

Modified Distal Shoe Appliance for Premature Loss of Multiple Deciduous Molars: A Case Report

PRASANNA KUMAR BHAT¹, NAVIN H.K.², MOHAMMED IDRIS³, PRADEEP CHRISTOPHER⁴, NIHARIKA RAI⁵

ABSTRACT

Preservation of the primary dentition until the normal time of exfoliation is one of the most important factor involved in preventive and interceptive dentistry. The premature loss of second primary molar before the eruption of permanent first molar can create a significant arch space/tooth size discrepancy. Distal shoe space maintainer is a valuable part of the Paediatric Dentist's armamentarium in those cases where the second primary molar is prematurely lost and it helps to guide the first permanent molar into place. Conventional design poses various limitations in cases of premature loss of multiple deciduous molars. Thus, it is required to modify the conventional designs according to the needs of the patient. This case report describes an innovative modification of distal shoe appliance in cases of premature loss of multiple deciduous molars. In the present case, modification of distal shoe space maintainer was advocated because of inadequate abutments caused due to multiple loss of deciduous molars. Bilateral design of distal shoe was planned for unilateral loss of deciduous molars.

Keywords: Modified distal shoe appliance, Premature loss of multiple deciduous molars

CASE REPORT

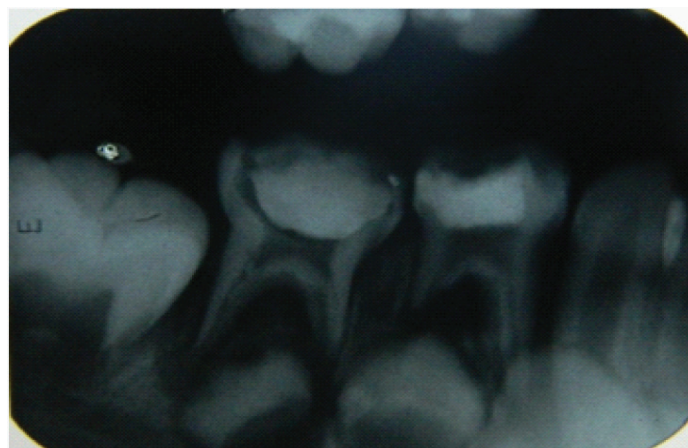
A 4.5-year-old boy reported to the Department of Pedodontics and Preventive Dentistry with a chief complaint of pain in the lower right back teeth region since one week. Clinical examination revealed deep carious lesion and IOPA radiograph showed pulpal involvement in relation to lower right and left primary first and second molars and upper left primary first molar. Pulp therapy was carried out on lower left primary first and second molars and upper left primary first molar, followed by stainless steel crown. Access cavity preparation was carried out on lower right primary first and second molars and closed dressing was given. Unfortunately patient did not turn up for follow up treatment and reported back to the department six months later with a swelling in the lower right back teeth region. Clinical examination revealed grade 3 mobility in relation to lower right primary first and second molars with associated swelling on buccal and lingual mucosa [Table/Fig-1]. IOPA radiograph showed huge periapical and furcal radiolucency with varying degree of external root resorption [Table/Fig-2]. The lower right permanent first molar showed D stage of development (Demirjian's age assessment index).

It was decided to extract right first and second deciduous molars. Distal shoe or intraalveolar eruption guidance appliance type of space maintainer was indicated in the present case. Modification of distal shoe space maintainer was advocated because of inadequate abutments caused due to multiple loss of deciduous molars on right side. Bilateral design of distal shoe was planned for unilateral loss of deciduous molars [Table/Fig-3]. The procedure was explained to the patient's parents and informed consent was obtained. Band adaptations were made on lower left second deciduous molar and lower right deciduous canine.

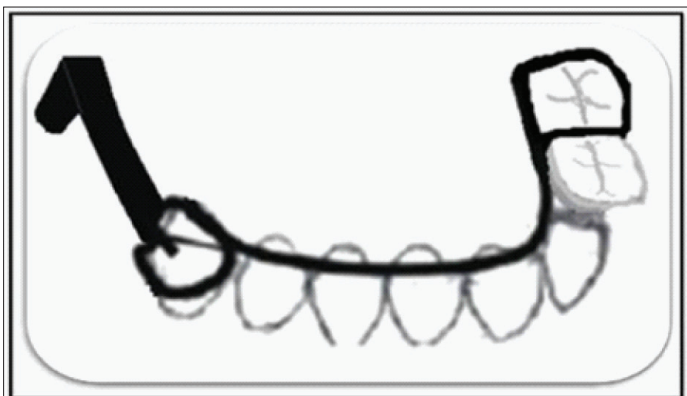
The primary second molar served as a guide on the working model for calculating the horizontal length of distal extension. The vertical depth of intra-alveolar projection was calculated radiographically, and a cut was made in the cast and wire components were adapted using 19-gauge wire. Anteriorly the wire component was made like lingual holding arch and posteriorly the wire component like distal shoe. The wire components were soldered to bands on both the sides. The solder was allowed to flow between the buccal and lingual wire to create a guide plate on the right side of the posterior wire component.



