

A novel posterior fixed functional cantilever space maintainer in children – A case report.

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Abstract

Band and loop space maintainer show good clinical success rates but have certain disadvantages like can cause supra-eruption of opposing teeth and does not help in mastication.

To overcome these disadvantages, a novel space maintainer is designed which is simple, easy to fabricate and can maintain the normal occlusion without causing supra-eruption of opposing teeth and hampering the chewing efficiency. This paper describes two cases with the clinical application of this posterior fixed functional cantilever space maintainer in children.

Keywords: Space maintainer, Functional, fixed space maintainer.

Introduction

A deciduous tooth plays a major role in maintenance of arch length and guiding the eruption of permanent teeth. Premature loss of deciduous teeth can cause loss of

space due to unsolicited movement of adjacent teeth and can eventually influence the position of permanent teeth¹. This is the one of the main reason for the occurrence of malocclusion such as crowding, ectopic eruption, and impaction of permanent teeth².

The preventive and interceptive treatment in case of premature loss of deciduous teeth is use of space maintainer. A space maintainer is a device use to maintain the space in case of early loss of deciduous teeth³. Several different types of space maintainers are available. They can be anterior or posterior, fixed or removable, unilateral or bilateral, maxillary or mandibular and functional or non-functional⁴. The choice of space maintainer depends on the missing teeth, arch involved, and status of the adjacent teeth. The removable space maintainer can be functional or non-functional, while most of the fixed space maintainers are non-functional such as band and loop, crown and loop,

lingual arch, Nance palatal arch.^{1,4} This traditional fixed space maintainer show good clinical success rates but have certain disadvantages like can cause supra-eruption of opposing teeth and does not help in mastication⁴.

To overcome these disadvantages, a novel space maintainer is designed which is simple, easy to fabricate and can maintain the normal occlusion without causing supra-eruption of opposing teeth and hampering the chewing efficiency. The novel space maintainer is a cantilever type of appliance. This is fixed and functional type of space maintainer consisting of two components – i) band (adapted on adjacent teeth) and ii) crown (replacing the space as a pontic), these two components will be attached together. An attempt is made to make a fixed functional space maintainer.

Case Report 1

5 year old male patient reported to the Department of Paediatric and Preventive Dentistry with the chief complaint of decayed teeth in upper right and left back region of the jaw. On clinical examination it was found that maxillary right and left first deciduous molar were grossly carious and were indicated for extraction. Extraction of maxillary right and left first deciduous molars was performed and patient was recalled after 5 days. On clinical examination the extraction socket were healed uneventfully.[Image -1] A posterior fixed functional cantilever space maintainer was planned for the replacement of the maxillary right and left first deciduous molars.

A impression of the maxillary and mandibular jaw were recorded using alginate impression material and perforated impression tray followed by pouring the impression using dental stone to obtain a cast. Posterior fixed functional cantilever space maintainers were fabricated using metal casting procedure.[Image 2]

Finally it was luted using type 1 GIC.[Image 3a, 3b, 3c, 3d].

Case report 2

Six year old female patient reported to the Department of Paediatric and Preventive Dentistry with the chief complaint of decayed teeth and pain in lower right and left back region of the jaw. On clinical examination root piece were observed with respect to 74 (mandibular left first deciduous molar) and grossly carious with 84 (mandibular right first deciduous molar).

[Image 4] Based on clinical and radiographical observation the teeth (74, 84) were advised for extraction. Extraction of mandibular right and left first deciduous molars was performed and patient was recalled after 5 days. On clinical examination the extraction socket were healed uneventfully. A posterior fixed functional cantilever space maintainer was planned for the replacement of the mandibular right and left first deciduous molars.

Similar to case 1, impression of the maxillary and mandibular jaw were recorded using alginate impression material and perforated impression tray followed by pouring the impression using dental stone to obtain a cast. Posterior fixed functional cantilever space maintainers were fabricated using metal casting procedure.[Image 5] Finally it was luted using type 1 GIC.[Image 6a, 6b, 6c, 6d]

Discussion

Band and loop space maintainer is most commonly used appliance for managing the early loss of posterior deciduous teeth⁶. It has shows good clinical success rate with some of the disadvantages like it is non functional, supra eruption of opposing teeth, solder failure leading to breakage.⁷ The ideal space maintainer should not interfere with the normal growth and development and

occlusion. However, no space maintainer fulfils all the ideal requirements.

