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Original Article

Placement of Posterior Composite Restorations: A Cross-Sectional Study of Dental Practitioners in Libya

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ABSTRACT

Dental practitioner-related factors can influence the quality and longevity of composite restorations. This study aimed to examine the clinical techniques used by dental practitioners (DPs) in Tripoli, Libya, when placing direct posterior composite restorations, with a focus on identifying any associations between clinical practices and years of experience. A questionnaire survey covering aspects of posterior composite placement, including material preference, cavity preparation, adhesive technique, isolation method, and occlusion adjustment, was distributed to 120 DPs in Tripoli. Data were statistically analyzed using Fisher's exact test to assess associations between years of experience and specific clinical practices. Composite was the preferred material for both small and large posterior cavities across all experience levels. No statistically significant associations were found between years of experience and key clinical practices, including preparation techniques (pulpal depth, p = 0.9005), adhesive choice (p = 0.5679), isolation method (p = 0.2515), and occlusal adjustment (p = 0.7469). The study found that DPs in Tripoli display a standardized approach to posterior composite restorations, with minimal variation in clinical techniques based on experience. These findings suggest the effectiveness of foundational training in establishing consistent practices among Libyan DPs, though further emphasis on specific techniques, such as rubber dam isolation, may be beneficial in education and training.

Keywords: Posterior Restoration; Composite; Dental Practitioners; Clinical Techniques; Libya

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يمكن أن تؤثر العوامل المتعلقة بأطباء الأسنان على جودة وطول عمر ترميمات الكومبوزيت. هدفت هذه الدراسة إلى فحص التقنيات السريرية التي يستخدمها أطباء الأسنان في طرابلس، ليبيا، عند وضع ترميمات الكومبوزيت الخلفية المباشرة، مع التركيز على تحديد أي ارتباطات بين الممارسات السريرية وعدد سنوات الخبرة. الطرق: تم توزيع استبيان يغطي جوانب وضع الكومبوزيت الخلفي، بما في ذلك تفضيل المواد، تحضير التجاويف، تقنية اللصق، طرق العزل، وضبط الإطباق، على 120 طبيب أسنان في طرابلس. تم تحليل البيانات إحصائيًا باستخدام اختبار فيشر لتقييم الارتباطات بين سنوات الخبرة والممارسات السريرية المحددة. كانت مادة الكومبوزيت هي المادة المفضلة لكل من التجاويف الصغيرة والكبيرة الخلفية عبر جميع مستويات الخبرة. لم تُظهر النتائج أي ارتباطات إحصائية ذات دلالة بين عدد سنوات الخبرة والممارسات السريرية الرئيسية، بما في ذلك تقنيات التحضير) عمق اللب، (p = 0.9005، اختيار تقنية اللصق (p = 0.5679)، طريقة العزل(p = 0.2515) ، وضبط الإطباق.(p = 0.7469) أظهرت الدراسة أن أطباء الأسنان في طرابلس يتبعون نهجًا موحدًا في ترميمات الكومبوزيت الخلفية، مع وجود تباين بسيط في التقنيات السريرية بناءً على الخبرة. تشير هذه النتائج إلى فعالية التدريب الأساسي في تأسيس ممارسات متسقة بين أطباء الأسنان الليبيين، ومع ذلك قد يكون من المفيد تعزيز بعض التقنيات مثل استخدام عزل المطاط (Rubber Dam) في التعليم والتدريب.

INTRODUCTION

The evolution of dental restorative materials has seen significant developments over the last century, with dental amalgam and resin-based composites (RBCs) being two of the most common materials used for restoring class I and II cavities in posterior teeth. Dental amalgam, introduced in the early 19th century, has been used extensively due to its durability, ease of application, and cost-effectiveness (Ferracane, 1). On the other hand, resin-based composites (RBCs), introduced in the mid-20th century, offer aesthetic benefits that amalgam lacks, as they can be color-matched to the natural tooth (Powers and Wataha, 2). Both materials have proven to be reliable, but their physical properties and clinical outcomes vary based on usage, preparation, and application techniques (Cramer et al., 3).

Over the past decade, RBCs have gradually replaced dental amalgam in many practices around the world. This shift has been driven by several factors, including the environmental and health concerns surrounding the mercury content in amalgam (Lynch and Wilson, 4). The European Union and other regulatory bodies have taken steps to reduce or eliminate the use of dental amalgam due to these concerns (European Commission, 5). Simultaneously, advancements in composite material technology—such as improved bonding techniques, better handling, and enhanced physical properties—have made RBCs a more viable option for posterior restorations (Van Meerbeek et al., 6). Additionally, the shift toward minimally invasive management of carious lesions has favored RBCs, which require less tooth structure removal compared to amalgam restorations (Deliperi et al., 7).

The increased use of resin-based composites has been observed in many countries, particularly in higher-income regions where the environmental impact of amalgam uses and the demand for aesthetically pleasing restorations have influenced clinical decision-making (Mjör and Gordan, 8). In many countries, government regulations and patient preferences are pushing the adoption of composite restorations over amalgam (ADA Council on Scientific Affairs, 9). Studies have shown that in North America, Europe, and parts of Asia, the proportion of RBCs used in posterior restorations has increased significantly over the past decade (Hickel and Manhart, 10). This shift reflects not only patient-driven aesthetics but also broader concerns over mercury disposal and sustainability. A similar trend has been observed in Kuwait, where RBCs have become the dominant choice among dental practitioners (Saleh et al., 12), and in New Zealand, where RBCs are increasingly replacing amalgam (Jansson et al., 19). In the United Kingdom, RBCs are now the most commonly used material for premolar restorations, while amalgam is still preferred in molar restorations (Burke and Lucarotti, 20).

Several studies have compared the clinical performance and survival rates of composite restorations to those of amalgam. While amalgam has historically been favored for its durability, recent research suggests that survival rates of posterior RBCs are slightly higher in some contexts (Opdam et al., 15). The longevity of composites has improved, thanks to advancements in polymerization techniques, reduced shrinkage, and better wear resistance (Demarco et al., 13). However, differences in survival rates may depend on factors such as cavity size, patient habits, and the skill of the operator (Heintze and Rousson, 14).

The use of questionnaire-based studies to assess the attitudes and practices of dentists has become a common approach in research (Forss and Widstrom, 22). However, to our knowledge, no such questionnaire has been previously conducted in Libya, particularly focusing on posterior composite restorations. Studies in other regions have suggested that more professional training is necessary to improve the outcomes of posterior composite restorations (Mjor and Gordan, 21). In Tripoli, Libya, it has been observed that private dental practitioners (DPs) tend to replace existing amalgam restorations with RBCs, reflecting the global shift towards composite materials (Al-Shehri et al., 20).

This study aims to fill the gap in existing research by investigating the clinical techniques used by dental practitioners in Tripoli when placing direct posterior composite restorations. It will also assess the relationship between the DPs' working sector (private or governmental) and the clinical techniques employed. No previous study has examined these aspects in Tripoli, making this research crucial to understanding local practices and identifying areas for improvement through professional training.

METHODS

Questionnaire Description

A self-administered structured questionnaire was designed using Google Forms to assess the clinical practices, attitudes, and preferences of dental practitioners (DPs) in Tripoli, Libya, regarding posterior composite restorations. The questionnaire was developed in English, as all participating DPs were proficient in English, given that dental education in Libya is conducted in English. The questionnaire was based on a review of existing literature to ensure comprehensiveness and relevance but was not subjected to a pilot test. The questionnaire consisted of four main sections: (1)Demographic Information: Age, gender, years of clinical experience, and professional role (General Practitioner, students, specialists , interns), (2)Material Use and Preferences: Questions regarding the types of materials used for small and large posterior cavities (e.g., amalgam, resin-based composites, other indirect restorations), (3)Clinical Techniques: This section covered techniques applied when placing posterior composite restorations, such as isolation methods, bonding techniques, cavity preparation methods, layering and curing techniques, and polishing protocols, (4)Attitudes and Perceptions: This section explored dentists' opinions on factors influencing material selection, their awareness of current guidelines, and the perceived need for additional professional training.

Sampling and Data Collection

This cross-sectional study targeted dental practitioners in Tripoli, Libya. Data were collected between [Month] and [Month] using an online Google Form distributed through professional dental groups, social media platforms, and email invitations. The survey was available for weeks, during which reminders were sent periodically to encourage participation.

Inclusion criteria required participants to be licensed dental practitioners actively performing posterior composite restorations. DPs specializing exclusively in non-restorative specialties were excluded. A convenience sampling method was employed to collect responses, and a sample size of [n=120] was determined to provide sufficient statistical power for the analyses at a confidence interval of 95% and margin of error of 5%. Participants were informed of the purpose of the study, and their responses were collected anonymously.

Statistical Analysis

Data was exported from Google Forms to a Microsoft Excel spreadsheet and analyzed using R version 4.3.1 (2023-06-16). Descriptive statistics, including frequencies, percentages, were calculated for demographic characteristics and responses to each questionnaire item. chi-square tests or Fisher's exact test with a significance level of 0.05 were conducted to assess associations between categorical variables.

RESULTS

Response Rate

A total of 120 dental practitioners participated in the questionnaire, achieving a response rate of 66%. Among the participants, 86 (71.7%) were female, and 34 (28.3%) were male. The majority of respondents were within the age group of 20–30 years (66.7%), followed by those aged 31–40 years (25%) and a smaller proportion aged 41–50 years (8.3%). Detailed demographic information on the dental practitioners who participated in the study is presented in Table 1.

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Table 1. The information of the dental practitioners (DPs) participated in the study.

DPs' Information	120, 100%)	0–2 Years	3–5 Years	More than 5 Years
General Dental Practitioner	77 (64.2%)	40 (33.3%)	24 (20%)	13 (10.8%)
Intern	22 (18.3%)	18 (15%)	3 (2.5%)	1 (0.8%)
Specialist	9 (7.5%)	2 (1.7%)	5 (4.2%)	2 (1.7%)
Student	12 (10%)	0 (0%)	5 (4.2%)	7 (5.8%)
0–2 Years	60 (50%)	60 (50%)	0 (0%)	0 (0%)
3–5 Years	32 (26.7%)	0 (0%)	32 (26.7%)	0 (0%)
More than 5 Years	28 (23.3%)	0 (0%)	0 (0%)	28 (23.3%)

Demographic Characteristics

A total of 120 dental practitioners participated in the survey. The majority of respondents were female (71.7%, n = 86), while males constituted 28.3% (n = 34). Most participants were within the age group of 20–30 years (66.7%, n = 80), followed by 31–40 years (25%, n = 30), and 41–50 years (8.3%, n = 10). No respondents were over the age of 50. (Figure 1A,1B).

1A **1B**

Figure 1

Occupational status

In terms of occupational status, the largest proportion of respondents were general practitioners (64.2%), followed by specialists (20.8%) and consultants (15%). (figure 2)

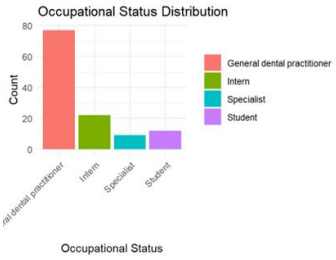

Figure 2

Years of clinical experience

Regarding clinical experience, nearly half of the participants had 0–2 years of experience (49.6%), while 27.1% had 3–5 years of experience. Practitioners with over 5 years of experience accounted for 23.3% of the sample (Figure 3).

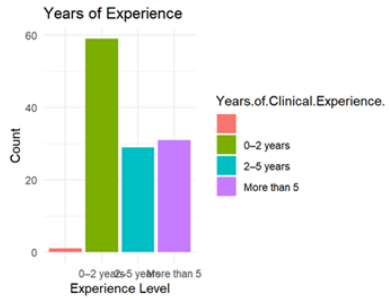

Figure 3

Material Preferences for Small Cavities by Years of Experience

Fisher's Exact Test was conducted to evaluate the association between years of experience and material preference for small posterior cavities. The p-value of 0.5754 indicates no statistically significant association between these two variables. Thus, the choice of material for small cavity restorations (e.g., composite vs. amalgam) does not appear to be influenced by the practitioner's years of clinical experience (Figure 4.A,4B).

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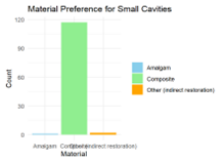

4A

4B

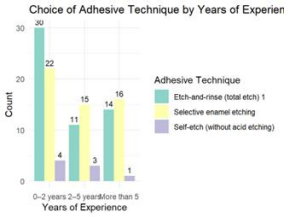

Figure 6

Cavity Preparation and Retention Practices (Ensuring Minimum Pulpal Depth by Years of Experience)

The association between years of experience and ensuring a minimum pulpal depth of 2 mm was also tested. The Fisher's Exact Test yielded a p-value of 0.9005, indicating no statistically significant relationship. This suggests that practitioners' likelihood of ensuring a minimum pulpal depth is not significantly affected by their years of experience (figure 5).

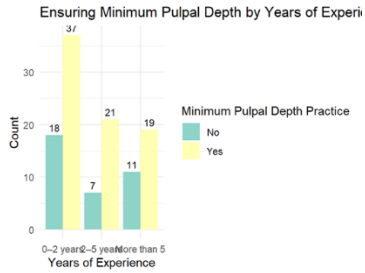

Figure 5

Adhesive Technique (Choice of Adhesive Technique by Years of Experience)

To examine whether years of experience influenced the choice of adhesive technique (e.g., etch-and-rinse, self-etch), Fisher's Exact Test was performed. The test produced a p-value of 0.5679, showing no statistically significant association. This implies that the adhesive technique selected by practitioners does not vary significantly based on their years of clinical experience (figure 6).

Isolation Method (Choice of Isolation Method by Years of Experience)

Fisher's Exact Test was used to assess the relationship between years of experience and the choice of isolation method (e.g., rubber dam, cotton rolls). The resulting p-value of 0.2515 indicates no statistically significant association between these variables. Therefore, practitioners' choice of isolation method is not significantly influenced by their experience level (figure 7).

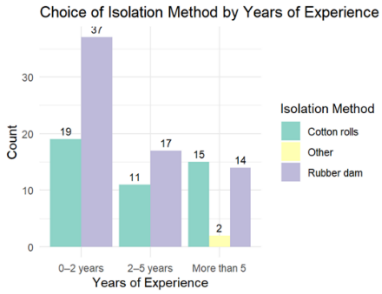

Figure 7

Occlusion Adjustment (Frequency of Occlusion Adjustment by Years of Experience)

The association between years of experience and the frequency of occlusion adjustment after placing posterior composites was also analyzed. The p-value of 0.7469 from Fisher's Exact Test indicates no statistically significant relationship. This suggests that the practice of adjusting occlusion post-restoration does not depend significantly on the practitioner's years of experience (figure 8).

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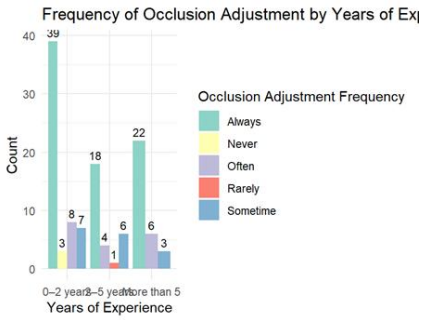

Figure 8

DISSCUSION

The increasing prevalence of composite restorations in posterior teeth reflects a shift in restorative practices, driven by both esthetic demands and concerns over mercury in amalgam restorations. This study aimed to examine the clinical techniques used by dental practitioners (DPs) in Tripoli, Libya, particularly focusing on how these practices vary by experience level. The findings indicate that while composite is overwhelmingly preferred for posterior restorations across all experience levels, there are minimal differences in clinical techniques between practitioners with varying years of experience. Composite emerged as the preferred material for both small and large posterior cavities, consistent with global trends that favor resin-based composites (RBCs) over amalgam (Cramer et al., 2011; Lynch & Wilson, 2013). This preference aligns with guidelines by the Academy of Operative Dentistry—European Section, which recommend composite as the material of choice for posterior restorations due to its ability to preserve tooth structure and meet esthetic demands. The lack of association between material preference and years of experience suggests that composite has become the standard for posterior restorations across all levels of practitioners in Tripoli. However, as previous studies have shown, the risk of failure for composite restorations increases with cavity size due to the greater masticatory forces involved (Opdam et al., 2014).

It is crucial that practitioners, regardless of experience, are aware of the limitations and best practices for large composite restorations. Our study found that most DPs in Tripoli adhere to recommended practices, such as ensuring a minimum pulpal depth of 2 mm and incorporating mechanical retention features. These preparation techniques are important for the durability of composite restorations (Mjör & Gordan, 2002), yet the lack of significant differences across experience levels suggests that educational foundations in Libya may effectively standardize this knowledge. Interestingly, a portion of practitioners reported beveling the occlusal and gingival margins, which can lead to unnecessary removal of sound tooth structure and complicate finishing and repair procedures. This finding highlights a potential area for educational reinforcement, as beveling of the occlusal margins is typically contraindicated in composite restorations (Van Meerbeek et al., 2003).

The choice of adhesive technique is another critical factor in restoration success. Our results show that the etch-and-rinse technique is the most commonly used adhesive approach, irrespective of experience level. This technique is known to provide a reliable bond, though it has potential drawbacks, such as the activation of matrix metalloproteinases, which can weaken the bond over time (Demarco et al., 2017). The uniformity in adhesive technique across experience levels suggests that dental education in Libya provides a solid foundation in adhesive bonding principles. However, considering advancements in adhesive technology, including self-etch and selective etching techniques, continuing education may benefit practitioners by updating them on newer, potentially more effective bonding strategies.

Effective isolation during composite placement is essential to avoid contamination and ensure optimal bonding. Rubber dam use is recommended, yet less than half of the practitioners reported using this method consistently, citing it as time-consuming. Many practitioners instead rely on cotton rolls or suction for isolation. Although clinical studies indicate similar survival rates for composite restorations isolated with rubber dams versus cotton rolls (Deliperi et al., 2007), the rubber dam provides additional protection and enhances visibility,

particularly in challenging cases. The lack of significant differences in isolation method preference across experience levels suggests that practical constraints, such as time and patient comfort, influence this choice more than experience does. Most practitioners, regardless of experience, reported routinely adjusting occlusion after placing posterior composites, which is critical for preventing premature contacts and potential restoration failure. The lack of association between experience level and occlusal adjustment practices suggests that this step is well-recognized as essential to achieving long-lasting restorations.

Ensuring appropriate occlusion is particularly important given the increased masticatory stress on posterior restorations. The findings of this study suggest a standardized approach to composite restorations among dental practitioners in Tripoli, with minimal variation in technique across experience levels. This consistency may reflect strong foundational training within Libyan dental education. However, specific areas—such as isolation methods, adhesive choices, and preparation techniques—could benefit from further emphasis in both undergraduate and continuing education. In particular, workshops or training sessions led by national scientific societies could address current trends and emerging techniques, including selective etching, rubber dam isolation, and best practices for managing larger composite restorations.

Given the global shift towards minimally invasive and esthetically pleasing restorations, the emphasis on composite material use in Libya aligns with international standards. Future training should continue to focus on composite placement techniques that enhance durability and adapt to patient-specific challenges, such as managing parafunctional habits and sub-gingival margins. This study has several limitations. First, it relied on self-reported data, which can introduce bias, as practitioners may overestimate their adherence to best practices. Additionally, the survey was conducted in English, which may have limited comprehension for some respondents, although all Libyan dentists are trained in English. The sample size, while adequate, was limited to dental practitioners in Tripoli, which may limit generalizability to other regions in Libya. Future research should expand to include practitioners from diverse geographic regions in Libya and investigate clinical outcomes associated with different techniques. Longitudinal studies examining the longevity of composite restorations in Libyan patients would provide valuable data on the practical implications of these techniques. Moreover, qualitative research, such as interviews or focus groups, could provide deeper insights into the challenges practitioners face in adopting recommended techniques for posterior composite restorations.

CONCLUSION

This study highlights the consistency in clinical practices among Libyan dental practitioners regarding posterior composite restorations, with few variations across experience levels. While foundational training appears effective, targeted continuing education initiatives could address specific gaps, such as adhesive and isolation techniques. As composite materials continue to replace amalgam, ongoing education will be critical to ensuring practitioners are equipped with the latest knowledge and skills to provide optimal patient care in posterior restorations.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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