[Table/Fig-1]: Showing pre-operative photograph of the mandibular arch



[Table/Fig-2]: Intraoral periapical radiograph showing huge periapical & furcal radiolucency with varying degree of external root resorption in the primary mandibular right first and second molar



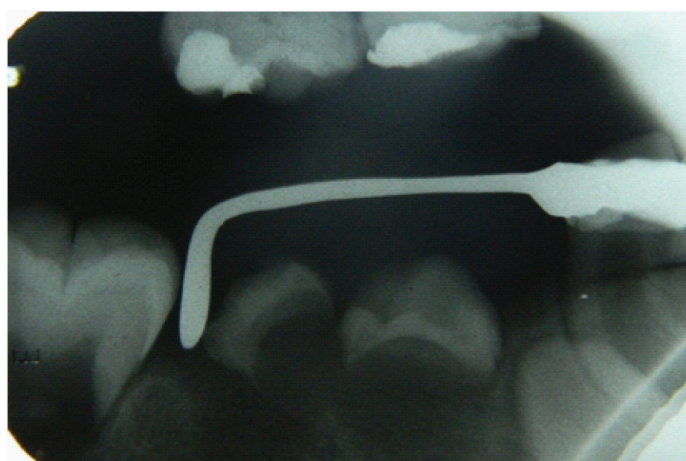
[Table/Fig-3]: Showing design of modified distal shoe appliance



[Table/Fig-6]: Showing modified distal shoe ten months after insertion



[Table/Fig-4]: Showing modified distal shoe immediately after insertion



[Table/Fig-7]: Intraoral periapical radiograph showing modified distal shoe ten months after insertion



[Table/Fig-5]: Intraoral periapical radiograph showing modified distal shoe immediately after insertion



[Table/Fig-8]: Showing post-operative photograph of the mandibular arch 1.5 years after insertion of modified distal shoe appliance

After extraction under antibiotic coverage, the intra-alveolar projection of the modified appliance was placed in the socket so as to touch and guide the vertical eruption path of the unerupted permanent mandibular right first molar [Table/Fig-4]. Periapical radiographs were taken to check the passive contact between the mesial end of the permanent first molar and the appliance before cementation [Table/Fig-5]. The recall visits were planned after every two months to check the condition of the modified distal shoe appliance, supporting teeth and status of eruption of lower incisors.

The recall after 10 months showed erupted lower right first and second premolar [Table/Fig-6]. The lower right permanent first molar showed signs of eruption with pre eruption bulge around it [Table/Fig-7]. It was then decided to remove the modified distal

shoe appliance and the patient was closely monitored during the recall visits. After one year, the lower right permanent first molar erupted [Table/Fig-8].

The erupted lower right first and second premolar were hypoplastic with brownish discoloration of enamel, severe pitting and irregularities of crown and hardly showed any root development. No treatment was currently advised for enamel hypoplasia and the patient is under regular follow up for future treatment.

The space maintainer was well-accepted by the child and his parents and was optimistic for the future of his dentition. As there was premature eruption of right first and second premolar prior to the eruption of right first permanent molar and the first permanent molar showed signs of eruption, the modified distal shoe appliance was removed before the eruption of right first permanent molar.

DISCUSSION

Dental caries is one of the most common reason for the premature loss of primary teeth [1]. Premature loss of the primary second molar prior to the eruption of the permanent first molar is often a challenging problem to the dentist in managing the developing dentition. Holding space to allow the teeth to erupt and to prevent impactions is valuable [2]. An erupting tooth adjacent to an edentulous area has a greater potential for space loss than fully erupted ones, indicating that clinical intervention should be considered [3]. A space maintainer that will guide the permanent first molar into its normal position was indicated. The appliance traditionally suggested as the treatment of choice is the distal shoe space maintainer [4]. The distal shoe space maintainer remains an acceptable standard of care, with an extension subgingivally to a location mesial to the unerupted first permanent molar [5]. This extension serves as a guide for the erupting first molar, and prevents mesial "drifting" of that tooth [6].

In certain clinical situations, conventional designs cannot be used and modification of conventional designs is necessary to meet patients' needs. Conventional design poses a variety of problems in cases of multiple loss of lower primary molars prior to eruption of first permanent molar. So it is required to modify the conventional designs for comfort, co-operation and success in different paediatric patients [7].

Conventional design of distal shoe space maintainer was not advocated in the present case due to multiple loss of lower primary molars. Stability of the appliance would have been a major issue in this case, if we had given distal shoe space maintainer by banding canine. So the design of distal shoe was modified such that it is able to maintain mesiodistal dimension of the space without any compromise on the stability or cooperation of the patient. But this type of design has certain disadvantages such as non-functional, difficulty in fabrication and cannot be given in uncooperative patients [7].

