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Enhancing clinical training through understanding patient attitudes toward rubber dam application by undergraduate dental students: a study at a university in Thailand

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ABSTRACT

Aims: This study aimed to determine patient attitudes toward rubber dam use in operative dentistry and identify associated factors among patients treated by undergraduate dental students at Western University, providing evidence-based insights to enhance clinical training strategies.

Methods: This cross-sectional study was conducted from February to December 2024 at the Operative Dentistry Clinic, Faculty of Dentistry, Western University. Data were collected using a closed-ended questionnaire, which included demographic information and experiences with operative dental treatment. Patient attitudes were assessed using an 11-question, five-point Likert scale. Total attitude scores were categorized into negative (1-33), neutral (34-43), and positive (44-55) based on modified Bloom's cut-off criteria.

Results: A total of 98 completed questionnaires consisted of 44.90% males and 55.10% females. The mean attitude score was 40.23±6.53. While most patients (79.6%) expressed a preference for future rubber dam use and recognized its benefits (95.92% for foreign body aspiration prevention; 91.84% for moisture control), their attitudes were primarily neutral (72.4%). Ordinal regression analysis showed that only the duration of the presence of the rubber dam significantly influenced patient attitude (p=0.016), with a 1-min increase associated with a 2.2% decrease in the odds of a more positive attitude (odds ratio=0.978, 95% confidence interval: 0.961-0.996). No significant association was found between gender, age, local anesthesia, prior experience, and explanation of benefits.

Conclusion: Based on the limitations of this study, the findings indicate the need for dental student training focusing on improving time management and patient comfort during rubber dam application to enhance patient satisfaction and acceptance.

Keywords: Dental students, operative dentistry, patient attitude, rubber dam isolation

INTRODUCTION

The application of rubber dam isolation in restorative dentistry is paramount for clinical efficacy and patient safety.[1] It is considered the gold standard for adhesive restorative treatments because it provides effective moisture control, which is crucial for material bonding and restoration longevity.[2] Beyond moisture control, the rubber dam improves patient safety by preventing accidental ingestion or aspiration of instruments and materials while also protecting soft tissues from injury; it also improves the operator's visibility and access to the working field. In the context of infection control, its use is vital for reducing aerosol dissemination, a benefit that has been particularly highlighted since the COVID-19 pandemic.[3]

Despite the integral inclusion of rubber dam application in the dental curriculum across dental schools, Gilbert et al.[4] reported that only 12% of tooth restorations were performed with a rubber dam. This limited adoption is frequently attributed to various barriers affecting practitioners and patients.[5,6] The time-consuming and difficult application of rubber dams, which can prolong the treatment duration and increase associated costs, are often mentioned by dentists.[4] Conversely, patients may express discomfort, such as difficulty breathing or gingival pain resulting from clamp pressure, resulting in refusal of its use. Studies among dental students also reflect these concerns. Mala et al.[7] found that 45% of dental students perceived patient dissatisfaction with rubber dam, a finding consistent with other research where 53% of final-year dental students deemed the application procedure complicated and 45% believed patients disliked its use. Despite recognizing its importance, 62% of dental students anticipated a decrease in their own rubber dam use after graduation.

Contrary to these perceived barriers, some patient-centered studies have reported positive experiences. For instance, a previous study in Czech patients indicated that 77% of the patients felt more comfortable when a rubber dam was used.[8] The review literature concluded that practitioner experience influences patient attitudes, whereas patient gender and

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age showed no correlation. Such variations across studies, potentially influenced by differing sociocultural contexts or clinical practices, suggest that geographical factors have an impact on patient attitudes.[9]

Providing enduring recommendations for infection control from aerosols in dental practice, even as the COVID-19 pandemic transitions to an endemic phase, and acknowledging the need for resource efficiency and patient-centric care are crucial. A limited body of research on patient attitudes toward rubber dam use in operative dentistry, particularly in a contemporary and evolving context, remains.

This study aimed to determine patient attitudes toward rubber dam use in operative dentistry and identify associated factors among patients treated by undergraduate dental students at Western University, thereby providing objectively derived insights for evaluation and enhancing clinical training strategies.

METHODS

This study was approved by the Western University Human Researches Ethics Committee (Date: 26.12.2023, Decision No: HE-WTU2566-0112). Thai independently, and providing voluntary informed consent after receiving comprehensive information about the research project before data collection. This study adhered to the principles of the Declaration of Helsinki.

A descriptive, cross-sectional study was conducted using a questionnaire to assess patient attitudes toward rubber dam used in operative treatment performed by undergraduate dental students. This study was conducted at the operative dentistry Clinic, Faculty of Dentistry, Western University. The undergraduate dental program is a full-time, 6-year program that encompasses theoretical instruction, clinical practice, and externship. The study participants were recruited from patients undergoing this operative treatment at the clinic. The operative treatment, including the application of rubber dam, was performed by 5th and 6th-year dental students as part of their clinical training.

Participants were selected based on the following specific inclusion criteria: male or female patients aged 20 years or older, undergoing operative dental treatment necessitating tooth restoration with filling materials under rubber dam isolation, and capable of independently reading and writing Thai. The exclusion criteria included patients under 20 years of age or those unwilling to participate.

The sample size was determined through an a priori sample size calculation with a finite population correction. Based on a known patient population of 124 at the operative dentistry clinic, 95% confidence level, and 5% margin of error, the required sample size to estimate patient attitudes was calculated to be 94. An additional 10% was recruited to account for the potential dropout rate, bringing the final recruitment goal to 103 participants. This methodology ensured that the sample size was adequately powered to provide a precise estimate of patient attitudes within the specific study population.

Data were collected using a closed-ended questionnaire structured into three sections: general demographic information (gender, age, and respiratory conditions), experiences with dental treatment, and attitudes toward rubber dam use in operative dental treatment.

Patient attitudes were assessed using an 11-question Likert scale with five response levels (strongly agree, agree, undecided, disagree, and strongly disagree). Total attitude scores were calculated and subsequently categorized into three groups-negative (score 1-33), neutral (score 34-43), and positive (score 44-55)-based on established scoring criteria derived from modified Bloom's cut-off categories.[10] The content validity of the questionnaire was evaluated by three experts using the Index of Item Objective Congruence (IOC), with questions deemed acceptable if their IOC value ranged between 0.50 and 1.00. Furthermore, a pilot study involving 20 subjects was conducted to determine the reliability of the questionnaire, yielding an acceptable Cronbach's alpha coefficient greater than 0.8. The duration of rubber dam placement and the total duration of rubber dam presence during the treatment procedure were meticulously recorded by an assisting student.

Upon recruitment, the participating patients received detailed information regarding the study objectives and the questionnaire. It was explicitly communicated that participation would not affect the standard of service received at the Faculty of Dentistry, Western University, and that participants retained the right to withdraw at any point. Following the signing of the consent form, the questionnaire was administered to the patient at the conclusion of their treatment.

Patients completed the questionnaire in a designated waiting area to mitigate potential bias from healthcare providers. Only fully completed questionnaires were included in subsequent data analysis.

Statistical Analysis

All collected data were entered into a computer for statistical analysis using the SPSS 22.0 software (SPSS, Chicago, IL, USA). Descriptive statistics were employed to characterize the general attributes of the participants. Continuous variables exhibiting a normal distribution are presented as mean standard deviation. All categorical data are summarized using percentages. Ordinal logistic regression analyses were used to ascertain associations between variables, with a statistical significance level at p-value <0.05.

RESULTS

Participants Characteristics

Out of 101 distributed questionnaires, 98 were successfully completed and included in the statistical analysis; two were excluded because of incomplete data. The study sample consisted of 44 males (44.9%) and 54 females (55.1%). The participant age distribution is detailed in **Table 1**. A small percentage of patients (2.0%) reported pre-existing respiratory conditions.

Main Results

Regarding prior experience with rubber dam application, 55.1% (n=54) of patients reported it as their first experience, whereas 44.9% had previously undergone dental treatment involving a rubber dam. The majority of previous rubber dam use was for restorative treatment (41.8%), followed by endodontic treatment (6.1%) and other dental procedures. Local anesthesia was administered to 23.5% of the patients during treatment, and 76.5% received an explanation of the benefits of rubber dam usage before treatment initiation. The duration of rubber dam placement ranged from 3 to 60 min,

Table 1. General demographic status and patient experiences (n=98)		
Characteristic		**Count (%)**
Gender	Male	44 (44.9)
	Female	54 (55.1)
Age (years)	20-30	29 (29.6)
	31-40	20 (20.4)
	41-50	10 (10.2)
	51-60	25 (25.5)
	>60	14 (14.3)
Respiratory condition	No	96 (98.0)
	Yes	2 (2.0)
Prior experience with rubber dam use	No	54 (55.1)
	Yes	44 (44.9)
Prior treatment involving rubber dam usage		
Operative		41 (41.8)
Endodontic		6 (6.1)
Prosthetic		1 (1.0)
Current experience		
Local anesthesia administration	No	74 (75.5)
	Yes	24 (24.5)
Explanation of benefits before treatment	No	23 (23.5)
	Yes	75 (76.5)

with a mean of 17±10.9 min. The duration of rubber dam presence during treatment ranged from 10 to 150 min, with a mean of 85±27.4 min (**Table 2**).

Table 2. Duration of rubber dam placement and presence			
Duration	**Mean±SD**	**Min (minute)**	**Max (minute)**
Rubber dam placement	17±10.9	3	60
Rubber dam presence	85±27.4	10	150

SD: Standard deviation, Min: Minimum, Max: Maximum

Patient attitude scores toward rubber dam application ranged from 25 to 55 points, yielding a mean score of 40.2±6.5. Based on the predefined scoring criteria, most patients exhibited neutral attitudes (72.4%), with 27.6% holding positive attitudes and 13.3% reporting negative attitudes. A high percentage of patients affirmed the benefits of rubber dam use: 95.9% stated that it prevents foreign body aspiration, and 91.8% indicated that it helps manage intraoral water accumulation. Conversely, the negative statement with the lowest mean score pertained to pain associated with the rubber dam. Notably, 42.9% of the participants agreed that the duration of rubber dam presence in the oral cavity was excessive. Nonetheless, a considerable majority (79.6%) of the patients expressed a preference for rubber dam use in future treatments. All categorical data are summarized using percentages. The response percentages for each Likert item and the total mean±standard deviation (SD) score are presented in **Table 3**.

Ordinal regression analysis showed that, among all factors examined, only the duration of rubber dam presence significantly influenced patient attitude (p=0.016). For every 1-min increase in the duration the rubber dam was present, the odds of a patient reporting a more positive attitude decreased by 2.2% [odds ratio (OR)=0.978, 95% confidence interval (CI): 0.961-0.996]. This indicates that longer durations are significantly associated with less favorable patient perceptions. Conversely, other factors such as gender (p=0.270, OR=1.547), age (p=0.547, OR=0.994), local anesthetic application (p=0.872, OR=0.908), prior experience with rubber dam (p=0.582, OR=0.801), duration of rubber dam placement (p=0.179, OR=1.000), and whether an explanation of benefits was given (p=0.679, OR=1.277) did not show a statistically significant association with patient attitudes in this regression model (**Table 4**). These factors did not significantly change the odds of a patient being in a higher attitude category.

DISCUSSION

The findings of this study revealed that a majority of patients held neutral attitudes (72.4%) toward rubber dam use, with a substantial proportion expressing positive attitudes (27.6%) and a notable percentage reporting negative attitude (13.3%). The ordinal regression analysis showed a significant inverse relationship between the duration of rubber dam presence in the oral cavity and patient attitude scores, indicating that longer durations lead to less favorable patient attitudes. The findings of this study on patient attitudes present agreement

Table 3. Attitudes toward rubber dam usage in percentage and mean±SD score using Likert's Scale analysis							
No.	**Questions**	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Mean±SD**
1	Rubber dam application for dental fillings makes you feel more comfortable during treatment compared with a filling without rubber dam	38.8	37.8	10.2	10.2	3.1	4.0±1.1
2	Rubber dam application causes pain	20.4	19.4	16.3	25.5	18.4	3.0±1.4
3	Rubber dam application makes it uncomfortable or causes breathing difficulty	17.4	17.4	15.31	35.7	14.3	2.9±1.3
4	Rubber dam application causes anxiety due to communication difficulties with the dentist	18.4	20.4	10.2	26.5	24.3	2.8±1.5
5	Procedure of rubber dam placement takes a long time	15.3	23.5	18.4	31.6	11.2	3.0±1.3
6	Duration of rubber dam presence is long	17.4	25.5	20.4	24.5	12.2	3.1±1.3
7	Prefer to receive dental filling treatment with rubber dam application rather than without	30.6	34.7	17.4	6.1	11.2	3.7±1.3
8	Rubber dam application in dental fillings is beneficial for patients	48.0	39.8	9.2	1.0	2.0	4.3±0.8
9	Rubber dam application helps prevent filling materials or foreign objects from falling into the throat area	65.3	30.6	1.0	1.0	2.0	4.6±0.8
10	Rubber dam application prevents water from accumulating in the oral cavity	54.1	37.8	6.1	1.0	1.0	4.4±0.8
11	Prefer to have a rubber dam applied in the next treatment	40.8	38.8	12.2	2.0	6.1	4.1±1.1

SD: Standard deviation

Table 4. Factors associated with attitude toward rubber dam use in the ordinal logistic regression analysis

Factors	Attitude			OR	95% CI	p-value
	Positive n (%)	Neutral n (%)	Negative n (%)			
Gender				1.547	0.717, 3.344	0.270
Male	15 (34.1)	23 (52.3)	6 (13.6)			
Female	12 (22.2)	35 (64.8)	7 (13.0)			
Age (years)				0.994	0.975, 1.013	0.547
20-30	6 (20.7)	18 (62.1)	5 (17.2)			
31-40	7 (35.0)	11 (55.0)	2 (10.0)			
41-50	3 (30.0)	4 (40.0)	3 (30.0)			
51-60	7 (28.0)	16 (64.0)	2 (8.0)			
>60	4 (28.6)	9 (64.3)	1 (7.1)			
Prior experience				0.801	0.389, 1.649	0.582
No	16 (29.6)	30 (55.6)	8 (14.8)			
Yes	11 (25.0)	28 (63.8)	5 (11.4)			
Local anesthetic administration				0.908	0.303, 2.716	0.872
No	19 (25.7)	45 (60.8)	10 (13.5)			
Yes	8 (33.3)	13 (54.2)	3 (12.5)			
Explanation of benefits				1.277	0.425, 3.834	0.679
No	4 (25.7)	16 (60.8)	3 (13.5)			
Yes	23 (33.3)	42 (54.2)	10 (12.5)			
Duration of rubber dam placement				1.000	0.985, 1.016	0.179
Duration of rubber dam presence				0.978	0.961, 0.996	0.016*

*Significance level=0.05, OR: Odds ratio, CI: Confidence interval

and disagreement with previous research. Unlike previous research, this study showed a higher prevalence of neutral and negative attitudes, which contrasts with literature reviews and studies on Czech dental patients, which generally found more positive patient experiences.[8,9] This variation may be influenced by regional or demographic factors, or it could be attributed to the study's use of a more nuanced Likert's rating scale, which allowed for a more comprehensive assessment of attitudes compared with a simplified binary approach. Additionally, while using Bloom's cutting point could involve some loss of granularity and subjective interpretation, it allows for the analysis of more subtle associations and underlying trends.[11]

This study's ordinal regression analysis revealed a significant inverse relationship between the duration of rubber dam presence in the oral cavity and patient attitude scores, indicating that longer durations lead to less favorable patient attitudes. This aligns with the perception of 42.86% of participants who agreed that the duration of rubber dam presence was excessive. This finding is consistent with previous studies by Erin et al.[7] and Kapitan et al.,[8] which similarly identified perceived prolonged treatment time as a factor influencing attitudes. The mean duration of rubber dam presence in this study was 85±27.35 minutes, potentially influenced by treatment being provided by undergraduate students. According to Stewardson et al.,[12] patients treated by undergraduate students reported significantly fewer positive experiences with rubber dam compared to those treated by experienced dentists, where mean durations were notably shorter. The duration of treatment time approximately under 30 minutes for experienced dentists versus over 1 hour for undergraduates. This suggests that operator experience plays a role in patient perception, potentially by influencing the efficiency of rubber dam placement and overall treatment time.[13] Although the mean duration of rubber dam placement was longer in this study compared to some others, the duration of rubber dam placement itself was not a significant predictor of patient attitude.

In terms of agreement, this study aligns with previous research on several key points. The ordinal regression analysis revealed a significant inverse relationship between the duration of rubber dam presence and patient attitudes, confirming findings from studies that similarly identified prolonged treatment time as a negative factor. The study's finding that demographic factors such as gender and age showed no statistically significant influence on attitude scores is also consistent with some previous research.[7]

This study suggests that although patients generally hold a positive view of the clinical benefits of rubber dam, the practical experience of the procedure itself, particularly its duration, is a critical factor that influences their overall attitude. Patient attitude was significantly associated only with the duration of rubber dam presence. This finding aligns with the study's objective to identify the factors influencing patient attitudes and underscores the need for more efficient procedural skills for rubber dam application.

Furthermore, the high rates of patient agreement regarding the benefits of rubber dam and their preference for its future use corroborate the existing literature, indicating a strong patient understanding and acceptance of its protective advantages despite potential discomfort. Previous studies have indicated that factors influencing patient attitudes include comfort levels, explanations of rubber dam usage, and first-time experience. This study found that administering local anesthesia did not independently dictate overall rubber dam attitude.[14] In this study, the percentage of patients with prior rubber dam experience was notably higher than that in some other studies. The benefits of rubber dam in infection control, by decreasing microbial content in aerosols and droplets during treatment, particularly affect the patient's perception of rubber dam used in dental treatment during the COVID-19 pandemic context.

The lack of impact from the explanation for rubber dam usage in this study may be attributable to an invalid method used to convey its benefits or suboptimal communication skills among the dental students, differentiating their approach from that of experienced operators. This highlights the need for future research to validate assessment methods for evaluating patient comprehension of procedural benefits. A key finding was that patient discomfort, specifically issues with breathing, was the primary reason patients in the negative group rejected future rubber dam use. According to the association with the lowest mean score for negative statements, comfort and duration remain significant barriers to a positive experience Therefore, clinical training strategies should emphasize techniques to minimize airway obstruction (by ensuring the proper position of rubber dam sheet) and incorporating the atraumatic clamp technique, such as a cushee-rubber dam cushion (Praction Inc., USA) or customized cushee could be valuable for reducing postoperative pain and gingival trauma from clamp pressure.[15]

The use of rubber dam isolation in restorative dental treatment is clinically important in improving the longevity of restorations and ensuring safe procedures.[16] Minimizing the duration of rubber dam presence during treatment should be a primary consideration to enhance positive attitudes. Emphasizing effective communication strategies and application efficiency might help overcome practitioner-related barriers concerning patient acceptance, particularly for dental students.[8] Furthermore, longitudinal and qualitative research is required to determine whether the observed negative influence of prolonged procedural duration persists over time. Although this study focused on patients receiving operative treatment under rubber dam, exploring the attitudes of patients undergoing different procedures or in varied clinical settings could provide broader generalizability.

Limitations

The study's limitations owing to its single clinic setting and patient population, which consisted of individuals proficient in Thai. Additionally, the mean duration of the procedure was considerably longer than that associated with experienced dentists, which may influence the results. Although the sample size was statistically justified, it may not have been sufficient to detect smaller effects from other variables. Furthermore, reliance on a self-reported questionnaire is susceptible to various biases, such as recall bias or social desirability bias, despite efforts to mitigate them by having patients complete the form away from healthcare providers.

CONCLUSION

This study aimed to understand the factors associated with patient attitudes toward rubber dam use. Although the benefits of rubber dam are widely recognized by patients, procedural duration emerged as a key factor that significantly influenced patient attitude. This outcome indicates a clear need to enhance clinical training strategies focused on optimizing treatment time to improve patient satisfaction and acceptance of rubber dam use in operative treatment, thereby elevating the quality of patient care delivered by future health professionals.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was carried out with the permission of the Western University Human Researches Ethics Committee (Date: 26.12.2023, Decision No: HE-WTU2566-0112).

Informed Consent

All dentistry students signed an open and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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