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Assessment of clinical knowledge and practice about space maintainers among Dental surgeons in West Bengal: An online questionnaire-based survey

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Abstract

Background: Space maintainers are crucial devices to prevent malocclusion following premature tooth loss. However, there is limited research on the knowledge and clinical application of space maintainers among dentists in West Bengal.

Aim: The aim of this study is to assess the knowledge & practice about space maintainers among general dentist, paediatric dentists, and dental practitioners of other specializations in West Bengal, through an online questionnaire survey.

Materials and Methods: This cross-sectional study utilized a self-administered structured online questionnaire, covering knowledge, and clinical practice about space maintainers among 400 dental surgeons in West Bengal, distributed through electronic media during September to November 2023. Data was collected and statistically analysed. Chi-square test and Fisher's exact test were used for measuring the association between the variables.

Result and Observations: The study revealed diverse clinical knowledge levels among surveyed dental surgeons. Highest number of most desirable answers were given by MDS pedodontics (96.4%), MDS of other specialization (77.3%) and General dentist (70%). While many had a good understanding of space maintainer appliances, a notable percentage including lacked in-depth knowledge of specific types and variations. This emphasizes the importance of ongoing education and training to improve efficiency among dental surgeons in West Bengal.

Conclusion: The findings from this study will enhance treatment outcomes, innovate educational programs, and support evidence-based practices in paediatric dentistry by offering valuable insights on space maintainers among dental practitioners in West Bengal.

Keywords: Premature extraction, space maintainer, space loss

Introduction

The primary dentition is crucial to a child's growth and development in terms of communication, eating, facial features, and the avoidance of undesirable habits like thumb sucking. It also guides the eruptive process of permanent teeth, which eventually replace the primary teeth.

It's a natural physiological procedure for permanent teeth to erupt following primary tooth exfoliation. Because they occupy the area above permanent teeth, primary teeth are the ideal space maintainers for permanent dentition. But in some cases, like early extractions, extensive caries that makes tooth loss inevitable; delayed eruption of permanent teeth can cause teeth to migrate mesially- losing arch length and potentially causing malocclusion in the permanent dentition ^[1], which can show up as crowding, supra-eruption of opposing teeth, impaction of permanent teeth, and other issues.

Along with dental caries, gingivitis, and dental fluorosis, malocclusion; the early loss of primary teeth also affects a disproportionate number of children and was once thought to be one of the most prevalent dental issues. According to a study conducted by Santanu Mukhopadhyay *et al.* (2015) ^[2], dental caries was the main cause of extractions in the children of the state of West Bengal.

The teeth that were prematurely extracted from children were most commonly the deciduous mandibular second molars followed by deciduous mandibular first molars [2].

Treatment for malocclusion consists of both interceptive and corrective measures. The usage of orthodontic brackets is one type of corrective measure. The primary or early mixed dentition is when interceptive interventions are used when the initial indications of occlusal maldevelopment are identified. Using space maintainers is the most popular interceptive approach for space maintenance. Children with mixed or primary dentition benefit greatly from space maintainers because they assist to preserve the space, which helps to avoid potential malocclusion.

For growing children, the incidence of developing malocclusions to be eliminated or reduced in severity, thereby reducing treatment complexity and future treatment time and expense, requires early detection and appropriate selection of patients in need of interceptive and preventative orthodontic care. It will also provide the individual a higher sense of self-worth and satisfy the parents. One of the preventative strategies is "space maintenance," which involves the use of specific equipment known as "space maintainers." These appliances can be either permanent or detachable, and their purpose is to preserve the length of the palatal arch after the primary tooth is extracted prematurely or voluntarily.

An essential step in the development of dentition is maintaining spacing. A number of issues, including crowding, ectopic eruption, dental impaction, the development of crossbite, including overjet and overbite, and dental centre-line inconsistencies, can result from the reduction of arch length [3]. Because space maintainers may one day eliminate the necessity for extractions, their use frequently influences the long-term dental requirements of a sophisticated orthodontic treatment.

