Case Report

A Modification of Distal Shoe Appliance for Premature Loss of Primary Second Molar-Comparison with Willet's Appliance: Report of Four Cases

Rajesh T. Anegundi, Sinjini Banerjee, Shruthi B. Patil, Vijay Trasad

Department of Pediatric and Preventive Dentistry, SDM Dental College and Hospital, Dharwad, Karnataka, India

Abstract

Primary dentition is important for space maintenance, mastication, speech, and development of occlusion, premature loss of which results in space loss, deep bite, crowding, tooth impactions, and midline shift. Deciduous second molar guides the erupting first permanent molar which uprights in position after following the forward and upward path of eruption. Prevention of the space loss due to premature loss of primary second molar always been a challenge for pedodontists. Several designs of guiding appliances are proposed, the most common design being the Willet's appliance. Willet's design unable to provide broad contact often results in dislodgment of the vertical arm, slipping, and rotation of erupting molar. In this article, a modified design of the distal shoe has been compared with three other cases with Willet's appliance.

Keywords: Interceptive orthodontics, guiding appliance, space maintenance

Introduction

Primary dentition is important for space maintenance, mastication, speech, and development of occlusion, premature loss of which results in space loss, deep bite, crowding, tooth impactions, and midline shift. Deciduous second molar guides the erupting first permanent molar which uprights in position after following the forward and upward path of eruption, whereas 70% space loss is due to premature loss of deciduous second molar. Several designs of guiding appliances are proposed, the most common design being the Willet's appliance.[1] In this article, a modified design of the distal shoe has been compared with Willet's appliance.

Case Reports

Case 1

A 5-year-old girl came to the outpatient department (OPD) with pain and recurrent abscess with 75. After clinical and radiographic examinations, 75 was indicated for extraction followed by distal shoe appliance [Figure 1]. A stainless steel crown was adapted 74 and Willet's appliance was given. After follow-up of 12 months, 36 erupted lingually with dislodgment of the horizontal arm of the distal shoe [Figure 2]. Radiographically, it showed space loss and mesial tilting of 36.

Case 2

A 4.5-year-old boy reported to the OPD with chronic pain with 75. After treatment planning and extraction of 75, Willet's design of the distal shoe was fabricated and was cemented on 74. After follow-up of 20 months, 36 erupted lingually with space loss and mesial tilting. Lingual side of the horizontal arm of the Willet's appliance was broken [Figure 3].

Case 3

A 4.5-year-old girl root stumps of 75 and 85 were indicated for extraction. 74 and 84 were treated with pulpectomy and restored with stainless steel crowns. Band adaptation was done on 74 and 84 and bilateral Willet's appliance was cemented

Received: 18-Apr-2019 **Revised:** 11-Jun-2019
Accepted: 03-Aug-2019 **Published:** 29-Nov-2019

Access this article online

Quick Response Code:

Website: www.ijpedor.org

DOI: 10.4103/ijpr.ijpr_9_19

Address for correspondence: Dr. Sinjini Banerjee, Department of Pediatric and Preventive Dentistry, SDM Dental College and Hospital, Dharwad - 580 009, Karnataka, India.
E-mail: sinjini.khardah@gmail.com

How to cite this article: Anegundi RT, Banerjee S, Patil SB, Trasad V. A modification of distal shoe appliance for premature loss of primary second molar-comparison with Willet's appliance: Report of four cases. Int J Pedod Rehabil 2019;4:84-7.

on 74 and 84. After follow-up of 24 months, 36 and 46 were erupted in the oral cavity. Radiographically, it showed space loss and mesial tilting of 36. The distal shoe at the right side was dislodged and lost by the patient and 84 showed resorption.

Case 4

A 5-year-old boy came to the OPD with pain and recurrent abscess with 85 [Figure 4]. After clinical and radiographic examinations, pulpectomy was performed with 84, followed by restoration with stainless steel crown. 85 was indicated for extraction due to the presence of furcal radiolucency and resorption [Figure 5]. Instead of conventional design of distal shoe appliance, a modified design with two U loops at horizontal arms and one broad U loop as intra-alveolar projection was given [Figures 6 and 7].

After 7 months of follow-up, 46 showed signs of eruption. Clinical and radiographic examinations showed upright positioning of 46, intact horizontal and vertical arms,

Figure 1: Grossly decayed 75 in a 5-year-old patient.

Figure 3: Broken horizontal arm of Willet's design, dislodgment of restoration with 74.

Figure 5: Furcal radiolucency with periradicular abscess with 85, irreversible pulpitis with 84

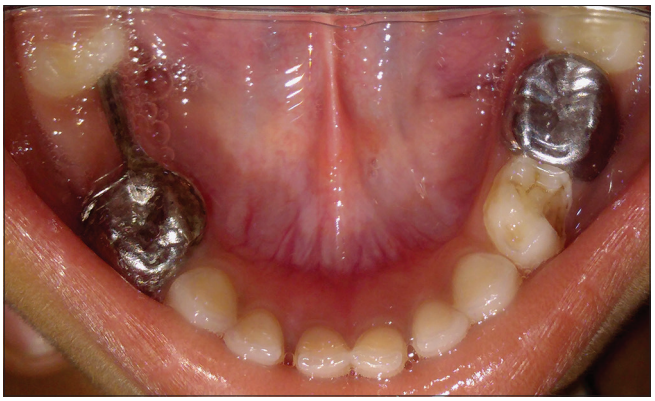

Figure 2: After 12 months of follow-up, dislodgment of horizontal arm of Willet's design, lingually erupted 36.

Figure 4: Grossly decayed 85 in a 5-year-old patient, indicated for extraction followed by distal shoe space maintainer.

Figure 6: Modified design of distal shoe space maintainer cemented on 84.

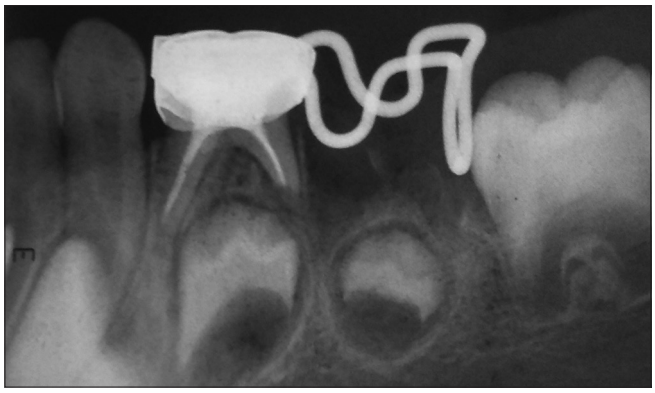

Figure 7: Radiograph immediately after cementation of the modified distal shoe space maintainer.

Figure 8: Seven months of follow-up, mesial side of 46 erupted without dislodgment of the appliance.

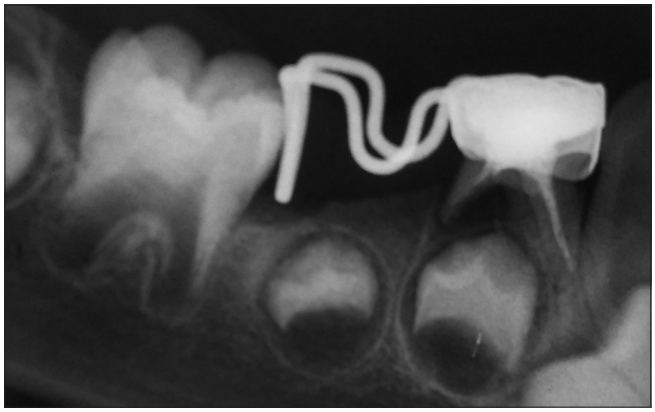

Figure 9: Radiograph taken after the eruption of 46.

nondislodgment of the tooth of the appliance, and no space loss [Figures 8 and 9].

Discussion

Prevention of the space loss due to premature loss of primary second molar always has been a challenge for pedodontists. Distal shoe space maintainers guide the erupting first permanent molars which have mesial path of eruption. Among several designs of guiding appliances, the most common are the Willet's appliance or the Roche's appliance.[1] The presented cases with Willet's appliance showed space loss, dislodgment of the horizontal arm during eruption, and subsequent lingual and mesial tilting of the permanent first molar. Willet's design unable to provide broad contact often results in dislodgment of the vertical arm, slipping, and rotation of erupting molar.

