

CLINICAL ASSESSMENT OF THE ABUTMENT TEETH OF CHILDREN UNDERGOING SPACE MAINTAINER THERAPY: A RANDOMISED CONTROLLED TRIAL

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Introduction: The band and loop space maintainer are one of the most commonly used fixed space maintainers in children. However, prolonged use of appliances in the oral cavity may lead to changes in gingival health and an increased risk of caries.

Objectives: This study aims to evaluate the clinical parameters of the abutment teeth, specifically the banded teeth and the tooth to which the loop is extended.

Methods: This prospective clinical study included 35 children between the age group of 5 to 9 years. The children were examined at baseline and 6-month follow-up. The abutment teeth were evaluated on bleeding on probing, pocket depth, gingival index, and occurrence of primary/secondary caries.

Results: There was a significant difference in the bleeding on probing, pocket depth, gingival index, and occurrence of primary/secondary caries ($p < 0.05$).

Conclusion: Precautions and thorough knowledge about the consequences of the delivery of appliances can prevent and overcome the causes. Oral health education and constant motivation should be provided to the children on dental hygiene and regular follow-ups to avoid any extensive invasive management.

Keywords: Band and loop, Gingival health, Fixed space maintainer, periodontal health

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Conflicts of interest:

The authors declare no conflicts of interest.

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ÉVALUATION CLINIQUE CHEZ LES ENFANTS DES DENTS PILIERS POUR MAINTENEUR D'ESPACE: UN ESSAI CONTRÔLÉ RANDOMISÉ

Introduction: Le mainteneur d'espace avec bague et boucle est l'un des mainteneurs d'espace fixe les plus couramment utilisés chez les enfants. Cependant, l'utilisation prolongée d'appareils dans la cavité buccale peut entraîner des modifications de la santé gingivale et un risque accru de caries.

Objectifs: Cette étude vise à évaluer les paramètres cliniques des dents piliers, en particulier les dents baguées et la dent à laquelle la boucle est étendue.

Méthodes: Cette étude clinique prospective a inclus 35 enfants âgés de 5 à 9 ans. Les enfants ont été examinés au départ et après 6 mois de suivi. Les dents piliers ont été évaluées en fonction du saignement au sondage, de la profondeur de la poche, de l'index gingival et de l'apparition de caries primaires/secondaires.

Résultats: Il y avait une différence significative dans le saignement au sondage, la profondeur des poches, l'indice gingival et l'apparition de caries primaires/secondaires ($p < 0,05$).

Conclusions: Des précautions et une connaissance approfondie des conséquences de la livraison des appareils peuvent prévenir et surmonter les causes. Une éducation à la santé bucco-dentaire et une motivation constante doivent être fournies aux enfants en matière d'hygiène dentaire et de suivis réguliers pour éviter toute prise en charge invasive extensive.

Mots clés: Bande et boucle, Santé gingivale, Mainteneur d'espace fixe, santé parodontale

Introduction

The most frequent cause of malocclusion is the premature loss or early exfoliation of a primary tooth [1]. Preserving primary teeth until their natural time of exfoliation is the most effective method for avoiding these issues. The statement that primary teeth are the best space maintainers for permanent dentition is widely acknowledged [2]. Engaging space maintainers will eliminate these later complications such as crowding, ectopic eruption, loss of arch perimeter etc [3]. Removable or fixed space maintainers are the two primary categories that space maintainers fall under [4]. It can be easier to maintain proper oral hygiene with removable space maintainers because they are often practical and simple to clean.

But it is comparatively huge to obtain retention from the entire arch. The effectiveness of appliances depends largely on patient compliance, which is problematic given that children make up the majority of the patients [5]. Additionally, there is always a danger that these items will break or go missing [6]. Moving to the fixed space maintainer, on comparing the bonded vs banded space maintainers, Bonded space maintainers like glass fibre reinforced composite resins such as Ribbond [7], Everstick [8], and super splint have less survival rate [9]. Banded fixed space maintainers, on the other hand, need less care (children-friendly), are more patient-acceptable, and lessen the requirement for patient compliance [10, 11].

