

# New Bilateral Rigid Extended Mandibular Distal Shoe Fixed Appliance for Space Maintenance of Premature Bilateral Loss of All Lower Posterior Primary Molars

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**Abstract:** *It is about a new technique using bilateral rigid extended distal shoe space maintainer, indirectly prepared in the dental lab, with band support on both lower canines and lingual arch in-between for stability. A 5.4 years old female child was referred to Paediatric Dentistry Unit, for advanced behaviour management. Treatment plan included complete dental rehabilitation under GA, Orthodontic Band selection on lower primary canines and lower alginate impression were possibly made on the dental chair prior to GA. In the Dental Lab, the bilateral rigid extended distal shoe was prepared, later on, in the Operating Theatre and as final part of the procedure, the fixed appliance was inserted and cemented in place after extraction of all the lower posterior primary teeth and following radiographic confirmation. Clinical and Radiographic Monthly follow up of the case post-operatively, showed no complication and the patient adapted functionally well to the appliance till the bilateral eruption of the lower first permanent molars in place. This New Technique is feasible for both planned and unplanned loss of all primary posterior teeth bilaterally, and can be done for also the upper arch with some minor difference: placement of the supporting wire palatally in-between the parallel bilateral distal extensions behind the canines (Orthodontic Bands or SSC with facial window) to avoid interference with the occlusion palatally.*

**Keywords:** Bilateral Extended Distal Shoe, Dental Space Maintainer, Mandibular Fixed Appliance, Posterior Primary Molars

## Abbreviation

- Early child hood Caries: ECC
- General Anaesthesia: GA
- Teeth Charting used: FDI double digit numbering system adopted by WHO

## 1. Introduction / Backgrounds

About 51% of the prematurely lost first primary and 70% of prematurely lost second primary molars result in a loss of space and consequent malposition of a permanent tooth in that quadrant[1].

Simple space maintenance of premature loss of posterior second primary teeth in children, planned or unplanned, (prior to the eruption of the first permanent molar) is always a challenge for the paediatric dentist [2], as it involves:

- 1) Behaviour management,
- 2) Prior assembling of the chair side type distal shoe (direct), or technical lab work preparation and adjustment (for the indirect lab made type) after determination of the approximate place of the mesial surface of the unerupted first permanent molar, clinically and radiographically.
- 3) Anaesthetising the place to be operated on, or as part of a comprehensive complete dental rehabilitation under GA, if the procedure is to be done under GA. Then extraction of the badly decayed tooth, or if already extracted earlier (unplanned), surgical incision and insertion and cementation of the space maintainer in place.
- 4) Radiographic confirmation prior and after insertion.

## 2. Clinical Objectives and Challenges

In some severe cases of early child hood caries the situation can get more tricky and complicated, and we end up with bilateral loss of both first and second primary posterior molars.

Solutions here are very limited and sometimes unpractical and require a lot of cooperation of a 4 to 5 years old child to wear a bulky partial denture with the risk of space loss if unworn. Also the unerupted tooth may migrate far mesially and erupt beneath this appliance [3].

Some solutions have been made in the past for fixed unilateral extended distal shoe with anchorage taken from the opposite side[4] or for unilateral extended from one side with second molar space maintenance for the other side in a none rigid appliance [5].

Only one was made for the bilateral extended cases: using integrated fixed acrylic denture covering with all the consequences of being unhygienic, potentially causing mucosal irritation and fungal growth. Also being functional, the risk of mobility, infection and traumatic bone resorption was inevitable at the distal shoe site, intra-gingivally and beyond [6].

Volume 7 Issue 4, April 2018

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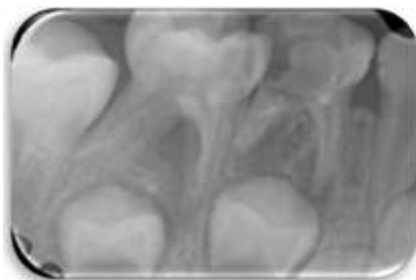
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### 3. Case Study / Case Presentation

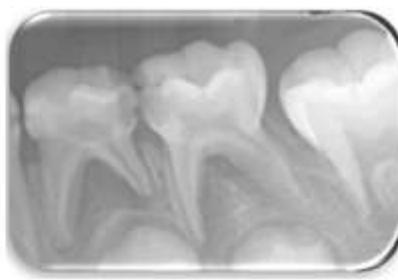
It is about a new technique using bilateral rigid extended distal shoe space maintainer, indirectly prepared in the dental lab, with band support on both lower canines and lingual arch in-between for stability.

A 5.4 years old female child was referred to Dammam Specialised Dental Centre, Paediatric Dentistry Unit, for advanced behaviour management.

She was categorised as a high caries risk patient with severe ECC, had definitely negative behaviour according to Frankl scale of behaviour, and requiring extensive dental treatment, hence she was enrolled for Complete Dental Rehabilitation under GA. On the dental chair, the patient allowed only Orthodontic Band selection for the 73 & 83 and lower alginate impression to be made, but the patient refused any further dental treatment requiring local anaesthesia or high speed hand piece. The patient was scheduled for blood test analysis and pre-anaesthetic assessment for Complete Dental Rehabilitation under GA.



**Figure 1(a)**



**Figure 1(b)**

Pre-op Periapical Radiograph Lower Right side

Pre-op Periapical Radiograph Lower Left side

As extraction of the 74,75,84,85 was part of the treatment plan (due to repetitive and long standing furcation involvement with bone rarefaction, (Figure 1 a, b) a Bilateral Rigid Extended Fixed Appliance was designed and constructed as follow:

The two wires on each side were filled and soldered together at the level of the distal shoe and some distance to the front to give strength to the appliance and to prevent impinging of the healing tissue to come in-between the wires. The whole frame from both sides was assumed to be about 3mm above the alveolar crest.

After the alginate impression was made, the Orthodontic Bands were removed from the patient mouth and placed in its respective places in the impression and secured with fast setting glue. In direct communication with the Paediatric Dental Lab Technician, a framework was designed from 1.0mm thickness stainless steel wire, soldered in-between the canines bands (Figure 2-3) and then two wires from 0.9mm thickness were extended distally from the Orthodontic Bands on each side paralleled and bilaterally till the estimated sites of the mesial surfaces of the first permanent molars (after removal of the planned teeth to be extracted '74,75,84,85' from the cast) and bent to sufficient depth to create the bilateral extended distal shoes.

In the Operating Theatre, Complete Dental Rehabilitation treatment was accomplished, according to the American Association of Paediatric Dentistry Guidelines, and extraction of the 74,75,84,85 was performed as planned,



**Figure 3**

1.0mm stainless steel wire soldered in-between the Orthodontic Bands



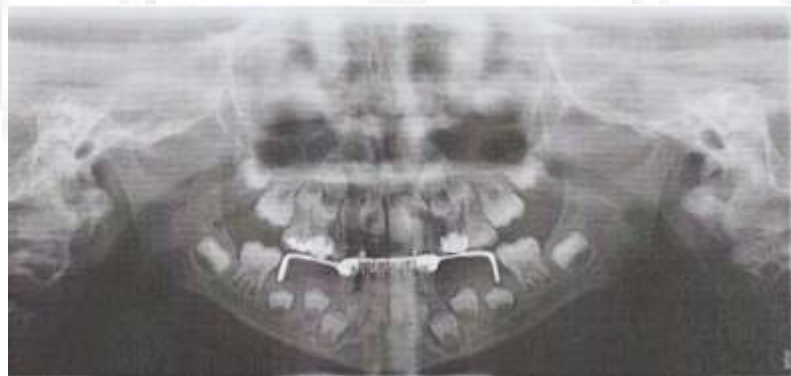
**Figure 2:** Bilateral Rigid Extended Distal Shoe Space Maintainer

the appliance was tried and then inserted and cemented in place after radiographic confirmation on site (Figure 4). The appliance was re-examined on a follow up monthly basis in the dental clinic, clinically and radiographically (Figure 5).



