



PATIENT- AND PARENT-CENTERED EVALUATION OF SATISFACTION WITH FIBER-REINFORCED COMPOSITE VERSUS CONVENTIONAL BAND-AND-LOOP SPACE MAINTAINERS IN PEDIATRIC DENTISTRY

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Abstract

Background: Fixed space maintainers for prematurely lost primary molars aim not only to preserve arch integrity but also to ensure patient comfort and satisfaction. The most widely used Band and Loop (BL) space maintainers have several drawbacks, such as non-function, poor gingival health, limited survival, laboratory work for fabrication, and multi-sitting procedure, decalcification of the abutment tooth, loosening because of breakage or dissolution of the luting agent, a tendency to get embedded in the soft tissue, and the possibility of metal allergy. Fiber-reinforced composite loop (FRCL) space maintainers are tooth-colored and bondable, avoiding impressions and bulky metal, which may improve patient-centered outcomes.

Objective: To compare patient and parent satisfaction, acceptability, comfort, and aesthetics between FRCL space maintainers and conventional band-and-loop (BL) maintainers.

Methods: In a split-mouth quasi-experimental study, 15 children (4–8 years) each received one FRCL maintainer and one BL maintainer on opposite sides after primary molar extraction. Satisfaction was assessed at baseline and 3, 6, 9, and 12 months' post-placement using a 5-point Likert scale (1 = very unsatisfied to 5 = very satisfied). Questionnaires were administered to patients and parents at each visit.

Results: At 12 months, children with FRCL maintainers reported markedly higher satisfaction: >80% were “satisfied” or “very satisfied” versus only 33% in the BL group. In contrast, the BL group had higher rates of dissatisfaction ($\geq 33\%$ unsatisfied/very unsatisfied). At 12 months, $p = 0.03$ demonstrated that Group A reported notably higher satisfaction, reflecting superior acceptance of FRCL space maintainers by both patients and parents.

Conclusion: FRCL space maintainers demonstrated superior patient and parent satisfaction over conventional band-loop appliances. These tooth-colored, less bulky devices were perceived as more comfortable and esthetic, indicating that FRCL maintainers can significantly improve the pediatric patient experience in routine dental care.

Keywords: Fiber-reinforced composite, Conventional Band and Loop, space maintainer, patient satisfaction, pediatric dentistry, acceptability, comfort, aesthetics.

Introduction

The exfoliation of primary teeth and subsequent eruption of permanent successors is a fundamental physiological process in human dental development. However, premature loss of primary teeth—arising from trauma, neonatal extractions, early childhood caries, periodontal disease, or systemic conditions—can disrupt this natural sequence and lead to space loss, arch integrity disturbance, and eventual malocclusion if unaddressed (1–4). In regions like Bangladesh, early primary tooth loss is a common challenge, underscoring the importance of timely preventive interventions. Primary teeth serve essential roles in effective mastication, speech development, esthetics, and guidance of erupting permanent dentition by preserving arch space (1,5,6). To mitigate the risks associated with early loss, the use of space maintainers is advocated in paediatric and interceptive orthodontics. Space maintainers are categorized as removable or fixed, active or passive, and unilateral or bilateral (2,7). Among fixed non-functional types, the **band-and-loop (BL)** appliance is widely used due to its established efficacy in space preservation (5,8). Nonetheless, BL devices present several drawbacks: they require impressions and laboratory fabrication, multiple visits, and involve bulky metal components that may impair gingival adaptation, cause decementation, increase risk of cervical caries on abutment teeth, allow loop slippage, abutment tipping, and elicit metal allergy responses (5,9–11). In response to these limitations, **fibre-reinforced composite loop (FRCL)** space maintainers have been introduced. These directly bond to tooth surfaces using esthetic composite resin, eliminating the need for impressions or laboratory processing, and are designed to be tooth-colored, minimally intrusive, and less bulky (8,12,13). In parallel, patient- and parent-

centered outcomes—such as comfort, aesthetics, acceptability, and satisfaction—are increasingly recognized as critical measures of success in pediatric dental care (10,14–16). The FRCL design, described in prior reports as “esthetic, less bulky, and more natural-feeling,” suggests improved acceptability among children and their parents relative to conventional BL devices (12,16,17). However, despite these promising claims, only a limited number of studies have systematically evaluated patient-reported outcomes of FRCL versus BL maintainers over time (13,18–20). Therefore, this study focuses on comparing patient- and parent-reported satisfaction, comfort, acceptability, and aesthetics for FRCL and BL space maintainers over a 12-month follow-up period.