Materials and Methods

A cross-sectional study was conducted through an online questionnaire survey from September to November 2023 among general dentist, paediatric dentists, and dentists of other specialisation. A self-administered online questionnaire consisting of 5 open-ended and 12 close-ended questions were prepared. The questions were divided in 3 sections which included 3 questions for demographics, 5 questions for knowledge and 9 questions for clinical practice of space maintainers. This questionnaire was distributed among dental surgeons of the state of West Bengal from September to November 2023 through the online survey "google forms". A simple random sampling was used to select the study participants through social media platforms from different dental communities of West Bengal. All the dental surgeons who were willing to participate were included. The questionnaire included an informed consent page. Filling the questionnaire was considered as an implicit consent as a part of the survey. Ethical approval for the study was obtained from the Institutional Ethics Committee (IEC), Guru Nanak Institute of Dental Sciences & Research (IEC ref no.: GNIDSR/IEC/23-24/01).

The aim of this study was to assess the knowledge & practice about space maintainers among general dentist, paediatric dentists, and dentists of other specializations in West Bengal, through an online questionnaire survey.

The objective of this study was to assess and evaluate knowledge and clinical practice experience about space maintainers among dental professionals in West Bengal, so as to identify treatment variations, explore treatment barriers,

and suggest improvements for education and training about space maintainers.

The tabulation of the data, generation of graphs and tables were done in Microsoft Excel. The statistical analysis was done using IBM SPSS statistics 27.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistics including frequency and percentage were calculated for socio-demographic characteristics of participants. Chi square test and Fisher's exact test were used for measuring the association between the variables. The Level of significance was fixed at $p=0.05$ and any value less than or equal to 0.05 were considered to be statistically significant and the results are presented by using bar charts, pie charts, and percentage tables.

Table 1: Descriptive characteristic of the participants

Variables	Frequency	Percentage (%)
<30 years	272	68
More than 30 years	128	32
Occupation		
BDS	200	50
MDS - pedodontics	112	28
MDS - other speciality than Pedodontics	88	22
Practice Duration		
10-30 years	68	17
Less than 10 years	332	83

Results and discussion

The following Table 1, shows demographic characteristics of the participants in the study. It divides the participants into three categories: age, occupation, and practice duration. The majority of the participants, 272 (68%), were 30 years old or younger. Only 128 (32%) of the participants were older than 30 years old. Dentists (BDS) made up the largest group at 200 (50%), followed by MDS - Pedodontics at 112 (28%), and MDS - other specialties at 88 (22%). Most of the participants, 332 (83%), had been practicing for less than 10 years. Only 68 (17%) of the participants had been practicing for 10 to 30 years.

The Table 2 shows the knowledge about space maintainers among dental surgeons according to their specialty. The survey questions focus on scenarios where a young child prematurely loses a deciduous tooth.

