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Cost-Effective, Patient-Centric, and Innovative Repurposing of a Broken Lingual Arch Space Maintainer: A Case Report

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Abstract

Introduction Premature loss of primary teeth due to caries or trauma can cause space discrepancies leading to malocclusion and other dental issues. Space maintainers are essential for preserving the arch space until the eruption of the permanent teeth. This case report presents an innovative modification of an existing space maintainer to address clinical challenges, improve patient outcomes, and reduce costs.

Case Report An 8-year-old female presented with a broken lingual arch space maintainer impinging on the lingual mucosa. Clinical examination revealed nonrestorable teeth 84 and 75 that required extraction. Radiographs showed tooth 34 erupting soon and tooth 45 delayed. Owing to financial constraints, the existing appliance was modified by lingually cutting and adapting the wire to the distal surface of the canine. The appliance was cemented using Type I Glass Ionomer Cement in a single visit. After 6 months, tooth 35 erupted normally, without impaction.

Conclusion This case demonstrates the effectiveness of modifying existing space maintainers to provide cost-effective patient-centric solutions in pediatric dentistry.

Keywords
- space maintainers
- tooth eruption
- pediatric dentistry
- glass ionomer cements
- dental arch

Introduction

Exfoliation of primary teeth is a physiological process that precedes eruption of permanent teeth in the oral cavity.[1] However, premature loss of primary teeth can occur due to various reasons such as severe dental caries or trauma. This untimely loss can lead to mesial drifting of the posterior teeth, resulting in inadequate arch space for eruption of the successor teeth. Consequently, this space discrepancy may manifest in the permanent dentition as malocclusion, crowding, crossbite, impaction of successor teeth, or supraeruption of their counterparts. Therefore, primary teeth are considered the best natural space maintainers.[2,3]

To avoid space discrepancies, it is essential to preserve the primary teeth in the oral cavity until the permanent successors erupt.[3] However, there are instances when premature extraction of primary teeth is inevitable, such as in the case of grossly decayed teeth or other dental conditions. In such scenarios, a space maintainer is required to maintain the space created by the loss of primary teeth, which can be unilateral or bilateral owing to multiple extracted teeth.[4]

Several factors influence the need for a space maintainer, including the time elapsed since tooth loss, dental age, rate of space loss, amount of bone covering the unerupted tooth, amount of space closure, eruption timing of successors, delayed eruption of permanent teeth, direction of space closure, congenital absence of permanent teeth, midline deviation, molar and canine relationships, facial growth patterns, and amount of space loss.[5] In addition, the design and maintenance of the appliances play a significant role.

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With the rapid evolution of dentistry, the design of space maintainers has been updated periodically.[6] Currently, space maintainers encompass both fixed and removable appliances. Although removable space maintainers offer restoration of function and aesthetics, they have been observed to exhibit lower patient compliance.[7–9]

In this case report, we present a novel approach for space maintenance by modifying an existing space maintainer to enhance its effectiveness. The concept of modification arose from the need to address specific clinical challenges and to improve patient outcomes. By integrating innovative design features, the modified space maintainer aims to provide better patient acceptance, reduce the need for multiple appointments, address cost concerns, and repurpose materials that are typically considered waste.[10] This report details the clinical procedures involved in the modification process, the rationale behind the design changes, and the outcomes observed in the patient. Through this approach, we aimed to highlight the potential benefits of customized space maintainers in managing premature primary tooth loss and ensuring optimal dental development.

Case Report

An 8-year-old female presented to a rural center under the flagship of A. B. Shetty Memorial Institute of Dental Sciences, Mangalore, Karnataka, India, with a complaint of a broken lingual arch space maintainer impinging on the lingual mucosa of the lower anterior teeth. ►**Fig. 2** the patient's medical history was unremarkable and she had no known allergies.

Upon clinical examination, it was evident that teeth 84 and 75 were severely decayed and nonrestorable, necessitating extraction. Additionally, no visible signs of erupting successors were observed at the extraction sites.