Many attempts have been made in literature to modify the standard band and loop space maintainer. Vinothini V et al.¹ in 2019 attempted to modify the band and loop space maintainer from a nonfunctional to functional space maintainer. They initially construct a conventional band and loop space maintainer followed by the placement of an acrylic tooth in the edentulous area which was then attached to the loop with the help of cold cure acrylic. Similarly, Antara Sinha et al.⁵ in 2022 in her case series has modified the conventional band and loop space maintainer and also the lingual arch space maintainer by the addition of acrylic teeth component with the help of cold cure acrylic. The limitation of these modified functional appliances was to maintain the hygiene beneath the acrylic flange and the tedious fabrication of the appliance.

Newer space maintainers were designed using the glass fibre reinforced composite resin which were esthetic as well as functional, but the chance of polymerization shrinkage for these appliances were not taken into consideration^{8,9}.

The novel fixed functional cantilever type of space maintainer was designed to overcome the limitation of conventional band and loop space maintainer. Selection of patients plays important role for success of the any appliance. Patient with poor oral hygiene and with low compliance are difficult to manage with the appliance. Limitation of novel fixed functional cantilever type of space maintainer appliance is regular follow-up of the patient to visualize the eruption of permanent teeth. The patients in above-described cases were followed up at one and three months, they did not report any discomfort or food lodgement. Parents were made aware regarding the future follow-up visits and the importance to inspect

the eruption of successor teeth. Though frequent follow up is needed to monitor the erupting permanent successor, functional space maintainers can be appraised as good alternative to conventional space maintainers.¹⁰

Technique of fabrication of posterior fixed functional cantilever space maintainer:

Casting process

Casting is the process by which a wax pattern of a restoration is converted to a replicate in a dental alloy¹¹. First step is to record the impression of maxillary and mandibular arch using the alginate impression material which is then poured using the dental stone to obtain cast. The casting method consists of forming a wax pattern, the wax pattern will consist of band encircling the adjacent teeth and a pontic in the extraction space, surrounding it with investment material, and later heating the investment mold to remove the wax before casting the molten metal into the mold. And then finally finishing and polishing of the space maintainer will be done.

3D printing

3D printing is a process by which 3D object are formed layer by layer using a computer created design.

First step is to record the impression of maxillary and mandibular arch using the alginate impression material which is then poured using the dental stone to obtain cast. The cast will be scanned using 3D digital dental scanner followed by designing of 3D model of fixed functional cantilever space maintainer using the CAD modelling software. The 3D model then will be converted to STereoLithography (STL) file format for recognition of the designed file³. Further the STL file will be converted to a G code by slicer for proper adjusting of model size, location and orientation. And finally the command will be given to 3D printer for printing the model using polymer resin, ceramic or metal

alloy materials. The model will then be removed from the printer followed by the finishing and polishing of the model.

Conclusion

The children in both cases reported satisfaction with the novel posterior fixed functional cantilever space maintainer and found that it is comfortable for eating. This modified space maintainer design did not interfere with maintenance of oral hygiene nor did it cause soft tissue irritation, or food lodgement. This design of space maintainer can be recommended as a superior alternative to the conventional band and loop space maintainer. Further studies are required to compare the longevity, clinical success of conventional band and loop space maintainer with the novel posterior fixed functional cantilever space maintainer.

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Legend Figures

Figure 1: 1 – 5 Days after Extraction of 54, 64.



Figure 2: Maxillary fixed functional cantilever space maintainer



Figure 3: Intraorally placed maxillary fixed functional cantilever space maintainer



a)Maxillary arch



b)Frontal view in occlusion



c)Right side view in occlusion



d)Left side view in occlusion

Figure 4: Grossly carious with 74, 84.



Figure 5: Mandibular fixed functional cantilever space maintainer



Figure 6: Intraorally placed mandibular fixed functional cantilever space maintainer



a)Mandibular arch



b)Frontal view in occlusion



c)Right side view in occlusion



d)Left side view in occlusion