

# Operational Distal Shoe Appliance for Harmonious Occlusion: A Case Report

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## ABSTRACT

Preserving deciduous teeth till their natural exfoliation is important to maintain arch length in different dentition periods. Premature loss of primary teeth may cause discrepancy in arch length due to drifting of teeth and supraeruption of the opposite teeth, thereby hindering the development of a harmonious, functionally and esthetically acceptable dentition. This article describes the fabrication and clinical application of a modified functional distal shoe appliance used due to pathological obliteration of the primary/deciduous mandibular second molar prior to the eruption of the permanent mandibular first molar. This modified functional intra-alveolar space maintainer appliance not only guides the first permanent molar eruption but also prevents ectopic eruption of the second premolar and supra-eruption of the second maxillary primary molar.

**Keywords:** Case report, Distal shoe, Functional appliance, Permanent first molar, Primary molars.

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## INTRODUCTION

The salvation of deciduous teeth until their physiological exfoliation schedule is one of the most crucial aspects of preventive and interceptive dentistry. The most thought-provoking situations while maintaining the progressive dentition is the premature loss of the second primary molar before the eruption of the first permanent molar.<sup>1</sup> Previously documented literature reveals that 51% of first primary and 70% of second primary molars that have been prematurely lost resulted in space loss and subsequent ectopic eruption of succedaneous teeth.<sup>2</sup> The premature loss of deciduous teeth may have an impact on the developing dentition, including a permanent decrease in arch length, increase in overbite, crowding, impactions, malpositioning of teeth, asymmetric arches, occlusal impairment, and disruption in the sequences of eruption.<sup>1</sup> The most common reasons for the loss of deciduous teeth can be deep dental caries, abscess, resorption, congenital absence, or trauma.<sup>3</sup> Mesial drifting or migration of the permanent molar may occur before and during its eruption, which may result in loss of space for the erupting second premolar.<sup>4</sup> To prevent this, different space maintainers are used, with the distal shoe being one such appliance. There are numerous conditions where the use of a distal shoe is contraindicated, such as poor oral hygiene, lack of patient and caregiver/parental assistance, multiple missing teeth, or definite medical conditions such as blood dyscrasias, rheumatic fever, congenital heart defects, immunosuppression, diabetes, and generalized debilitation.<sup>5</sup>

## AIM

In the present case report, we discuss the clinical chairside management of a carious primary second mandibular molar followed by using a fixed modified functional distal shoe appliance for guiding the first permanent molar eruption in the arch, thus preventing ectopic eruption of the second premolar and supraeruption of the maxillary second molar.

## CASE DESCRIPTION

A 4-year-old male patient visited the Outpatient Department of Pedodontics and Preventive Dentistry with a chief complaint of pain, mobility, and swelling in the lower right back teeth region

