



## The Distal Pole-Alternative to Conventional Distal Shoe Space Maintainer: A Case Report

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### Abstract

**Aim and Background:** A major clinical challenge for pedodontist is space maintenance in primary dentition associated with the premature loss of primary teeth. When a primary second molar is lost prematurely, it is the distal shoe appliance (DSA) most widely used and proved to be the effective tool in guiding the permanent first molar into its proper place.

**Case Description:** The sole purpose of this case report is to describe briefly the clinical management of unilateral extensively carious primary mandibular second molar with a modified distal shoe space maintainer which we named it as "distal pole" which is highly inevitable to prevent space loss and following malocclusion development in later stages.

**Clinical Significance:** The prime importance in pediatric dentistry is preserving the primary teeth in the dental arch until their physiological exfoliation time however there are certain conditions which are challenging at times where extraction seems unavoidable.

**Keywords:** distal shoe, space maintenance, E space, Deciduous Dentitions

## Introduction

The prime importance in pediatric dentistry is preserving the primary teeth in the dental arch until their physiological exfoliation time however there are certain conditions which are challenging at times where extraction seems unavoidable due to extensive dental caries or trauma. When a primary second molar is lost prematurely, it is the distal shoe appliance (DSA) most widely used and proved to be the effective tool in guiding the permanent first molar into its proper place. The distal shoe space maintainer was first introduced by Gerber<sup>1</sup> and modified by Croll<sup>2,3</sup>. Indications and contra-indications of this space maintainer were discussed in detail by Hicks<sup>4</sup> who chose fabrication of a cast gold appliance. Modifications like appliances with attachments which are soldered to stainless steel crowns or bands were also clinically acceptable. Brill<sup>5</sup> in the year 2002 described chairside fabrication of a distal shoe space maintainer which can be delivered immediately after the extraction of the poor prognosed primary second molar showed a high success rate if the patient was cooperative.

It has also been proved that early loss of primary second molars and the absence of eruption guidance for erupting permanent molars results in a higher reduction of arch length which is measured about 8mm in each maxillary quadrant and about 4-6 mm in each mandibular quadrant.<sup>6</sup> Hence the use of distal shoe space maintainer in early loss of primary second molar is highly inevitable to prevent space loss and following malocclusion development in later stages.

Based on the eruption pattern, upper arch molar teeth erupt distally and buccally whereas in lower arch, it is mesially and lingually which proved that special attention should be given while fabricating the design for this space maintainer.<sup>7</sup> However there are some contraindications which should also be taken into consideration. These include, absence of adequate number of abutments (loss of multiple teeth), highly uncooperative child and/or parents, congenital absence of permanent first molar, systemic conditions such as diabetes mellitus which interferes with wound healing and cardiac anomalies which require prophylactic antibiotics regime prior to dental procedure.<sup>4</sup> In these conditions, the pediatric dentist is left with only two choices before considering giving this appliance that include: regaining the lost space after the eruption of permanent first molar and the usage of a fixed or removable appliance that neither penetrate the tissues but applies pressure on the ridge immediately mesial to the unerupted permanent first molar.<sup>6</sup>

The sole purpose of this case report is to describe briefly the clinical management of unilateral extensively carious primary mandibular second molar with a modified distal shoe space maintainer which we named it as "distal pole"

## Appliance Fabrication

The first step in the appliance fabrication is the appropriate selection of band which can be done directly from the mouth or indirectly after taking an impression followed by cast pouring. In this case we had plans to place the loop component

to the stainless steel crown since the adjacent tooth was pulpally treated. The loop component in this design consisted of two parts namely horizontal and vertical. Horizontal part maintains the mesio-distal dimension of the extracted primary second molar and the vertical part actually serves as a pole of guidance for the erupting permanent first molar.

Horizontal part of the loop follows the residual alveolar ridge and the vertical part extends into the extracted socket till it reaches 1 mm beyond the mesial marginal ridge of the erupting permanent first molar. The free ends of the loop were then approximated and soldered to the stainless steel crown of adjacent tooth.

### Case Report

A 5 years old boy reported to my clinic in the month of December 2022 with a chief complaint of pain and frequent swelling in the lower left back region for a brief period of time. He has non-contributory medical history. Clinical examination revealed a grossly decayed primary mandibular left second molar and pulpally involved mandibular left first molar. A

radiovisiography of the same teeth had been taken which showed the extensively decayed and mesial root resorption in primary second molar and dental caries involving the mesial pulp horn of primary mandibular first molar. (Figure 1)

We planned to proceed with pulpectomy for primary first molar followed by stainless steel placement and extraction of primary second molar followed by modified DSA which is soldered with SSC of primary first molar. Before cementation, a RVG was taken to determine the relationship of intra-gingival extension with mesial surface of the permanent molar. (Figure 2) Final cementation is done with type - 1 glass ionomer luting cement (GC Fuji, Tokyo, Japan). (Figure 3) Post extraction, post cementation and oral hygiene maintenance instructions were given to the patient as well as his parents.

Recalling and reviewing visits has been given every 3 months to check the integrity of the appliance and the eruption status of permanent molar. Follow up after one year showing the ideal eruption of lower left permanent first molar without any clinical signs of mesial drift (Figure 4)



Figure 1: Pre-operative radiovisiograph



Figure 2: Immediate post cementation radiovisiography showing the tip of the distal pole just reaching beyond the mesial marginal ridge of unerupted lower left permanent first molar



Figure 3: Immediate post cementation image



Figure 4: Follow up after one year showing the ideal eruption of lower left permanent first molar without any clinical signs of mesial drift

## Discussion

Premature loss of multiple primary molars is a potential challenge for the pedodontists to manage and preserve the arch integrity. In this case of premature loss of primary second molar before the eruption of permanent first molar, it is mandatory to provide a distal shoe appliance which serves as a space maintainer as well as guides the eruption. Since the conventional distal shoe has its own disadvantages, modified distal shoe has been adopted in this case which favours simple design with minimal adjustment, high stability & strength and

patient acceptance. This unilateral modified distal shoe appliance is considered as a short-term appliance for eruption guidance.<sup>8</sup>

In such situations, if they left untreated, the first permanent molar would definitely migrate mesially and proficient space loss would occur evidently which could possibly result in a need for active therapy. Active appliances also have some complications and patients and their parents should have full cooperation. However, it is desirable to have an affordable method that requires a moderate level of patient cooperation



that can guide the eruption of permanent first molars towards their correct position in the dental arch. For this purpose, the use of modified distal shoe appliance would be suggested as the treatment plan. Benefitting from the anchorage provided by the remaining teeth in the dental arch, a fixed, bilateral appliance with an intra-alveolar extension was fabricated, which was capable of guiding the eruption of the first permanent molar into its proper position. By placing this appliance, space loss due to mesial drifting of the permanent first molar could be prevented. Moreover, this appliance would be more easily tolerated by children due to its fixed nature, simplicity, and optimal stability compared to removable appliances. However, this design has some shortcomings as well, including its difficult fabrication, relatively high cost, and non-functionality.<sup>9</sup>

In uncooperative children, this appliance is preferred to removable alternatives. Modified distal shoe space maintainer is considered a short-term appliance that will be replaced with other appliances depending on the eruption of the first permanent molars and permanent incisors. In contrast to our case, *Gujjar et al*<sup>9</sup> & *Dhinda and Pindat*<sup>10</sup> used uniform appliances that did not have the potential of chairside adjustability and the whole appliance was fabricated in a laboratory. The current appliance was fabricated by soldering a part of the Gerber-type distal shoe to confer chair-side adjustability to the appliance. However, the appliance could be adjusted easier and more precise. Movement of the distal blade in the tube enables and ensures the correct position of the intra-alveolar extension of the appliance. Following the complete eruption of the first permanent molar or observing any interference with the eruption of permanent incisors, the appliance must be replaced with other types of space maintainers depending on the clinical conditions of patients.

Research works conducted by *Anegundi* and his colleagues proposed that the horizontal U-loops space maintainers with an extended vertical arm length which can be easily adjustable against the mesial tipping movement of the first permanent molar.<sup>11</sup> There are various other studies that have reported many designs of the conventional appliances effectively modified for premature loss of multiple primary molars with inadequate abutments.<sup>12,13,14</sup> In our case study, we presented a simple method distal pole being soldered to the stainless steel crown (similar to crown and loop space maintainer) of pulpally treated first primary molar. Following which a custom-made stainless-steel wire was used for the horizontal and vertical parts of the distal shoe; moreover, SSCs have a perfect contour and shape easily adapts to the anatomy of first primary molars. Our case study also showed the healthy gingival tissue around distal shoe appliance and the abutments after more than a year; also the appliance did not intervene or impede the eruption of the first permanent molars. When considering the oral hygiene maintenance after the appliance insertion is of great importance to maintain healthy gingival conditions, especially of the fixed appliance whose vertical arm extends into the gingival tissue. Fluoridated toothpaste will greatly help with plaque removal and caries prevention in such kids. An interdental brush or end tuft brush will prove to clean underneath the wires as well as the abutments. Parents were equally advised to provide assistance in oral cleaning, especially for young children who are in their developmental stages where their fine motor skills are yet to develop.

Also, this appliance has an added advantage of fabricating in the same visit as the extraction of the hopeless primary second molar and can be done in a very cost-effective manner compared to other appliances that included lab expenses and

frequent visits subsequently. Moreover, after the eruption of permanent first molar, conversion of this distal shoe appliance to a band and loop maintainer is quite easy and simple which can be done without the need of local anaesthesia & cumbersome procedures. Hence this appliance serves as a valuable and effective asset to the paediatric dentist in space management and eruption guidance.

## Conclusion

To conclude, the placement of modified distal shoe appliance preserves the integrity of dental arch and prevents space loss following the early loss of several primary molars in the cases that the use of conventional distal shoe appliance is not possible. However, regular patient follow-ups are critical for the success of this contemporary treatment plan.

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