



## Knowledge and Attitudes of Dentists toward Space Maintainers: A Study among General Dentists in Benghazi

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### ABSTRACT

Space maintainers are critical orthodontic devices that prevent malocclusion and ensure the proper alignment of permanent teeth following the premature loss of primary teeth. Despite their importance, the effective utilization of space maintainers depends heavily on the knowledge and attitudes of dental practitioners. This study investigates the perspectives of general dentists in Benghazi, examining their awareness, understanding, and practical implementation of space maintainers. Through a detailed analysis of survey data, the study highlights both strengths in knowledge and notable gaps in practice. Furthermore, it juxtaposes these findings with global studies to provide a comparative perspective, emphasizing the need for enhanced training and advocacy. The outcomes of this research aim to inform strategies that improve the adoption and effective use of space maintainers in dental practice, thereby addressing long-term orthodontic challenges.

Keywords: Space maintainers, primary teeth loss, orthodontic devices, dentist attitudes, pediatric dentistry, dental practitioners.

### INTRODUCTION:

The premature loss of primary teeth is a common issue that often leads to significant orthodontic complications, including malocclusion, crowding, and misalignment of permanent teeth. Space maintainers serve as a preventive solution by preserving the necessary space for proper tooth eruption and alignment. However, the effective adoption and application of space maintainers depend on the knowledge and attitudes of dental practitioners. Several global studies have highlighted the challenges faced in this regard. For instance, Kurian et al., (2022) conducted a cross-sectional study in India, revealing a strong theoretical understanding among dental students but inconsistent application in practice. Similarly, Andreeva et al., (2016) reported a lack of awareness and training among dental practitioners in Bulgaria, which hindered their ability to recommend and utilize space maintainers effectively. In Nigeria, Denolye et al., (2007) identified barriers such as limited resources and insufficient patient education, further emphasizing the global disparity between knowledge and practice. This study investigates the knowledge and attitudes of general dentists in Benghazi, Libya, providing a comparative analysis with global findings and offering actionable recommendations to bridge the gaps identified.



Fig. 1. Space maintenance.

### Identification and Importance of Space Maintainers

Space maintainers are orthodontic devices designed to preserve the space for permanent teeth to erupt correctly when primary teeth are lost prematurely. While the initial absence of a tooth may not appear to be a critical concern, failure to maintain the gap can lead to significant complications, including

malocclusion and expensive corrective treatments (Ramakrishnan et al., 2019). The reasons for premature loss of primary teeth vary, encompassing trauma, congenital defects, accidents, or decay. Regardless of the cause, the disruption to normal dental development necessitates intervention.

Under normal physiological conditions, primary teeth are replaced by well-aligned permanent teeth. However, pathological conditions such as caries, trauma, or systemic diseases can lead to premature tooth loss, causing tilting of adjacent teeth and loss of arch space. This disruption often results in crowding, supra-eruption of opposing dentition, and impaction of permanent teeth (Vinothini et al., 2019). These challenges underscore the critical role of space maintainers in maintaining dental arch integrity and ensuring proper alignment of the permanent dentition.

Studies emphasize the importance of early prevention to mitigate these issues. For instance, Kurian et al., (2022) highlighted that dental students in India showed awareness of space maintainers' role but required practical training to enhance their application. Similarly, Andreeva et al., (2016) identified a lack of understanding among Bulgarian dental practitioners regarding the significance of space maintainers in addressing premature tooth loss. These findings align with the old adage, "prevention is better than cure," which is particularly relevant in preventive orthodontics.

Primary teeth play a vital role beyond chewing. They aid in speech development, establish healthy eating habits, and provide children with self-confidence. Most critically, they serve as guides for the eruption of permanent teeth (Lundstrom, 1955). The premature loss of these teeth can lead to shifting, where neighboring teeth tilt or encroach upon the space, thereby obstructing the proper positioning of adult teeth (Ramakrishnan et al., 2019). To address these risks, dentists recommend space maintainers to "hold the space" and guide the permanent teeth into the correct position.