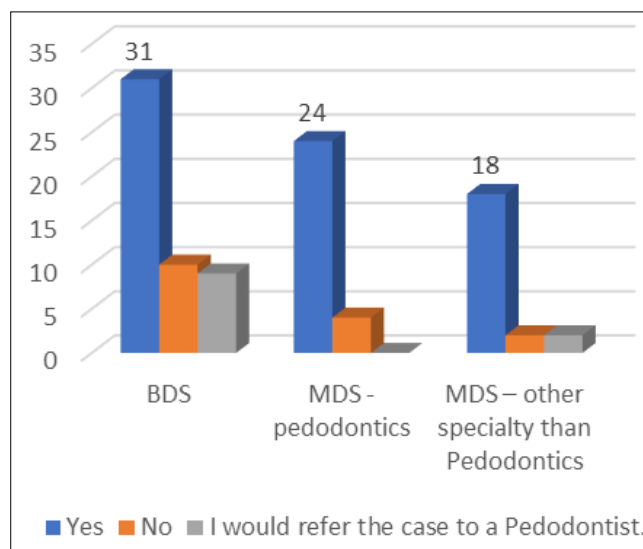


Fig 1: Usage of Space maintainers in regular practice

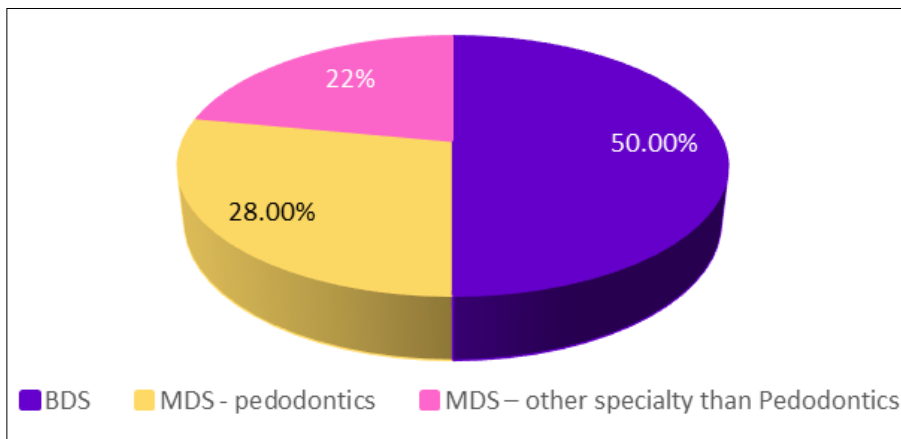


Fig 2: Qualification

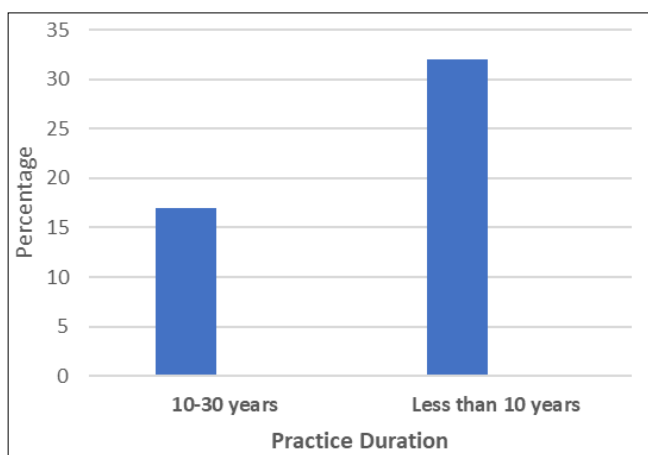


Fig 3: Practise Duration

The survey encompassing 400 dentists unanimously agreed on the course of treatment, unanimously advocating for the extraction of deciduous teeth followed by the placement of space maintainers. However, differences in knowledge

regarding space maintainers were evident across different dental specialties. Among general dentists, 89.1% recognized the purpose of space maintainers in avoiding supra-eruption of opposing teeth, with a smaller percentage acknowledging their role in preventing space loss (24.1%), addressing arch length discrepancy (24.1%), or addressing already closed spaces (3.4%). In contrast, Pedodontists demonstrated a higher awareness, with all respondents recognizing the purpose of avoiding opposing teeth eruption and a significant majority (93.3%) acknowledging the role in preventing adjacent space closure. Nonetheless, a smaller percentage were familiar with their use for arch length discrepancy (20%), and none mentioned their application for closed spaces. Similarly, dentists with MDS in other specialties showed awareness of the primary function (100%), but a lower proportion recognized their role in preventing space closure (22.2%), with no mention of arch length discrepancy or closed spaces among respondents in this category. Similar results were found in a study by Ravindran *et al.* (2022) [4] among dental practitioners in Chennai [4].

Table 2: This table summarizes responses from dental professionals (BDS, MDS in Pedodontics, and MDS in specialties other than Pedodontics) regarding treatment options for a 5-year-old patient with a grossly carious left mandibular deciduous first molar and the use of space maintainers in pediatric dentistry.