Materials and Methods

Study Design and Participants: A split-mouth quasi-experimental study was conducted from June 2023 to September 2024 with 15 pediatric patients (age range 4–8) who each had bilateral premature loss of a primary molar. Each child received an FRCL space maintainer on one side (group A) and a conventional custom-made band-and-loop (BL) on the contralateral side (group B). The protocol was approved by the institutional review board, Bangladesh Medical University (No. BSMMU/2023/9148, Registration no:4403), and informed consent was obtained from parents.

Space Maintainer Fabrication: Under all aseptic precautions, a total of 30 extraction sites that fulfilled the inclusion criteria were selected for this study after completion of a full mouth clinical examination and appropriate radiograph. FRCL maintainers were fabricated chairside by bonding fiber-reinforced polyethylene “e-Splint” material in a loop between the abutment teeth using a 7th-generation bonding agent and flowable composite (BeautiBond and Beautifil II). BL maintainers were made by taking impressions and a prefabricating stainless-steel band, and a custom made loop (made by 0.9mm SS wire) was soldered and fabricated in the lab, then cemented with glass ionomer. Both types were placed under rubber-dam isolation with high-volume suction.

Satisfaction Assessment: Patient and parent satisfaction was assessed at baseline (immediately after placement) and at 3, 6, 9, and 12 months. A structured questionnaire used a 5-point Likert scale.

Statistical Analysis:

Data were entered, then processed and analyzed using SPSS 26 (Statistical Program for Social Science). Descriptive analyses were expressed by frequency & percentage. Statistical associations between two categorical variables were assessed by Fisher's Exact test. A P-value of less than 0.05 was measured to be statistically significant.

Results

A sample of 30 age ranges are represented in the data.

In Table 1-The average age of the participants is 6 as indicated by the mean age of 6. The standard deviation, which stands at 0.84, indicates that, with some variance, most ages are quite near the mean. The highest age distribution occurs at age 6 (46.7%), followed by age 5 (26.7%), with smaller frequencies at ages 5.5, 7, and 8. With fewer participants at the extreme ages, this suggests that most people are grouped around the mean age of 6.

Table 1: Distribution of Patients by age in both groups by percentage (n=30)

Age	Frequency	Percent (%)
5	8	26.7
5.5	2	6.7
6	14	46.7
7	4	13.3
8	2	6.7
Total	30	100
Mean age		6
Standard deviation		0.84

The gender composition of the study population demonstrated a nearly balanced distribution between males and females. Among all respondents, **47% were male** and **53% were female**, as illustrated in Figure 1. This indicates a slightly higher representation of females in the study group. The **male-to-female ratio** was calculated to be approximately **1:1.08**, suggesting that for every male participant, there were about 1.08 female participants. Such a balanced distribution ensures that both genders are adequately represented, reducing potential gender-related bias in the interpretation of results.

