributing factors for the high prevalence of ECC are lack of parental education, feeding habits and practice, and lack of access to dental care [3].

Although preventive procedures have reduced caries, early loss of deciduous teeth, which have pulp involvement, is still a common problem. Providing preventive treatment like fluoride application and removing caries followed by filling restorations are considered common procedures [4]. However, dentists with advanced S-ECC cases have only two options in the majority of cases, either root canal treatment (pulpectomy) with crown reconstruction, or extraction of the affected

primary teeth and to provide a space maintainer to preserve space for the erupting permanent teeth [5]. The child's behavior and their cooperation also play a crucial role in the dentists' final decision [6].

Preserving primary teeth to make them safe till natural exfoliation has many advantages: acting as a natural space maintainer for permanent teeth, playing a crucial role in chewing food, improving speaking skills, having a nice smile and supporting positive confidence. Moreover, primary second molars are responsible for directing the first permanent molar while erupting. Losing primary second molars in early ages will create problems in the occlusion requiring a fix by long-term orthodontic treatment [3]. Fortunately, they have less complicated root anatomy compared to first ones [7], therefore, they have a higher percentage of successful RCT rate if the case was correctly diagnosed, treated and restored [8].

A pulpectomy is indicated in a primary tooth with irreversible pulpitis or necrosis or a tooth treatment planned for pulpotomy in which the radicular pulp exhibits clinical signs of irreversible pulpitis (for example: excessive hemorrhage that is not controlled with a damp cotton pellet applied for several minutes) or pulp necrosis [9]. The roots should exhibit minimal or no resorption. Root canal treatment (RCT) is a sensitive technique especially when instruments are used with the complicated morphology of canals in primary molars [10].

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Primary teeth have a variable and complicated canal system; therefore, understanding the morphology of the human dentition is the key to doing an effective root canal treatment. Doing a root canal treatment with insufficient knowledge of root morphology may result in the case failure, especially when inadequate procedures and instruments are used [5, 10]. Mandibular primary second molars usually have two root canals, and it is common to find accessory roots in the furcation area. They might have two or three canals in the mesial root, but the distal one may have one to three separate canals. The case of three canals in the distal root has been reported in extracted mandibular primary second molars by using CBCT [11].

On the other hand, extracting primary molars, which have a necrotic pulp especially in early ages due to losing the child's cooperation might be the preferred choice, especially when it affects the quality of treatment. However, extraction procedure, in most cases, should be accompanied by space maintainers application which include: band and loop, transpalatal arch (TPA), nance arch, lingual holding arch (LA), distal shoe [12].

Distal shoe is the sole indicated space maintainer when the dentist decides to extract primary second molars in order to preserve arch space with adjacent unerupted first permanent molars. This appliance is contraindicated when there are poor oral hygiene, and poor patient and parents' cooperation. Unfortunately, it also does not work in premature loss of multiple deciduous molars [12, 13].

To conclude, preserving primary second molars is quite important especially when the first permanent molar is not fully erupted. Although distal shoe is indicated for premature loss of second primary molar before eruption of first permanent molar, it does not help in cases when multiple teeth are lost on the same side. Finally, the complexity of the root system and good knowledge of managing this kind of primary teeth should be considered, especially when doing root canal treatments.

This case report aimed to show a new approach to preserving a mandibular primary second molar, which was without any adjacent molars, by doing a root canal treatment followed by a hemisection procedure over 36 months of following up.

2. Case presentation

A 5-year-old female child presented with Early Childhood Caries (ECC) for treatment in the Pediatric Dentistry Clinic. The family had a monthly income higher than the average wages, representing a high socioeconomic level. The patient's parents mainly complained about the unhealthy appearance of her anterior teeth without any previous symptoms. In the anamnesis and dietary diary, they reported that the patient used to eat a large amount of chocolate bars given by her relatives every day, and the parents could not control this habit. No significant past medical or dental family history was reported, fluoride supplies also have not been given since she was born. Moreover, there were no previous dental interventions.

The clinical examination did not show any abnormal changes in the extra-oral and intra-oral soft tissue examination, while intra-oral hard tissue showed multiple decayed teeth with soft cavities in dentin (Class IV) in maxillary anterior teeth #52, #51, #61, #62 and #63. On the other hand, it revealed that the mandibular arch was worse and contained more decayed teeth than the maxillary one. In other words, there were extensive carious coronal destruction (Class II) in the mandibular molars #75, #74 and #84. Moreover, all lower anterior teeth had cavities (Class III) #72, #71, #81 and #82, excessive caries were also in the dentin in #73, #83. Radiographic examination matched the clinical findings and helped to detect three additional teeth #55, #54 and #53 with interproximal caries (Class II, III).