Different types of space maintainers, including fixed and removable devices, cater to varying patient needs. The choice of maintainer depends on the specific clinical scenario, including the child's cooperation and the extent of tooth loss. Aishwarya et al., (2022) emphasized the importance of tailoring treatments to individual cases, advocating for heightened awareness and expertise among practitioners to maximize treatment success. Therefore, space maintainers are indispensable in preventing the long-term consequences of premature tooth loss. Their timely application ensures proper dental development, avoids costly interventions, and underscores the significance of proactive, preventive orthodontic care.

### Space Maintenance: A Detailed Overview

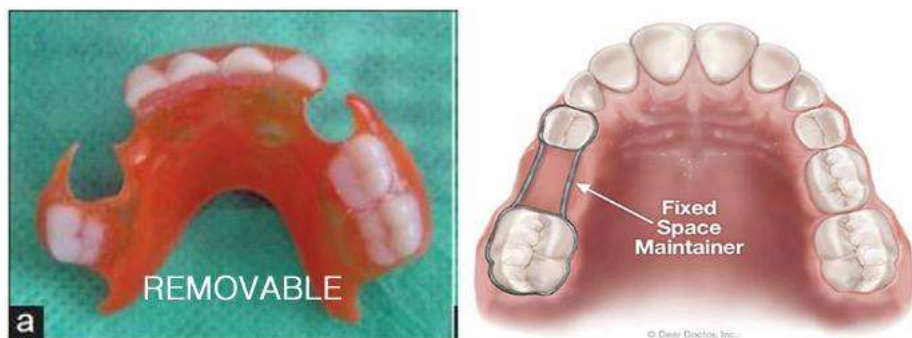
Space maintenance refers to the process of preserving the space within a dental arch previously occupied by a tooth or group of teeth. This practice is crucial for ensuring the proper alignment and eruption of permanent teeth.

#### *Space Maintainers: Definition and Purpose*

Space maintainers are dental appliances, either fixed or removable, designed to retain the space created by the premature loss of a primary tooth or multiple teeth. These devices prevent adjacent teeth from shifting into the empty space, ensuring that the permanent teeth erupt in their correct positions.

#### *Types of Space Maintainers*

There are two primary categories of space maintainers used in pediatric dentistry: fixed and removable.



**Fig. 2. Removable and fixed space maintenance.**

**Fixed Space Maintainers** are cemented onto the teeth and remain in place until the permanent teeth erupt. Dentists frequently use the following types of fixed space maintainers:

**Unilateral (Band-and-Loop) Maintainer.** This device is employed when space maintenance is required on one side of the mouth. It consists of a metal band fitted around an adjacent tooth, with a wire loop extending to the empty space to preserve it.



**Fig. 3. Unilateral maintainer.**

**Crown and Loop Maintainer.** Similar to the unilateral maintainer, this device uses a crown instead of a band. The crown is placed over the supporting tooth, with a wire loop extending to maintain the space for the missing tooth.



**Fig. 4. Crown and loop maintainer.**

**Distal Shoe Maintainer.** This is a specialized device used when the second primary molar is lost before the eruption of the first permanent molar. The distal shoe is inserted beneath the gum to guide the proper eruption of the permanent molar.



**Fig. 5. Distal shoe maintainer.**

**Lingual Holding Arch.** This appliance is utilized for space maintenance on both sides of the lower jaw. It is cemented to the molars and features a wire running along the lingual side of the lower front teeth.



**Fig. 6. Lingual holding arch.**

**Removable Space Maintainers** serve the same purpose as their fixed counterparts but offer greater flexibility. These devices, typically made of acrylic, can be removed by the patient. In cases where jawbone density is a concern, dentists may include an artificial tooth in the removable maintainer to fill the space temporarily.