To gather more information, a radiographic examination of the extraction sites was performed. Radiographs revealed that the lower right premolar (tooth 34) was erupting with less than 2 mm of overlying bone, indicating imminent emergence. No space maintainer was needed; space supervision was deemed sufficient. Conversely, tooth 45 on the lower left side had an overlying bone of approximately 4 mm, suggesting that eruption would not occur immediately (►**Fig. 1A** and **B**). This highlights the need for continued use of a space maintainer to preserve space and ensure proper alignment of the dental arch until tooth 45 erupts.[11]

The patient presented with a broken lingual arch space maintainer at the solder joint on one side of the appliance. The broken appliance was decemented and the remaining luting cement was thoroughly cleaned. The bands on both sides were removed and the tooth was meticulously cleaned to ensure that all residual luting cement was eliminated, thus maintaining adequate oral hygiene. Topical fluoride varnish was applied to prevent decay due to decalcification caused by placement on the banded teeth.[12] The patient was advised to have the lingual arch refabricated; however, owing to financial constraints, the parents refused to opt for a new space maintainer.

Given that sufficient wire remained, excess wire was cut at the midpoint. The wire was then adapted to the distal surface of the canine from the lingual aspect, in contrast to the traditional buccal adaptation observed in Mayne's appliance.[13] This lingual adaptation was chosen to reuse an existing appliance while ensuring better stability and comfort for the patient. Following wire adaptation, the occlusion was meticulously checked to ensure that there were no discrepancies or high points that could affect the patient's bite or comfort.[14] Finally, the modified appliance was cemented using the luting consistency of Type I Glass Ionomer Cement (►**Fig. 2**; ►**Fig. 3**).

Completing this entire procedure in a single sitting was crucial for minimizing the patient's discomfort and anxiety, reducing the number of dental visits, and decreasing chairside time. This approach also avoided the need for rebanding, which could be distressing for a pediatric patient.[15]

Postoperative care instructions were effectively reinforced. The patient and her guardians were educated about

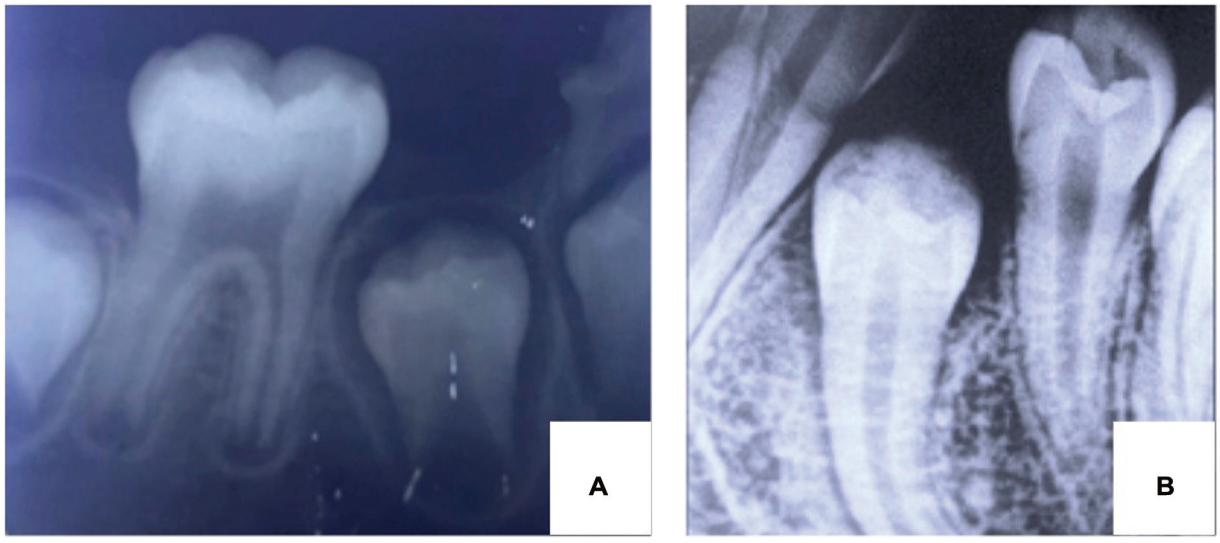

Fig. 1 Eruption status of 85 (**A**) and 75 (**B**) as appreciated on the intraoral periapical radiograph.

