Effectiveness of Starkey’s appliance as space maintainer; a 21 months clinical follow-up

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Abstract
Primary dentition plays an important role in child’s growth and development not only in terms of mastication, esthetics, and phonetics but also in the guidance and eruption of permanent teeth. In cases of premature loss of primary teeth, correct planning and choice of a space maintainer are required to avoid future space loss. A 5-year-old female patient reported to the department of pediatric and preventive dentistry with a chief complaint of grossly decayed teeth in her mandibular right back teeth region since 6 months. Clinical examination revealed grossly decayed tooth wrt 85, radiographic examination revealed radiolucency approaching root and furcation area. Diagnosis was made as chronic irreversible pulpitis wrt 85 and extraction wrt 85 followed by Starkey’s modification of distal shoe space maintainer was planned. Space maintainers are the appliances which guide the eruption of permanent teeth. In the present case, the first permanent molar had already pierced the bone but was inside the gingiva therefore a modification of distal shoe – Starkey’s space maintainer was fabricated with an acrylic extension that aids in mastication. The Starkey’s modification of distal shoe with an acrylic extension is the most appropriate appliance to be given in cases where there is premature loss of second primary molar before eruption of first permanent molar.

Keywords: Distal shoe, modified distal shoe, premature exfoliation, space maintainer, Starkey’s appliance

Case Report
A 5-year-old female patient reported to the department of pediatric and preventive dentistry with a chief complaint of grossly decayed teeth in her mandibular right back teeth region since 6 months. Patient had no past dental history and medical history was non-contributory.

On clinical examination deep occlusal caries were present wrt 85. Radiographic examination revealed radiolucency involving enamel, dentin and pulp, and root resorption with periapical radiolucent area [Figure 1]. Diagnosis was made as chronic irreversible pulpitis wrt 85 and treatment was planned extraction wrt 85, followed by the Starkey’s modification of distal shoe space maintainer.

In first appointment, the procedure was explained to the parent and the patient and informed consent was obtained for extraction of 85. Band fabrication was done wrt 84 with 0.005 * 0.180 stainless steel band material and a mandibular impression was made. The band was removed and stabilized into the impression and the impression was poured.
The gingival extension was calculated radiographically. Since the 46 has already pierced the bone, the loop was fabricated with 0.036 mm (19 gauges) wire spanning from the distal surface of the band to the mesial surface of the permanent first molar.

The loop was then soldered to the band and trimming and finishing was done.

Acrylic was then poured over the extension of loop and was allowed to flow just 1 mm below the distal extension of the band gingivally, that is, perpendicular to the loop and parallel to the band [Figure 2].

In second appointment, after taking the brief history, local anesthesia was administered and 85 was extracted. The bleeding was controlled and then the Starkey’s modification appliance was seated on 84 with the gingival extension placed in the socket and the appropriate position confirmed with the radiograph and then was cemented with glass ionomer cement [Figures 3 and 4].

Patient was recalled after 1 day, 1 week, 1 month, and then every 3 months. After 14 months permanent first molar partially erupted [Figure 5] and on 21 months follow-up, the Starkey’s appliance has proved to be a viable option with good prognosis and no space loss was observed [Figure 6].

**Discussion**

Premature loss of the second primary molar before the eruption of the first permanent molar is one of the most common problems during the development of dentition.

Mandibular permanent first molars erupt with a mesio occlusal pattern. Moreover, the eruption is guided by the distal surface of the primary second molar. The absence of the second primary molar may lead to mesial movement and migration of the permanent first molar before and during its eruption.[2] However, in cases where primary second molar has to be extracted before the eruption of the first permanent molar, the pattern of eruption alters. An unerupted first permanent molar may drift mesially within the alveolar bone resulting in a loss of arch length and resulting in the possible impaction of the second premolar.

When the second primary molar is lost prematurely, distal shoe space maintainer is indicated. It guides the first permanent...
Thus, the loss of primary second molar before the eruption of permanent first molar may result in loss of mandibular arch circumference which in future might require complex orthodontic treatment.

Nayak et al.\(^4\) stated that about 51% of the prematurely lost first primary molars and 70% of prematurely lost second primary molars result in loss of space and a consequent malposition of a permanent tooth in that quadrant. Many of the orthodontic cases involving crowding and lack of space in permanent dentition could have their problems prevented if the intervention of the practitioner could maintain adequate space in mixed dentition.\(^5\)

In the present case, since the permanent molar had already pierced the bone, but it was in the gingiva there was a limitation to fabricate distal shoe. Therefore, Starkey's modification of distal shoe was preferred.

**Conclusion**

The Starkey's modification of distal shoe is cost and time effective, meets all the criteria for proper space maintenance, and can be fabricated easily. It is advocated to use Starkey's modification of distal shoe space maintainer appliance during this most crucial time to guide the erupting first molar in cases where there is premature loss of second mandibular molar.

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