#### *Duration of Space Maintainer Usage*

The length of time a child needs to wear a space maintainer varies. Some children may only need the device for a few months, while others might require it for several years. Regular dental checkups are essential to monitor the eruption of permanent teeth and determine when the space maintainer can be removed.

#### *Caring for Space Maintainers*

Proper care is vital for maintaining the effectiveness of space maintainers, especially removable ones, as they are less durable than fixed devices. The following guidelines can help ensure the device remains in good condition:

- Avoiding sticky or chewy foods, such as caramel and chewing gum.
- Refraining from biting hard foods like apples or raw carrots.
- Discouraging tampering with the maintainer using the tongue, fingers, or other objects.
- Practicing good oral hygiene by brushing and flossing thoroughly around the appliance after meals.
- Using a fluoridated mouthwash to enhance oral hygiene and protect against decay.

#### *Risks and Considerations*

While space maintainers are effective in preserving arch space, their use is not without risks. Poor oral hygiene can lead to inflamed gums and increased susceptibility to tooth decay around the maintainer. Regular brushing, flossing, and professional dental monitoring are essential to mitigate these risks.

Space maintainers play a crucial role in guiding the proper eruption of permanent teeth, particularly when premature tooth loss occurs due to decay or trauma. They can prevent the need for more extensive orthodontic treatments in the future. Parents should consult their dentist to determine whether a space maintainer is necessary for their child. Proper care and regular dental checkups will ensure the device functions effectively and supports the development of a healthy, aligned smile.

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## **LITERATURE REVIEW:**

Space maintainers are pivotal in pediatric dentistry to prevent complications such as malocclusion, crowding, or improper eruption patterns following the premature loss of primary teeth. While their theoretical importance is widely acknowledged, several studies have revealed inconsistencies in knowledge, attitudes, and application among dental practitioners and students across different regions. These studies provide valuable insights into global trends and underscore the importance of understanding local perspectives, such as that of general dentists in Benghazi.

### **India**

In 2022, Kurian et al., conducted a self-administered cross-sectional questionnaire study to evaluate dental students' knowledge and attitudes regarding space maintainers. The findings highlighted a general awareness of the role of space maintainers but revealed variability in understanding the nuances, such as indications, contraindications, and practical management strategies. For example, while students understood that space maintainers prevent misalignment, fewer were confident in selecting appropriate appliances or managing patient-specific scenarios. The authors emphasized the need for improved curricula focusing on practical applications and decision-making skills.

Similarly, Aishwarya et al., (2022) performed an online cross-sectional study to examine the knowledge, awareness, and perception of dental students in India. This study found that while students were familiar with the basic concepts of space maintainers, significant gaps existed in their ability to implement this knowledge clinically. These findings underline the importance of practical exposure and patient interaction during training to reinforce theoretical knowledge with real-world application.

### **Bulgaria**

Andreeva et al., (2016) explored the awareness of dental practitioners in Bulgaria regarding the use of space maintainers after premature loss of primary teeth. The study revealed that practitioners were generally aware of the importance of these appliances in maintaining arch integrity. However, their application in clinical practice was inconsistent. This inconsistency was attributed to factors such as insufficient training during dental school, patient compliance challenges, and limited access to materials and support for constructing space maintainers. The study recommended targeted workshops and continuing education programs to enhance practical skills and confidence.

### **Nigeria**

In Nigeria, a study by Adeyemi et al., (2007) evaluated the knowledge and attitudes of general dentists toward the use of space maintainers. While the dentists displayed theoretical knowledge, they lacked confidence in their clinical application. Many participants reported that their undergraduate training provided minimal exposure to the practical use of these appliances. This highlights a common trend where dental education programs may prioritize theoretical learning over practical implementation, leading to gaps in competency. The authors suggested integrating more hands-on training and clinical exposure into dental school curricula.

### **Saudi Arabia**

Al-Dlaigan conducted a study among private dentists in Riyadh, Saudi Arabia, focusing on their knowledge, awareness, and perception of space maintainers. The results showed that although dentists were aware of the importance of these appliances, their use in practice was limited. Common barriers included patient acceptance, concerns about cost-effectiveness, and perceived complexity in appliance fabrication and maintenance. The study emphasized the need for structured training sessions and accessible resources to overcome these barriers and promote the routine use of space maintainers in private practice.

### **Relevance to Benghazi**

The findings from these studies collectively point to a global trend: while awareness of the importance of space maintainers exists among dental professionals and students, gaps in practical application, confidence, and training hinder their consistent use. These trends suggest the need for region-specific investigations to understand how local contexts, education systems, and clinical practices influence knowledge and attitudes toward space maintainers.

In Benghazi, general dentists may face unique challenges influenced by their educational backgrounds, access to resources, and patient demographics. By examining their knowledge and attitudes toward space maintainers, this study aims to identify specific barriers and opportunities for improvement. Insights from other regions highlight the importance of incorporating hands-on training, continuing education, and patient education to bridge gaps in knowledge and practice. Establishing a comprehensive understanding of these factors will contribute to enhancing pediatric dental care in Benghazi and beyond.

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## **METHOD AND RESULTS:**

A descriptive cross-sectional study was carried out to evaluate the knowledge and attitudes of general dentists in Benghazi's private clinics. The study involved distributing a self-administered questionnaire among eligible participants. The questionnaire was designed to assess key areas including dentists' knowledge and attitudes regarding specific dental procedures and concepts. The instrument consisted of carefully structured questions to ensure clarity and relevance to the study objectives.

### **Inclusion Criteria**

General dental practitioners with at least two years of clinical experience and not affiliated with or employed by any educational institutions were eligible to participate in this study.

### **Description of Result Data**

The following tables present the demographic characteristics of the study participants and the results of the questionnaire. These tables summarize the responses of general dental practitioners in Benghazi's private clinics regarding their knowledge and attitudes related to space maintainers in pediatric dentistry. The data highlights participants' educational background, years of experience, and familiarity with essential concepts, as well as their clinical practices and decision-making processes. The findings provide valuable insights into the current state of knowledge and application of space management principles among the study population.

Table 1 outlines the gender distribution among participants. It shows that 17.2% of the participants were of one gender, while 82.8% belonged to the other, highlighting the demographic representation within the study population.

**Table 1 - Gender distribution of participants.**

1 - Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid				17.2	17.2
				82.8	100.0
Total		116	100.0	100.0	

The second table presents the age distribution of the participants. Most participants (79.3%) were between 25 and 40 years old, indicating a predominantly young professional group. A smaller portion (18.1%) were under 25, while 2.6% were aged 41-60 years.

**Table 2 - Age distribution of the participants.**

2- Age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 25	21	18.1	18.1	18.1
	25 - 40 years	92	79.3	79.3	97.4
	41 - 60 years	3	2.6	2.6	100.0
Total		116	100.0	100.0	

This table (3) categorizes participants based on their clinical experience. The majority (64.7%) had 0–5 years of experience, followed by 32.8% with 6–15 years. A minimal percentage (2.6%) had over 15 years of experience.

**Table 3 - Participants clinical experience.**

3- Years of experience		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 5 years	75	64.7	64.7	64.7
	6 - 15 years	38	32.8	32.8	97.4
	more than 15 year	3	2.6	2.6	100.0
Total		116	100.0	100.0	

The below table (4) illustrates the highest qualifications of participants. Most held a Bachelor of Dental Surgery (BDS) degree (71.6%), with 12.9% each holding either a Master's degree (MSc) or a postgraduate diploma. Only 2.6% had a PhD.