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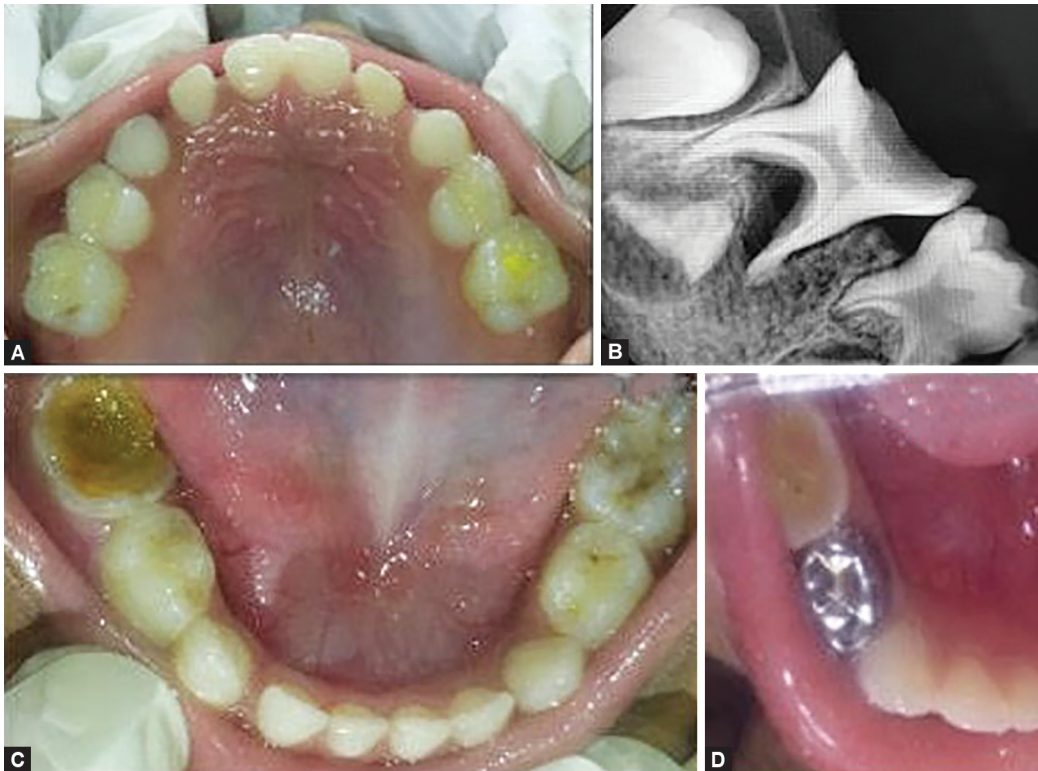
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for the past 1 week. Medical history was irrelevant. On intraoral examination, all deciduous teeth were present. Initial caries developed in relation to 55, 65, and 74; deep dentinal caries were evident in relation to 85. The tooth was tender to percussion, and right submandibular lymphadenitis was present on palpation (Figs 1A and C). Radiovisography (RVG) revealed pulpal involvement and pathological root resorption of the mesial root along with interradicular bone loss. The right permanent first mandibular molar (46) was in Nolla's stage VI, and the second premolar (45) was in stage IV (Fig. 1B). As the intrabony rate of eruption is about 1 mm per day (Orbans Oral Histology & Embryology, 14th edition), the treatment plan included composite restorations in relation to 55, 65, and 74 followed by extraction and space maintainer in relation to 85. A modified functional distal shoe space maintainer was planned that would not only guide the eruption of 46 but also maintain the masticatory and occlusal harmony. The clinical procedure was discussed and consent was obtained from the patient's guardian.



**Figs 1A to D:** (A) Preoperative intraoral occlusal view of maxilla; (B) Preoperative intraoral diagnostic radiograph of 85; (C) Preoperative intraoral occlusal view of mandible; (D) Intraoral occlusal view showing crown adaptation in relation to 84