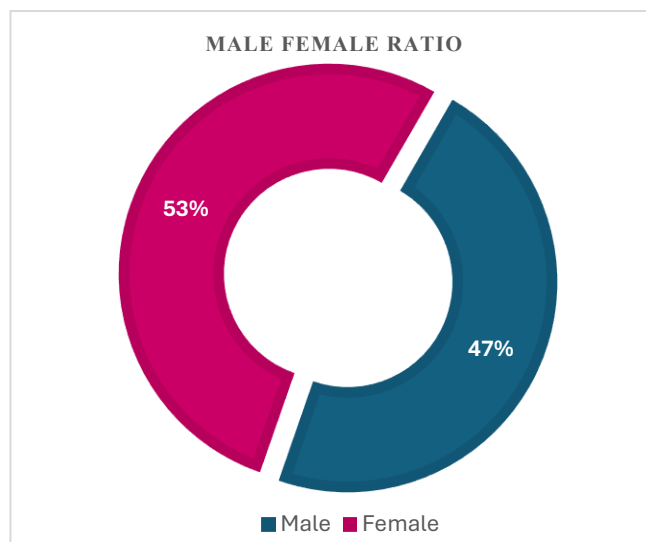


Figure 1: Gender distribution by percentage among the study participants

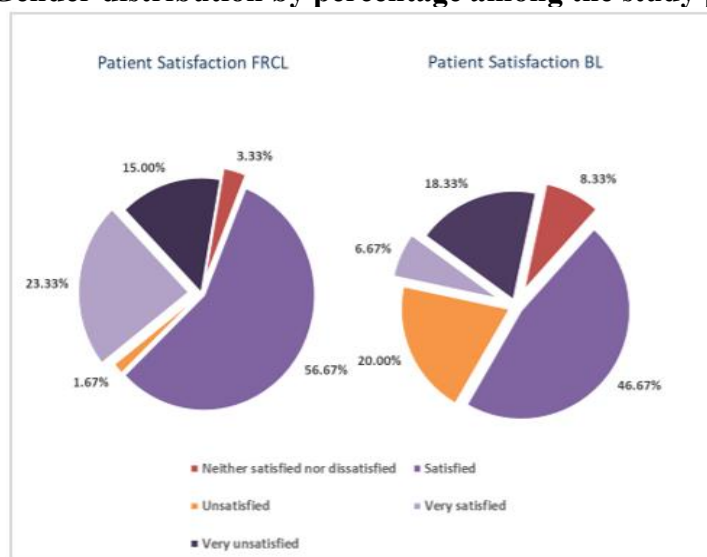


Figure 2: Group comparison of average patient or parents' satisfaction at different follow-up intervals by percentage.

FRCL-Fiber reinforced composite loop space maintainer

BL- conventional custom-made Band & Loop space maintainer

Figure 2- illustrates the comparative distribution of patient or parent satisfaction levels for the Fiber Reinforced Composite Loop (FRCL) and Band and Loop (BL) space maintainers. Among participants in the FRCL group, 56.67% reported being satisfied and 23.33% were very satisfied, indicating a generally positive response to this appliance. In contrast, 1.67% expressed dissatisfaction, and 15% were very unsatisfied, representing a small proportion with negative experiences.

For the BL group, satisfaction was slightly lower, with 46.67% satisfied and 20% very satisfied, while 6.67% were unsatisfied, 8.33% very unsatisfied, and 18.33% neutral (neither satisfied nor dissatisfied).

Overall, these findings suggest that patients using the FRCL space maintainer reported a more favorable experience compared to those using the BL type, highlighting better acceptance and comfort among FRCL users.

Patient and parent satisfaction, comfort, acceptability, and aesthetics remained high overall but diverged between groups over time. Immediately post-placement, virtually all children were satisfied with both types of appliances. By 12 months, the FRCL group maintained markedly higher satisfaction >80% of patients/parents reporting being satisfied or very satisfied, compared to only 33% in the BL group ($p=0.035$). Conversely, dissatisfaction (score ≤ 2) was significantly more common with the BL maintainer (combined 33%) than with the FRCL (20%) at 12 months.

Table 2- shows the distribution of satisfaction ratings at the 12-month follow-up. Notably, a majority (53%) of FRCL patients were “very satisfied,” whereas the BL group had only 13% “very satisfied” and a substantial fraction expressing dissatisfaction.

Table 2: Group comparison of patients or parental satisfaction at a different follow-up interval.

Group	Patients and parental satisfaction	Follow up				
		Baseline	3 rd months	6 th months	9 th months	12 th months
Fiber reinforced composite loop SM(Group-A) N _a =15	very unsatisfied	0(0%)	1(6.67%)	2(13.33%)	3(20%)	3(20%)
	unsatisfied	0(0%)	1(6.67%)	0(0%)	0(0%)	0(0%)
	Neither satisfied nor dissatisfied	0(0%)	1(6.67%)	1(6.67%)	0(0%)	0(0%)
	satisfied	15(100%)	12(80%)	11(73.33%)	7(46.66%)	4(26.67%)
	very satisfied.	0(0%)	0(0%)	1(6.67%)	5(33.33%)	8(53.33%)
Conventional custom made Band & Loop SM(Group-B) N _b =15	very unsatisfied	0(0%)	0(0%)	2(13.33%)	4(26.67%)	5(16.7%)
	unsatisfied	0(0%)	3(20%)	1(6.67%)	3(20%)	5(16.7%)
	Neither satisfied nor dissatisfied	0(0%)	3(20%)	1(6.67%)	1(6.67%)	0(0%)
	satisfied	15(100%)	9(60%)	11(73.33%)	7(46.66%)	1(3.3%)
	very satisfied	0(0%)	0(0%)	2(13.33%)	4(26.67%)	4(13.3%)
p-value		-	0.330	0.736	0.058	0.035*