**Table 4 - Participant qualifications.**

4- Level of education		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BDS.	83	71.6	71.6	71.6
	MSC.	15	12.9	12.9	84.5
	Post graduate diploma.	15	12.9	12.9	97.4
	PHD.	3	2.6	2.6	100.0
Total		116	100.0	100.0	

As shown in table 5, an overwhelming majority (98.3%) of participants recognized the importance of space management in children, indicating strong foundational knowledge in this critical aspect of pediatric dentistry. Only 1.7% of respondents were unaware of its significance.

**Table 5 - Importance of space management in children.****1- Do you know the importance of space management in children?"**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	2	1.7	1.7	1.7
	yes	114	98.3	98.3	100.0
Total		116	100.0	100.0	

Table 6 shows that most participants (96.6%) demonstrated knowledge of the appropriate scenarios for using space maintainers, while a small percentage (3.4%) lacked this understanding.

**Table 6 - Awareness of when space maintainers are used.****2- Do you know when are space maintainers used?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	4	3.4	3.4	3.4
	yes	112	96.6	96.6	100.0
Total		116	100.0	100.0	

A majority (92.2%) acknowledged that space maintainers require specific care with brushing (see table 7), reflecting an understanding of their maintenance requirements. However, 7.8% of participants did not recognize this need.

**Table 7 - Special care required for space maintainers with brushing.****3 - Do you think that space maintainers require special care with brushing?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	9	7.8	7.8	7.8
	yes	107	92.2	92.2	100.0
Total		116	100.0	100.0	

The majority (70.7%) indicated that space maintainers should be placed one week after extraction as indicated in table 8. A notable portion (17.2%) supported immediate placement, and a smaller group cited other timings such as one month after extraction (5.2%) or dependent on individual cases and patient cooperation (0.9%).

**Table 8 – Timing of space maintainer placement after tooth extraction.****4 - Placing of S.M after teeth extraction?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 week after extraction.	82	70.7	70.7	70.7
	After 2-3 weeks	1	.9	.9	71.6
	1 month after extraction.	6	5.2	5.2	76.7
	Immediately after extraction.	20	17.2	17.2	94.0
	At any time.	6	5.2	5.2	99.1
	Depends on the case and the age and the cooperation of the child	1	.9	.9	100.0
Total		116	100.0	100.0	

Table 9 shows that about two-thirds (66.4%) were aware of the types of food to avoid when using space maintainers, while 33.6% lacked this knowledge, suggesting a gap in dietary guidance.

**Table 9 – Knowledge of food restrictions with space maintainers.****5 - Do you know what types of food should be avoided when having space maintainers?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	39	33.6	33.6	33.6
	yes	77	66.4	66.4	100.0
Total		116	100.0	100.0	

**DISCUSSION:**

For this study, a questionnaire-based approach was employed to assess the knowledge and attitudes of general dental practitioners regarding the use of space maintainers. This methodology allowed for the evaluation of the extent to which space maintainers are understood and utilized in clinical practice. The data collection was conducted among general practitioners in Benghazi, Libya, providing insights into local clinical practices.

**Comparison with Previous Studies**

While limited studies have addressed the specific objectives of this research, particularly concerning the knowledge and application of space maintainers, several studies provide a contextual framework. For example, Andreeva et al., (2016) found that 68% of dental practitioners in Bulgaria neglected space maintainer therapy, leading to increased orthodontic treatment needs in the future. In contrast, this study revealed a more favorable response, with over 70% of participants acknowledging the necessity of space maintainer placement, typically one week after tooth extraction. This timing aligns with recommendations to prevent or reduce the severity of developing malocclusion (Andreeva et al., 2016). As noted by Lindemeyer and Glavich et al., timely space maintenance is critical to prevent the mesial or distal drift of adjacent teeth and the supra-eruption of opposing teeth into areas lacking occlusion. The high response rate supporting the use of space maintainers in this study reflects a positive trend toward adherence to these principles.

