

SPACE MAINTAINERS IN PREVENTIVE AND INTERCEPTIVE ORTHODONTICS: A REVIEW

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ABSTRACT

Premature loss of primary teeth often results in loss of arch length, predisposing to malocclusion. Early intervention through preventive and interceptive orthodontics is essential to maintain arch integrity and minimize future orthodontic complications. Space maintainers are one of the most commonly employed appliances in pediatric dentistry for preserving arch length following premature tooth loss. This review highlights the importance of space maintainers, their classification, indications, contraindications, clinical considerations, advantages, and limitations, with emphasis on their role in preventive orthodontics.

Keywords: premature tooth loss, space maintainers, interceptive orthodontics, preventive dentistry, mixed dentition, arch length preservation

INTRODUCTION

The primary dentition plays a pivotal role in guiding the eruption of permanent teeth, maintaining arch integrity, mastication, phonetics, and esthetics. Premature loss of primary teeth is common in children, often caused by dental caries, trauma, or pathological resorption. If untreated, early loss can lead to mesial or distal migration of adjacent teeth and subsequent crowding, midline deviation, or ectopic eruption of permanent successors¹.

According to the American Academy of Pediatric Dentistry (AAPD), timely management of premature tooth loss is crucial for ensuring proper occlusal development². Space maintainers are appliances specifically designed to preserve space until eruption of the permanent successor. They are a core element of preventive and interceptive orthodontics, reducing the likelihood of complex malocclusions and minimizing the need for later orthodontic correction^{3,4}.

RATIONALE FOR SPACE MAINTENANCE

The placement of a space maintainer after premature tooth loss is supported by several reasons:

- **Prevention of space loss:** Migration of adjacent teeth into the extraction space has been reported as early as 6 months post-extraction⁵.
- **Maintaining arch integrity:** SMs preserve arch length and perimeter, crucial for avoiding crowding.
- **Guiding eruption:** Proper eruption pathways for permanent teeth are maintained⁶.
- **Reducing malocclusion risk:** Studies have shown that space loss is greater in the maxillary arch than the mandibular, with second primary molar loss having the

greatest impact⁵.

- **Avoiding complex orthodontics:** Early intervention reduces treatment time and cost⁷.

FACTORS AFFECTING SPACE MAINTENANCE

The decision to place a space maintainer depends on:

1. **Age of the patient** – younger children benefit more due to ongoing dental development.
2. **Timing of tooth loss** – early loss is more critical than loss close to normal exfoliation
3. **Arch length analysis** – evaluation of available vs. required space is essential.
4. **Dental development** – radiographs help confirm presence and position of permanent successors.
5. **Oral hygiene and caries risk** – poor oral hygiene is a contraindication to fixed appliances.
6. **Patient cooperation** – compliance influences choice between fixed and removable Sms.

CLASSIFICATION OF SPACE MAINTAINERS⁸

A. Based on Mode of Retention

- **Removable space maintainers** – simple acrylic appliances with clasps, sometimes with prosthetic teeth for esthetics.
- **Fixed space maintainers** – cemented to abutments, not dependent on patient compliance, most commonly used.

B. Based on Design and Location

1. Unilateral fixed

- o **Band and loop:** For single missing primary molar.
- o **Crown and loop:** Modified version for carious abutment teeth.

2. Bilateral fixed

- o **Lingual arch:** Used in mandibular arch for bilateral molar loss.
- o **Transpalatal arch:** For maxillary molar stabilization.
- o **Nance appliance:** Provides additional anchorage with palatal acrylic button.

3. Removable appliances

Acrylic plates, sometimes with artificial teeth, used where esthetics is important.

Indications

- Premature loss of primary molars prior to eruption of premolars.
- Loss of canines causing midline deviation.
- Multiple losses requiring maintenance of arch perimeter.
- Guidance in eruptive irregularities or crowding tendencies.⁸

Contraindications

- Absence of permanent successor (tooth agenesis).
- Poor oral hygiene or rampant caries.
- Uncooperative child in cases of removable appliances.
- Cases where space already closed or orthodontic treatment indicated.⁹

Clinical Considerations

- Space analysis (Moyers, Tanaka-Johnston) prior to appliance selection.
- Radiographic assessment for eruptive stage.
- Condition of abutment teeth—must be caries-free or restored.
- Appliance selection must balance esthetics, compliance, and hygiene.

Advantages

- Simple and cost-effective preventive strategy.
- Maintains eruption path of permanent teeth.
- Reduces need for comprehensive orthodontic treatment.

Limitations and Complications

Although highly effective, SMs are associated with complications:

- Plaque accumulation and increased caries risk.
- Soft tissue irritation and ulceration.
- Appliance breakage or dislodgement.
- Obstruction of permanent tooth eruption if not regularly monitored.

Simsek et al.¹⁰ reported caries development adjacent to SMs in 19% of cases after 2 years, underscoring the importance of periodic evaluation.

RECENT ADVANCE

- **Fiber-reinforced composite (FRC) SMs** – esthetic, metal-free, and easily fabricated; Sasa et al.¹¹ reported good survival rates in short-term studies.
- **CAD/CAM appliances** – allow digital precision and better adaptation.
- **3D-printed SMs** – emerging as customized, rapid fabrication solutions.

Clinical Protocol

1. Diagnosis and space analysis.
2. Radiographic confirmation of permanent successor.
3. Selection of appliance type.
4. Fabrication and cementation (for fixed SMs).
5. Oral hygiene reinforcement and recall every 3–6 months.
6. Appliance removal once permanent successor erupts.

DISCUSSION

The importance of SMs has been well documented in literature. Shashua and Artun⁵ demonstrated that the most significant space loss occurs within the first 6 months after premature tooth loss, especially in the maxillary arch. Qudeimat and Fayle⁷ reported that band and loop appliances have the highest longevity among SMs, with average survival of more than 18 months.

However, clinical success depends on careful case selection and regular follow-up. Simsek et al.¹⁰ highlighted the risk of caries around abutment teeth, emphasizing the need for strict oral hygiene and fluoride use. Fiber-reinforced composite SMs, though promising in esthetics, still require long-term clinical trials before replacing conventional metal SMs¹¹. Overall, SMs are a cornerstone in preventive orthodontics. Their timely application reduces the severity of malocclusion, shortens future orthodontic treatment, and enhances overall prognosis.

CONCLUSION

Space maintainers are indispensable in pediatric dentistry, especially in interceptive orthodontics. Their proper selection, placement, and monitoring preserve arch integrity, ensure normal eruption of permanent teeth, and prevent future malocclusion. Despite some limitations, advances in materials and digital technology continue to improve their

clinical efficiency.

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