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Full paper

Evaluation of Dental Practitioners' Knowledge, Attitudes, and Clinical Application of Deep Margin Elevation

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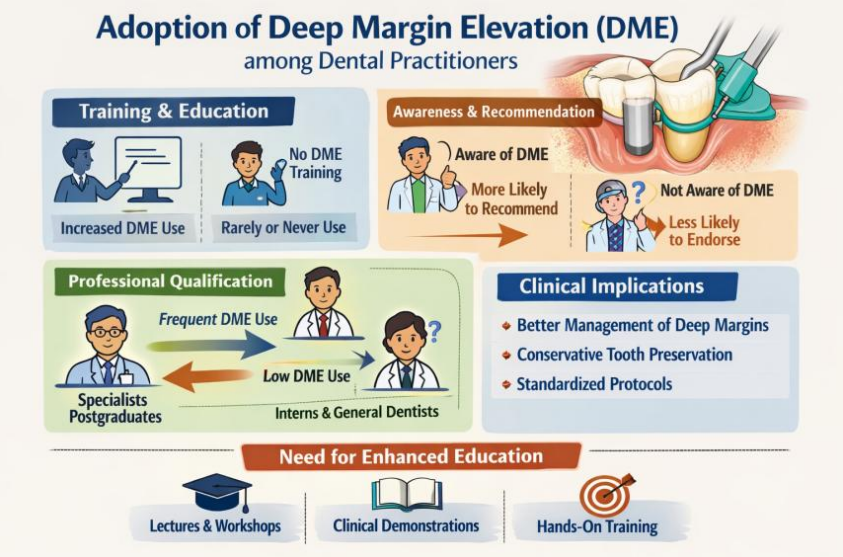
Abstract

Background: Deep Margin Elevation (DME) is a conservative technique for managing subgingival proximal caries, yet its clinical adoption varies among dentists.
Objective: To assess the knowledge, attitudes, and practices regarding DME among Libyan dental practitioners and identify factors influencing its use.
Methods: A cross-sectional survey was conducted among 152 licensed dentists using a 21-item electronic questionnaire. Data on socio-demographics, DME knowledge, attitudes, and clinical practices were collected and analyzed using descriptive statistics and chi-square tests. Associations between formal training, awareness, professional qualifications, and DME adoption were examined ($p < 0.05$).
Results: Most participants (82.9%) were aware of DME, but only 40.8% had formal training. Positive attitudes were observed, with 63.8% recommending DME as standard practice. Formal training, awareness, and advanced professional qualifications were significantly associated with a higher frequency of DME use and recommendation ($p < 0.001$).
Conclusion: Education, awareness, and specialization strongly influence DME adoption. Expanding structured training may promote evidence-based management of deep subgingival lesions.

Keywords: Deep Margin Elevation, Proximal Caries, Subgingival Restoration, Dental Knowledge, Clinical Practice



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1. Introduction

Today, one of the most frequent clinical situations seen is the restoration of extensive subgingival defects below the cemento-enamel junction (CEJ) in posterior teeth with proximal caries [1]. Restoring these cavities presents not only difficulties in achieving proper isolation but also challenges in attaining a well-adapted restoration with good marginal integrity. Because of this, these deep gingival margins create a “double-edged sword” that can impair isolation while also jeopardizing appropriate restorative adaptation [2].

Unfortunately, there are two main clinical issues that may arise when restoring cavities with deep cervical margins: biological issues and technical-operative issues [3]. Because polymerisation shrinkage can negatively affect the outcome of direct composite restorations in deep cervical areas, indirect restorations are thought to be superior as the resin luting agent is thinner, and polymerisation shrinkage has less of an effect on indirectly cemented restorations. Nevertheless, both adhesive-luting and impression-making methods are sometimes hampered by the gingival seat of the proximal box, which is positioned below the gingiva [4].

The traditional method involves surgically exposing the cervical margin, orthodontic extrusion, or a combination of the two methods, which results in the apical relocation of supporting tissues to reach the subgingival margin and create sufficient room for the reestablishment of the biological width (BW) [3]. While there have been reports of success with surgical crown lengthening in preserving restored teeth, the deep margin elevation (DME) method has been demonstrated to have favorable clinical outcomes [3].

Based on case reports, DME has attracted attention in dentistry since its introduction by Dietschi et al. [5]. The DME procedure is a minimally invasive dental procedure that elevates deep cavity margins while preserving tooth structure. To simplify margin isolation for better impressions or digital scans, deep cavity margins are elevated using a composite material [1].

This technique improves dental anatomy by preserving the original tooth structure, enabling more accurate impressions and precise prosthetic rehabilitation, while also reducing postoperative pain and the need for crown lengthening or gingival displacement [6,7]. However, the validity and reliability of DME have been questioned due to the lack of “scientific evidence” and clear case-selection standards; this discrepancy has resulted in a practical knowledge gap [7].

The approach is becoming an increasingly practical choice for both patients and dental professionals due to its ease of use and excellent results. Regarding the long-term effects of this technique, most practitioners are uncertain whether it should replace the traditional crown-lengthening operation [8].

A study designed to evaluate the impact of DME on the marginal adaptation of ceramic inlays found no difference between inlays placed directly on dentin and those placed after DME [9]. Because of the procedure's positive clinical and histological results, reconstructive dentistry can routinely employ it [10]. According to Ilgenstein et al. (2015), “proximal box elevation (PBE) had no impact on either the marginal integrity or the fracture behavior of mandibular molars restored with feldspathic ceramic onlays after receiving root canal therapy” [11].

Furthermore, it has been demonstrated that maintaining proper oral hygiene and having well-defined, finished filling margins are critical factors in avoiding injury to the periodontium around subgingival resin composite restorations [11]. Despite the many benefits of this approach as a shift in restorative dentistry, there are still questions about whether dental clinics are actually using it efficiently. Currently, no studies have assessed dental professionals' knowledge, attitudes, and practices regarding the use of DME in Libya. Hence, the purpose of this study is to evaluate the level of knowledge, attitudes, and practices regarding DME among dental practitioners in Libya and to identify factors associated with its clinical adoption.

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2. Materials and methods

2.1. Study Design

A descriptive, cross-sectional survey was implemented over a seven-month period to evaluate the knowledge, attitudes, and practices (KAP) related to DME among dental practitioners in Libya.

2.2. Study Population and Location

The study population comprised licensed dental professionals working in both private and public clinics throughout Libya.

Inclusion criteria were as follows:

- Male or female
- Able to read and understand English

Minimum qualification in dental surgery or equivalent.

- At least one year of clinical experience
- No mental or physical disabilities affecting participation

Exclusion criteria:

- Less than one year of professional experience

2.3. Sampling Technique

A non-probability convenience sampling strategy was employed in this study. Licensed dental practitioners practicing in Libya were invited to participate voluntarily through professional networks, university affiliations, and commonly used digital communication platforms. The survey was distributed electronically via Google Forms using email, WhatsApp, Telegram, Messenger, and Viber to facilitate broad geographic reach and accessibility.

Participation was entirely voluntary, and no incentives were provided. Responses were collected anonymously to encourage honest reporting and reduce social desirability bias. Only fully completed questionnaires were included in the final analysis.

The questionnaire consisted of 21 structured items developed based on an extensive literature review and adapted from previously published instruments, particularly the studies by Samartzi et al. (2022) and Binalrimal et al. (2021)) [6,8]. The instrument comprised four sections: (1) socio-demographic characteristics (5 items), (2) knowledge regarding Deep Margin Elevation (5 items), (3) attitudes toward DME (3 items), and (4) clinical practice patterns related to DME (8 items).

Due to the absence of publicly accessible national registry data, the exact total number of practicing dentists in Libya could not be determined. Consequently, the response rate relative to the overall dental workforce could not be calculated, and the representativeness of the sample cannot be precisely quantified.

2.4. Ethical Approval

This study was examined and approved by the Research Ethics Committee, Faculty of Dentistry, University of Benghazi (August 2024 / Reference Code: 0224). Participants were informed about the study aims and provided their informed consent. Every participant was advised that taking part in the questionnaire would be confidential, and all the information collected would stay confidential and would be used strictly for research reasons.

2.5. Statistical Analysis

The data were analyzed with both descriptive and inferential statistics. Categorical variables were summarized using absolute frequencies (n) and corresponding percentages (%). Associations between categorical variables, including formal training in DME, awareness of DME, professional qualification, frequency of DME usage, and readiness to promote DME, were examined using the chi-square test for independence. Statistical significance was set at $p<0.05$. All analyses were conducted using SPSS (Statistical Package for Social Sciences) software, version 29.

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3. Results

A total of 152 dental practitioners responded to the survey assessing their knowledge, attitudes, and clinical implementation of Deep Margin Elevation (DME).

3.1. Demographic Characteristics

The demographic profile of the participants is summarized in Table 1. The majority of respondents were female, and most belonged to the mid-career age group. In terms of professional qualifications, specialists represented the largest proportion of participants, followed by general dental practitioners and dentists with postgraduate training.

Regarding clinical experience, a considerable proportion of respondents reported more than ten years of professional practice, indicating that the sample included a substantial number of experienced clinicians. Most participants reported working in both private and government sectors, reflecting the mixed practice environment commonly observed among dentists in Libya.

Table 1. Demographic characteristics of study participants (N=152)

Demographic Variable		Number (N=152)	Percentage
Gender	Female	122	80.3%
	Male	30	19.7%
Age	25 - 34	43	28.3%
	35-44	77	50.7%
	45-54	25	17%
	≥55	6	4%
Qualification	Intern	4	2.6%
	General dental practitioner	48	31.6%
	Post-graduate dentist	39	25.7%
	Specialist	61	40.1%
Years of experience in dentistry	1-5	33	21.7%
	5-10	25	16.4%
	10-20	66	43.4%
	>20	28	18.4%
Type of practice	Government practice	44	28.9%
	Private practice	28	18.4%
	Both	80	52.7%

3.2. Knowledge of Deep Margin Elevation

The majority of respondents demonstrated prior awareness of DME, indicating widespread theoretical familiarity among practitioners (Table 2). The majority of respondents reported prior familiarity with the technique, suggesting that DME is widely recognized within the professional community. However, self-reported depth of understanding varied considerably. While a proportion of participants indicated moderate to excellent understanding, a notable segment demonstrated limited or no understanding, highlighting variability in conceptual clarity despite broad awareness Familiarity with clinical indications and contraindications showed a similar distribution pattern, with approximately two-thirds of respondents expressing confidence in identifying appropriate case selection criteria. Nevertheless, a substantial minority reported limited knowledge in this area, suggesting potential gaps in formal instruction or structured clinical exposure. When questioned regarding the minimum biological width required for DME, responses were inconsistent, reflecting uncertainty in the application of periodontal principles within restorative decision-making. This variability may indicate differences in educational background or the absence of standardized teaching regarding biologic considerations in subgingival restorative procedures.

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Table 2. Knowledge of dental practitioners regarding Deep Margin Elevation (DME)

Variable	Response	n (%)
6. Have you heard about deep marginal elevation/cervical margin elevation?	Yes No	126 (82.9) 26 (17.1)
7. What is your understanding of Deep Margin Elevation (DME)?	Excellent Moderate Limited None	27 (17.7) 72 (47.4) 41 (27) 12 (7.9)
8. How familiar are you with the indications for DME in dental procedures?	Very familiar, Somewhat familiar Not very familiar Not at all familiar	35 (23) 66 (43.4) 35 (23) 16 (10.5)
9. Are you aware of the contraindications for using DME in dental procedures?	Very aware, Somewhat aware Not very f aware Not at all aware	27 (17.8) 63 (41.4) 49 (32.2) 13 (8.6)
10.What is the minimum standard biological width to be considered for DME?	0.5 mm 1 mm 2 mm	36 (23.7) 63 (41.4) 53 (34.9)

3.3. Attitudes Toward Deep Margin Elevation

Overall, respondents demonstrated generally positive attitudes toward the use of DME in restorative dentistry (Table 3). Many practitioners indicated openness to incorporating the technique into their clinical practice, and a substantial proportion believed that DME could improve restorative outcomes when managing deep proximal margins.

Participants also expressed strong interest in remaining updated on developments related to the technique, suggesting recognition of the evolving nature of adhesive and minimally invasive restorative procedures. This positive attitude may reflect increasing awareness of conservative alternatives to more invasive surgical approaches.

Table 3. Attitude of dental practitioners toward Deep Margin Elevation (DME)

Variable	Response	n (%)
11. How receptive are you to adopting DME in your practice?	Very receptive Neutral Not at all receptive	65 (42.7) 49 (32.2) 28 (25)
12. Do you believe DME improves clinical outcomes compared to conventional techniques?	Agree Neutral Disagree	106 (69.7) 37 (24.3) 9 (5.9)
13. How important do you think it is for dental practitioners to stay updated on DME techniques?	Very important Neutral Not important at all	108 (77.7) 30 (19.7) 4 (2.7)

3.4. Clinical Practice Patterns Related to DME

Clinical practice patterns related to DME revealed moderate adoption of the technique among surveyed dentists (Table 4). While some practitioners reported frequent use of DME, many indicated that they incorporate it only occasionally in their clinical practice. This pattern suggests that although awareness of the technique is relatively high, routine implementation remains variable.

Clinical indication was identified as the primary factor influencing the decision to use DME, emphasizing the importance of case-specific clinical judgment. However, the findings also revealed that less

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than half of the respondents had received formal training related to DME, indicating that much of the exposure to the technique may occur through informal learning or self-directed study.

Participants reported relying on continuing dental education courses and professional literature as the most common sources for updating their knowledge of DME. The perceived advantages of the technique were mainly related to improved marginal adaptation and potentially better long-term restorative outcomes.

Despite these perceived benefits, several barriers to wider adoption were identified. The most frequently reported concerns included technical difficulty and the perception that the procedure is time-consuming. These factors may contribute to hesitation among practitioners, particularly those with limited training or experience in adhesive restorative techniques.

Table 4. Practice of dental practitioners towards Deep Margin Elevation (DME)

Variable	Response	n (%)
14. How frequently do you incorporate DME into your dental procedures?	Always Sometimes Rarely Never	36 (23.7) 71 (46.7) 31 (20.4) 14 (9.2)
15. What factors influence your decision to use DME in clinical practice?	Clinical indication Patient preference Time constraints Cost effectiveness Others (please specify)	107 (70.4) 11 (7.2) 8 (5.3) 8 (5.3) 18 (11.8)
16. Have you undergone formal training or education on DME techniques?	Yes No	62 (40.8) 90 (59.2)
17. How do you stay updated on the latest advancements and techniques in DME?	Continuing dental education courses Professional journals/publications Online forums/discussion groups Workshops/conferences Other (please specify)	40 (26.3) 36 (23.7) 33 (21.7) 23 (15.1) 20 (13.2)
18. In your opinion, what are the main advantages of incorporating DME into dental procedures?	Improved marginal adaptation Enhanced retention of restorations Preservation of tooth structure Better long-term outcomes Others (please specify)	66 (43.4) 25 (16.4) 16 (10.5) 36 (23.7) 9 (5.9)
19. What are the main challenges or barriers you encounter when implementing DME in your practice?	Lack of patient acceptance Time consuming procedure Technical difficulty Lack of refund Others (please specify)	23 (15.1) 43 (28.3) 60 (39.5) 3 (2) 23 (15.1)
20. How do you assess the success or effectiveness of DME in your clinical practice?	Clinical examination Radiographic evaluation Patient feedback Long-term follow up Others (please specify)	28 (18.4) 48 (31.6) 8 (5.3) 58 (38.2) 10 (6.6)
21. Would you recommend DME as a standard technique in dental practice?	Yes, strongly recommend Yes, recommend Neutral No, not recommend No, strongly not recommend	38 (25) 59 (38.8) 43 (28.3) 8 (5.3) 4 (2.6)

