

Original article

Awareness and Perception of Sealer Puff among Libyan Dental Practitioners: A Cross-Sectional Survey

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ABSTRACT

Sealer puff, the extrusion of endodontic sealers beyond the apex during root canal treatment (RCT), remains a topic of debate among dental professionals. Some consider it a sign of optimal obturation, while others associate it with complications such as inflammation. Limited data exist regarding dental practitioners' awareness and perception of sealer puff in countries with emerging healthcare systems, such as Libya. This study aimed to assess the awareness, perceptions, and practices of Libyan dental practitioners regarding sealer puff in endodontic treatment. A cross-sectional online survey was conducted over one month using Google Forms. The survey targeted dental practitioners in Libya who actively perform root canal treatments. The questionnaire covered demographics, RCT practices, knowledge of sealer puff, and perceptions of its clinical significance. Chi-square tests were used to analyze the associations between occupational status, years of experience, and perceptions of sealer puff. 160 dental practitioners participated. The majority were general practitioners (68.1%), with 60.6% having 1-3 years of experience. Most respondents performed fewer than three RCTs per week (50.6%), and 81.9% owned an apex locator. Perception of sealer puff varied, with 56.9% considering it a non-significant event and 34.4% viewing it as a sign of good obturation. Chi-square analysis revealed a significant association between occupational status and perception of sealer puff, ($p < 0.001$). The findings highlight the need for improved education on sealer puff among Libyan dental practitioners. Targeted programs should focus on enhancing practical skills and standardizing clinical guidelines to optimize endodontic outcomes.

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INTRODUCTION

Endodontic therapy plays a critical role in the preservation of teeth by eliminating infection and maintaining the tooth's function within the oral cavity [1]. One essential component of endodontic treatment is the use of root canal sealers, which help to fill and seal the space between the gutta-percha and the canal wall, preventing bacterial infiltration [2]. During obturation, a "sealer puff" refers to the extrusion of root canal sealer beyond the apex of the tooth. This phenomenon has sparked debate among dental professionals regarding its clinical significance.

The controversy surrounding sealer puff revolves around whether it is detrimental to the outcome and prognosis of root canal treatment or not. Some clinicians view sealer puff as a sign of optimal canal filling, indicating that the sealer has completely filled the canal space and any voids, thereby ensured better sealing and potentially enhanced long-term

success. Proponents argue that when extruded in small amounts, sealer puff is harmless [3, 4] and may even aid in sealing lateral canals, promoting periapical healing.

On the other hand, critics of sealer puff associate it with potential complications. The extrusion of material beyond the apex can lead to overfilling or overextension, which are often regarded as negative outcomes in root canal therapy [5,6]. The toxicity of different types of sealers when over-extruded is another significant consideration [7]. Resin-based sealers, for instance, have been shown to induce an inflammatory response when they come into direct contact with periapical tissues due to the release of toxic byproducts during polymerization [8]. These materials can cause persistent discomfort, delayed healing, and in some cases, allergic reactions [9]. Zinc oxide-eugenol sealers, though widely used, have also demonstrated cytotoxicity when extruded, as the eugenol component can irritate tissues and cause necrosis [10]. Bioceramic sealers, often considered more biocompatible, have been suggested as less toxic alternatives, with the ability to promote healing even when extruded beyond the apex. However, despite their favorable properties, even bioceramic sealers are not entirely free from the risk of inducing inflammatory reactions when in excessive contact with peri-apical tissues [11].

Despite the importance of these considerations, there is limited awareness and understanding of sealer puff among dental practitioners, particularly in countries with emerging healthcare systems, such as Libya. With no clear consensus on whether sealer puff is a positive outcome or a complication to be avoided, it is essential to assess the awareness and attitudes of dental professionals toward this phenomenon. The present survey aims to evaluate the awareness, knowledge, and practices related to sealer puff among Libyan dental practitioners. Understanding these factors may help improve clinical outcomes and inform future guidelines for endodontic treatments

METHODS

Study design

This study employed a cross-sectional survey design to assess the awareness and perceptions of dental practitioners in Libya regarding sealer puff. A self-administered questionnaire was developed and distributed to participants over a one-month period. The survey was distributed online using Google Forms, allowing for ease of access and widespread participation from dental professionals practicing in various regions of Libya. The inclusion criteria for the study required that participants be actively performing root canal treatments. The online format facilitated data collection from a broad range of practitioners, ensuring that responses were gathered efficiently within the designated time frame.

Participants

A total of 160 dental practitioners participated in the study. The majority were general practitioners (68.1%), followed by interns (27.5%) and specialists (4.4%). Participants were recruited through professional dental associations, social media groups, and clinics. Participation was voluntary, and informed consent was obtained from all respondents prior to their participation in the survey.

Data collection

The survey comprised 10 multiple-choice questions designed to capture information about years of practice, knowledge of sealer puff, frequency of root canal treatments performed per week, use of radiographic techniques, and preferences for different sealer types. Questions were validated by a panel of experts in endodontics to ensure clarity and relevance. Data were collected anonymously to encourage honest responses and minimize social desirability bias. Additionally, the final question (Question 10) included three radiographs for participants to evaluate their preference. The first radiograph depicted obturation at the anatomical apex but shorter than the radiographic apex, the second showed obturation to the radiographic apex, and the third illustrated obturation with a visible sealer puff (Figure 1).

Data analysis

Descriptive statistics, including frequencies, percentages, were used to summarize the data. Chi-square tests were performed to explore associations between variables such as years of experience and knowledge of Sealer Puff. A p-value of <0.05 was considered statistically significant. All analyses were conducted using SPSS software version 26.0.

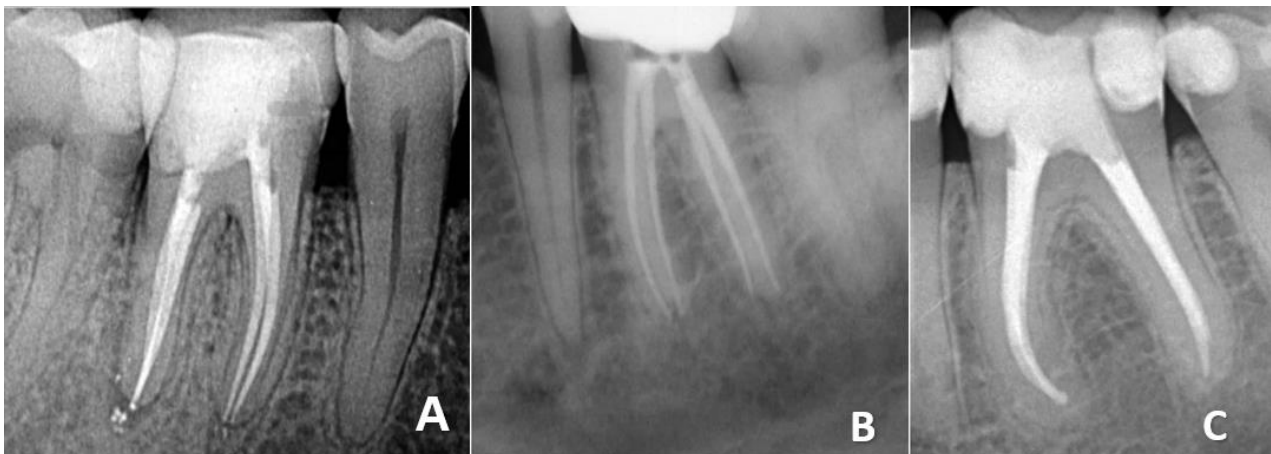


Figure 1. (A) Obturation to the anatomical apex but shorter than the radiographic apex, (B) obturation to the radiographic apex, (C) obturation with a visible sealer puff

RESULTS

A total of 160 dental practitioners participated in this survey, evaluating their awareness and perceptions of sealer puff in root canal treatment (Figure 2). The majority of respondents were general practitioners (68.1%), followed by interns (27.5%) and specialists (4.4%) (Table 1). A Chi-square test revealed a significant association between occupational status and the perception of sealer puff ($p < 0.001$), indicating that the occupational status of dental practitioners influences their view on sealer puff. Specifically, general practitioners and specialists had varying opinions on whether sealer puff was a sign of good obturation or a non-significant event. Most participants had 1-3 years of experience (60.6%), while 24.4% had more than 5 years, and 8.8% had 3-5 years of experience (Table 1). Interestingly, there was no significant association between years of experience and the type of sealer used ($p = 0.06$), suggesting that the choice of sealer (whether resin-based, bioceramic, or zinc oxide-based) was not heavily influenced by how long the practitioners had been performing root canal treatments.

Table 1. Demographics of Participants

Question	Category	Percentage (%)
Occupational Status	Intern	27.5
	General Practitioner	68.1
	Specialist	4.4
Years of Experience	1-3 Years	60.6
	3-5 Years	8.8
	More than 5 Years	24.4

Half of the respondents (50.6%) performed three or fewer root canal treatments per week, while 25% performed 3-5 treatments, and 24.4% performed more than five (Table 2). This distribution indicates that most of the participating practitioners were not performing root canal treatments in high frequency, which might affect their confidence and familiarity with complex concepts such as sealer puff.

The majority (58.1%) reported taking 2-3 X-rays per visit, while 22.5% took only one X-ray, and 19.4% took more than three (Table 2). Frequent use of radiographs likely contributed to practitioners' ability to evaluate obturation quality, including the presence of sealer puff.

Table 2. Clinical Practices

Question	Category	Percentage (%)
Number of Root Canal Treatments/Week	3 or less	50.6
	3-5	25
	More than 5	24.4
Frequency of X-ray Use/Visit	1	22.5
	2-3	58.1
	More than 3	19.4

A significant portion (71.9%) reported definitely knowing the difference between the anatomical and radiographic apex, 21.3% had some knowledge, and 6.9% admitted they did not know the difference (Table 3). This knowledge is critical for identifying and managing sealer puff during root canal procedures, especially since apex locators play a key role in determining working length. Most respondents (81.9%) owned an apex locator, and among those with the device, 64.4% used it always, while 21.9% used it sometimes, and 13.7% used it rarely (Table 3). This high ownership and usage rate likely reflects the importance placed on using accurate technology for root canal treatment, which in turn affects how often sealer puff occurs and is managed.

Table 3. Knowledge and Use of Apex Locator

Question	Category	Percentage (%)
Knowledge of Difference (Anatomical vs Radiographic Apex)	Definitely Know	71.9
	Some Knowledge	21.3
	Do Not Know	6.9
Ownership of Apex Locator	Yes	81.9
	No	18.1
Frequency of Apex Locator Use	Always	64.4
	Sometimes	21.9
	Rarely	13.7

More than half of the participants (56.9%) considered sealer puff a non-significant event, while 34.4% regarded it as a sign of good obturation, and 8.8% viewed it as a misfortune event (Table 4). These results show a divide in how Libyan dental practitioners interpret sealer puff, with the majority not viewing it as a significant complication, but a considerable proportion still seeing it as a positive outcome in obturation quality. The most commonly used sealers were resin-based (55%), followed by bioceramic (24.4%), and zinc oxide-based (20.6%) (Table 4). Given the different levels of toxicity associated with these sealers, practitioners' choices may reflect their perceptions of safety and effectiveness in preventing overfilling.

Table 4. Perceptions of Sealer Puff and Types of Sealers Used

Question	Category	Percentage (%)
Perception of Sealer Puff	Good Obturation	34.4
	Non-significant Event	56.9
	Misfortune Event	8.8
Type of Sealers Used	Resin-based	55
	Bio-ceramic	24.4
	Zinc Oxide-based	20.6

Nearly half (49.1%) of respondents preferred seeing obturation with a sealer puff on radiographs, while 26.4% preferred obturation to the radiographic end, and 24.5% preferred obturation shorter than the radiographic end (Table 5). This preference for a sealer puff indicates that a significant number of practitioners value visual confirmation of the sealer filling the canal space, even if it extrudes slightly beyond the apex.

Table 5. Preferred Radiographic Outcome

Radiographic Outcome	Category	Percentage (%)
Preferred Radiographic Outcome	Obturation with Sealer Puff	49.1
	Obturation to Radiographic End	26.4
	Obturation Shorter than Radiographic End	24.5

DISCUSSION

The survey results reveal a significant gap in the understanding and attitudes towards sealer puff among Libyan dental practitioners. While most practitioners (56.9%) consider sealer puff a non-significant event, 34.4% view it as a marker of good obturation (Table 4). This aligns with some literature, which suggests that small amounts of sealer extrusion may not be a big deal [12]. However, a notable 8.8% still regard sealer puff as a complication, highlighting the persistent clinical debate regarding overfilling and the need for clear, standardized clinical guidelines [13].

The divided opinions among Libyan dental practitioners regarding sealer puff reflect the ongoing global debate about its clinical implications. Some studies suggest that small amounts of sealer extrusion, often termed "sealer puff," may

not cause adverse outcomes and can be harmless if controlled, especially when bioceramic-based sealers are used [14]. Bioceramic sealers, known for their biocompatibility and ability to promote healing, are increasingly favored, particularly in cases where slight extrusion occurs [15]. However, this contrasts with findings from other studies that highlight the potential inflammatory risks associated with sealer extrusion, especially when using resin-based sealers, which are known to release cytotoxic byproducts during polymerization [11].

A substantial proportion of respondents in this study (55%) preferred resin-based sealers, likely due to their strong adhesive properties, which improve the overall seal of the root canal system. Yet, concerns remain regarding the toxicity of these materials, particularly when over extruded beyond the apex [6]. This finding is consistent with other research highlighting the popularity of resin-based sealers despite the potential risks [8]. There is a clear need to address these risks through standardized guidelines that promote safe and effective endodontic practices.

Occupational status significantly influenced perceptions of sealer puff, with specialists demonstrating more caution regarding overfilling. This is likely due to their advanced training in endodontic techniques and greater awareness of the potential complications associated with overextension [4]. Specialists, who made up only 4.4% of the respondents, are likely more focused on avoiding overfilling, which is often associated with discomfort, delayed healing, or even the failure of root canal treatments. On the other hand, general practitioners, who constituted the majority of the respondents (68.1%), may have a more relaxed view of sealer puff, given its frequent occurrence in general practice settings and the lack of complications reported in many cases [16]. This variation in perception underscores the need for consistent, evidence-based guidelines that can be adopted across different levels of dental practice.

Despite the widespread use of apex locators (81.9% ownership among respondents), a significant number of practitioners (49.1%) still preferred radiographic evidence of a sealer puff as an indicator of successful obturation. This reliance on traditional radiographic methods, even when modern tools like apex locators are available, suggests that practitioners blend technology with established practices in their clinical judgment [17]. While apex locators provide precision in determining working length and avoiding overfilling, radiographic confirmation offers visual reassurance of the treatment outcome. This hybrid approach, while common, highlights the need for further training on how to integrate technology and evidence-based protocols effectively to minimize risks like overfilling and sealer extrusion.

The findings from this study have important implications for clinical practice in Libya and similar emerging healthcare systems. The variability in perceptions of sealer puff and the choice of sealers, as well as the reliance on both modern and traditional tools, indicate that dental practitioners would benefit from enhanced educational programs focused on the risks and benefits associated with different endodontic materials and techniques (Gordon & Chandler, 2004) [16]. Educational initiatives should prioritize the potential toxicities of over extruded sealers and promote the use of apex locators in conjunction with radiographic techniques for optimal treatment outcomes.

It is important to consider that the majority of Libyan dental practitioners in this study reported performing less than three endodontic cases per week. This limited clinical exposure could be a contributing factor to the variability in perceptions of sealer puff. Practitioners who handle fewer endodontic cases may not encounter a wide range of clinical scenarios or complications, potentially resulting in less familiarity with best practices in obturation and sealer use. Limited experience with endodontic cases could also lead to practitioners relying more on traditional methods, such as radiographic evidence of sealer puff, as opposed to adopting more modern approaches like apex locators to determine working length. This underexposure could impact their confidence in evaluating outcomes and managing complications, such as overfilling or sealer extrusion. Consequently, targeted training and continuing education programs are needed to bridge this experience gap and ensure that practitioners, regardless of case volume, are equipped with up-to-date knowledge and skills in endodontic procedures.

This study is limited by its reliance on self-reported data, which may introduce bias, such as social desirability bias, where practitioners may report behaviors that align with perceived best practices rather than their actual routines. Additionally, the cross-sectional design provides only a snapshot of current practices and perceptions, without accounting for changes over time or regional differences within Libya. The relatively small proportion of specialists in the sample (4.4%) also limits the generalizability of the findings to more advanced endodontic practitioners.

Future research should focus on longitudinal studies to track changes in endodontic practices and perceptions over time, particularly as new materials and technologies become more widely adopted [18]. Further studies should also explore the impact of different educational interventions on improving adherence to standardized endodontic protocols. Additionally, conducting research in other emerging healthcare systems would help to better understand the global relevance of sealer puff awareness and its clinical implications in endodontic care.

CONCLUSION

In conclusion, the results point to a clear need for enhanced education and training programs for Libyan dental practitioners, particularly in understanding the potential risks associated with sealer puff and adopting standardized protocols for root canal treatment. Targeted efforts should focus on increasing awareness of the toxicity of certain sealers, promoting the use of apex locators, and integrating radiographs as complementary tools for optimal root canal outcomes. As healthcare systems in Libya and similar countries continue to develop, establishing evidence-based guidelines will be essential in improving endodontic care and ensuring better patient outcomes.

Conflict of interest. Nil

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الوعي والإدراك للنفث السدادي بين أطباء الأسنان الليبيين: دراسة استقصائية مقطعية

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المستخلص

يعتبر "النفث السدادي"، وهو خروج مواد سد قنوات الجذور خارج القمة أثناء علاج قناة الجذر، موضوعًا جدليًا بين أطباء الأسنان. يعتبره البعض علامة على الإغلاق الجيد، بينما يربطه آخرون بمضاعفات مثل الالتهابات. توجد بيانات محدودة حول وعي وإدراك أطباء الأسنان بشأن النفث السدادي في البلدان ذات النظم الصحية الناشئة، مثل ليبيا. هدفت هذه الدراسة إلى تقييم الوعي والمفاهيم والممارسات بين أطباء الأسنان الليبيين بشأن النفث السدادي في علاج قنوات الجذور. تم إجراء استبيان مقطعي عبر الإنترنت لمدة شهر باستخدام نماذج قوئل. استهدف الاستبيان أطباء الأسنان في ليبيا الذين يقومون بعلاجات قنوات الجذور بشكل نشط. شمل الاستبيان بيانات ديموغرافية، وممارسات علاج قناة الجذر، ومدى العرفة بالنفث السدادي، ومفاهيم حول أهميته السريرية. تم استخدام اختبارات كاي-سكوير لتحليل العلاقات بين الوضع المهني وسنوات الخبرة والمفاهيم حول النفث السدادي. شارك ما مجموعه 160 من أطباء الأسنان. كانت الأغلبية من الممارسين العاميين (68.1%)، وكان 60.6% منهم يمتلكون خبرة من 1 إلى 3 سنوات. أجرى معظم المشاركين أقل من ثلاثة علاجات قنوات جذر في الأسبوع (50.6%)، وامتلك 81.9% منهم جهاز محدد قمة الجذر. تنوعت المفاهيم حول النفث السدادي، حيث اعتبره 56.9% حدثًا غير مهم، بينما رآه 34.4% علامة على الإغلاق الجيد. كشف تحليل كاي-سكوير عن ارتباط كبير بين الوضع المهني والمفاهيم حول النفث السدادي. ($p < 0.001$) تسلط النتائج الضوء على الحاجة إلى تحسين التعليم حول النفث السدادي بين أطباء الأسنان الليبيين. يجب أن تركز البرامج المستهدفة على تعزيز المهارات العملية وتوحيد الإرشادات السريرية لتحسين نتائج علاج قنوات الجذور.

الكلمات المفتاحية: النفث السدادي، مانعات تسرب، حشو، تعبئة زائدة، بثق زائد.