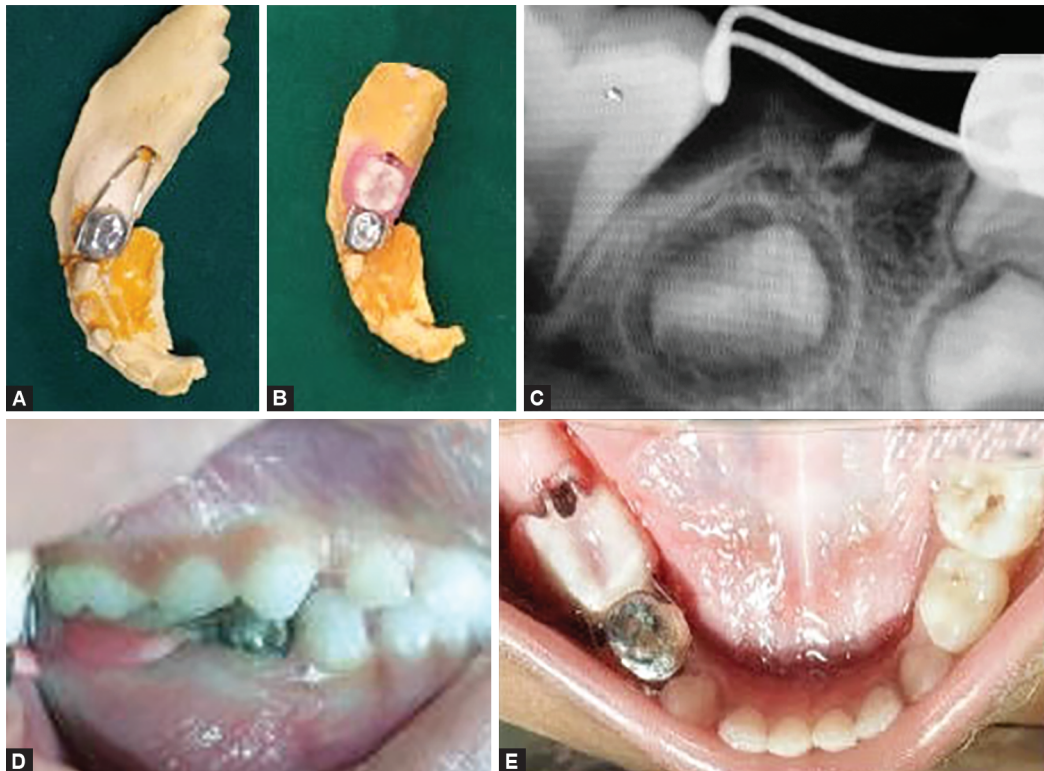
### Fabrication of Appliance

Prior to the extraction of 85, alginate impressions were registered for both maxillary and mandibular arches, and study models were prepared. The second primary molar was retained to serve as a guiding tool on the operational model. A stainless steel crown on 84 was planned for better stability and retention of the modified distal shoe. Crown selection, preparation, and placement were done on 84 without crown crimping (Fig. 1D); alginate impression was registered, crown transfer and stabilization were done, and a working model was prepared. The intra-alveolar component was fabricated into a "U" shape, and a vertical depth was planned from the RVG (Fig. 2A). An elastomeric impression of 75 was registered for fabrication of pontic using tooth colored self-cure acrylic. An acrylic saddle was prepared under the pontic and the horizontal wire component (Fig. 2B). This saddled pontic along with the wire components was stabilized on the working cast and soldered onto the stainless steel crown. Trimming and polishing were done followed by intraoral try-in. The stainless steel crown was crimped and cemented using type I glass ionomer cement (GIC) (Fuji-I) onto the first primary molar while the intra-alveolar part approximated to the mesial marginal ridge of 46; postcementation RVG was registered (Figs 2C to E). The patient was prescribed medications and was advised to maintain proper oral hygiene. Recall was scheduled at 3-month, 1-year, and 2-year intervals. At 1 year follow-up, partially erupted 46 was seen. A reverse crown and loop space maintainer was planned and delivered (Fig. 3). This was followed by replacement with band and loop space maintainer at 2-year follow-up (Fig. 4). It was decided that this appliance would be retained till the emergence of the right mandibular second premolar tooth (45).

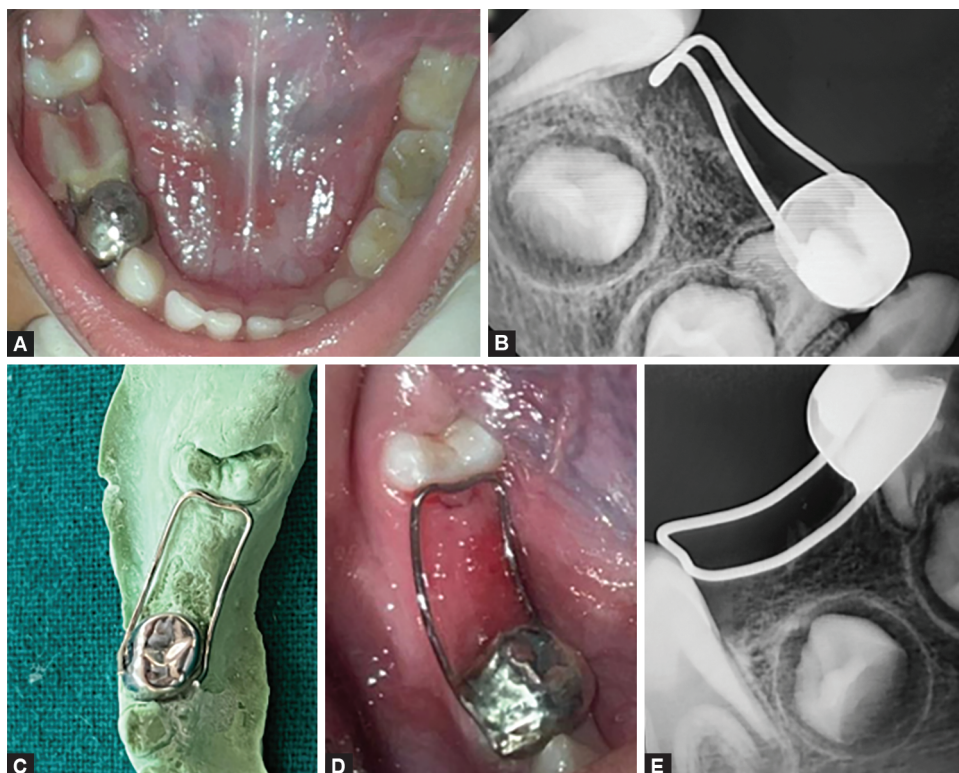
### DISCUSSION

The premature damage of deciduous teeth before their physiological shedding might cause a collapse of occlusal relations in primary, mixed, and permanent dentitions both vertically and horizontally. So, it is crucial to hold the space formed by premature loss of primary teeth in order to allow the succedaneous teeth to erupt in their respective places. Space maintainers can prevent the extent of undesirable outcomes such as space loss, impaction, ectopic eruption, crowding, and uncanny molar relationships.<sup>6</sup> The distal shoe space maintainer is an appreciated tool in the pediatric dentist's armamentarium; it helps to guide the first permanent molar into place and prevents its mesial migration where the second primary molar is prematurely lost.<sup>7</sup> Different appliances such as Willet's distal shoe and Roche's crown and bar maintainer with distal extension are most commonly used.<sup>8</sup>

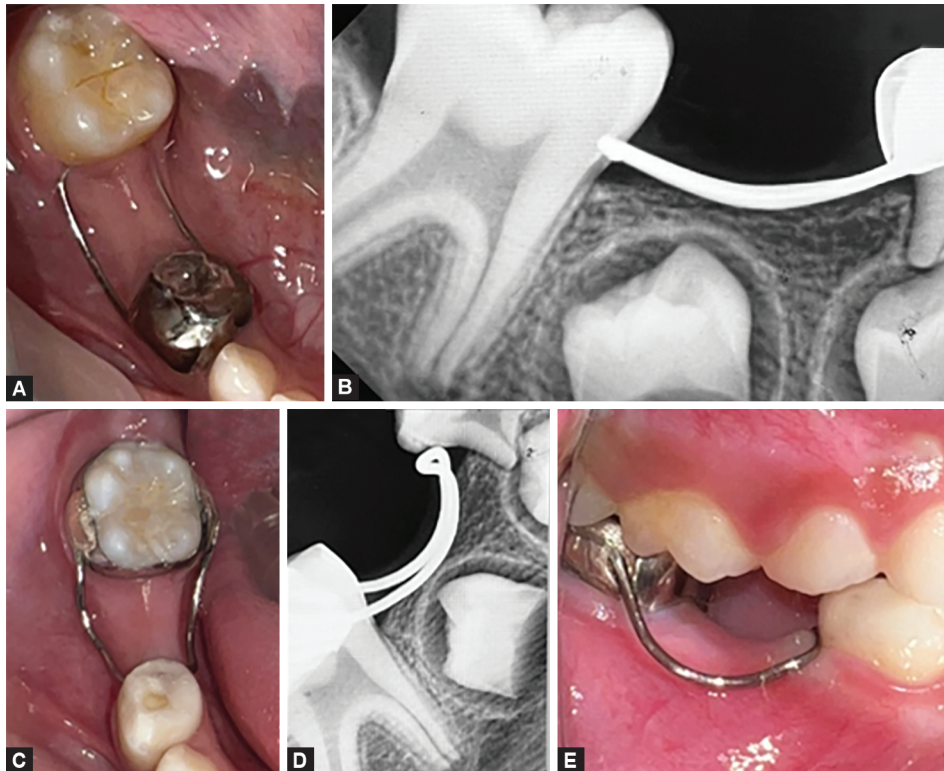
In the present case, a modified functional distal shoe appliance was considered to aid the guidance for the right permanent mandibular first molar and prevent supraeruption of the maxillary second primary molar besides facilitating the eruption of the second premolar in its natural space. This modification showed the following advantages: masticatory function restored due to its functional pontic, simple design with minimal adjustment, increased stability and strength due to integration of the wire component with the acrylic component, ability to maintain the mesiodistal space for the second premolar, favorable eruption guidance of the permanent mandibular first molar, better appliance integrity, and better retention and stability due to the stainless steel crown adapted to the first primary molar. Disadvantages of this appliance could be difficulty maintaining oral hygiene and is contraindicated in medically compromised children. After 1 year of follow-up (radiographic and clinical), the appliance was removed and a reverse crown and loop



**Figs 2A to E:** (A) Wire component of the appliance design on working model; (B) Mesiodistal dimensions of primary acrylic tooth (85) on working model; (C) Intraoral radiograph postcementation of functional distal shoe; (D) Occlusion of 85 in relation to 55 postcementation (intraoral view); (E) Postcementation of the appliance—intraoral occlusal view



**Figs 3A to E:** (A) Partially erupted 46 at 1-year follow-up; (B) Radiograph of distal shoe in relation to 85 at 1-year follow-up; (C) Reverse crown and loop space maintainer in relation to 85 (working model); (D) Reverse crown and loop space maintainer in relation to 85 (intraoral); (E) Radiograph of reverse crown and loop in relation to 85



**Figs 4A to E:** (A) Completely erupted 46 at 2-year follow-up; (B) Radiograph at 2-year follow-up; (C) Band and loop space maintainer in relation to 85; (D) Radiograph of band and loop in relation to 85; (E) Band and loop space maintainer in occlusion

was fabricated and placed intraorally to maintain the arch intact for the eruption of succedaneous teeth (Fig. 3). The patient was cooperative during the procedure as well as during the follow-ups, both the child and caretaker followed the oral hygiene instructions for proper maintenance of the appliance. Thus, this modified functional distal shoe appliance was more stable and retentive, time efficient, had better child satisfaction, and met all the requirements of space management for maintaining occlusal integrity.

The functional distal shoe appliance fabricated chair-side with a stainless steel crown used as the retainer is beneficial for the clinician when met with the choice of carious primary second molar extraction prior to the emergence of the first permanent molar. The appliance can be fixed in the same visit, and after eruption of the permanent molar, it can be replaced simply with either a crown/band and loop components.<sup>1</sup> It has been observed that a tooth erupting near an edentulous area has a greater possibility for loss of space than fully erupted ones; here, clinical intervention should be considered during its eruption. Traditionally, the distal shoe space maintainer has been a customary care in early harm of primary second molars before the eruption of the first permanent molars.<sup>9</sup> Follow-up was done till the child was 7 years of age (Fig. 4).

## CONCLUSION

This case report demonstrates the successful use of a modified functional distal shoe appliance in managing the premature loss of a primary second molar in a child. This appliance effectively guided the eruption of the permanent first molar, prevented complications such as space loss and ectopic eruption, and restored masticatory function. The design offered advantages such as increased stability, ease of use, and improved patient satisfaction. Hence, this technique may prove to be a valuable tool for pediatric dentists dealing with similar case scenarios.

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