Fig. 2 Broken lingual arch.

the importance of maintaining good oral hygiene, particularly around the space maintainer.[16] They were advised to brush carefully around the appliance and use a fluoride mouth rinse to prevent decay. Regular follow-up visits were scheduled to monitor the space maintainer's effectiveness and to check for the eruption of tooth 35.[17]

During follow-up appointments, the patient demonstrated good compliance with the oral hygiene instructions.[18] No signs of irritation or discomfort related to the space maintainer were observed. Radiographic and clinical evaluations confirmed the proper positioning and function of the space maintainer, verifying the ongoing health of the surrounding teeth and gingiva.[17]

After 6 months, tooth 35 erupted normally into the oral cavity without any impaction. This case highlights the importance of prompt and efficient management of broken dental appliances in pediatric patients. The innovative approach of adapting the wire from the lingual aspect ensured the stability of the space maintainer and patient comfort. This case also highlights the necessity of regular follow-up and patient education to maintain oral health, especially in a pediatric population with specific dental needs. Regular monitoring and tailored oral care interventions are crucial to manage and prevent dental complications in young patients.

Discussion

This case report illustrates a practical and innovative approach for managing a broken lingual arch space maintainer in a pediatric patient, emphasizing cost-effectiveness and patient comfort. The primary objective was to maintain space and prevent malocclusion, despite financial constraints and the need for immediate intervention.

The decision to repurpose the broken appliance by adapting the wire from the lingual aspect has proved beneficial in several ways. First, it minimized the financial burden on the patient's family, who could not afford a new space maintainer. This adaptation not only salvaged the existing materials, but also maintained the essential function of space maintenance without the need for a completely new appliance.

Clinical examination and radiographs played a critical role in guiding the treatment plan.[19] Radiographs revealed that the premolar on the lower right side was on the verge of eruption, while the premolar on the lower left side required more time. This insight was crucial in determining the necessity of maintaining space on the lower left side, ensuring proper dental development.

Single-visit modification of the space maintainer was pivotal in reducing patient anxiety and discomfort. Pediatric patients often exhibit lower tolerance for prolonged or multiple dental procedures, making swift and effective modification of existing appliances particularly advantageous. Additionally, the use of Type I Glass Ionomer Cement for recementation ensured a secure and durable attachment, reducing the likelihood of future complications.[20,21]

Regular follow-up was integral to the success of this case. Monitoring the function of the modified appliance and the patient's oral hygiene helped prevent potential issues, such as plaque accumulation and gingival health deterioration. The patient demonstrated good compliance with oral hygiene instructions, which was vital for maintaining the effectiveness of the space maintainer and overall oral health.[18]

However, some potential disadvantages have been noted, including the risk of dislodgement due to tongue movement, interference with tongue function, and plaque accumulation. These risks underscore the importance of thorough patient and parental education regarding appliance maintenance and care.[22,23]

Looking ahead, this case underscores the need for continued innovation in space maintainer design to enhance

