Overview of attitudes, knowledge, and barriers to the use of rubber dam in endodontic and restorative treatments by new dentists

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Abstract. The use of rubber dams remains uncommon among dentists, prompting further investigation. This 2022 study assessed the attitudes, knowledge, and perceived barriers to rubber dam use among new dental graduates at Universitas Muhammadiyah Yogyakarta (UMY). A cross-sectional survey was conducted among 2022 graduates from UMY's Faculty of Dentistry. Data were analyzed descriptively and using Chi-square tests. Results showed that 72.7% used rubber dams in all endodontic cases and 76.8% in restorative procedures. Most respondents believed rubber dams enhanced treatment success, with 98.4% for endodontic and 95.8% for restorative. However, barriers included patient discomfort (85.1%), increased treatment time (75.2%), insertion difficulty (71.9%), and high cost (61.2%). No significant gender differences were found in rubber dam use or knowledge. Despite these challenges, most respondents viewed rubber dams as an ideal isolation tool for dental procedures due to their clinical benefits. The limitation in this study was the small sample size, potentially limiting the generalizability of the findings

1 Introduction

Isolation is one of the standard procedures that is mandatory in dental treatment, especially endodontic and restorative treatment. Rubber dams were introduced by Dr. Sanford C. Barnum in 1864 as an alternative method of isolating teeth during restorative procedures. Rubber dams are able to isolate teeth from the rest of the mouth, keep the area of the tooth restored dry, and are relatively less exposed to intraoral bacteria [1]. Rubber dams are currently the first choice of isolation tool, which is considered an ideal isolation tool for dental treatment.

Rubber dams are used to provide an aseptic work area, reduce the risk of swallowing small instruments and irrigating chemicals, clean the area, and protect oral tissue from cutting tools. Focus and protection from saliva-borne diseases including AIDS, hepatitis, and tuberculosis are given to the operator[2]. Isolation of the tooth during restorative procedures is essential to prevent saliva contamination[3]. Tooth isolation allows and ensures proper

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bonding of the restorative material to the tooth, thereby preventing recurrent infections and failure of the restoration [4].

The recent COVID-19 pandemic experienced throughout the world has forced all health and non-health professions to work together to improve health protocols to prevent transmission. Airborne contamination and direct contact are the main infection routes for transmission of this virus. Transmission during dental procedures can occur through inhalation of droplets from infected patients or direct contact with contaminated mucous membranes, oral fluids, and instruments. Dentists represent the category with the highest risk of contracting the virus due to exposure to blood, saliva, and inhalation of droplets from an infected person, so the use of rubber dams to reduce the spread of aerosols and blood exposure during dental treatment is necessary [5].

Previous research shows that 15.2% of endodontists and 78.4% of dentists do not use rubber dams during endodontic treatment [6]. Fejjeri et al. (2024) stated in their research that most Tunisian dentists do not use rubber dams as an isolation tool[7]. In another study, it was found that 68% respondents did not use rubber dams due to the relatively high cost [4]. In a previous survey studying the clinical practice of posterior resin composites among general dentists in the UK, 68% (173 dentists) of respondents reported that they never used rubber dams, while 94% stated they routinely used cotton roll isolation. Based on a Dental Practice Study in Saudi Arabia, 64% of participating dentists reported that they do not use rubber dams on any restorations [8].

Several reasons for not using rubber dams in dental care are related to cost, lack of training in installation, lack of confidence in use, and the unavailability of rubber dams in clinics. A comparable study on health science students showed that even with excellent conceptual understanding, actual compliance remained low due to habit, convenience, and environmental factors [9]. Previous research also cited various reasons for the low use of rubber dams by dental practitioners, the most frequently cited reasons being concerns about patient comfort, increased application time, inadequate training and confidence, the sensitivity of the technique, cost of rubber dams, and other financial constraints [4].

Of the many advantages that rubber dams have, their use is still considered low, with each operator having certain reasons. It encourages researchers to carry out further evaluations regarding the use of rubber dams, especially in the post-COVID-19 pandemic, which places dentists in the category with the highest number of professionals infected by the COVID-19 virus[10]. This study aims to determine the attitude, knowledge, and barriers to using rubber dams in endodontic and restorative treatment among new dentists at the Faculty of Dentistry, Universitas Muhammadiyah Yogyakarta in 2022.

2 Methods

This research used a cross-sectional research design with a descriptive observational research type. The sample in this study was 121 new dentist graduates in 2022 (January-December 2022 period) from the Faculty of Dentistry, Universitas Muhammadiyah Yogyakarta. Sampling was carried out based on a purposive sampling technique, namely selecting samples by providing their assessment of the samples among the selected population.

The research was carried out using a questionnaire instrument, which had previously been tested for validity and reliability after being distributed to a sample of 80 respondents with similar eligibility criteria. The results of the reliability test showed that 1 item did not meet the criteria of the reliability test; therefore, the item was excluded from the questionnaire. All remaining items demonstrated acceptable reliability, with Cronbach's alpha values of 0.691 for the knowledge and attitude items, and 0.790 for the obstacles items. Data collection was carried out by distributing questionnaires online to dentists who graduated from the Faculty of Dentistry, Universitas Muhammadiyah Yogyakarta. The collected data were then processed using the quantitative descriptive analysis method. To assess the association between gender and categorical variables such as the use of rubber dams in treatment, and

knowledge about the benefits of rubber dam application, the Chi-square test was used. The effect size was calculated using Cramer's V to measure the strength of association. Ethical approval for this study was granted by the Ethics Committee from Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, as documented under clearance number : 225/EC-KEPK FKIK UMY/VII/2023.

3 Result and discussion

3.1 New dentists' attitude and knowledge

Table 1. Attitudes and knowledge of new dentists in installing rubber dams in endodontic treatment

	Yes			No			Total (n=121)
	Male (n=33)	Female (n=88)	Total	Male (n=33)	Female (n=88)	Total	
Attitudes towards the use of rubber dams in endodontics treatment							
1. Are rubber dams used in all endodontic treatment cases?	24 (72.7%)	64 (72,7%)	88 (72,7%)	9 (27,3%)	24 (27,3%)	33 (27,3%)	121 (100%)
2. What type of rubber dam do you use in carrying out endodontic treatment?	Rubber dam konvensional						117 (96,7%)
	OptraDam						6 (5%)
	OptiDam						11 (9,1%)
3. What rubber dam technique do you use in carrying out endodontic treatment?	Dam first technique: single						75 (62%)
	Clamp in dam technique						61 (50,4%)
	Dam first technique: multiple						45 (37,2%)
Knowledge of the use of rubber dams in endodontics treatment							
1. Does a rubber dam increase the success of endodontic treatment?	33 (100%)	86 (98.3%)	119 (98,4%)	0 (0.0%)	2 (2,27%)	2 (1,6%)	121 (100%)
3. Does the rubber dam increase operator access and visibility during endodontic treatment?	33 (100%)	86 (98,3%)	119 (98,4%)	0 (0,0%)	2 (2,27%)	2 (1,6%)	121 (100%)
4. Is a rubber dam the ideal isolation tool for endodontic treatment?	33 (100%)	88 (100%)	121 (100%)	0 (0,0%)	0 (0,0%)	0 (0,0%)	121 (100%)

Based on Table 1, it was found that the average attitude of male respondents was 72.7% and female respondents were 72.7%, the average knowledge of male respondents was 100%, and female respondents were 98.3% regarding endodontic treatment. This suggests a standardized approach in clinical behavior regarding rubber dam usage during endodontic procedures among recent graduates. These findings reflect a high level of awareness and knowledge regarding the benefits of rubber dam use, highlighting the effectiveness of the dental education provided at UMY in emphasizing the importance of isolation tools in clinical practice.

Table 2. Attitudes and knowledge new dentists in installing rubber dams in restorative treatment

	Yes			No			Total (n=121)
	Male (n=33)	Female (n=88)	Total	Male (n=33)	Female (n=88)	Total	

Attitudes towards the use of rubber dams in restoration treatment							
1. Are rubber dams used in all restoration treatment cases?	26 (78.7%)	67 (76.1%)	93 (76,8%)	7 (21.2%)	21 (23.8%)	28 (23,2%)	121 (100%)
2. What type of rubber dam do you use in carrying out restoration treatment?	Rubber dam conventional OptraDam OptiDam						115(95%) 10 (8.3%) 8 (6.6%)
3. What rubber dam technique do you use in carrying out restoration treatment?	Dam first technique: single Clamp in dam technique Dam first technique: multiple						71 (58.7%) 60 (49.6%) 40 (33.1%)
Knowledge of the use of rubber dams in restoration treatment							
1. Does a rubber dam increase the success of restoration treatment?	31 (93.9%)	85 (96.5%)	116 (95,8%)	2 (6.06%)	3 (3.40%)	5 (4,2%)	121 (100%)
2. Does a restoration with a rubber dam have a better level of durability?	29 (87.8%)	78 (88.6%)	107 (88,5%)	4 (12.1%)	10 (11.4%)	14 (11.5%)	121 (100%)
3. Does the rubber dam increase operator access and visibility during restoration treatment?	32 (96.9%)	84 (95.4%)	116 (95,8%)	1 (3.03%)	4 (4.54%)	5 (4,1%)	121 (100%)
4. Is a rubber dam the ideal isolation tool for restoration treatment?	33 (100%)	88 (100%)	121 (100%)	0 (0%)	0 (0%)	0 (0%)	121 (100%)

Based on Table 2, it was found that the average attitude of male respondents was 78.7% and female respondents were 76.1%, the average knowledge of male respondents was 93.9%, and female respondents were 96.5% regarding restoration treatment. Although slightly higher among males, the gender difference was minimal, indicating an overall favorable attitude toward rubber dam usage in restorative dentistry.

3.2 Obstacles in installing rubber dams

Table 3. Obstacles for new dentists in installing rubber dams

	Yes			**No**			**Total (n=121)**
	Male (n=33)	**Female (n=88)**	**Total**	**Male (n=33)**	**Female (n=88)**	**Total**	
Barriers to the use of rubber dams							
1. Is it difficult to use a rubber dam?	22 (66.7%)	65 (73.9%)	87 (71,9%)	11 (33.3%)	23 (26.1%)	34 (28,1%)	121 (100%)
2. Does using a rubber dam waste treatment time?	23 (69.7%)	68 (77.2%)	91 (75,2%)	10 (30.3%)	20 (22.7%)	30 (24,8%)	121 (100%)
3. How long does it take to install a rubber dam?	10 minutes 5 minutes 15 minutes >15 minutes						64 (52.9%) 29 (24.0%) 17 (14.0%) 11 (9.1%)
4. Is the rubber dam expensive?	13 (39.4%)	61 (69,3%)	74 (61,2%)	20 (60,6%)	27 (30.7%)	47 (38,8%)	121 (100%)
5. Does the patient complain of discomfort when using the rubber dam?	27 (81,8)	76 (86,3%)	103 (85,1%)	6 (18,2%)	12 (13,4%)	18 (14,9%)	121 (100%)

The result in Table 3 reports that the majority of respondents are experiencing various barriers to rubber dam usage in clinical practice. Approximately 71.9% respondents indicated that installing rubber dams is technically challenging. The barriers regarding treatment time were also reported to be high, with 75.2% respondents believing that its use increases treatment time. The most common time required for installation was 10 minutes (reported by 52.9%), although some respondents indicated longer durations, suggesting variability in proficiency.

In terms of cost, 61.2% of dentists perceived rubber dams to be expensive, with a greater proportion of females (69.3%) reporting this than males (39.4%). Additionally, 85.1% of respondents noted that patients often complain of discomfort during treatment involving rubber dams, making this the most frequently cited obstacle.

3.3 Gender association in attitude, knowledge, and obstacles

Table 4. Chi-square test and Cramer's V effect size

Variable	Chi-Square	p-value	Cramer's V
Attittude_Endodontics	0.000	1.000	0.000
Attitude_Restoratives	0.004	0.947	0.006
Knowledge_Endodontics	0.005	0.942	0.007
Knowledge_Restoratives	0.02	0.889	0.013
Obstacles	0.115	0.734	0.031

Based on the Chi-Square analysis, there was no significant association between gender and the attitude of rubber dams in endodontic treatment ($\chi^2 = 0.000$, $p = 1.000$) and restorative treatment ($\chi^2 = 0.004$, $p = 0.947$). There was also no significant association in knowledge of rubber dam in endodontics ($\chi^2 = 0.005$, $p = 0.942$), and knowledge of rubber dam n restorative treatment ($\chi^2 = 0.020$, $p = 0.889$). As for the obstacles while installing rubber dams, it also shown no significant association ($\chi^2 = 0.115$, $p = 0.889$). The effect sizes, as measured by Cramer's V, were consistently very small across all comparisons (0.000–0.031), indicating a negligible association between gender and the all variables.

3.4 Discussion

3.4.1 New dentists' attitude and knowledge

Attitude is described as a person's knowledge of real and potential behaviors. Male and female respondents in this study had similar attitudes on rubber dams in restoration treatment. Based on the results of research describing the use of rubber dams in endodontic and restorative treatment by new dentists at Universitas Muhammadiyah Yogyakarta in 2022, the majority of new dentists used rubber dams in endodontic treatment, 72.7%. Research conducted by Stasic et al. (2024) showed that 37% of dentists used rubber dams during endodontic treatment. In dental restoration treatment, research results showed that 78.7% stated they used rubber dams in restoration treatment[11]. Research conducted by Fejjeri et al. (2024) showed that rubber dam was utilized by 44.1%, 63.6%, and 94.8% of respondents during anterior, premolar, and molar endodontic procedures[7].

Rubber dams have several types in terms of how they are used, such as conventional rubber dam, OptiDam, and OptraDam. The choice of rubber dam type depends on the preferences of each operator or dentist, adjusted to the case and the difficulty of installation. In this study, it was found that 96.7% used conventional rubber dams in carrying out endodontic treatment, 5% used OptraDam, and 9.1% used OptiDam. Meanwhile, inrestorative treatment, 95.0% of respondents used conventional rubber dams, 8.3% of respondents used OptraDam, and 6.6% of respondents used OptiDam. These results indicated that dentists more often choose conventional rubber dams as the first choice of rubber dam

type isolation tool compared to OptraDam and Optidam rubber dams. Research conducted by Mahima et al. (2023) demonstrated that the conventional rubber dam system is preferable compared to the use of OptraDam[12]. Waheed et al. (2024) revealed in their research that the majority of patients stated that the use of conventional rubber dams was better than the use of OptraDam[13]. Conventional rubber dams are more widely used nowadays due to their greater availability; they are considered easier to find and more economical compared to newer types of rubber dams.

There are various rubber dam installation methods. The technique employed relies on the case and operator preferences. Patient comfort is also important when choosing a rubber dam placement method. According to the research, 62% of respondents employed the dam first technique (single technique) in endodontic treatment and 58.7% in restorative treatment. The dam-first technique places the rubber sheet before the clamp. For restorative procedures, single-tooth isolation is preferred over multiple-tooth methods because it provides superior field control.

Knowledge is defined as everything that is known based on experience and will increase according to the experience of the individual[14]. According to Al-Nahlawi (2019), knowledge is the foundation that influences a person's attitude, which in turn leads to action [15]. This study found no significant gender difference in knowledge of rubber dam use in restorative treatment, indicating comparable understanding. As a bacterial barrier in endodontics, the rubber dam is considered integral to treatment success, and studies report better outcomes with its use.

Based on the findings in this study, the results showed that 98.4% of respondents agreed with the use of rubber dams in endodontic treatment, and 95.8% agreed that the use of rubber dams in restorative treatment could increase treatment success. The success of restoration depends on several factors, one of which is effective moisture control. The findings obtained in this research also showed that 88.5% of respondents agreed that restorations carried out using rubber dams had better durability compared to those carried out without using rubber dams. In contrast to research conducted by Miao et al., (2021), statements regarding the influence of the use of rubber dams on the level of success and durability of restoration cannot yet be explained because the evidence is very uncertain over a longer time[1]. Rubber dam isolation effectively controls moisture. However, restoration outcomes are multifactorial. Evidence that rubber dams improve success or longevity remains limited. Nonetheless, their use is still warranted during treatment.

Rubber dams improve operator access and visibility of maintenance work areas. This study indicated that 98.4% agreed that rubber dams could improve endodontic operator access. Using a rubber dam during endodontic treatment helps focus the therapy and prevents mouth mirror fogging, according to several responses.

Restoration success is often associated with adequate isolation of the work area. There are several methods of isolating the work area for dental treatment, one of which is a rubber dam. The use of a rubber dam isolation tool is considered the ideal method recommended for effective isolation[6,]. It is generally emphasized that isolation using rubber dams is necessary for successful restoration. This research revealed that 100% of respondents agree that a rubber dam is the most ideal isolation tool for endodontic and restorative treatment. Rubber dams, as isolation tools in dental treatment, have been implemented as standard procedures and mandatory protocols due to their many advantages. Another alternative method is the use of a cotton roll combined with a high-volume saliva ejector, the most commonly used alternative method besides rubber dams. However, until now, the use of rubber dams has still been highly recommended as an isolation procedure for ideal dental care [2].

This study found no significant difference between male and female respondents in the usage of rubber dams during endodontic and restorative treatments. This finding is consistent with previous studies by Boreak et al. (2021), who discovered that gender had no significant association with the usage of rubber dams among Saudi dentists[4]. These findings

corroborate the conclusion that gender does not appear to influence clinical decisions or knowledge of rubber dam application, particularly among newly practicing dentists.

3.4.2 Obstacles in installing rubber dams

Although rubber dams benefit restorative and endodontic care, they are not used in all cases. This study examined operators' reasons and installation barriers, which may shape attitudes toward use, and found no significant gender differences in reported barriers for restorative treatment. It shows that male and female respondents experience the same barriers in using rubber dam. This research shows that 71.9% of respondents stated that installing rubber dams was difficult to carry out.

3.4.3 Time consuming

The length of time it takes to install a rubber dam is sometimes also a consideration. As dentists, we are required to work appropriately and effectively in terms of treatment and treatment time. This research shows that 75.2% of respondents answered that they agreed that using rubber dams wastes treatment time. Research conducted by Boreak et al. (2021) also showed that 30% of general practitioners agreed that rubber dams were more time-consuming, so rubber dam installation was not carried out[4]. In Abuzenada's research (2021), 61.8% of dental professional students in the study agreed that using rubber dams in restorative treatment could prolong treatment time.

3.4.4 High costs

High costs are one of the obstacles to using rubber dams. Based on the research results, 61.2% of respondents agreed that high costs were a reason for not using rubber dams when carrying out maintenance. These results are in line with research conducted by Boreak et al. (2021), demonstrating that 68% of general dentists did not use rubber dams due to their high operational costs[4]. Other research also stated that 5.5% of dentists do not use rubber dams due to the high cost of rubber dams[7].

4 Conclusion

Based on research, it can be concluded that among UMY Faculty of Dentistry graduates, the rubber dam was commonly used in endodontics (72.7%) and restorative (76.88%). Conventional rubber dams were more widely used in this study (>95%), typically via the dam-first technique, followed by the clamp-in-dam and dam-first-multiple techniques. Most 2022 graduates (over 88.5%) agreed that the rubber dam has a better success rate, durability, access, and visibility, and is the ideal isolation tool for endodontic and restorative procedures. Barriers centered on patient complaints (85.1%), with the lowest figure being the high cost of the rubber dam (61.2%). Installation difficulties and time-consuming were also reported (>70%). The findings are limited by the small sample size, which may affect their representativeness. Future studies should aim for larger, more diverse cohorts and comparative analyses between endodontic specialists and general practitioners. Given that the Indonesian Dentist Competency Standards require proficiency, curricula should strengthen comprehensive, hands-on training with rubber dams, especially in clinical education, to build confidence and promote consistent use in practice.

Acknowledgments

The authors would like to express their sincere gratitude to the Academic Dental Hospital of Universitas Muhammadiyah Yogyakarta for providing clinical facilities and continuous support.

Authors' Contribution Statement

All the authors contributed to the investigation, data collection, data analysis, and manuscript writing. First and corresponding author, Erma Sofiani, was responsible for providing academic validation of the findings, and critically revised and finalised the manuscript for submission.

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