3.5. Association Between Formal Training and Frequency of DME Use

A statistically significant association was identified between having undergone formal training or education in DME and the self-reported frequency of incorporating DME into clinical practice. The chi-square test for independence demonstrated a significant relationship between formal training and frequency of DME use ($\chi^2 = 4$, df = 35.81, $p < 0.001$). Practitioners who reported formal training were more likely to use DME "sometimes," or "always," whereas those without formal training more frequently reported "rarely" or "never" using the technique.

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3.6. Awareness of DME and Willingness to Recommend Its Use

Awareness of DME was closely linked to practitioners' willingness to recommend it as a standard technique in dental practice. Chi-square analysis showed a significant association between awareness and recommendation status ($\chi^2 = 4$, df = 42.17, $p < 0.001$). Participants who knew about DME were much more likely to recommend or strongly recommend its use. In contrast, those who were unaware mainly chose neutral or non-recommendation responses.

A statistically significant association was also observed between professional qualification and the reported frequency of DME use. The chi-square test for independence indicated a strong relationship between these variables ($\chi^2 = 16$, df = 154.73, $p < 0.001$). Specialists and postgraduate dentists reported more frequent use of DME compared with general dental practitioners and interns, who more commonly reported rare or no use of the technique.

3.7. Summary of Key Associations

Across all analyses, formal training compared to frequency of use, awareness compared to recommendation, and professional qualification compared to frequency of use; chi-square tests showed statistically significant associations (all $p < 0.001$). Practitioners with more exposure to DME through formal education, greater awareness, and higher professional qualifications reported increased levels of clinical adoption and stronger support for DME as a standard restorative technique.

4. Discussion

This survey examined the relationship between dental practitioners' training, awareness, and professional qualifications and their use and endorsement of Deep Margin Elevation (DME). The results indicate a consistent pattern in which increased educational exposure and higher levels of specialization are closely linked to more frequent use of DME and more favorable attitudes toward the technique. This trend aligns with previous literature describing DME as a technique most commonly adopted by clinicians with advanced training in adhesive and restorative dentistry [12,13]. Similar investigations evaluating knowledge, attitudes, and practices related to Deep Margin Elevation (DME) have been conducted in several countries, including Saudi Arabia, India, Turkey, and various European populations [6,8,12,13]. A study conducted in Saudi Arabia reported moderate to high awareness of DME among practitioners, although formal training exposure varied considerably. Likewise, surveys from India and Turkey indicated that while many dentists were familiar with the concept of margin relocation, actual clinical implementation depended largely on postgraduate education and continuing professional development. European reports have similarly shown that DME is more frequently adopted by clinicians with advanced restorative or prosthodontic training [6]. Compared with these findings, the present study demonstrates a comparable level of awareness among Libyan practitioners; however, the proportion of respondents who received structured formal training remains relatively limited. This parallel suggests that educational exposure and specialization play a consistent and influential role in the global adoption of DME.

4.1. Impact of Formal Training on DME Adoption

The significant association between formal training and frequency of DME use suggests that education is a crucial determinant of clinical adoption. