

Causes of premature loss of primary teeth and frequency of the utilization of space maintainers in children aged 6-8 years attending the School of Dentistry at the University of Cuenca during the period 2019-2022

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Abstract

Space maintainers are fixed or removable appliances whose main purpose is to maintain the space caused by the loss of one or more primary teeth, preventing the migration of adjacent teeth into the edentulous space.

Objective: To determine the cause of premature loss of one or more teeth and the frequency of the use of space maintainers in children aged 6-8 years attending the Faculty of Dentistry during the period 2019-2022.

Materials and methods: Observational, descriptive, cross-sectional and retrospective study, through the analysis of 123 undergraduate clinical records of the orthodontic clinic of the Faculty of Dentistry of the University of Cuenca with 78 boys and 45 girls between the ages of 6 and 8 years. For the bibliographic analysis, search strategies were used in the Pubmed, Scielo, Science Direct and Google Scholar databases published between 2015 to 2022.

Results: The most common space maintainer used in children is the Ansa band, followed by the lingual arch, Hawley plate, Nance button and the least frequent was the Schwartz plate. The most frequent etiology causing premature tooth loss is dental caries, followed by pathological root resorption of the deciduous tooth and trauma leading to the need for the use of space maintainer.

Conclusions: Dental caries is the factor that causes the greatest premature loss of primary teeth, with the Ansa Band space maintainer being one of the most commonly used appliances in both boys and girls aged 6 to 8 years.

Keywords: Space maintainer; Frequency; Children; Etiology; Orthodontics

1. Introduction

Primary dentition plays a crucial role in guiding the eruption of permanent teeth. Therefore, the premature loss of a primary tooth, whether due to cavities, dental trauma, pathological root resorption of deciduous teeth, can lead to consequences such as crowding, ectopic eruption, impaction, and loss of interproximal contacts, resulting in space loss. For this reason, space maintainers are used in preventive orthodontics. They are fixed or removable devices, unilateral or bilateral, designed to maintain the space between teeth caused by the loss of one or several primary teeth, thus preventing premature migration of adjacent teeth into the edentulous space. The choice to place a space maintainer, as well as the type of maintainer, depends on several criteria such as when the tooth was lost, how many teeth have been lost, the presence or absence of the permanent successor, the patient's cooperation level, oral hygiene, absence of

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cavities, and a non-cariogenic diet. Preservation of space is an integral part of preventive and interceptive orthodontics [1,2].

The Royal College of Surgeons' guideline conducted a study on the extraction of primary teeth, establishing that space maintainers would be most valuable in two situations: 1) Loss of a primary molar, as it can influence arch development by reducing the length available for eruption of permanent teeth. This occurs due to mesial shifting during the eruption of posterior teeth, resulting in crowding, inclinations, rotations, ectopic eruption, and retention of permanent teeth, as well as premature eruption of permanent teeth where crowding is severe, and extraction of a premolar may be insufficient to alleviate resulting crowding; 2) Loss of a second primary molar, except in separate arches [1,3].

Therefore, the aim of this article is to determine the causes of premature loss of one or more teeth and the frequency of space maintainer usage in children aged 6 to 8 years who attended the School of Dentistry at the University of Cuenca during the period 2019-2022.

2. Material and methods

This study was an observational, descriptive, cross-sectional, and retrospective analysis of 123 undergraduate clinical records from the orthodontic clinic of the School of Dentistry at the University of Cuenca. The records included 78 boys and 45 girls between the ages of 6 and 8 years. The study focused on the causes of premature tooth loss and the frequency of space maintainer usage.

To conduct this study, authorization was obtained from the Dean of the School of Dentistry at the University of Cuenca. A total of 500 clinical records from the period between 2019 and 2022 were collected, and 123 records that met the inclusion criteria were selected. The inclusion criteria consisted of records that documented the use of space maintainers in the treatment plan, regardless of whether they were fixed or removable, and had complete information on patients aged 6 to 8 years. The exclusion criteria included records with incomplete information, patients with permanent dentition, and records where the treatment plan did not include space maintainers.

