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Research Article

Adoption of Rubber Dam Isolation in Private Dental Practices in Tunisia: A National Cross-Sectional Study

Mayada Jemâa[1]*, Azza Arfaoui[2], Mahdi Tlili[3], Lilia Rebaï[4] and MB Khattech[5]

[1]Professor, Department of Dental Medicine, Military Principal Hospital of Instruction, Oral Health and Oro-Facial Rehabilitation Laboratory Research (LR12ES11), Faculty of Dental Medicine, University of Monastir, Avicenne Avenue, Tunisia

[2]Resident, Department of Dental Medicine, Military Principal Hospital of Instruction, Laboratory of Dento-Facial Clinical and Biological Approach (ABCDF) LR12ES10, Faculty of Dental Medicine, University of Monastir, Avicenne Avenue, Tunisia

[3]Assistant Professor, Department of Dental Medicine, Military Principal Hospital of Instruction, Oral Diseases in the Military UR17DN04, Faculty of Dental Medicine, University of Monastir, Avicenne Avenue, Tunisia

[4]Dentist, Private Practice, Tunis, Tunisia

[5]Professor, Department of Dental Medicine, Military Principal Hospital of Instruction, Oral Diseases in the Military UR17DN04, Faculty of Dental Medicine, University of Monastir, Avicenne Avenue, Tunisia

***Corresponding Author:** Mayada Jemâa; Professor, Department of Dental Medicine, Military Principal Hospital of Instruction, Oral Health and Oro-Facial Rehabilitation Laboratory Research (LR12ES11), Faculty of Dental Medicine, University of Monastir, Avicenne Avenue, Tunisia.

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Abstract

Introduction: The rubber dam is widely recognized as an essential tool that enhances both clinician and patient comfort by enabling high-quality and safe dental treatment. Despite strong recommendations for its routine use in the scientific literature, the adoption of rubber dams in clinical practice remains relatively low. This study aimed to assess the knowledge, attitudes, and utilization patterns of rubber dams among Tunisian dentists in their daily practice.

Materials and methods: A descriptive cross-sectional study was conducted using a self-administered questionnaire distributed to a sample of 311 Tunisian dentists practicing in the private sector.

Results: The survey revealed that only 27% of the participating dentists reported using rubber dams in their clinical practice. Usage was higher (40.4%) among practitioners who acquired rubber dam skills outside dental school than among those trained during their formal dental education (23.9 %). The primary advantages cited were optimal asepsis (80.4%), enhanced patient safety (75.6%), and moisture contamination prevention (70.4%). The main disadvantages included difficulty of application (71.7%), perception of the rubber dam as cumbersome by some patients (66.2%), and limited applicability in certain clinical situations (46.9%). Rubber dams were predominantly used during endodontic procedures (39%). The most frequently used alternative was surgical suction (79%). The reported adverse events associated with the non-use of rubber dams included ingestion of anesthetic solution (50%) and soft tissue injury caused by rotating instruments (32%). Notably, 48% of respondents expressed concern about potential legal liability in the event of an accident related to the non-use of rubber dams.

Conclusion: It is imperative to enhance dentists' awareness of the critical role of rubber dam application in routine clinical practice. Furthermore, implementing targeted continuing education programs is essential to improve knowledge and skills and, ultimately, increase the adoption of rubber dam use.

Keywords: Rubber Dam, Dental Care, Infection Control, Dental Practice, Endodontics, Cross-Sectional Studies, Patient Safety, Asepsis, Tunisia

Introduction

Rubber dams are widely regarded as indispensable tools in contemporary dental practice, particularly for endodontic and operative procedures [1].

Their use is considered essential in bonding techniques, as consistently emphasized in scientific literature [2,3].

In Ireland, rubber dams have been widely recommended as valuable tools in both operative and root canal treatments since 1962. They serve as an effective infection control measure, significantly reducing bacterial contamination in prepared cavities and root canal systems and limiting the transmission of infectious agents between clinicians and patients (Cochran *et al.*, 1989; Forrest and Perez, 1989) [4].