**Preferred Types of Space Maintainers**

This study revealed that 90.5% of dentists prefer using the band and loop space maintainer, consistent with findings by Olsen (1959), who emphasized its versatility and effectiveness in fulfilling clinical requirements. However, less common types, such as the distal shoe, were reported by four dentists. The limited use of distal shoes is likely due to their complexity and associated risks, such as infection, as also noted by Aishwarya et al., (2022).

**Barriers to Space Maintainer Usage**

The study identified several barriers to the use of space maintainers in clinical practice. Notably, 54.3% of participants cited parental lack of education as a primary reason for non-usage. This underscores the need for enhanced communication and educational initiatives targeting parents to increase awareness of the benefits of space maintainers in preventing malocclusion.

Additionally, 17% of respondents attributed the non-use of space maintainers to cost. Similar findings have been reported in other studies, including Al-Dlaigan, who highlighted cost as a significant deterrent in Riyadh, Saudi Arabia. Addressing cost-related challenges, perhaps through subsidies or insurance support, could encourage wider adoption of space maintainer therapy.

**Follow-Up Practices**

Regarding follow-up care after space maintainer placement, 53.4% of practitioners reported scheduling follow-ups every three months until the eruption of permanent teeth. This aligns with best practices but highlights the need for more frequent follow-ups for effective monitoring. Encouraging biannual follow-ups, as recommended in the literature, could improve outcomes and reduce complications associated with inadequate maintenance (Ramakrishnan et al., 2019).

**Clinical Implications**

The findings of this study emphasize the importance of continued professional development and education for dental practitioners to enhance their confidence in providing interceptive orthodontic care. As Barrie et al., (2020) observed in Scotland, a significant barrier to providing orthodontic interventions, such as space maintainers, is practitioners' lack of self-confidence in their chosen treatment plans. Enhancing training and resources for dentists, along with parental education initiatives, could bridge the gap between knowledge and practice.

This study highlights positive trends in the knowledge and use of space maintainers among dentists in Benghazi while identifying areas for improvement. By addressing barriers such as cost and parental awareness, and by promoting consistent follow-up practices, the effectiveness and adoption of space maintainer therapy can be further enhanced. These findings align with global studies emphasizing the critical role of early intervention in preventing malocclusion and improving long-term oral health outcomes.



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## CONCLUSION:

This study concluded that the majority of practicing dentists in Benghazi possess adequate knowledge regarding space management, and over half actively incorporate space maintainers into their clinical practice. Notably, 70.7% of participants adhered to the recommended timing of placing space maintainers one week after tooth extraction, demonstrating an understanding of best practices for preventing malocclusion. The Band and Loop appliance emerged as the most commonly used type of space maintainer, preferred by 90.5% of dentists due to its effectiveness and ease of use. Despite these promising findings, 32.8% of practitioners reported rarely using space maintainers, and 11.2% never employed them in treatment. The main barriers to space maintainer use were parental refusal (54.3%) and financial constraints (17.2%), highlighting areas that require further attention.

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## LIMITATION AND RECOMMENDATIONS:

One limitation of this study is its reliance on self-reported data from questionnaires, which may be subject to recall bias or social desirability bias, potentially leading to overestimations of knowledge. Additionally, the study was geographically limited to dentists in Benghazi, Libya, and may not fully represent the knowledge and attitudes of dentists in other regions or healthcare settings. Another limitation is the cross-sectional design, which captures data at a single point in time, making it difficult to assess changes in behavior or knowledge over time.

Future studies should aim to expand the geographical scope of the research to include dental practitioners from various regions and healthcare systems for broader applicability. Longitudinal studies could also provide insights into how knowledge and attitudes evolve over time. To address the barriers identified, educational programs for parents highlighting the importance of space maintainers in preventing malocclusion should be developed and disseminated. Additionally, efforts to reduce the cost of space maintainers, such as introducing subsidies or affordable alternatives, could encourage their widespread adoption. Training programs for dentists to increase their confidence and competency in interceptive orthodontic care are also recommended to ensure consistent and effective use of space maintainers in pediatric dentistry.

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