Since a long time ago, band and loop space maintainers have been employed successfully to preserve space [12]. Despite strong patient compliance, the drawbacks mentioned include cement disintegration, plaque accumulation and poor gingival health, demineralisation around the bands, caries development along the band's edges and the loop contours against the abutment teeth due to food lodgement,

gingival inflammation etc [13]. Focusing on the primary intention of preserving the space, clinicians miss out on the supplementing factors that play a contributing role in the same [14].

As the importance of evidence-based dental practices continues to burgeon, this study endeavours to contribute meaningfully to the existing body of knowledge in interceptive orthodontics in pediatric dentistry. Limited literature has given data on the gingival and periodontal health of children, there are no studies involving the occurrence of caries on the abutment tooth where the appliances are extended. Despite everything said above, there is still no solid agreement on how interceptive orthodontic appliances affect children's dental and gingival health. Information on the impact of space maintainers used throughout the era of mixed dentition on dental and periodontal parameters is lacking.

Hence, through meticulous assessment and a judicious interpretation of outcomes, the study aims to illuminate the path towards evidence-based practices to assess the clinical parameters such as gingival health, bleeding on probing, pocket depth and occurrence of primary/secondary caries on the abutment teeth of band and loop space maintainer.

Materials And Methods

Study Setting and study population

This interventional prospective trial was conducted in the outpatient department of pediatric and preventive dentistry. The study was conducted between December 2021 to October 2022. 35 children including 18 boys and 17 girls of age group 5 to 9 years were included in the study who require fixed band and loop space maintainer treatment. The mean age of the children was 7.8 years.

Ethical Clearance: Prior to the start of the study, ethical clearance was obtained from the scientific Review board- IHEC/SDC/PEDO-2104/21/013

- Written informed consent was obtained from the parent/guardian of the study participants.
- In order to protect the privacy of the participants, their anonymity was carefully preserved.
- Children from the same demographic region and similar socioeconomic status were considered.

Inclusion Criteria

Clinical criteria

Children who had undergone unilateral loss of primary molars within the age group of 5 to 9 years.

- Children who are free of systemic illness
- Sound and healthy teeth adjacent to the extracted site.
- Absence of any malocclusion such as crowding, crossbite, open bite or deep bite.

Radiographic criteria

- Presence of underlying succedaneous tooth bud.
- Presence of at least 1 mm remaining bone thickness between the extracted site and the succedaneous tooth
- Tooth germ with less than one-third of the root formed.

Exclusion Criteria

- Grossly carious teeth were adjacent to the created space.
- Absence of teeth on the mesial or distal side of the teeth to be extracted

Sampling: According to the study by Hosseinipour ZS, Poorzandpoush K, Heidari A, *et al* (2019) [15] with a p-value of 0.05% and 95 power with an effect size of 0.636, G Power calculation was estimated the sample size. The estimated sample size was 35. Estimating the dropout rate of 30 percent, 46 participants were included at the beginning of the study.

Survey Instrument: All the appliances are fabricated by the same trained dental technician throughout the study. Clinical examination at the baseline and 6 months was done by the same postgraduate training dentist who has been calibrated to produce the reproducibility prior to the study [16].

Bleeding on probing: BOP was examined using a Michigan probe with Williams marking with a 0.4mm diameter was kept parallel to the long axis of the tooth [17, 18] The probe was made to run through the sulcus. If bleeding has occurred within 10 to 15 seconds of probing, a positive score was given. If not, BOP was marked absent [19].

Pocket depth: Pocket depth was also measured using the same Michigan probe walking along the pocket probing depth. This parameter was recorded after the assessment of gingival bleeding. Pocket depth was assessed to the nearest millimetre [20].

Gingival index: The gingival index was measured by the criteria of the gingival index system by Loe and Silness, 1963. The buccal, lingual, mesial, and distal gingival units of each individual tooth are given a score ranging from 0 to 3, known as the GI for the region. The GI for the

tooth was calculated by adding the scores from the four zones of the tooth and dividing the result by 4.

0: Normal gingiva; 1: Mild inflammation – a slight change in colour and slight oedema but no bleeding on probing; 2: Moderate inflammation – redness, oedema and glazing, bleeding on probing; 3: Severe inflammation – marked redness and oedema, ulceration with a tendency to spontaneous bleeding [21].

Occurrence of primary/secondary caries: The presence or reoccurrence of caries was evaluated by visual and tactile examination using Explorer to run across the tooth if any discolouration or catch is found [22].

Data Collection

Data was entered into a Microsoft Excel spreadsheet and analysed using SPSS software (version 23.0). Data was analyzed by descriptive statistics, including frequency, percentages, mean and standard deviation with 95% confidence interval.

Statistical Analysis

The Shapiro-Wilk test was used in analytical statistics to evaluate the normal relationship between category variables. Wilcoxon tests were also employed to determine if the means of continuous variables var-

ied across the groups. At $p < 0.05$, the U test was utilised to evaluate differences between ordinal variables.

Results

The study population consisted of 35 children who visited 2 appointments with baseline and 6-month follow-up. Bleeding on probing, gingival index, probing depth and presence of secondary caries were assessed at baseline and 6 months. The frequency and percentage of distribution of parameters at baseline and 6 months are described in Table 1.

The mean and standard deviation of probing depth are described in Table 2. Data was checked for normality using Shapiro Wilk test and it was revealed that the parameters were not normally distributed.

Wilcoxon sign rank test was used to assess the difference of the parameters at 6 months from baseline. For bleeding on probing, there was a significant difference between the timelines with BOP higher at 6 months than at baseline. Similarly in probing depth, there was a significant difference between the timelines with probing depth higher at 6 months than baseline.

Also, in the presence of secondary caries, there was a significant

Table 1. Distribution of bleeding on probing, presence of secondary caries and gingival index at baseline and 6 months in the study participants

		Baseline	6 months
BOP	BOP Negative	18(51.4)	11(31.4)
	BOP Positive	17(48.6)	24(68.6)
Primary/ Secondary Caries	Present	0	5(14.3)
	Absent	35(100)	30(85.7)
Gingival Index	No gingival inflammation	15(42.9)	11(31.4)
	Mild gingivitis	20(57.1)	12(34.3)
	Moderate gingivitis	0	12(34.3)

Table 2. Distribution of probing depth at baseline and 6 months in the study participants

	N	Mean (SD)
Probing depth - Baseline	35	0.314(0.529)
Probing depth - 6 months	35	0.485(0.701)

Table 3. Wilcoxon sign rank test assessing the difference of BOP, probing depth, Gingival index and caries at 6 months from baseline

		Z	p-value
BOP: Baseline to 6months	Negative Ranks	2.646	0.008*
	Positive Ranks		
Probing Depth baseline to 6months	Negative Ranks	2.449	0.014*
	Positive Ranks		
Gingival Index baseline to 6months	Negative Ranks	2.463	0.014*
	Positive Ranks		
Caries baseline to 6months	Negative Ranks	2.236	0.025*
	Positive Ranks		

* Statistically significant when $p < 0.05$

difference between the timelines where caries prevalence was higher in 6 months than baseline. However, in the assessment of the gingival index, gingival health was better in the baseline than in 6 months and they had a significant difference between the timelines (Table 3).

Discussion

Space maintenance therapy in pediatric dentistry is a crucial intervention aimed at preserving the integrity of the dental arch following premature loss of primary teeth. The effectiveness of space maintenance therapy has been extensively studied such as the impact on the occlusal relationship, facilitation of eruption by ensuring that there is adequate space available for the succedaneous teeth to erupt, time of intervention with the level of prognosis or favourable outcome, orthodontic consideration to reduce the severity and complexity of orthodontic complains in the later/permanent dentition stage.

Information on the criteria for

abutment teeth selected for fixed space maintainers has been made available by this study. 34% of the participants and their parents in the research who chose the treatment option were educated about space maintainers and their advantages in the prevention of malocclusion. The majority of patients in the present research who received fixed space maintenance therapy are between the ages 5 to 9 years (100%) with a mean age of 7.5 to 7.8 years (67%). Of the delivered space maintainers, 65% of the SMs are in the mandibular arch and 35% are in the maxillary arches [23]. This may be due to the complex morphological structure of posterior teeth and due to the pooling of saliva [24, 25].

This study investigated gingival, periodontal parameters and caries assessment at baseline and six months after the placement of space maintainers (SMs). Control groups included the contralateral side in patients with healthy periodontal status. In patients with FSMs, probing pocket depth (PPD) did not signifi-

cantly change at 6 months in mesio-buccal, midbuccal, distobuccal, and midlingual areas, but significantly increased in mesiolingual and distolingual areas of abutment teeth. Bands, commonly used in FSMs, have a sharp edge that may penetrate deeper into the gingival sulcus than Adams clasps used in RSMs. Conversely, in the distal of Es, the gingiva extends above the cemento-enamel junction, making this area more susceptible to injury due to band placement. In the mesial and distal areas, the gingiva was more coronally positioned, making it more prone to traumatization during band placement. Additionally, the lingual surface in FSMs is harder to access for oral hygiene maintenance. In abutment teeth, the loop compresses the distal gingiva, and food impaction beneath the loop can lead to periodontal problems.

Our findings on the study align with Huser et al [26], who found no significant difference in Periodontal probing depth (PPD) between case and control groups. However, our

results contrast with Arikan et al [27] findings. Comparing gingival index (GI) at baseline and after six months of space maintainer use revealed a significant increase, indicating poor oral hygiene in most patients. Despite dental cleaning before the study, the space maintainers further complicated oral hygiene, changing tooth contour and enhancing plaque accumulation, leading to gingivitis. Our results on GI changes were consistent with Arikan et al [27], Thilagrani et al [28], Zachrisson [29]. Changes in bleeding on probing (BOP) were also significant after using both types of space maintainers, except for the abutment tooth in band and loop space maintainers, where this difference was not significant due to no change in the contour of the anchor tooth and intact free gingiva.

Comparing caries index before and after six months of space maintainer use showed a significant change with. Our findings in this regard were consistent with Deshpande et al [10] who found no significant change in DMFT after fixed appliances were used. A larger sample size and longer follow-ups in future studies are needed to assess the re-

versibility of increased GI, BOP, and PPD after space maintainer removal. Against a backdrop of advancing clinical methodologies, this study strives to bridge gaps in our current understanding of the consequences of space maintainer therapy on abutment teeth underfolding the seamless nuances that integrate the theoretical underpinnings of space maintainer therapy with its practical implications for the abutment teeth of children.

On final observation on the study, gingival and periodontal health in children which was in the 2nd and 4th quadrants in comparatively better in terms of score than in the 1st and 4th quadrants which was significant based on their toothbrushing side as many Asian populations are right-handers [30].

Discussing Primary/secondary caries, Occlusal caries was seen in two of the participants and six participants reported proximal caries. This may be due to the possible fact that there can be retained/ lodged food particles between the loop and the proximal surface of the abutment tooth [31].

Conclusion

The present study reveals that there was a significant difference in gingival health, periodontal health and the occurrence of primary/ secondary caries on the abutment tooth was corroborated. Precautions and thorough knowledge about the consequences of the delivery of appliances should be well aware by the dentist. Oral health education and constant motivation should be provided to the children on dental hygiene and regular follow-ups in order to avoid any extensive invasive management.

Limitations

The duration of the follow-up period in this study may be considered relatively short. The study's sample size may pose limitations, and the demographic characteristics of the participants may not fully represent the diverse population. The study did not incorporate a blinding protocol for the clinical assessments, potentially introducing bias into the evaluation of outcomes

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