By looking at the clinical and radiographic examination, the final diagnosis was necrotic pulp in #74, #84 and #75 due to the lesions in the bifurcation area and the radiolucency around the mesial root apices, respectively. Other teeth were vital due to healthy periodontium, absence of abscess and only coronal involvement caries.

Initially, the treatment plan was functional oral rehabilitation which was accurately explained and discussed with the patient's parents,

especially the poor prognosis of #84, #74 and #75, and the importance of preserving #75 to guide the unerupted first permanent molar. Then, they signed an approved informed consent form authorizing the treatment and disclosure to publish this case report.

2.1. Treatment phase

The patient's behavior was definitely positive according to Frankl behavioral scale this was the main reason to do all treatment in the dental clinic without any kind of sedation or general anesthesia. Several appointments were scheduled to go along with the approved treatment plan. The first appointment was to apply SSC (3M-USA) on #54 with Hall technique using Tell-Show-Do (TSD). The following session was to apply another SSC on #55 with Hall technique where an elastic separator was applied three days in advance. The same procedure was applied on #54 in the following appointments. Hall technique was applied first on both #55 and #54 because it does not need injections and drilling, it is also indicated when there are more than 1 mm of non-decayed dentin between the caries and pulp tissues in radiographic examination. [Figure 1](#) All procedures were done under local anesthesia with rubber dam isolation to treat a quadrant at each appointment. A pulpotomy treatment was done in #52, #51, #61, #62, and #83 using MTA Pro Root (Dentsply-USA) which followed directly by Glass Ionomer Cement (GIC) at the same appointment, then they were restored by composite cosmetic fillings (A2, Z250-3M Espe-USA) in the next session. The tooth #63 was treated by removing the whole caries which were not involved in pulp tissues and filled with the same kind of composite, while teeth #74 and #84 were extracted due to the lesion in the bifurcation area which was in excess of more than two thirds of the root length. [Figure 2](#) At the same time tooth #75 was managed by root canal treatment (single visit pulpectomy). However, tooth #73 also received the same treatment due to the excessive hemorrhage. The teeth #75 and #73 were filled by Metapex then composite for the canine, and SSC for the molar respectively. The treatment done on #75 used an approach of preserving a primary molar, therefore, more details should be presented to explain the object of publishing this case report.

It was obvious by the clinical examination that tooth #75 had excessive caries in the dentin and the radiographic findings revealed that there was a lesion around the mesial root and bifurcation as well. Unerupted adjacent teeth were quite challenging, mandibular first molar #74 due to the extraction and #36 because of the patient's young age of only 5 years, and it played an important role to think of restoring #75. [Figure 3](#).

The patient's positive behavior, the consent of parents, the good results of tooth mobility test (Grade 1- normal perceptible mobility) and the abundance of crown structure in the distal half contributed in the decision to do root canal treatment for distal followed by a hemisection procedure. The following steps explain this procedure on #75 step by step: Firstly, local anesthesia and rubber dam isolation were applied to avoid discomfort and contamination. All caries were excavated, then access cavity was done carefully to make the pulp chamber clearly visible. A dental probe was used to touch the mesial side beneath the root canal orifices which were exposed to the periodontal tissue, therefore, a piece of Teflon was used to make sure that distal root was well isolated.

Secondly, the negotiation was done by K file #10 and #15 which showed that distal root had three canals, then, a root canal treatment was started by cleaning and shaping following this protocol: Mechanical phase done by endodontic files which were selected and adjusted to stop exactly at the apical by using manual files #10, #15 and #20 respectively. Then, the final file used was a rotary file SX #0.04 (Coxo SC-Pro, China). An electronic apex locator (J Morita ZX II-Japan) was used to accurately determine the apical foramen and Naocl 5.25% was the sole irrigation solution used in all steps of Endo treatment for the purpose of disinfecting and chemical cleaning. After the end of preparing all canals in the distal root, ultrasonic activator was used for 30 s in each canal followed by using point paper to dry the canals which did not show any inflammation.

Thirdly, Metapex was used as a final root filling which entered the canals by injection, followed by using lentulo spiral. After the root canal

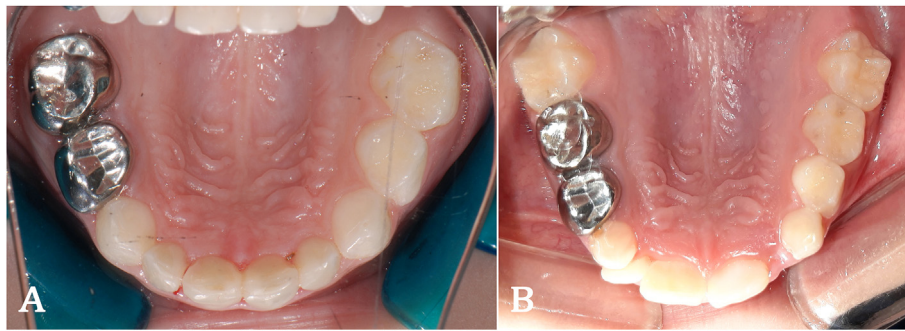


Figure 1. Intraoral photographs of maxillary teeth after all treatments were completed (lingual view) view. (A)- Teeth #54 and #55 with SSCs Hall technique. (B)- Postoperative clinical photograph after 36 month follow up of SSCs all technique.



Figure 2. (A)- An intraoral photograph of maxillary anterior primary teeth immediately after all treatments were completed (buccal view). (B)- Diagnostic X-ray of teeth #51, #52, #61, #62 directly after fillings polishing. (C)- Postoperative X-ray of maxillary anterior primary teeth after one year follow up.



Figure 3. Diagnostic X-rays of the mandibular second primary molar before the beginning of pulpectomy with lesions at mesial and furcation areas.

treatment was finished, all tooth structure was etched by 35% phosphoric acid followed by boning agent (3M Espe-USA), then flow composite (A2,3M Espe-USA), filled the ground of the pulp chamber to make sure that it filled every minor cavity and the root canal treatment in this root was isolated as well. Afterwards, the whole cavity was restored by 3M

composite followed by the hemisection procedure done by sterile high-speed diamond burs then the mesial root was extracted. Finally, a suitable SSC was chosen to fit the new shape of the surviving crown structures. An upper primary first right molar of SSC crowns was used to restore #75 and it was cemented by GIC (Medicem-Germany). **Figure 4** Two space maintainers (band and loops) were applied on #75 and #85 to maintain the space for successor permanent teeth (mandibular first premolars) and teeth #71, #72, #81 and #82 were managed by only discing due to the small size of caries in those teeth. **Figure 5.**

2.2. Follow up phase

After one year, #51, #52, #61 and #62 have absorbed even six months before the active eruption of anterior successors, while #73 and #83 took a longer time around 20 months to root absorption due to the active eruption of #32 and #42. It is important to notice that the Metapex completely disappeared in radiographic follow up over one year in tooth #75 and 20 months in tooth #73. **Figures 2 and 4** Although tooth #75 did not have any clinical symptoms (pain, abscess, mobility) in 20 months, it was necessary to change the kind of space maintainer from band and loop to lingual arch, where the first permanent molar fully

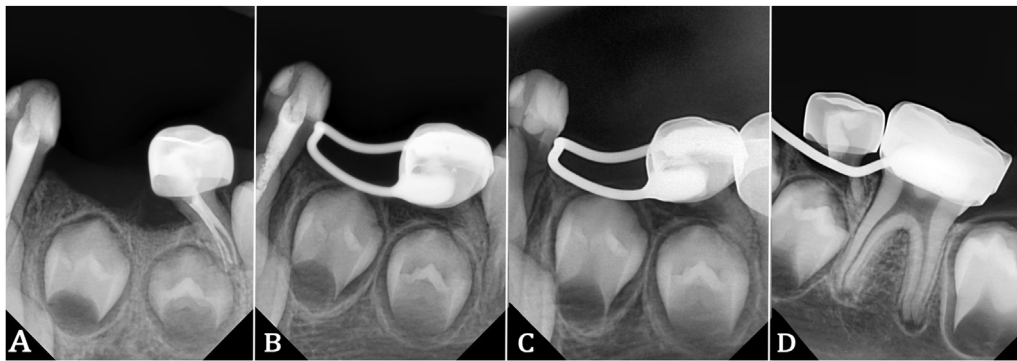


Figure 4. Diagnostic X-rays of the mandibular second primary molar in the different follow up phases. (A)- Immediately after the root canal filling and SSC cementation done at a single visit. (B)- Postoperative X-ray after one year of treatment and space maintainer application. (C)- Postoperative X-ray after 20 month follow up with absorbed canine's root. (D)- X-ray image of the tooth #75 after 36 month follow up.



Figure 5. Intraoral photographs of mandibular teeth (lingual view) in three phases. (A)- one week after pulpectomy, SSC and band and loop application. (B)- Postoperative photograph where band and loop should exchange to lingual arch (LA) after 20 months. (C)- Teeth #75 survived safely with SSC After 36 month follow up.

erupted in both sides and it should be applied after eruption of lower anterior teeth. Moreover, it was used to avoid any space loss due to the mobility of #73. Figures 4 and 5.

After three years (36 months), the patient came to receive orthodontic consultation. The clinical examinations (abscess and mobility tests) and the intraoral radiographic images showed that teeth #54 and #55 (hall technique) were without any symptoms. Figure 1 In addition, tooth #75, which was the purpose of presenting this case report, was sound without any clinical and radiographic symptoms even the Metapex was fully absent in radiographic image. Figures 4 and 5.

3. Discussion

Dental caries is the most common chronic disease in childhood. Therefore, decayed teeth might require extraction in some cases, which will lead to early loss of primary teeth. Children, eventually, may suffer from masticatory disorder, non-aesthetic smile among their peers and psychological problems [5]. Recent studies encourage clinicians to maintain primary teeth in the oral cavity by doing pulpectomy as an alternative treatment to extraction, especially if they are able to restore (good tooth structure) and do not have severe symptoms in the mobility and abscess [5, 14]. Moreover, a retrospective study done to evaluate the survival rate of pulpectomized primary teeth (227 in total) for patients under 5 years old with a 5 year follow up after the treatment. The results showed that 87% of primary teeth treated by pulpectomy with local anesthesia, had survived [5]. On the other hand, another study recorded the long-term outcomes of pulpectomy done to preserve primary teeth (592 in total) with pulpitis or pulp necrosis over a two and a half year follow up. This study revealed that only 37% of primary molars survived [15]. In those two studies, the number of samples, who received pulpectomy treatment in one single visit, were higher than other studies [16,17,18,19], and the success rate of treating anterior teeth were higher than posterior teeth due to the complex morphology between one-canal and multi canals respectively. Furthermore, the high survival rate in the first study was due to the young ages of

samples (under 5 years) compared to the second one (under 9 years). Thus, doing pulpectomy treatment would be more likely to survive longer if it was done in younger patients as happened in this case [5, 15].

Another systematic review, which included 4 studies (3 in vivo clinical study and 1 in vivo microbial study), concluded that single-visit pulpectomy procedure could be preferred whenever possible over the multiple-visit one in primary teeth [20].

During the root canal treatment, using rotary files is more favorable compared to the manual files in primary teeth. It also has many advantages like, decreasing working time to maintain patient cooperation, shaping the root canal conically and increasing the high quality of the canal fillings [21]. In addition, using ultrasonic to activate sodium hypochlorite in root canal treatment is still controversial although some studies went along with the higher effect in microbial control while using ultrasonic in comparison to conventional irrigation [22,23,24]. The final issue in this phase is the filling materials, although there is no statistical difference between the success rate of Metapex and ZOE [14], Metapex has more possibility to fill the root canal system without excessive fillings outside the roots in primary teeth [25,26]. However, there are some drawbacks of using ZOE including a slower rate of resorption than the physiological one of the roots of the primary teeth, transitory to severe irritation of the periapical tissues. It also showed a risk of causing a deviation of eruption trajectory of the permanent successor tooth if the paste was forced through the radicular apex [26].

Choosing the final restoration plays a crucial role in the survival rate of treated teeth. For example, the importance of good sealing after root canal treatment. Moreover, restoring primary teeth with stainless steel crowns (SSC) increases the success rate of primary molars especially after doing a pulpectomy procedure [27].

The Hemisection procedure is more common to apply on permanent teeth, especially with periodontally and endodontic affected teeth. There are many case reports of a hemisection procedure applied in first permanent molars which received a crown or bridge and had a long survival rate [28, 29].

Only a small number of studies used this technique on primary molars due to wide range of reasons. In the orthodontic treatment in cases where the lower second premolar was missing, resection and removing the distal half of the second primary molar provided an excellent first step in the process of space closure. Then, the next step was to remove the mesial root and space closure continued successfully [30]. In another study, A two year follow up showed retained distal half of the mandibular second deciduous molar with correction of crowding and space closure after extracting the mesial root to solve the anterior crowding [31].

Hemisection was a conservative procedure used as an alternative treatment option for space maintenance by amputation of the fractured primary mandibular second molar followed by a cast crown restoration. In this case, the root canal treatment was done in the mesial root, while the distal half was extracted. The first permanent molar was also fully erupted [32].

4. Conclusion

The hemisection procedure of primary second molars might be considered a healthy alternative solution to preserve the molar in the case of multiple loss of primary molars with unerupted first permanent molars. It could prevent from orthodontic disorders which happen by extracting primary molars and leaving the space of successor teeth without any space maintainers. It is obvious that this procedure is unique and should be done in specific conditions including: The cooperation of parents, positive behavior of child, wide knowledge of the complicated primary teeth morphology, clinical and radiographic examination and suitable dental tools and materials.

This new approach of treating primary molars is published for the first time in this case with a three year follow up. However, it is a conservative procedure which should be done in more samples and presented through research and randomized clinical trials to make it widely reliable.

Declarations

Author contribution statement

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Data will be made available on request.

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The authors declare no conflict of interest.

Additional information

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