Questions	BDS (n=200)	MDS. Pedodontics (n=112)	MDS other specialty than Pedodontics (n= 88)	Total (400)	p-value
1) A 5-year-old male deciduous 1st molar. with in your practice? patient reports What would With a grossly be the treatment Carious left option you Mandibular would like To proceed					
Extraction of deciduous first molar tooth followed by placement of a space maintainer	176(89.1%)	112(100%)	SS (100%)	376 (94%)	0.026*
Extraction of deciduous first molar tooth only	24(10.9%)	0	0	24 (6%)	
2) What are indications of a space maintainer? (Multiple choices were selected)					
To avoid supra- eruption of tooth from the opposing arch	48 (24.1%)	40 (46.7%)	0	88 (22%)	0.039*
If the space loss has already occurred after premature loss of primary tooth	8 (3.4%)	12 (13.3%)	0	20 (5%)	
In case of arch length tooth size discrepancy	48 (24.1%)	16 (20%)	20 (22.2%)	84 (21%)	
None of the above	8 (3.4%)	0	0	8(2%)	
If the space after premature loss of deciduous teeth shows signs of closing	172 (86.2%)	104 (93.3%)	88 (100%)	364 (81%)	
3) Space Maintainer a space is mostly used space regarding in? (Multiple eruption choices were permanent selected)					
Permanent Dentition	0	0	0		0.278
Deciduous Dentition	84 (41.4%)				
	116 (58.6%)				
	200 (100%)				

Most dentists (68%) recognized that space maintainers are predominantly used in mixed dentition scenarios, where both

deciduous and permanent teeth are present in the oral cavity. Additionally, an overwhelming majority (92%) acknowledged

that space maintainers aid in guiding permanent teeth into proper alignment, and the consensus (93%) leaned towards recommending their use until the eruption of permanent teeth. 85.7% of pedodontists, 77.8% of other specialist dental surgeons, and 62% of general dental surgeons reported placing space maintainers in their practice. The conventional

band and loop space maintainer was the most frequently used (54%), followed by the distal shoe space maintainer (7%), pre-fabricated space maintainer (6%), and bonded space maintainer (2%) [Table3]. These results were in accordance to the study by Petcu A *et al.* (2016) [5] and Al-Jewair *et al.* (2021) [6].

Table 3: Clinical Practice of Space Maintainer among dental surgeons

Questions	BDS (n=200)	MDS-Pedodontics (n=112)	MDS – other specialty than Pedodontics (n= 88)	Total (400)	p-value
6) Do you routinely place space maintainers in your practice?					
Yes	124(62%)	96 (85.7%)	72 (77.8%)	292 (73%)	<0.001**
No	40 (20%)	16 (14.3%)	8 (11.1%)	64(16%)	
I would refer the case to a Pedodontist.	36 (18%)	0	8 (11.1%)	44(11%)	
7) If yes, then which is the most commonly used space maintainer in your practice?					
Conventional band and loop space maintainer	80 (40%)	88 (78.6%)	48 (54.5%)	216 (54%)	0.007*
Prefabricated band and loop space maintainer	0	8 (7.1%)	16 (22.2%)	24 (6%)	
Bonded type space maintainer	0	0	8 (11.1%)	8 (2%)	
Distal shoe space maintainer	28 (14%)	0	0	28 (7%)	
Has not used yet	16 (8%)	0	0	16 (4%)	
8) How many space maintainers have you placed till date? (Contains only the participants who said yes to the question 6)					
Less than 20	124 (62%)	72 (64.3%)	64 (72.7%)	220 (55%)	0.002*
More than 20	0	24 (21.4%)	8 (9%)	32 (8%)	
9) How much do you charge for the space maintainer that you mentioned above: (Contains only the participants who said yes to the question 6)					
< Rs.1500	68 (34%)	40 (35.7%)	36 (40.9%)	144 (36%)	0.247
>Rs. 1500	56 (28%)	48 (42.8%)	36 (40.9%)	140 (35%)	
10) Do you fabricate it yourself?					
Yes.	24 (12%)	48 (42.8%)	4 (4.5%)	76 (19%)	0.04*
No, fabrication is done by dental technician.	24 (12%)	32 (28.5%)	4 (4.5%)	60(15%)	
Fabricated by my consultant Pedodontist, who visits my clinic.	76 (38%)	0	48 (54.4%)	124(31%)	
I use pre-fabricated space maintainer.	0	8 (7.1%)	16 (18.2)	24 (6%)	
11) What were the advantages you observed while using the space maintainer of your choice? (Multiple options were selected in this question)					
Easy to fabricate	76 (38%)	72 (64.3%)	4 (4.5%)	152 (38%)	0.08
Ease of placement	140(70%)	24 (21.4%)	48 (54.4%)	212 (53%)	0.178
Good patient acceptability	84 (42%)	72 (64.3%)	16 (18.2)	172 (43%)	0.03*
Less time consuming	80 (40%)	8 (7.1%)	36 (40.9%)	124 (31%)	0.085
Economical	60(30%)	32 (28.5%)	36 (40.9%)	128 (32%)	0.097
Does not interfere with eruption of succedaneous tooth	164 (81%)	104 (93.3%)	48 (54.4%)	316 (79%)	0.006*
12) What were the disadvantages you observed while using the space maintainer of your choice? (Multiple options were selected in this question)					
Difficulty to fabricate	80 (40%)	72 (64.3%)	16 (18.2)	168(42%)	0.34
Difficulty in placement	60 (30%)	24 (21.4%)	36 (40.9%)	120 (30%)	0.004*
Cementation failure	164 (81%)	72(64.3%)	36 (40.9%)	272 (68%)	0.234
Fracture of components	84 (42%)	8 (7.1%)	20 (33.3%)	112 (28%)	0.005*
Less economical	64 (32%)	32 (28.5%)	0	96 (24%)	0.349
Poor patient acceptance	168 (84%)	104 (92.8%)	40 (45.4%)	112 (28%)	0.05
Time consuming/ cumbersome procedure	88 (44%)	44 (39.3%)	12 (13.6%)	144 (36%)	0.06
Interferes with the path of succedaneous tooth	92 (46%)	24 (21.4%)	20 (22.7%)	136 (34%)	0.001*
Supraeruption of opposing tooth	68 (34%)	32 (28.5%)	0	100 (25%)	0.67
13) What was the most common feedback you received from patient after placing the space maintainer of your choice? (Multiple options were selected in this question)					
Difficulty in mastication	72 (36%)	56 (50%)	28 (31.8%)	156 (39%)	0.067
Food lodgment within the appliance	76 (38%)	32 (28.5%)	20 (22.7%)	128 (32%)	0.02*
Discomfort to the gingiva / abutment tooth /other oral soft tissue	136 (68%)	32 (28.5%)	32 (36.3%)	200 (50%)	0.078
Esthetically unpleasant / other esthetic concerns	76 (38%)	44 (39.2%)	16 (18.2%)	136 (34%)	0.002*
Patient satisfied and did not report any complaint	36 (18%)	72(64.2%)	4 (4.5%)	152 (38%)	0.127

Table 3 shows the distribution of practice about space maintainers among dental practitioners with different qualifications. Association between knowledge and different qualifications are measured using Chi-square and Fisher's exact test. P-value >0.05 are considered statistically significant.

Less than 20 space maintainers are placed by 72.70% of dentists of other specializations, 64.30% of pedodontists, and 62% of general dentists. More than 20 space maintainers are placed by 9% of dentists of other specializations, 21.40% of pedodontists, and none by general dentists. 42.80% of pedodontists fabricate space maintainers on their own, while 28.50% avail technician services for fabrication. Additionally,

54.40% of other specialist dentists and 38% of general dentists have their space maintainers fabricated by consultant pedodontists.

The main advantages reported were that space maintainers do not interfere with eruption (79%) and good patient acceptability (43%). However, participants also mentioned difficulties in placement (30%), fracture of components (28%), interference with the path of eruption (34%), and cementation failure (68%). Patient feedback revealed significant concerns regarding food lodgement within the appliance (32%), esthetic concerns (34%), and discomfort in the gingiva (50%).

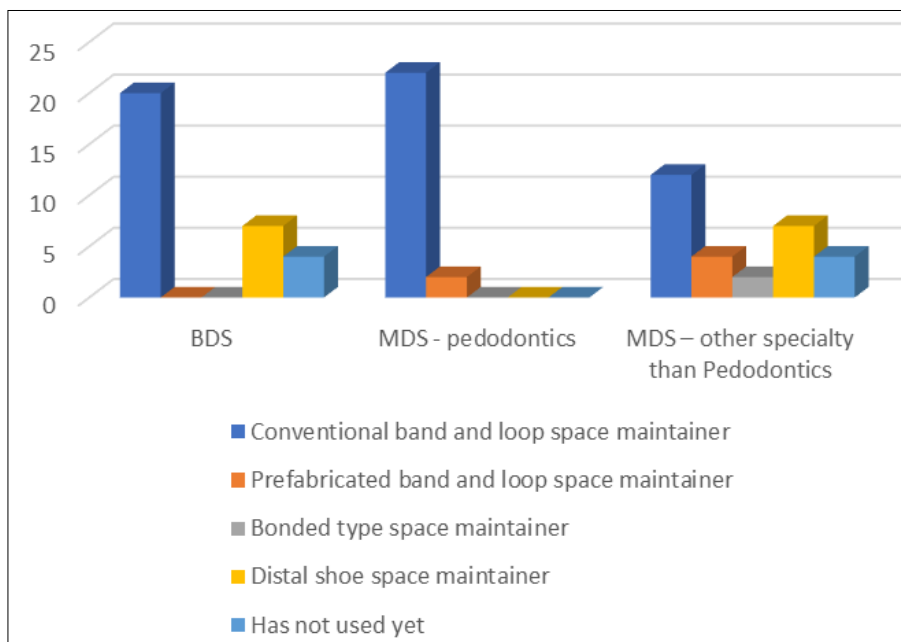


Fig 4: Commonly used Space maintainers -

Table 4: Attitude of Dental surgeons about space maintainers.

Questions	BDS (n=200)	MDS-Pedodontics (n=112)	MDS – other specialty than Pedodontics (n= 88)	Total (400)
14) Anything you would like to suggest to innovate a newer type of space maintainer. (Any new suggestion is welcomed in the other option)				
Add an acrylic tooth to create a functional space maintainer	48(24%)	36 (33.3%)	16 (22.2%)	0.388
Create a space maintainer with acrylic or other material that matches tooth color	68(34%)	24 (20%)	16 (22.2%)	
Esthetic, prefabricated, more biocompatible, functional, fixed space maintainer	0	8 (6.7%)	0	
Fixed space maintainer	0	8 (6.7%)	0	
Create a space maintainer with a flexible polymer	56 (28%)	48 (13.3%)	20 (33.3%)	
No need for innovation as the existing space maintainers works fine	28 (14%)	24 (20%)	28 (11.1%)	
No suggestions given	0	0	8 (11.1%)	

Table 4 shows the distribution of feedbacks about space maintainers among dental practitioners with different qualifications. Association between knowledge and different qualifications are measured using Chi-square and Fisher’s exact test. P-value >0.05 are considered statistically significant.

The participants were asked about the new innovation they would like to suggest in the fabrication of space maintainer, the results reflect a significant interest among dentists in introducing new features to enhance space maintainers, with a particular emphasis on improving functionality and aesthetics. The most favoured option was adding an acrylic tooth to create a functional space maintainer, with 36% of dentists supporting this idea across all specialties. Additionally, creating space maintainers with tooth-coloured materials was mentioned by 25% of respondents, with slightly higher favourability among Pedodontists. Only a small minority suggested a combination of aesthetic, prefabricated, biocompatible, functional, fixed space maintainer features, while a similarly small number advocated for fixed space maintainers, primarily among other dental specialists (except pedodontists). A considerable proportion (31%) expressed interest in space maintainers made from flexible polymers, indicating a preference for more comfortable materials.

Conversely, 14% of dentists were content with existing solutions, with a higher percentage of general dentists than dental surgeons of dental speciality.

The results indicate variations in the understanding and clinical practice of space maintainers among dental surgeons of different dental specialties. Pedodontists demonstrate a higher rate of space maintainer placement and fabrication compared to other specialist dentists and general dentists, reflecting their specialized training in pediatric dentistry. The predominance of conventional band and loop space maintainers suggests their efficacy and popularity among practitioners of all dental specialties. Challenges such as difficulties in placement, component fractures, and interference with eruption pathways highlight areas for improvement in clinical practice and appliance design. Patient feedback underscores the importance of addressing functional and aesthetic concerns to enhance treatment outcomes and patient satisfaction. Collaboration between specialties, particularly with consultant pedodontists for fabrication, can potentially optimize space maintainer utilization and mitigate associated challenges. Further research is warranted to explore innovative techniques and materials to improve space maintainer performance and patient experience in dental practice.

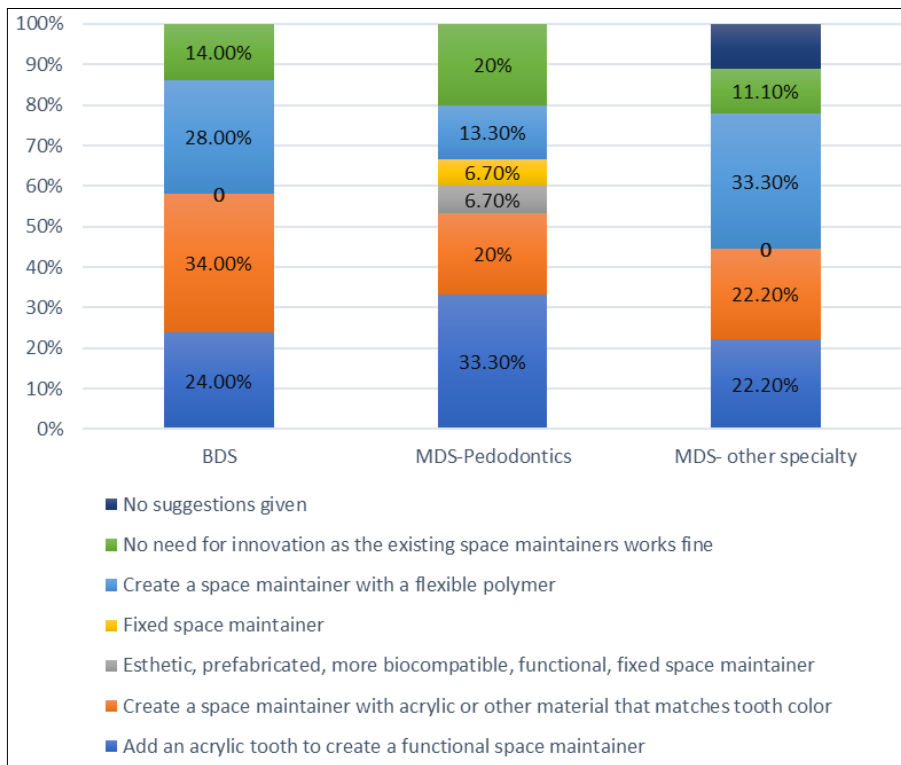


Fig 5: Performance and patient experience in dental practice.

Conclusion

As per this survey we can conclude that knowledge and clinical practice about the space maintainer is highest among the Paediatric dentist. Even though general dentist and other specialist dentist have shown good to fair knowledge in some aspect, but there is a significant deficit in their clinical practice patterns. The findings from this study will enhance treatment outcomes, innovate educational awareness programs for general dentists and other specialist dentist by offering valuable insights on practice of space maintainers.

Conflict of Interest

Not available

Financial Support

Not available

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