For the literature review, the following inclusion criteria were used: articles in Spanish and English that primarily discussed space maintainers and causes of premature tooth loss, published between 2015 and 2022, and available in full text. The exclusion criteria included studies unrelated to space maintainers and those not published within the specified years. The bibliographic analysis was conducted by searching electronic databases, including PubMed, SciELO, Science Direct, and Google Scholar. A total of 15 articles were selected based on the inclusion criteria and were used for data analysis from 2015 to 2022. The search strategy involved using a combination of English and Spanish keywords such as "space maintainer," "frequency," "children," "etiology," and "orthodontics," along with Boolean operators (AND/NOT).

Tables and graphs were created using Excel 2018, and statistical analysis was performed using variables such as age, sex, etiology of premature tooth loss, type of space maintainer, and the placement site of the space maintainer (upper or lower jaw).

3. Results

Table 1 Type of space maintainer employed according to age

Age	Treatment	Percentage	Number
6	Ansa Band	13.01%	16
6	Hawley Plate	5.69%	7
6	Lingual Arch	4.07%	5
6	Schwartz Plate	0.81%	1
6	Nance Button	0.81%	1
7	Ansa Band	17.89%	22
7	Lingual Arch	8.13%	10
7	Nance Button	6.50%	8
7	Hawley Plate	4.88%	6
7	Schwartz Plate	3.25%	4
8	Ansa Band	13.82%	17
8	Lingual Arch	7.32%	9
8	Hawley Plate	7.32%	9
8	Nance Button	4.07%	5
8	Schwartz Plate	2.44%	3

Table 2 Type of space maintainer used in the lower jaw and according to sex

Maxilar	Treatment	Sex	Percentage	Number
Lower	Lingual Arch	M	25.81%	16
Lower	Lingual Arch	F	12.90%	8
Lower	Ansa Band	M	29.03%	18
Lower	Ansa Band	F	17.74%	11
Lower	Hawley Plate	M	8.06%	5
Lower	Hawley Plate	F	3.23%	2
Lower	Schwartz Plate	M	1.61%	1
Lower	Schwartz Plate	F	1.61%	1

Table 3 Space maintainer used in the upper jaw and according to sex

Maxilar	Treatment	Sex	Percentage	Number
Upper	Ansa band	M	22.95%	14
Upper	Ansa band	F	19.67%	12
Upper	Nance button	M	11.48%	7
Upper	Nance button	F	11.48%	7

Upper	Hawley plate	M	18.03%	11
Upper	Hawley plate	F	6.56%	4
Upper	Schwartz plate	M	9.84%	6

Table 4 Etiology of premature loss of deciduous teeth

Cause	Percentage	Number
Dental caries	73.17%	90
Cause unknown to the informant	15.45%	19
Pathological root resorption of the deciduous tooth	7.32%	9
Traumatism	2.44%	3
Agenesis	1.63%	2

The obtained results demonstrate that the most commonly preferred space maintainer in boys and girls aged 6-8 years is the Banda Ansa, with a frequency of 17.89%. It is followed by the Lingual Arch with 8.13%, the Hawley plate with 7.32%, the Nance button with 6.50%, and the least frequent is the Schwartz plate with 2.44% (graph 1 and table 1). Additionally, it was found that in male patients, the most commonly used space maintainer was the Banda Ansa, both in the upper jaw with a frequency of 22.95% (table 3 and graph 3) and in the lower jaw with a frequency of 29.03% (table 2 and graph 2).

Similarly, in female patients, the Banda Ansa remained the most commonly used space maintainer, with a frequency of 19.67% in the upper jaw (table 3 and graph 3) and 17.74% in the lower jaw (table 2 and graph 2). The most frequent etiology leading to premature loss of deciduous teeth was dental caries, accounting for 73.17%, followed by pathological root resorption of the deciduous tooth (7.32%), and trauma (2.44%), necessitating the use of space maintainers (table 4 and graph 4).

4. Discussion

A study by Katherine G. et al. in 2022 on early loss of deciduous teeth in children under 10 years of age found that dental trauma and dental caries were the main causes, resulting in a space deficit for erupting teeth. They emphasized the importance of selecting an appropriate space maintainer to avoid future problems related to space loss or incorrect appliance use. This finding differs from our results, which indicate that dental caries accounts for 73.17% of cases, followed by pathological root resorption of deciduous teeth. Other studies, such as the one conducted by Barahona Joselyne in 2018, confirm that dental caries is the primary cause of premature loss of deciduous molars, accounting for 71%, followed by pulp injuries, residual roots, and pathological resorptions. Similarly, a study by Palaquibay Santiago in 2017 demonstrated that dental caries was the most common etiology for deciduous molars, accounting for 61%.

Maria Espin et al. in 2021 discussed premature loss of deciduous teeth (PPDT) and found no statistically significant differences between genders. They observed that the highest percentage of PPDT occurred at 8 years of age and noted that the lower teeth exhibited a greater accumulation of biofilm in the posterior region, leading to food packing and decreased salivary flow vestibularly. Although they did not mention a specific etiology, it suggests that dental caries, particularly due to *S. mutans*, is the primary reason for PPDT. Regarding gender, we cannot draw a definitive conclusion due to the imbalance in the sample distribution. However, there is a noticeable difference in the percentage by age since their study covered ages 4 to 8 years, while ours focused on 6 to 8 years, indicating that the highest loss occurred at 7 years of age. Siria Cornejo stated in 2019 that "the probability of caries progression and premature loss of teeth increases with age," which is consistent with Sakr et al., who found a higher loss of dental structure with increasing age in children, explaining the progression of dental caries [8]. While this may have some severity, if that were the case, our study would also indicate a higher loss at the age of 8, similar to Espin's study. However, as we explained before, we do not have equal samples in terms of age and gender, so we cannot provide an accurate statistical inference.

Regarding space maintainers, the Banda Ansa retainers have a higher percentage in the three age groups examined, considering that there was a high prevalence of their use in the lower jaw. Similarly, the lingual arch was widely used as the second most common appliance. According to Tania Salvador's study, among patients with one missing deciduous molar, 27 out of 33 patients were planned for a fixed Banda Ansa retainer [9].

Bajaña R in 2016 determined that the lingual arch is the appliance of choice when there are bilateral extractions of deciduous molars in the mandible, allowing the arch length to be maintained until the eruption of permanent second premolars [10]. This helps us summarize that Banda Ansa retainers are the preferred space maintainers when there is a loss of a single tooth, and they are installed more frequently in the lower jaw. Additionally, when there is bilateral loss of primary mandibular molars, the lingual arch is highly useful.

Karen Nuñez in 2015 confirms, in her study with Gutierrez and Lopez, that Banda Ansa retainers were the most commonly used type of space maintainer in the prevention of premature space loss. They studied 1,646 patients who received Banda Ansa, lingual arch, Nance arch, distal shoe, fixed prosthesis, transpalatal, and removable retainers [11].

Elizabeth Pino et al. in 2017 determined in their research that it is unnecessary to place a space maintainer after the loss of the first deciduous molar. They argue that the loss of space is not significant after the eruption of the first permanent molar (between 7.5 and 8 years old). They point out that it is unnecessary, especially if there is good interdigitation between the second deciduous molars and first permanent molars, which prevents mesial displacement of the molars [3].

Echeverría in 2019 concluded in their work on space maintainer failure that one of the factors is the young age of patients, which can negatively affect cooperation and diet, particularly the consumption of sweets and hard or sticky foods, impacting the retention appliance negatively [12].

In conclusion, the mentioned appliances are used to prevent space loss in primary and mixed dentition, avoiding dentomaxillary anomalies, improving prognosis, and preventing skeletal alterations. This helps patients avoid future complications. Therefore, anticipating such problems in dental space and providing early intervention for their etiology is the responsibility of the general dentist and should be addressed in primary healthcare [13].

5. Conclusion

Overall, the main cause of early unilateral or multilateral loss of deciduous teeth is dental caries, followed by pathological root resorption of deciduous teeth and trauma, which necessitates the use of space maintainers. The general dentist and specialists play an important role in preventing the onset of dental caries through good oral hygiene control. Once one or more deciduous teeth have been lost, the most common alternative is the use of the Banda Ansa retainer, regardless of gender and jaw.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors state that they have not had any inconvenience in writing this article.

Statement of informed consent

Individual consent was obtained from each participant and the institution to conduct the study.

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