The modified design was planned to increase flexibility, broaden the contact area, and prevent the dislodgment. Banding was done over the stainless steel crown on 84 after tracing and modified calculation for the vertical depth of intra-alveolar projection.

Vertical depth of intra-alveolar projection = Thickness of overlying bone on 46 extending up to 1 mm below the mesial marginal ridge + distance between distal root tip of 85 to be extracted and crown of 46 = 7 mm.

On contrary to the conventional design, where the intra-alveolar extension is kept 1 mm below the mesial marginal ridge of erupting permanent molar, in the presented design, the extended length of intra-alveolar extension prevented the slipping during eruption. In the intra-alveolar extension, U loop was incorporated to broaden the contact to prevent buccal or lingual deflection during eruption.

At the buccal and lingual arms of horizontal component, U loops distributed the stresses from the permanent first molar during active eruption. The modified design did not show any signs of breakage and dislodgment and could withstand the stress of eruption. The horizontal U loops can be used for activation if any signs of space loss are anticipated during the follow-up period. In the cases with Willet's appliance, all the three cases showed mesial tilting, space loss, or signs of ectopic eruption.

A similar type design by Dhull *et al*. without the extended length of intra-gingival extension was used in reduced intraocclusal space. Instead of fabricating appliance in accordance with the bucco-palatal width of the maxillary second primary molar, the buccolingual width of the horizontal arms in the presented appliance was 1 mm away from the alveolar ridge.[1] Another modification was given by Croll and Johnson, in which ligation of the wire into sheath was done for minor adjustments to prevent gingival submergence of the horizontal arm.[2]

In the modified design by Afshar and Milani, components of Gerber's space regainer were used, and in the design of Garcia-Godoy, two U loops at horizontal arms were given along with lingual arch to make it semi-adjustable.[3,4] Chawla has recommended to fabricate the U loops horizontally at horizontal arms to avoid impingement to the gingiva.[5] Another semi-adjustable appliance design was fabricated in which male and female attachments were given.[6] In contrary to semi-adjustable design, Gujjar *et al*.,[7] Dhindsa and Pandit,[8] and Bhat *et al*.[9] fabricated rigid bilateral appliances without chair side adjustability. Another design was made

by Gegenheimer, in which the gingival extension could be removed after eruption of the permanent first molar.[10] The limitations of the designs were their rigidity, complex design, technique sensitivity, and failure to provide broad contact, which were the advantages of the presented design.

Conclusion

It can be concluded from the case series that this semi-adjustable modified design can withstand the force of eruption by providing broad contact and preventing lingual or buccal deflection during eruption. This design can be an alternative treatment showing advantages over the conventional design for premature loss of the mandibular second molar.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Dhull KS, Bhojraj N, Yadav S, Prabhakaran SD. Modified distal shoe appliance for the loss of a primary second molar: A case report. Quintessence Int 2011;42:829-33.
2. Croll TP, Johnson R. The stainless steel crown, welded sheath, and wire loop for posterior space maintenance. Pediatr Dent 1980;2:56-8.
3. Afshar H, Milani S. Modified distal shoe appliance for bilateral early loss of primary molars: Reports of four cases. J Islam Dent Assoc Iran 2017;29:79-85.
4. Hunter SB. Space maintenance with the Garcia-Godoy appliance. J Clin Orthod 1989;23:529-31.
5. Chawla HS, Goyal A, Khera H. Modified space maintainers. J Indian Soc Pedod Prevent Dent 1984;2:34-5.
6. Brill WA. The distal shoe space maintainer chairside fabrication and clinical performance. Pediatr Dent 2002;24:561-5.
7. Gujjar KR, Indushekar KR, Amith HV, Sharma SL. Modified distal shoe appliance – Fabrication and clinical performance. J Dent Child (Chic) 2012;79:185-8.
8. 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;26:132-5.
9. Bhat PK, Navin HK, Idris M, Christopher P, Rai N. Modified distal shoe appliance for premature loss of multiple deciduous molars: A case report. J Clin Diagn Res 2014;8:ZD43-5.
10. Gegenheimer R, Donly KJ. Distal shoe: A cost-effective maintainer for primary second molars. Pediatr Dent 1992;14:268-9.