**Figure 4**

Full Photos Post-op insertion of the Appliance intra-orally



**Figure 5: Post-op OPG**

There was no clinical complications observed postoperatively and the patient adapted functionally well to the appliance. Figure 6 (a, b, c) show the appliance intra-orally after the partial eruption of the lower first permanent molars in place.



**Figure 6(a,b,c)**

*The Bilateral Fixed Appliance intra-orally after the Eruption of the First Permanent Molars in place*

#### 4. Assessment / Reflection / Discussion

The concept of space loss due to premature loss of deciduous teeth was described by Davenport as early as 1887[7].

Active eruption of first permanent molar beings as early as 4 ½ years of life and continues until they are in full occlusal contact, i.e. 6 ½ to 7 years of age. Depending upon when the deciduous second molar is lost during this eruption time the space loss and space needs also vary[8].

If the mesio-distal dimension of the second premolar has been duplicated in the appliance, the length of the loop will be correct. It is not necessary for the distal extension to be in direct contact with the permanent molar unless the tooth has already moved mesially. That can be explained as the terminal end of this type of space maintainer exerts pressure which is received by the neuromuscular spindles in the area, also called proprioceptive receptors, which absorb directional information regarding the tooth eruptive movement, hypothetically permitting an eruption without mesial migration[9]. Also the depth of the intra-gingival extension should be about 1.0 to 1.5mm below the mesial marginal ridge of the molar, or just sufficient to 'capture' its mesial surface as the tooth erupts and moves forward[8].

In the mandibular arch the first permanent molar erupts in a lingual and mesial direction using the distal surface of the second primary molar as the buttress to guide into position. Hence the design of the distal extension of the appliance should have a slight lingual position over the crest of the alveolar ridge in order to engage the mesial contact area of the first permanent molar. This consideration is important in preventing the erupting permanent molar from slipping contact with the appliance, resulting in rotation of both the molar and the appliance[3].

The fixed appliance is hygienic, does not need the compliance of the patient and are non- pressure appliance. These appliances when designed appropriately will not promote mesial migration of the erupting tooth [8].

Follow up of patients is crucial to assess the integrity of the cement and to evaluate and clean the abutment teeth [10]. It is also necessary to monitor the development of succedaneous teeth and to ensure that their eruption is not hindered by the appliance [11].

The design maintains the occlusion as well as prevents the supra-eruption of opposing teeth. Also the same appliance can be used as a space maintainer after the removal of gingival extension following the eruption of first permanent molar [8].

The framework design integrated 1.0mm thickness stainless steel wire, soldered in-between the canines bands, this design give support, stability and rigidity to the appliance, that was non-existent in the previous fixed partial denture design[6].

#### 5. Conclusion

This technique solve some clinical complicated cases that encounter the Paediatric Dentist when managing space maintenance in severe cases of ECC, where there is bilateral loss of all posterior deciduous teeth.

This New Technique is feasible for both planned and unplanned loss of all primary posterior teeth bilaterally, and can be done for also the upper arch with some minor difference: placement of the supporting wire in-between the parallel bilateral distal extensions behind the canine (Orthodontic Bands or SSC with facial window) to avoid interference with the occlusion palatally.

Team Work and communication between the clinician and the dental lab technician is a corner stone and primordial in the progress, success, invention and innovation in dentistry. It remove any difficult barriers, find solutions and help improve ways of treatments.

#### 6. Acknowledgements

Authors would like to thank Mr Abdelaziz Alzahrani, certified dental lab technician for Paediatric Dentistry and Orthodontics, Dammam Specialised Dental Centre, for his cooperation in the design and fabrication of this new bilateral distal shoe appliance.

#### 7. Ethical Consent

The protocol of the present case report was approved by the Ethical Committee at Eastern Province Directorate, Ministry of Health. The informed consent was agreed about by the patient carer (father). All dealings performed in this case were in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

#### 8. Conflict of Interest

Authors declare no potential conflict of interest.

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