



Knowledge, Attitude, And Possible Barriers to Fluoride Application Among Libyan Dentists in Benghazi

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ABSTRACT

Fluoride remains the most effective preventive measure against dental caries and for arresting early, non-cavitated lesions. Dentists have a pivotal responsibility to educate patients and the wider community and to provide reliable, evidence-based guidance on caries prevention and management. This study aimed to assess knowledge, attitudes, and perceived barriers to professional topical fluoride application among Libyan dentists in Benghazi. A descriptive cross-sectional study using a structured, closed-ended questionnaire was conducted among dentists working in public and private dental clinics. Data were collected via interviewer-administered questionnaires in clinic waiting areas and analyzed using SPSS. A total of 89 dentists participated; 70% were female, and more than half were aged 31–45 years. Over half (55%) supported fluoride use for children younger than six years. However, 60.6% expressed doubt that topical fluoride effectively prevents tooth decay, and only 56.17% believed it increases enamel resistance to caries. Conversely, 60.6% agreed that topical fluoride is safe when used at recommended concentrations and dosages. Despite these perceptions, most respondents (79%) reported that they do not routinely apply topical fluoride in daily practice. Reported barriers included limited knowledge and unfavorable attitudes, outdated undergraduate training, insufficient continuing education, and low participation in effective educational programs. These constraints may hinder the consistent implementation of evidence-based preventive dentistry in Benghazi clinics. Targeted continuing professional development, updated undergraduate curricula, and clear clinical protocols are needed to improve uptake substantially. Enhancing access to fluoride materials and strengthening patient communication may support routine implementation and ultimately improve population oral health outcomes in Benghazi.

المعرفة، المواقف، والعوائق المحتملة تجاه تطبيق الفلورايد بين أطباء الأسنان الليبيين في مدينة بنغازي

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الكلمات المفتاحية:

المعرفة
المواقف
العوائق
الفلورايد
ليبيون

الملخص

يُعد الفلورايد الطريقة الوقائية الأكثر فعالية ضد تسوس الأسنان وعكس مراحل التسوس السني البادئة. يلعب أطباء الأسنان دوراً محورياً في تثقيف المرضى والمجتمع الأوسع، حيث يمثلون مصدراً رئيسياً للمعلومات الموثوقة والمستندة إلى الأدلة حول الوقاية من تسوس الأسنان وإدارته. لذا، يهدف هذا البحث إلى دراسة المعرفة والاتجاهات والعوائق المحتملة لتطبيق الفلورايد لدى مجتمع أطباء الأسنان الليبيين في بنغازي. المنهجية
أجري تصميم بحث وصفي ومقطعي قائم على استبيانات منظمة مغلقة بين أطباء الأسنان. تم اختيار العينة من كل من عيادات الأسنان الخاصة والعامة في بنغازي. تم استخدام استبيان مقابلات لجمع البيانات المطلوبة في

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غرفة الانتظار بكل بيئة سريرية. جُمعت البيانات وحُللت باستخدام برنامج SPSS شملت الدراسة 89 طبيب أسنان كانوا يرتادون العيادات المختارة. كان الجزء الأكبر من المشاركين من الإناث (70%)، وكان أكثر من نصفهم تتراوح أعمارهم بين 31 و 45 عامًا. أيد أكثر من نصف المشاركين (55%) استخدام الفلورايد للأطفال الأصغر من ست سنوات. ومع ذلك، شكك جزء كبير (60.6%) في أن الفلورايد الموضوعي يمنع تسوس الأسنان بشكل فعال، واعتقد 56.17% فقط أنه يعزز مقاومة المينا للتسوس. بالإضافة إلى ذلك، وافق 60.6% على أن الفلورايد آمن عند تطبيقه بالجرعات الموصى بها. على الرغم من هذه الآراء، فإن معظم أطباء الأسنان (79%) لا يستخدمون الفلورايد الموضوعي بانتظام في ممارستهم السريرية، حيث أبلغ عدد قليل فقط عن استخدامه الروتيني. على الرغم من إيمان الكثيرين بفعالية الفلورايد الموضوعي، تحد من استخدامه عدة عوائق. يُعد نقص المعرفة والاتجاهات لدى الممارسين تجاهه عاملاً رئيسياً. بالإضافة إلى ذلك، يشكل التدريب الجامعي القديم، ونقص التعليم المستمر المناسب، والمشاركة المنخفضة في البرامج التعليمية الهادفة، عوائق. يمكن لهذه التحديات أن تمنع الأطباء من تطبيق طب الأسنان القائم على الأدلة في ممارستهم اليومية

1. Introduction

Fluoride is considered the most effective way to prevent caries and reversing incipient dental caries. (1,2) Fluoridation of community water supplies and the widespread use of fluoride in multiple delivery methods have contributed notably to the decline in dental caries rates (3). The use of professionally applied topical fluoride has been proven to be effective in the demineralization of enamel caries and the arrest of active dentinal caries (4). Hence, for its effective utilization, dental professionals should have a sound knowledge of the appropriate application of topical fluorides (5-6). According to the Centre for Disease Control (CDC), laboratory and epidemiological research has led to a better understanding of how fluoride plays a crucial role in preventing dental caries. indicates that fluoride's predominant effect is post-eruptive and topical and that the effect depends on fluoride being in the right amount, in the right place, at the right time. (7) Fluoride works primarily after the teeth have erupted. Fluoride has been shown to be most effective when small amounts are consistently maintained in the oral cavity, particularly in the saliva and dental plaque. This understanding contrasts with the previously accepted belief that the primary benefit of fluoride was systemic and pre-eruptive. Dentists are the primary source of oral health information for patients and are well positioned to communicate evidence-based knowledge to the public. Furthermore, they play a critical role in implementing community-based oral health programs (8). An acceptable level of knowledge, positive attitude, and appropriate clinical practices regarding both topical and systemic fluoride applications are essential, particularly in relation to the preventive benefits for children (9). Therefore, it is important to ensure that dental professionals possess the necessary understanding and perspective of fluoride therapies as a core component of preventive dentistry.

In light of the rising prevalence of dental caries among Libyan children (10,11), this study aimed to assess the knowledge, attitudes, and potential barriers to fluoride application among Libyan dentists practicing in Benghazi

2. Methods:

A descriptive, cross-sectional survey was conducted in Benghazi, the second largest city in Libya with approximately one million inhabitants, located on the Libyan coast. Benghazi also hosts the oldest school in Libya, and its inhabitants descend from different races in Libya, making it representative of different Libyan tribes and groups. Population and sampling: The target population was Libyan dentists working in both private and public dental clinics in Benghazi. The sample size was estimated to be 140 dentists to be sufficient for a 95% confidence level and 0.05 margin of error. The sample was conveniently selected from dental clinics in Benghazi. The Participants were well informed that the Information provided will be held privately, and all precautions have been established to ensure the confidentiality of their responses. Participation was voluntary, and consent was implied by the return of the completed questionnaire. Data collection: An interview questionnaire was used to collect the required data in the waiting room of each clinical setting to protect participants confidentiality and make them more comfortable. Researchers first introduced herself to the participants and explained

the purpose of this study was to encourage cooperation. Points for them. Questionnaire: ensure their cooperation also clarified some unclear the questionnaire was proposed from previous studies, Based on the American Dental Association (ADA) guidelines and the latest available evidence (9). It was then validated through discussion among the research team and piloted the preliminary questionnaire among a group of 10 dentists. The final questionnaire comprised two sections. Section I which was a closed –ended questionnaire, It included: Demographic profile (gender, work place, years of experiences, specialty, Age) Section II: Consisted of 11 self-completion questions the study was designed to explore dentists' knowledge and attitudes toward fluoride use, as well as to identify barriers that may hinder its adoption as a preventive measure. Benghazi, Libya. Ethical considerations and Approvals: The form was anonymous to gain participants' trust and confidence, in addition to encouraging them to respond very well to the questionnaire. Participants provided verbal consent before participating in the study. Permissions were obtained from the Higher Institute of Medical Professions in Benghazi. Private clinics and public centers were also contacted, and their approvals were obtained. Statistical analysis: Each questionnaire was assigned an individual identification number to check for inconsistent responses. All questionnaires were included, and data entry was performed using Microsoft Office Excel 2013 database and checked for entry errors than coded. SPSS version, was utilized for statistical analysis of the results. Descriptive statistics are displayed as frequencies and percentages for qualitative variables.

3. Results

The study included 89 dentists who were attending the selected clinics. The characteristics of the participants are summarized in table the majority of participants were females (70%), and more than half of them were between 31 and 45 years of age. More than two-thirds of the participants were general dental practitioners (65%), whereas one-third worked in private practices only (33%).

Table 1: Demographic characteristics of the study participants.

Variables	Frequency	Percentage	
Gender	Male	27	30%
	Female	62	70%
Age group	Less than 30	37	41%
	31-45	46	52%
	More than 45	6	7%
Practice type	Public	31	39%
	Private	28	33%
	Both	30	28%
years of experience	Less than 10 years	51	57%
	10-20 years	29	34%
	20-30 years	8	9%
Education level	Specialist	29	35%
	General Dental Practitioner	60	65%

More than half of the respondents recommended the use of fluoride for children aged less than six years (55%). However, a considerable proportion were either unsure (28%) or did not recommend fluoride (Figure 1).

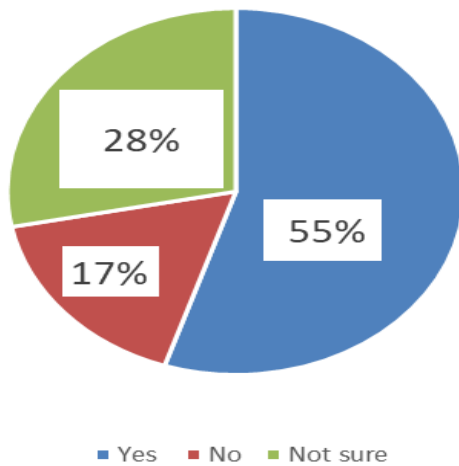


Fig.1: Dentists attitudes toward recommending fluoride for children under the age of six years.

More than half that of dentists (51.6%) knew that fluoride varnish has a high fluoride concentration, while less than a quarter of them (22.4 %) believed that its safety is not acceptable. The majority of dentists (57.3%) reported that fluoride varnish did not change the color of the teeth.

Table 2: Dentist's knowledge of fluoride varnish.

Fluoride varnish	Frequency	Percent
Has a high fluoride concentration	46	51.6
Has a low fluoride concentration	23	25.8
Its safety is not acceptable	20	22.4
Cause a temporary change in tooth colour	25	28.0

Table 4 highlights that the primary reason for not using topical fluoride in clinical practice is the lack of time. In contrast, approximately 47.1% of dentists disagreed with the notion that caries cannot be prevented because of their multifactorial nature. Additionally, most dentists (52.8%) agreed that water fluoridation is the most effective method for preventing tooth decay in children

Table 4: Reasons for not applying professional topical fluoride application in clinical practice

Reason	n (%)
Lack of availability of fluoride materials/products	41 (46.1)
Insufficient training or lack of clinical experience	36 (40.4)
Belief that fluoride toothpaste alone is sufficient	33 (37.1)
Fear of fluoride toxicity or overdose	29 (32.6)
Concern about possible adverse effects	25 (28.1)
Time constraints during routine clinical practice	38 (42.7)
Cost-related issues	31 (34.8)
Low patient demand or poor acceptance	27 (30.3)
Lack of clear clinical guidelines or protocols	34 (38.2)
Lack of patient cooperation	22 (24.7)

Figure 2 illustrates that although the application is effective in managing a multifactorial disease, the majority of dentists (79%) do not incorporate it into their routine dental practice, with only a few reporting its use.

Cause a permanent change in tooth colour	13	14.6
No change in the colour of the teeth	51	57.3

The majority of participants (60.6%) believed that topical fluoride does not prevent caries, and 56.17% believed that it does not make the enamel more resistant to decay. However, 60.6% of the respondents agreed that fluoride was safe when used at the recommended concentration. Regarding the risk of overdose, 37.1% and 36.0% dentists disagreed and were uncertain, respectively.