Despite these well-established benefits, their adoption in general dental practice remains inconsistent. A survey of general dental practitioners in the United Kingdom revealed that only 19% routinely used rubber dams, while 45% reported never using them (Jenkins *et al.*, 2001). Furthermore, recent graduates are more likely to employ rubber dams than their more experienced colleagues, highlighting potential gaps in clinical training and practice habits (Whitworth *et al.*, 2000) [5].

Material and Methods

A cross-sectional study was conducted among licensed dentists practicing in private dental clinics across Tunisia between January 2018 and February 2020. The study population comprised voluntary participants recruited through the Tunisian National Dental Council registry and targeted social media groups for dental professionals.

Data were collected via an anonymous, self-administered digital questionnaire (Google Forms®), consisting of two sections: (1) Demographic and professional characteristics (gender, age), and (2) Rubber dam utilization patterns (training history, perceived advantages/disadvantages, clinical indications, and medico-legal considerations).

The questionnaire included binary, open-ended, and multiple-choice questions.

All 311 responses were retained for analysis. Data processing utilized SPSS® version 24.0, with descriptive statistics and chi-square tests ($\alpha = 0.05$) applied to examine variable associations, ensuring methodological rigor and analytical validity.

Results

A total of 311 dentists completed the questionnaire, of whom 56% (n = 174) were female and 44% (n = 137) were male. The reported use of the dental dam was 26.4% among female practitioners and 27.0% among male practitioners. Statistical analysis using the chi-square test revealed no significant difference in dental dam utilization between the genders ($p = 1.00, > 0.05$).

The distribution of dental dam usage across different age groups was as follows: 29.2% among dentists aged 25-35 years, 21.3% among those aged 35-45 years, 12.5% for the 45-55 years group, and 18.8% for practitioners over 55 years of age. Statistical analysis using the chi-square test indicated no significant difference in dental dam utilization between the age groups ($p = 0.396$).

The analysis revealed that the prevalence of rubber dam use was 23.9% among practitioners who received training in rubber dam placement during their undergraduate dental education, compared to 40.4% among those who acquired this skill outside of formal dental studies, such as through self-directed learning in clinical practice or participation in postgraduate training workshops.

This difference in rubber dam usage between practitioners who received university-based training and those who received alternative training was statistically significant ($p = 0.024$), indicating that the type of training is a significant factor influencing the adoption of rubber dams in clinical practice.

The primary advantages of rubber dam use identified by the respondents were optimal asepsis (80.4%), enhanced patient safety (75.6%), and effective prevention of moisture contamination (70.4%). The detailed distribution of the perceived advantages associated with rubber dam utilization is presented in Table 1.

The most frequently reported disadvantage of rubber dam use among respondents was the difficulty of placement, as cited

Advantages	Percentage of respondents (%)
Improved ergonomics	35.7
Optimal asepsis	80.4
Patient safety	75.6
Dentist safety	22.2
Improved visibility of the operative field	56.9
Assistance in maintaining mouth opening	41.8
Protection of soft tissues against laceration from rotary instruments, chemical agents, and medications	46.6
Time saving	13.8
Absence of any moisture contamination	70.4
Therapeutic success	51.8

Table 1: Perceived Advantages of Rubber Dam Use Among Dentists (n = 311).

by 71.7% of participants. The overall distribution of the perceived disadvantages associated with the rubber dam application is summarized in Table 2.

Among practitioners who reported using a rubber dam, its application was most frequently indicated for endodontic procedures (39%), followed by restorative treatments (22%) and dental bleaching (15%). The overall distribution of the clinical indications for rubber dam use is illustrated in Figure 1.

Analysis of the responses from practitioners who did not use rubber dams revealed the following primary reasons: 24.2% reported lack of time as the main barrier to its use, 22.1% indicated that patient discomfort was a deterrent, and 21.7% cited the perceived difficulty of placement as their reason for not employing the rubber dam in clinical practice.

Disadvantages	Percentage (%)
Difficulty of placement	71.7
Need for additional training	30.2
Not suitable for all clinical situations	46.9
Sensation of choking reported by some patients	61.1
Sensation of bulkiness reported by some patients	66.2

Table 2: Reported Disadvantages of Rubber Dam Application Among Dentists (n = 311).

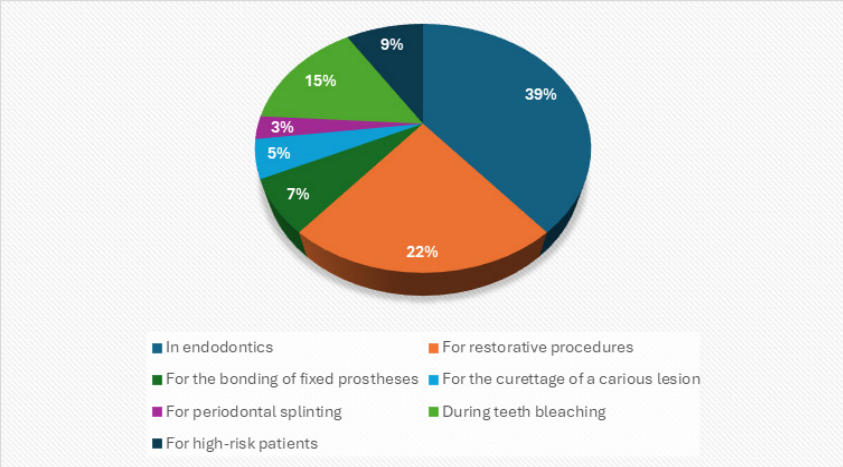

Figure 1: Distribution of Clinical Indications for Rubber Dam Placement.

Among practitioners who did not use a rubber dam, the primary alternative reported was the use of a surgical suction device, selected by 79% (n = 179) of respondents. The use of cotton rolls alone was the second most common alternative, reported by 16% (n = 37) of respondents. The overall distribution of alternatives to rubber dam placement is shown in Figure 2.

The study found that, among a list of six types of accidents, the most frequently reported incident associated with the absence of

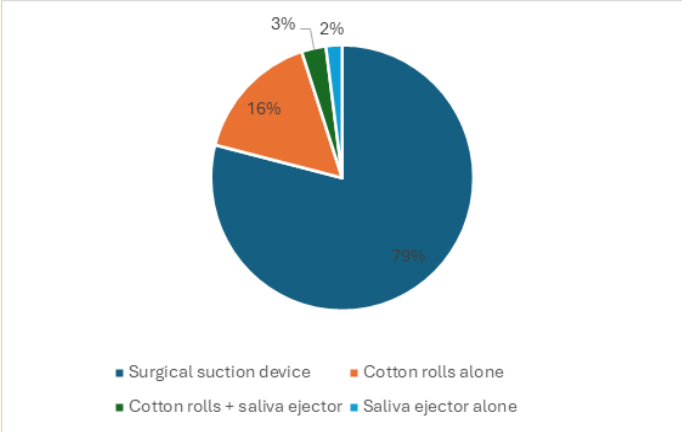

Figure 2: Alternative Devices to Rubber Dam Placement.

rubber dam use was the ingestion of anesthetic solution, cited by 229 respondents (50% of the responses). This was followed by soft tissue laceration caused by rotary instruments, reported by 149 practitioners (32% of respondents). The overall distribution of accidents related to the absence of rubber dam placement is shown in Figure 3.

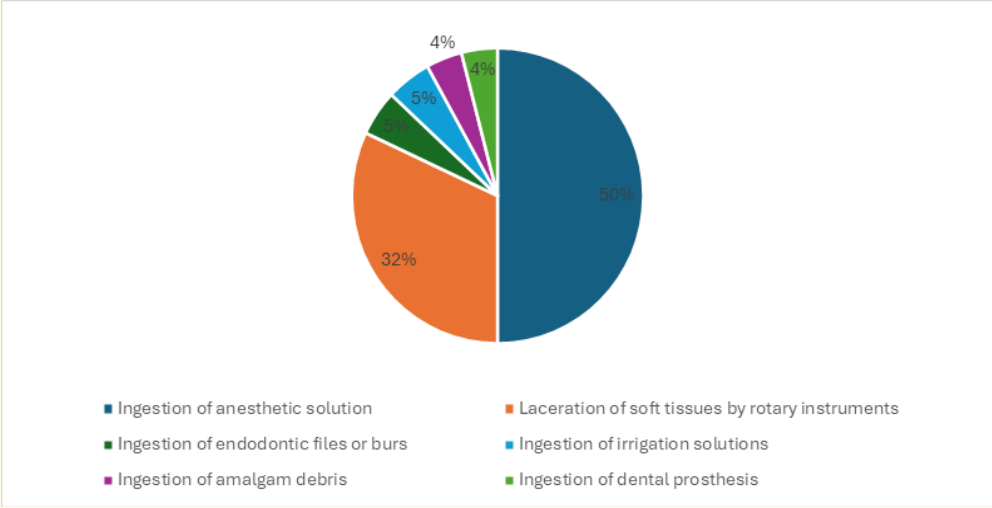

Figure 3: Distribution of reported accidents related to the absence of rubber dam placement.

Among the entire study population, 149 dentists (48%) believed that they could face criminal liability in the event of not using a rubber dam and subsequent ingestion of foreign objects (such as files or burs). Conversely, 162 practitioners (52%) did not consider themselves at risk of such legal consequences.

Among practitioners who use rubber dams, 54.22% believe they could face criminal prosecution in the event of an accident caused by its non-use, compared to 45.61% of non-users. The difference between users and non-users regarding awareness of the risk of criminal liability in case of an accident due to the absence of rubber dam use was not statistically significant ($p = 0.2 > 0.05$).

Discussion

In the present study, only 27% of the 311 practitioners reported using rubber dams, while 73% did not employ this isolation technique. This low adoption rate is consistent with findings worldwide, highlighting the persistent underutilization of rubber dam isolation in dental practice.

Comparable results were observed in Saudi Arabia, where Madarati and Bani Younes (2016) reported that 62.7% of respondents did not use rubber dams [6].

Similarly, Kapitán and Šustová (2011) found that over 70% of Czech dentists had never used a rubber dam [7].

The 2002 Belgian study by Slaus and Bottenberg also revealed a high prevalence of non-use, with 77% of participants never having used a dental dam [8].

Likewise, research conducted in Jordan by Al-Omari and Al-Dwairi (2005) showed an even lower usage rate, with only 13.6% of private general practitioners employing this isolation method [9].

Conversely, some studies reflect higher adoption rates: Koshy and Nicholas (2002) observed that 57% of general dentists in New Zealand reported regular use of the rubber dam, while Koch., *et al.* (2009) documented an unexpected majority usage exceeding 90% among Swedish practitioners [10,11]. These contrasting patterns across countries underscore the influence of region-specific factors such as educational curricula, clinical guidelines, and cultural attitudes toward procedural safety.

The present study found no statistically significant difference between male and female practitioners in the use of rubber dams ($p = 1.0$). Specifically, 37 male dentists (27%) and 46 female dentists (26.4%) reported rubber dam usage, indicating similar adoption rates across sexes. These results suggest that sex does not influence the likelihood of rubber dam utilization in this sample.

This finding aligns with the results of a 2016 study conducted in China by Zou *et al.*, who also reported no significant sex-related differences in rubber dam usage among dental professionals ($p > 0.05$) [12]. Conversely, other studies have reported contrasting outcomes. For example, Singh., *et al.* (2015) in India observed a statistically significant difference ($p < 0.05$), with a higher proportion of male dentists (57.9%) reporting rubber dam use than female dentists (32.1%) [13].

Additionally, a 2008 study by Atlassi investigating clinical dental students in Dakar identified a significant gender influence on the application of rubber dams. The authors attributed this disparity to differences in manual dexterity, suggesting that male students are generally more skilled in practical clinical procedures than their female counterparts [14].

Taken together, these studies reveal divergent findings regarding sex as a determinant of rubber dam use. While some contexts indicate parity between sexes, others suggest that male practitioners exhibit higher usage rates, potentially due to differences in technical proficiency or sociocultural factors. Further research is warranted to elucidate the underlying reasons for these discrepancies and determine whether targeted training can mitigate gender-related gaps in clinical practice.

In the present study, rubber dam usage was slightly more prevalent among practitioners aged 25-35 years; however, the differences in utilization rates across age groups were not statistically significant ($p > 0.05$). These results indicate that age did not influence the use of rubber dam isolation in this sample.

This finding is consistent with a study conducted in Nigeria by Udoye and Hamid Jafarzadeh (2010), who reported higher rubber dam usage among less experienced practitioners than among their more experienced counterparts, although this difference also lacked statistical significance [15].

Conversely, Kapitán and Šustová (2011) documented a statistically significant association between career length and rubber dam use in the Czech Republic, with dentists practicing for less than 15 years demonstrating higher adoption rates. The authors attributed this trend to the historical context: before 1989, rubber dams were scarcely available, and their systematic inclusion in dental curricula is a relatively recent development [7].

In contrast, Jenkins., *et al.* (2001) found that older clinicians tended to use rubber dams more frequently than younger practitioners in the United Kingdom, suggesting geographic and educational variations in practice patterns related to age [16].

Our results indicate that the rate of rubber dam usage among practitioners who received university-based training (23.9%) was significantly lower than that observed in practitioners who acquired this skill outside of formal dental education (40.4%) ($p < 0.05$). This difference may be attributed to the greater opportunity for hands-on practice and mastery of placement techniques in non-academic settings, where time constraints are often less stringent.

Statistical analysis revealed that a substantial majority of respondents (72%) reported receiving training in rubber dam application during their undergraduate dental studies. This finding aligns with the previous research by Sarr., *et al.* (2011), who reported that 90% of practitioners in Dakar had been introduced to rubber dams as part of their initial dental education [17]. Similarly, Révol's 2019 doctoral research in France found that 74% of surveyed dentists identified their primary source of knowledge regarding rubber dam use as foundational training [18].

In contrast, postgraduate education and continuing professional development accounted for the acquisition of rubber dam skills by 28% of the practitioners surveyed in our study. These forms of training typically occur through workshops, seminars, and self-directed clinical learning, which are integrated into routine practice. Supporting this, Bouquard's 2011 investigation involving 251 general dentists demonstrated that 17.73% of the participants reported learning rubber dam placement through ongoing professional development activities [19].

Collectively, these findings highlight the critical role of both undergraduate and continuing education in promoting rubber dam use proficiency. The lower usage rates observed among those trained at university underscore potential gaps in practical training efficacy or curricular emphasis, warranting an enhanced focus on hands-on skill acquisition within dental programs. Additionally, the notable contribution of postgraduate learning suggests that continuous education is essential for reinforcing and updating clinical competencies in rubber dam application.

The most frequently cited advantage of rubber dam use among the study population was optimal asepsis, reported by 80.4% of respondents. Similar findings were observed in Dakar by Sarr., *et al.* (2011), who reported that 81.1% of the surveyed practitioners identified asepsis as the primary benefit of rubber dam application [17].

Patient safety concerning the prevention of ingestion or aspiration accidents was also highlighted as a significant advantage by 75.6% of the participants in our study. This protective function has been previously emphasized by Walton and Torabinejad [19] and corroborated more recently by Thaminee., *et al.* (2019) in India. In their survey of 150 dentists, 60% considered the rubber dam

effective in preventing the inhalation and ingestion of instruments. Beyond patient safety, this attribute has medico-legal importance, potentially mitigating dental practitioners' liability risks [21].

Therapeutic success was cited as a key benefit by 51.8% of respondents, consistent with the findings of Goldfein., *et al.* (2013) in the United States. Their study aimed to evaluate the impact of rubber dam use during the placement of prefabricated post-cores on the endodontic treatment outcomes. Among the 174 teeth treated without a rubber dam, 128 (73.6%) were deemed successful at the final radiographic follow-up, whereas 28 of the 30 teeth (93.3%) treated under rubber dam isolation achieved success. This difference was statistically significant ($p = 0.035$), supporting the positive influence of rubber dam use on the treatment prognosis [22].

Similarly, Thaminee., *et al.* (2019) reported that 65% of the participants acknowledged improved therapeutic outcomes as a considerable advantage of rubber dam usage [21].

Collectively, these findings underscore the multifaceted benefits of rubber dam isolation, including infection control, patient safety, legal protection, and enhanced clinical success, reinforcing its role as the standard of care in dental practice.

The primary disadvantage reported by our study sample was the difficulty of rubber dam placement, as cited by 71.7% of respondents. This perception echoes the findings of Lynch and McConnell's 2007 study in Ireland, where 57% of the 300 general dental practitioners surveyed considered rubber dam application challenging [4].

Furthermore, 46.1% of practitioners in our survey believed that rubber dams are not appropriate for all clinical situations. This concern aligns closely with the results reported by Sarr., *et al.* (2011) in Dakar, who found that 63.8% of respondents viewed the rubber dam as inadequate in certain clinical contexts [17].

The present study highlights endodontics as the most frequently cited indication for rubber dam placement, with 82 practitioners (39%) reporting its use in this context. This predominance is consistent with the findings of previous studies. Bouquard (2013) similarly demonstrated that endodontics was the leading indication, with 30.37% of respondents always utilizing the dam for endodontic procedures and 44% reporting routine use in such cases [19].

Numerous studies, including those by Whitworth (2000), Bjørndal (2005), Peciuliene (2010), Vasudev (2013), and Awooda (2016), have specifically examined the prevalence of rubber dam use in endodontics, given its central role in infection control and procedural isolation. Notably, these investigations underscore that most research on rubber dam practice has centered on endodontic applications, reflecting prevailing clinical guidelines and the recognized necessity of absolute moisture control during root canal treatment. [23-26].

The strong association between rubber dam use and endodontics likely stems from both educational standards and the critical importance attributed to asepsis and procedural safety during the therapy. In general dental practice, the rubber dam is primarily indicated for endodontic treatments, whereas its adoption in other restorative or prosthetic procedures is more limited.

For example, only 7% of our sample reported using a rubber dam for fixed prosthesis cementation. This finding closely aligns with Bouquard (2013), who documented a 5.9% usage rate under similar circumstances [19]. Such low prevalence underscores the perception among practitioners that the benefits of the rubber dam may be less pronounced, or its use less practical, for non-endodontic clinical scenarios.

Statistical analysis of our questionnaire revealed that the most frequently cited reason for not using a rubber dam was lack of time, reported by 24.2% of practitioners. This observation is consistent

with Csinszka., *et al.* (2015), who identified the perceived time-consuming nature of rubber dam placement as the principal barrier to its adoption in clinical practice [27].

However, objective data suggest that the time required for rubber dam placement decreases significantly with increasing familiarity and experience. Stewardson and McHugh (2002) documented that dental students required an average of 4.65 minutes to place the dam, whereas experienced practitioners completed the procedure in just 1.27 minutes [28]. This indicates that time constraints may primarily reflect a lack of mastery rather than an inherent inefficiency of the procedure.

Other commonly reported reasons for non-use in our study included patient discomfort (22.1%) and difficulty of placement (21.7%).

These barriers have been consistently highlighted in the literature. Tarlo., *et al.* (1997), Al-Omari (2004), Ahmad., *et al.* (2009), and Madarati., *et al.* (2016) all reported patient discomfort and perceived technical difficulty as significant factors influencing the reluctance to routinely employ the rubber dam [29-32].

Additional findings from Whitworth., *et al.* (2000) in the UK revealed that 48% of respondents felt that the dam was uncomfortable for patients, while Hill., *et al.* (2008) in the US reported similar concerns, with 40% of dentists perceiving the dam as bothersome to patients and 11% noting outright patient refusal [2,26].

A smaller proportion of practitioners in our study (10%) attributed their non-use to difficulties in obtaining rubber dams. While this was not a major issue in our context, Ahmed., *et al.* (2000) reported that in Sudan, the primary obstacle was the dam's lack of availability and cost concerns when it was accessible [33].

Nevertheless, the costs associated with rubber dam equipment remain modest compared to overall practice expenses, as most components are sterilizable and are designed for long-term use [34].

In our study, practitioners who did not use rubber dam isolation reported the use of alternative techniques, predominantly surgical suction (reported by 79%), followed by the sole use of cotton rolls (16%), and, less frequently, combinations of both. These findings mirror those reported by Bouquard (2013), where the majority of non-users substituted rubber dam isolation with high-volume suction (96%) or cotton rolls (92%) [19].

Several earlier studies, such as those by Hisanaga., *et al.* (2010) and Sarr., *et al.* (2011), Bouquard (2013), Anabtawi., *et al.* (2013), and Madarati., *et al.* (2016) have consistently demonstrated that most dentists who forgo the rubber dam rely on cotton rolls alone or in combination with other isolation aids for moisture control [17-19-31-35-36]. While such alternatives may provide partial field isolation, their efficacy in achieving complete protection, especially against irritating liquids, is debatable. Notably, these methods do not prevent the accidental ingestion or aspiration of dental instruments and materials, thereby potentially increasing the risk of adverse events and legal issues.

Furthermore, a study conducted in Saudi Arabia by Alqarni (2013) highlighted that operative dentistry specialists were significantly more likely to use rubber dams during restorative procedures than general practitioners or specialists from other domains, who predominantly reported using cotton rolls. This pattern suggests that generalists tend to abandon routine rubber dam use after undergraduate dental training [37].

Supporting this, survey data from Mala., *et al.* (2009) in Ireland indicated that 62% of dental interns anticipated a reduced use of rubber dams upon entering professional practice, reinforcing the observation that practical constraints and perceived inconvenience contribute to its decline post-graduation [5].

The risk of adverse incidents in dental practice is markedly increased when rubber dam isolation is omitted. In our study, 50% of practitioners identified the ingestion of anesthetic agents as the most common accident in the absence of rubber dam use, while

32% cited soft-tissue laceration caused by rotary instruments as the primary adverse event.

These findings are corroborated by a study conducted in Dakar by Sarr., *et al.* (2013), in which the majority of practitioners reported incidents of anesthetic solution ingestion (32.2%) or irrigation fluid ingestion (38.8%) as prevalent accidents occurring without rubber dam isolation [17]. Similarly, a study from Tokyo by Hisanaga., *et al.* (2008-2009) revealed that 29.7% of reported accidents were cases of ingestion, with no isolation technique employed to safeguard the pharynx in any of these clinical scenarios [36].

The clinical consequences of such accidents are severe. For example, Lambrianidis and Beltes (1996) documented a case of endodontic instrument ingestion resulting in throat obstruction and respiratory distress—an incident that could have been prevented by using a rubber dam, thereby averting an emergency [38].

Rubber dam placement is widely recognized in the literature as the most efficient and reliable preventive measure to avoid accidental ingestion or aspiration of foreign bodies during dental procedures. However, isolated case reports indicate that, on rare occasions, rubber dams can be implicated in adverse events. For instance, a patient in Turkey aspirated a fractured clamp fragment, which was retrieved bronchoscopically without complications, and in Colombia, a patient ingested a displaced clamp that traversed the digestive tract uneventfully [39,40].

Our study findings indicate that 48% of practitioners perceive potential criminal liability in the event of an accident related to the non-use of a dental dam. Similar results were reported in a survey conducted in Tunisia by Daas, who found that 45.3% of dentists were unaware of the medico-legal importance of the dental dam. In contrast, a higher percentage was observed in Bouquard's 2013 study, where 78% of respondents believed they could face legal action in the case of an accident [1,19].

The lower percentages reported in our study compared to Bouquard's may be attributed to the fact that dental dam use is not legally mandated in Tunisia during endodontic procedures. In France, however, if a patient files a complaint following the ingestion of an endodontic instrument, civil liability is typically invoked, and the practitioner may be prosecuted for failure to adhere to guidelines set forth by the Haute Autorité de Santé (HAS). Indeed, the most recent HAS guidelines (2008) require the use of a dental dam during endodontic treatment [19].

In the United States, the use of a dental dam is considered the standard of care. Consequently, failure to use it during treatment is regarded as negligence in a court of law [42].

Moreover, our study revealed no statistically significant difference ($p < 0.05$) in dental dam usage between practitioners who perceive a criminal risk from its omission and those who do not. This finding suggests that awareness of medico-legal risk does not influence the decision to use a dental dam among Tunisian dentists.

Change in clinical behavior is unlikely without legislative measures mandating dental dam use as a standard prerequisite for dental procedures, thereby reinforcing its application through legal obligation.

Conclusion

This study demonstrates a low rate of rubber dam use among dental practitioners in Tunisia, despite its recognized benefits for infection control and patient safety.

Improving practical training during undergraduate and continuing education may help address barriers such as perceived difficulty and time constraints. Ultimately, mandating rubber dam use through legislation and clinical guidelines is essential to ensure its consistent application and enhance treatment safety and quality.

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