As it is a bilateral appliance it is possible for it to create hindrance in the path of eruption of permanent mandibular incisors. Thus, a short term modified bilateral design of the distal shoe appliance was planned whose duration of use was subjected to closely watched eruption of permanent mandibular incisors both radiographically and clinically. An alternative space maintainer is a bilateral acrylic "saddle" appliance. However poor retention and patient compliance are the major drawbacks with this appliance [6]. The modified distal shoe appliance offered several advantages over the conventional appliance such as increased stability and strength, fixed appliance, less chairside time and less co-operation of the patient.

A tooth in a very early stage of root development can erupt prematurely when a periapical infection of the overlying primary

tooth causes extensive bone destruction [8]. In the present case reported here, there was a premature eruption of right first and second premolars prior to the eruption of right permanent first molar. Thus the modified distal shoe appliance was removed before the eruption of right permanent first molar.

Apart from the eruption disturbance, other abnormalities that may arise from periapical lesions associated with primary dentition include enamel hypoplasia, (Turners Hypoplasia); displacement and rotation of the tooth, partial or complete stoppage of root growth of the succeeding permanent tooth. The present case showed hypoplastic crown with brownish discoloration of enamel, severe pitting and irregularities of crown in relation to right second premolar.

Arrested permanent tooth development has been reported as a consequence of pulpal infection of carious primary teeth [9]. Failure of the tooth germ to develop as a sequelae to periapical or inter-radicular infection of the primary tooth is uncommon but has been reported [10]. In the present case, the right first and second premolars showed hardly any root development showing signs of complete stoppage of root development.

CONCLUSION

The modified distal shoe appliance is time efficient, more stable, better accepted by the child and meets all the criteria for proper space maintainer. It is a valuable asset to the paediatric dentist faced with the decision that a primary first and second molar needs to be extracted prior to the eruption of the first permanent molar. In the present case, several advantages such as increased stability and strength, less chairside time and less co-operation of the patient were shown by the modified distal shoe appliance over the conventional appliance. However, further clinical studies are needed to establish its feasibility and usefulness in paediatric dentistry.

REFERENCES

- [1] Nayak UA, Loius J, Sajeev R, Peter J. Band and loop space maintainer - made easy. *J Indian Soc Pedod Prev Dent.* 2004;22:134-36.
- [2] Kupietzky A. Clinical technique: removable appliance therapy for space maintenance following early loss of primary molars. *Eur Arch Pediatr Dent.* 2007;8(1):30-34.
- [3] Dhull KS, et al. Modified distal shoe appliance for the loss of a primary second molar: A case report. *Quintessence Int.* 2011;42:829-33.
- [4] Hicks EP. Treatment planning for the distal shoe space maintainer. *Dent Clin N Amer.* 1973;17:135-50.
- [5] Willet RC. Preventive orthodontics. *J Am Dent Assoc.* 1936;23:2257-70.
- [6] Gegenheimer R, Donly KJ. Distal shoe: A cost-effective maintainer for primary second molars. *Paediatr Dent.* 1992;14:268-69.
- [7] Dhindsa A, Pandit IK. Modified Willet's appliance for bilateral loss of multiple deciduous molars: A case report. *J Indian Soc Pedod Prev Dent.* 2008;26(3):132-35.
- [8] Camm JH, Schuler JL. Premature eruption of the premolars. *ASDC J Dent Child.* 1990; 57:128-33.
- [9] Brook AH, Winter GB. Developmental arrest of permanent tooth germs following pulpal infection of deciduous teeth. *Br Dent J.* 1975;139:9-11.
- [10] Nik-Hussein NN, Majid ZA. Arrested development of a permanent tooth. *J Clin Pediatr Dent.* 1993;17:167-69.

PARTICULARS OF CONTRIBUTORS:

1. Senior Lecturer, Department of Pedodontics & Preventive Dentistry, Rajarajeswari Dental College and Hospital, Bangalore, India.
2. Reader, Department of Pedodontics & Preventive Dentistry, Rajarajeswari Dental College and Hospital, Bangalore, India.
3. Professor, Department of Conservative Dentistry and Endodontics, Rajarajeswari Dental College and Hospital, Bangalore, India.
4. Consultant, Department of Oral and Maxillofacial Surgeon, Chief of Staff, Specialist Dental Centre, Sakaka, Al-Jouf, KSA.
5. Post Graduate Student, Department of Pedodontics & Preventive Dentistry, AECS Maaruti College of Dental Sciences and Research Centre, Bangalore, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Prasanna Kumar Bhat,
683, 4th Main, 12th Cross, BHEL Layout Extension, Pattanagere, Rajarajeshwari Nagar-560098, Bangalore, India.
Phone :9980185581, E-mail : dr_prasannabhat@yahoo.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Apr 29, 2014**
Date of Peer Review: **Jul 01, 2014**
Date of Acceptance: **Jul 04, 2014**
Date of Publishing: **Aug 20, 2014**