

# Free-end Space Maintainers: Design, Utilization and Advantages

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*Primary molars are a determining factor in the development of occlusion. Given their importance, when restorative treatment is not feasible and a primary molar must be extracted, the practitioner should keep in mind the risk of losing space, and the consequent malocclusion. Preservation of the space can eliminate or reduce the need for prolonged orthodontic treatment. For that reason, there are various kinds of space maintainers and the pediatric dentist must decide which one to utilize, on the basis of general and local factors related to the child. In the selection of a treatment option for space maintenance, the greatest complications occur when the first permanent molar has not yet erupted. A large variety of appliances have been devised to deal with this situation. This article proposes the use of a removable space maintainer that is open on one end and can be employed to guide the first permanent molar, maintaining the integrity of the mucous membrane and serving as a prosthetic appliance, preventing the complications and contraindications often caused by sub-gingival maintainers.*

**Keywords:** space maintainers; alterations in eruption; eruption control; free-end space maintainer  
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## INTRODUCTION

Primary dentition plays a very important role in the child's growth and development, not only in terms of speech, chewing, appearance and the prevention of bad habits, but also in guiding the eruption of permanent teeth.<sup>1,3</sup> Primary molars are a particularly vital element in the development of occlusion, and because of their importance, pediatric dentists are faced with a dilemma: Extraction or restoration.<sup>4,5</sup> When restorative treatment is not feasible and a temporary tooth must be extracted, the practitioner should keep in mind the risk of losing space and the consequent malocclusion.<sup>6-9</sup>

Many authors<sup>2,7,10</sup> have described the effects of the premature loss of primary molars, including a decreased arch length, increased

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overbite, dental malposition, impaction, arch asymmetry and alterations in eruption. For this reason, preservation of the dental arches should play a principal goal in pediatric dentistry.<sup>11</sup>

There are a large number of factors that influence the magnitude of the alterations caused by the premature loss of primary molars, among them dental age, eruption patterns, the amount of bone covering the succedaneous tooth bud, and the type of tooth lost.

The second primary molar is fundamental in the normal eruption and positioning of the first permanent molar.<sup>6</sup> Early loss of this tooth can create a major discrepancy between the space in the arch and dental size.<sup>7,10,12,13</sup>

Preservation of the space can eliminate or reduce the need for prolonged orthodontic treatment.<sup>4,9</sup> For that reason, there are various kinds of space maintainers and the pediatric dentist must decide which one to utilize, on the basis of general and local factors related to the child, as well as the dentist's familiarity and experience with different types of maintainers.<sup>5,7,14</sup>

One of the important aspects to consider when choosing an appliance for space maintenance previously occupied by a primary second molar is whether the first permanent molar is erupting, or, is intraosseous or extra-osseous.<sup>2,3,5,7,8,12</sup>

The permanent molar, under normal conditions, erupts with guidance from the distal surface of the second primary molar and as a result its absence causes mesial migration, space loss and a decreased arch length.<sup>2,8,15</sup>

When the first permanent molar has not yet erupted, it entails the greatest complications related to the choice of treatment options for space maintenance.

A large variety of appliances have been devised to guide the first permanent molar. In 1930, Willett<sup>16</sup> presented the first space main-

tainer with a distal extension, which was called the “distal shoe,” and since then many modifications have been made. Generally this type of intralingual appliance, designed to guide the permanent molar’s eruption, consists of a crown fitted on the first primary molar, and an L-shaped bar with an intra-alveolar extension soldered to the crown’s distal surface.<sup>3,5,6,14,15,17</sup> This bar is submerged subgingivally in the mucous membrane and lead to complications in the area affecting the unerupted permanent molar.<sup>6,10,11,12</sup>

Some authors<sup>7,10,11,12,15,17,18</sup> contraindicate this type of appliance when several teeth are lost, when there is a history of systemic illnesses such as kidney disease, rheumatic fever, low resistance to infection, juvenile diabetes, or certain blood diseases and for patients with congenital heart defects who need prophylactic antibiotics.