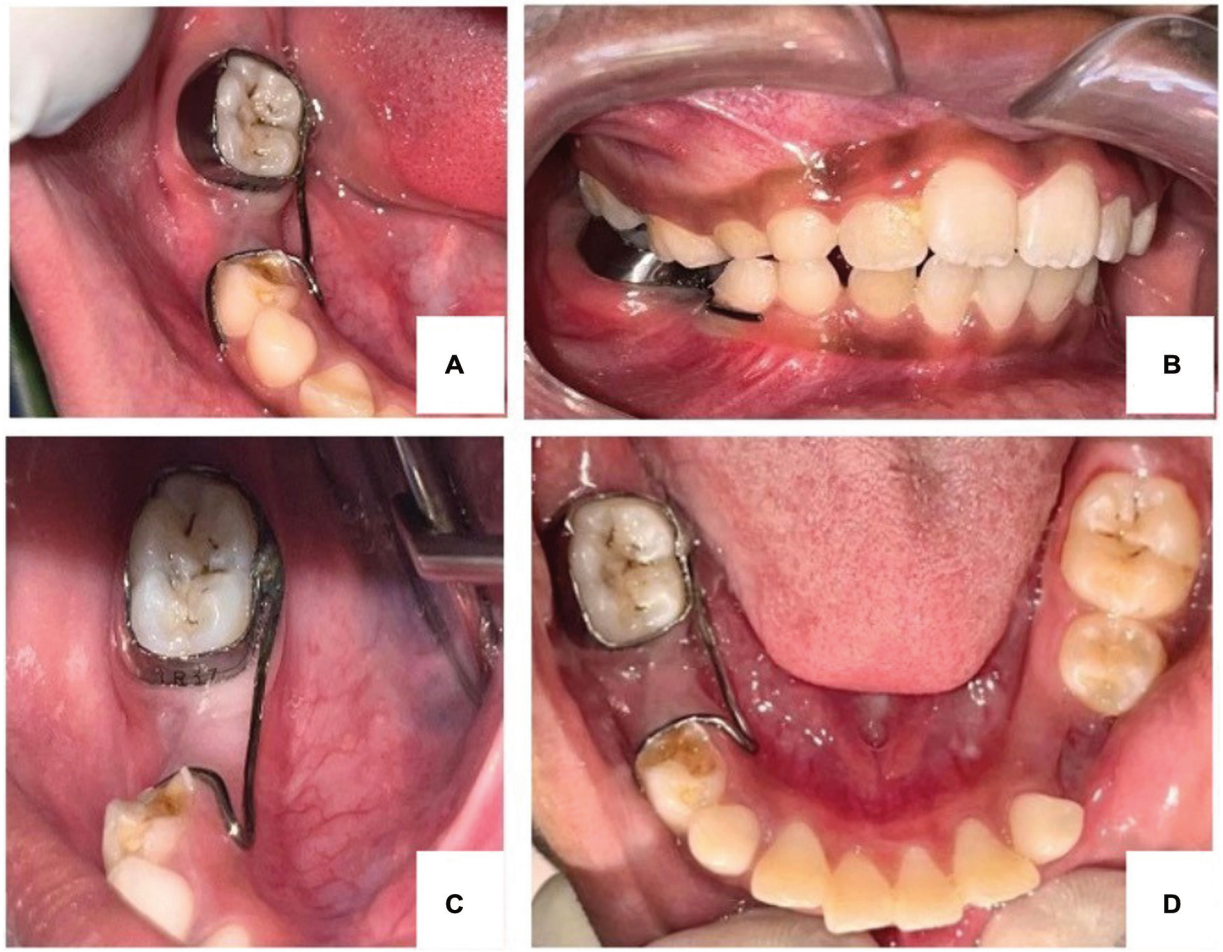

Fig. 3 Appliance design (**A1**, **A2**: buccal views; **B**: lingual view; **C**: occlusal view).

durability and patient comfort. Further research and development could lead to more resilient and user-friendly appliances, reducing the likelihood of complications such as those encountered in this case.

In conclusion, the innovative modification of the broken lingual arch space maintainer in this case highlights the importance of cost-effective patient-centric solutions in pediatric dentistry. This approach not only addresses immediate clinical needs, but also ensures long-term benefits by preserving space for proper dental development. This case reinforces the value of regular follow-ups, patient education, and adaptability of existing dental appliances to meet individual patient needs effectively.

Conclusion

This case report demonstrates that modifying existing space maintainers can be a novel and effective alternative to remaking traditional fixed-space maintainers in pediatric dentistry. This approach significantly reduces chairside time and the number of appointments, which are particularly beneficial for apprehensive patients.[15] By adapting and reusing the existing appliance, we addressed both the financial constraints of the patient's family and the clinical need to maintain a proper dental arch space.

A properly fabricated and modified space maintainer can effectively serve its purpose when monitored and kept under the vigilance of a trained pediatric dentist.[24] Regular follow-ups and patient education are crucial to ensure the stability, functionality, and overall oral health of the appliance.[16,17] This case highlights the importance of innovative, cost-effective solutions in pediatric dentistry, ultimately improving patient outcomes and comfort while maintaining the necessary orthodontic function.

Data Availability Statement

Data supporting the findings of this study are available upon request from the corresponding author.

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Patient Consent

The father (legal guardian) of the patient provided consent for the publication of this case report, and the patient provided assent.

Conflict of Interest
None declared.

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