P<0.05 is Significant

Group A (Fiber reinforced composite loop SM) showed rising levels of satisfaction over time, with a large number of patients/parents being very satisfied by the 12th month. Group B (Conventional custom-made Band & Loop SM) reported more mixed satisfaction, with some participants expressing dissatisfaction, particularly at later follow-up intervals.

At the 12th month, the p-value = 0.035 indicates that Group A had significantly higher satisfaction than Group B, implying that patients and parents were more satisfied with the fiber-reinforced composite loop SM by the end of the study.

Discussion

This study demonstrates that fiber-reinforced composite loop space maintainers achieve superior patient-centered outcomes compared to conventional band-and-loop appliances. Over the 12 months, children (and their parents) consistently reported greater satisfaction, comfort, and acceptability with the FRCL design. By the final follow-up, the FRCL group's satisfaction was significantly higher than the BL group's.

Several factors likely underlie these findings. Firstly, premature loss of primary molars can lead to occlusal complications such as crowding, space loss, and misalignment of erupting permanent teeth, emphasizing the critical role of effective space maintenance (1,2). Traditionally, band and loop (BL) space maintainers have been widely used; however, they are associated with several drawbacks, including cement failure, solder breakage, gingival impingement, and the requirement for multiple visits and laboratory procedures (5,9). Moreover, the discomfort caused by impression making and band adaptation often reduces cooperation in young children, particularly those with a pronounced gag reflex (5,10,21).

Secondly, in the present study, a significant difference in patient acceptability was observed between the two groups. Fiber-reinforced composite loop (FRCL) space maintainers demonstrated superior acceptance. In Group A, FRCL maintainers were directly bonded to the buccal and lingual surfaces of abutment teeth, facilitating single-visit placement and minimal chairside time. Their reduced bulk and improved aesthetics enhanced both comfort and parental satisfaction. Furthermore, the material properties of FRCL may enhance perceived comfort, offer flexibility, tooth-like translucency, and smooth, rounded contours, reducing the risk of soft tissue injury and discomfort compared to metal. Resin bonding eliminates cement dissolution and related emergencies, contributing to better tolerance and fewer follow-up visits, consistent with literature reporting FRCL maintainers as “well tolerated” by children. In contrast, Group B, which received BL maintainers, exhibited lower acceptability due to challenges during band adaptation and impression procedures, consistent with earlier findings (5,8,12).

Thirdly, these results align with previous studies by Garg et al. (2014), Goenka et al. (2014), Mittal et al. (2018), Kamal and Muhammad (2017), Tyagi et al. (2021), Yadukrishnan et al. (2024), Ramesh et al. (2023), and Spodzieja & Olczak-Kowalczyk (2022), all of whom reported that FRCL maintainers are more comfortable, aesthetic, and better accepted by patients compared to BL types (12,13,16,18–23). Additionally, Kargul et al. (2003) noted that FRCL maintainers eliminate the need for annual removal and fluoride application required for BL appliances (24), as also highlighted by McDonald and Avery (2000) (1). Deshpande et al. (2018) further emphasized that bonded maintainers can serve as an effective alternative to traditional banded appliances when appropriate design, fabrication, and maintenance are ensured (19).

Overall, the findings of this study suggest that FRCL space maintainers provide a simpler, more aesthetic, and comfortable alternative to BL space maintainers, supporting their broader use in paediatric dental practice and aligning with modern, minimally invasive, patient-centred principles of dentistry.

Conclusion:

FRCL space maintainers offer a superior patient and parent experience compared to conventional band-and-loop appliances. Their esthetic, lightweight design and ease of single-visit placement enhance comfort and acceptability, making them a practical and child-friendly option. Incorporating FRCL maintainers in pediatric dental practice can improve patient satisfaction, compliance, and support long-term oral health outcomes.

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