Table3: Dentists' beliefs regarding the benefits and risks of professional topical fluoride application

Statement	Agree n (%)	Disagree n (%)	Not sure n (%)
Can prevent caries	54 (60.6)	19 (21.3)	16 (17.9)
Has a beneficial effect on children's oral health	52 (58.4)	18 (20.2)	19 (21.3)
Has a beneficial effect on adult oral health	42 (47.2)	19 (21.3)	28 (31.4)
Makes enamel more caries resistant	50 (56.2)	28 (31.4)	11 (12.3)
Preferable to systemic fluoridation	38 (42.6)	31 (34.8)	20 (22.4)
Preferable to brushing twice daily with fluoride toothpaste	62 (69.7)	13 (14.6)	14 (15.7)
Decreases interest in tooth brushing	42 (47.2)	36 (40.4)	11 (12.3)
Safe at recommended concentration	42 (60.6)	17 (19.1)	18 (20.2)
Has no adverse effects	45 (50.5)	25 (28.1)	19 (21.3)
Has no risk of overdosing	24 (26.9)	33 (37.1)	32 (36.0)

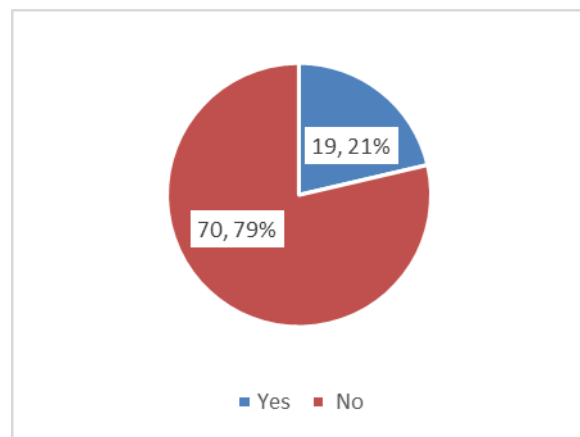


Fig. 2: Routine Use of Topical Fluoride in Dental Clinics

4. Discussion

Fluoride is an important tool for preventing and controlling caries, with several mechanism of actions. The primary benefits are largely attributed to its topical effect on the tooth surface (12). Fluoride helps protect the hard tissues of the teeth by inhibiting mineral loss and supporting the restoration of minerals on the tooth surface. In addition, it reduces the metabolic activity of acid-producing bacteria (13). In this study, only 21.3% of dentists reported applying fluoride in their clinics. Among those who did not use topical fluoride, 43.8% cited lack of time and a busy practice schedule as reasons for not using it. Additionally, 60.6% and 58.4% of dentists in this study acknowledged that topically applied fluoride was beneficial for preventing caries in children and adults, respectively. These findings contrast with those of a study conducted in Kuwait, where 80% of dentists agreed that topical fluoride effectively prevents dental caries (14). Despite advances in research, knowledge, and dental technology, it was unexpected that

28% of the participants in this study did not endorse topical fluoride for preventing caries. They believed that because caries is a multifactorial condition, prevention is not feasible in some cases. This result is consistent with a study from Kuwait, in which 31% of dentists shared the same opinion. The widespread acceptance of the term “multifactorial disease” may influence dentists’ choices and reduce their likelihood of implementing preventive measures in daily dental care. The application of fluoride varnish is a simple, safe, and widely accepted procedure. One of its main benefits is that it sticks well to the tooth surface, allowing the fluoride to remain in contact with the enamel for a longer period and enhancing its absorption into the enamel layers. Additionally, from a toxicological and safety perspective, fluoride varnishes are preferred because they have a relatively low fluoride bioavailability (15,16). Approximately half of the dentists knew that fluoride varnish contains a high concentration of fluoride

5. Conclusion

In summary, although topical fluoride is recognized as effective, several obstacles prevent its widespread use. Gaps in knowledge and attitudes of practitioners significantly influence this. Factors such as outdated undergraduate training, inadequate continuing education, and limited involvement in effective learning activities create barriers, making it difficult for dentists to apply evidence-based practices in their daily work. This study had a limitation as participants were selected from clinics during work hours, which could make some of them in a hurry or unwilling to participate. One other limitation of our study is that only dentists practicing in Benghazi were included; therefore, the generalizability of the study’s results may be questioned.