In order to avoid the possibility of such complications, we propose the utilization of a removable space maintainer, open at one end, that can serve as the guide for the first permanent molar, thus preserving the integrity of the mucous membrane, avoiding complications and contraindications linked to intralingual maintainers.

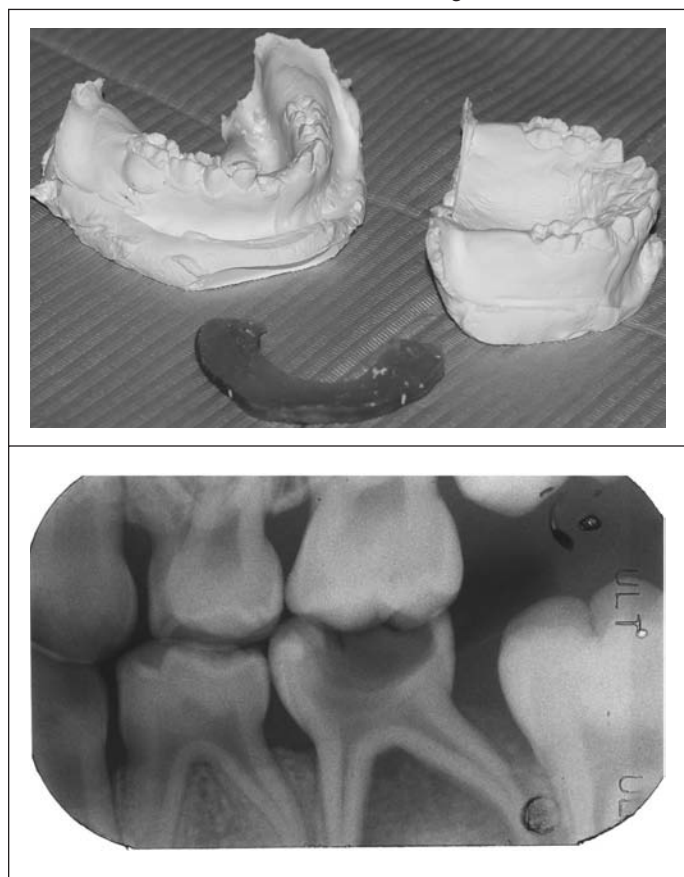
**Clinical management of the free-end maintainer**

**A. PREPARATION OF THE PROSTHESIS**

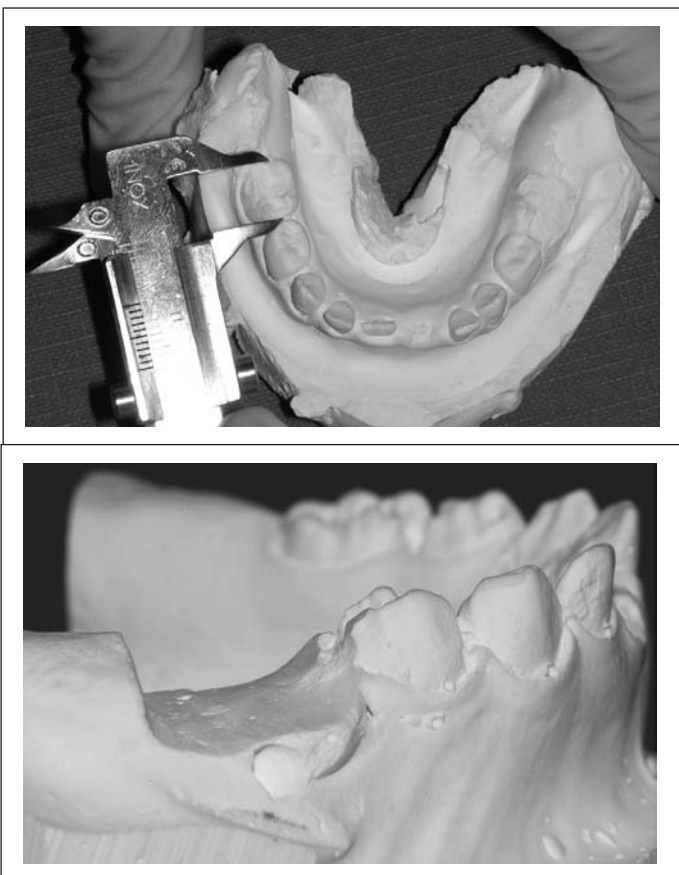
1. Compilation of complementary data: models of the patient’s upper and lower arches and X-rays of the primary molar to be extracted, and of the permanent molar we intend to guide. This information will make it possible, subsequently, to determine the size of the free end (Fig. 1).

2. Evaluation of the permanent molar’s position. The X-ray will reveal one of two circumstances:

**Figure 1:** Complementary data is needed to determine the size of the maintainer’s free edge.



**Figure 2:** Measurement of the mesio-distal distance of the second primary molar to be replaced.



**Figure 3:** Working model is trimmed and prepared before being sent to the laboratory.



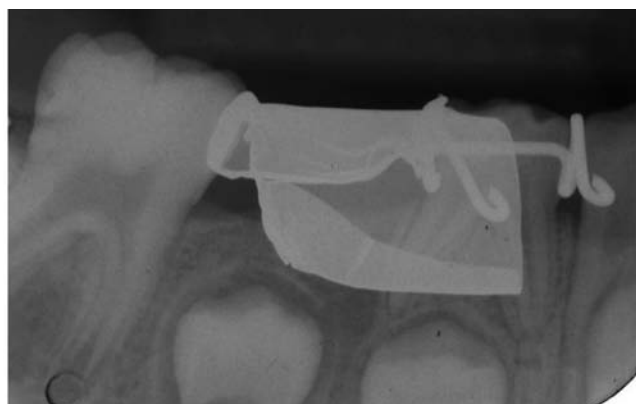
**Figure 4:** Clinical and radiographic monitoring of the length and suitability of the free end.



**Figure 5:** Impression on the gingiva produced by pressure on the supported edge. The prominence of the permanent molar can be noted as it erupts.



**Figure 6:** The permanent molar begins to emerge.



a. The first permanent molar is extraosseous. This situation can be identified by observing in the X-ray the total absence of bone above the molar's occlusal surface, at least in the mesial area.

b. The permanent molar is still intraosseous. The appliance will be designed and situated in the same way as the previous case, but it is very important to remember that it will not begin its role of maintaining the space and guiding the eruption until the molar is extraosseous.

3. Determination of the size of the free end by measuring, intraorally or using the models, the mesio-distal size of the molar to be replaced, if the mesial and distal walls are preserved (Fig. 2). If that is not the case, the size must be obtained by measuring the contralateral molar and confirming, in the X-ray the molar to be extracted, that the measurement is appropriate.

One millimeter is always added to the measurement obtained, in order to avoid complications. This will be explained further on in this article.

4. Preparation of the working model for the laboratory. The dentist must cut out the molar to be replaced in the plaster 1 to 3 mm below the gum line and parallel to the occlusal plane. The measurement in millimeters to the distal wall is the same as the measurement determined for the free end, and the cut will form a straight vestibular-lingual plane. The distal and cervical cuts form a perfectly visible right angle (Fig. 3).

This cut is the fundamental step, because it will make it possible for the prosthesis to be placed on the mucous membrane, exerting significant pressure without cutting into the membrane. On the most distal portion, the acrylic resin should have an occluso cervical thickness of approximately 9 mm and a vestibular-lingual thickness of 10 mm. This distal area, different from the design of any other prosthesis or space maintainer, is what will "trick" nature by simulating the cervical part of the root and the distal surface of the second primary molar.

5. Prosthesis design. The maintainer's design is painted on the corresponding model, specifying the positioning of the Adams clamps, double or single, and clearly writing on it the number of millimeters of the free end. If possible, the morphology of the lost tooth should be recreated; otherwise, only acrylic resin is used. This design is sent to the laboratory.

6. The molar is extracted and measures for correct healing are carried out.

## B. PLACEMENT OF THE PROSTHESIS

7. No more than one week should pass from the time the tooth is extracted until placement of the prosthesis, just as with any other maintainer.

Upon receiving the prosthesis from the laboratory, and before the patient arrives, the practitioner should confirm that the prosthesis conforms to the design and is the right size.

8. The mucous membrane's healing process is examined. Given that only one week should have transpired, healing is not complete.

9. The prosthesis-maintainer is adjusted in the child's mouth:

a. The practitioner confirms that the distal extension is long enough to make contact with the mesial surface of the first permanent molar. This can be verified by placing a lead protection used in periapical X-rays lining the maintainer's distal wall. The appliance is placed in the mouth and the periapical X-ray of the area is taken (Fig. 4).



Given that the size of the free end has been estimated 1 mm larger than the extracted molar, it is possible to observe that the device is situated over the tooth bud (Fig. 4). The acrylic resin must be cut to the appropriate dimension and the straight-edge design must be maintained. This is much simpler than adding on acrylic resin if the device is too short.

**b.** The practitioner verifies that the occlusion has not been altered, retouching the appliance if necessary.

**10.** The patient and parents are instructed in how to insert and clean the appliance, explaining that it should be worn all day, including mealtimes. The practitioner emphasizes that the maintainer should only be removed when the patient brushes his teeth and cleans the appliance.

In addition, the practitioner continues to take proper measures to aid in the healing of the mucous membrane.

### C. FOLLOW-UP

**11.** Healing is checked within a few weeks. At that time, the mouth's adaptation to the appliance is observed and adjustments are made if necessary. At this time, the clinical image is usually very characteristic: the acrylic resin has made an impression in the gingival tissue (Fig. 5) resulting from the pressure exerted by the maintainer on the edge. This indicates that the maintainer is functioning properly.

**12.** Follow-up visits should be approximately every two months, in order to observe the progress of the first permanent molar's eruption. When the maintainer is placed before the tooth bud becomes extraosseous, it must be monitored even more rigorously, because the bud may present a mesial migration, in which case the prosthesis will interfere with the eruption. If there is a high risk of mesial migration at an early stage, screws or other accessories can be added, for use when needed.

**13.** When the tooth begins to emerge, the appliance is maintained and the practitioner verifies that it does not create any interferences (Fig. 6).

**14.** Once the first permanent molar has erupted sufficiently, a dentally supported maintainer should be utilized. A basket crown or a lingual arch can be employed, or alternatively the same prosthesis can be transformed into a dentally supported maintainer, incorporating into its design an Adams clasp into the first permanent molar.

### DISCUSSION

As a result of the complications involved with the use of intragingival maintainers<sup>11,15,17</sup> and as an alternative to these, proprioceptive maintainers have emerged, with the objective of taking advantage of the periodontal ligament's capacity for proprioceptive reception.<sup>12</sup>

Theoretically the terminal end of this maintainer exerts pressure which is received by the neuromuscular spindles in the area, also called proprioceptive receptors, which absorb directional information regarding the tooth's eruptive movement, hypothetically permitting an eruption without mesial migration.<sup>12,19</sup>

The success of this maintainer is determined by the efficiency in which it serves as a guide for the emergence of the unerupted first permanent molar – sagittally, transversely and even vertically – preventing the extrusion of antagonists. In their clinical practice, the authors have confirmed the effectiveness of this appliance on numerous occasions.

Furthermore, given that these patients are children with a great caries tendency, this removable maintainer has the advantage that it

is easy to clean, unlike intragingival maintainers. However, it requires a high level of cooperation on the child's part and strong support from the parents to motivate the children to use it.

The follow-up, subsequent adjustment and maintenance carried out by the dentist is somewhat more complex than what is required with other removable maintainers, but it is easy when compared with the clinical management of intragingival maintainers.

In regard to cost effectiveness, these maintainers must be replaced or readapted when they have fulfilled their function as eruptive guides and the permanent molar has erupted.

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