6. References

- [1]- Beltran-Aguilar, E. D., Barker, L. K., Canto, M. T., Dye, B. A., Gooch, B. F., Griffin, S. O., et al., (2005), Surveillance For Dental Caries, Dental Sealants, Tooth Retention, Edentulism And Enamel Fluorosis—United States, 1988–1994 And 1999–2002., *MMWR Surveillance Summaries*, 54(3), 1–43. DOI:
- [2]- Centers For Disease Control And Prevention, (2001), Recommendations For Using Fluoride To Prevent And Control Dental Caries In The United States., *MMWR Recommendations And Reports*, 50(RR-14), 1–42. DOI:
- [3]- Bratthall, D., Hansel Petersson, G., Sundberg, H., (1996), Reasons For The Caries Decline: What Do The Experts Believe., *European Journal Of Oral Sciences*, 104, 416–422. DOI:
- [4]- Gao, S. S., Zhang, S., Mei, M. L., Lo, E. C. M., Chu, C. H., (2016), Caries Remineralisation And Arresting Effect In Children By Professionally Applied Fluoride Treatment—A Systematic Review., *BMC Oral Health*, 16, 12. DOI:
- [5]- Main, P. A., Lewis, D. W., Hawkins, R. J., (1997), A Survey Of General Dentists In Ontario, Part II: Knowledge And Use Of Topical Fluoride And Dental Prophylaxis Practices., *Journal Of The Canadian Dental Association*, 63, 607, 610–617. DOI:
- [6]- Yoder, K. M., Maupome, G., Ofner, S., Swigonski, N. L., (2007), Knowledge And Use Of Fluoride Among Indiana Dental Professionals., *Journal Of Public Health Dentistry*, 67, 140–147. DOI:
- [7]- Swigonski, N. L., Yoder, K. M., Maupome, G., Ofner, S., (2009), Dental Providers’ Attitudes Regarding The Application Of Fluoride Varnish By Pediatric Health Care Providers., *Journal Of Public Health Dentistry*, 69, 242–247. DOI:
- [8]- Steptoe, A., Wardle, J., Vinck, J., et al., (1994), Personality And Attitudinal Correlates Of Healthy And Unhealthy Lifestyles In Young Adults., *Psychology & Health*, 9, 331–343. DOI:
- [9]- Park, K., (Year not provided), *Park’s Textbook Of Preventive And Social Medicine*, 18th edn. (Publisher/place/pages not provided). DOI:
- [10]-Centers For Disease Control And Prevention, (2001), Recommendations For Using Fluoride To Prevent And Control Dental Caries In The United States., *MMWR Recommendations And Reports*, 50(RR-14), 1–42. DOI:
- [11]-Arheiam, A., Omar, S., (2014), Dental Caries Experience And Periodontal Treatment Needs Of 10-To 15-Year Old Children With Type 1 Diabetes Mellitus., *International Dental Journal*, 64(3), 150–154. DOI:
- [12]-Arheiam, A. A., Harris, R. V., Baker, S. R., (2020), Changes In Dental Caries And Sugar Intake Before And During The Conflict

In Libya: A Natural Experiment., *Community Dentistry And Oral Epidemiology*, 48(3), 201–207. DOI:

- [13]-American Dental Association Council On Scientific Affairs, (2006), Professionally Applied Topical Fluoride: Evidence-Based Clinical Recommendations., *Journal Of The American Dental Association (JADA)*, 137(8), 1151–1159. DOI:
- [14]- Akbar, A. A., Al-Sumait, N., Al-Yahya, H., Sabti, M. Y., & Qudeimat, M. A. (2018). Knowledge, Attitude, and Barriers to Fluoride Application as a Preventive Measure among Oral Health Care Providers. *International Journal of Dentistry*, 2018, 1–8. <https://doi.org/10.1155/2018/8908924>
- [15]-Øgaard, B., Seppä, L., Rolla, G., (1994), Professional Topical Fluoride Applications—Clinical Efficacy And Mechanism Of Action., *Advances In Dental Research*, 8, 190–201. DOI:
- [16]-Beltran-Aguilar, E., Boldstein, J., Lockwood, S., (2000), Fluoride Varnishes: A Review Of Their Clinical Use, Cariostatic Mechanism, Efficacy And Safety., *Journal Of The American Dental Association (JADA)*, 131(5), 589–596. DOI: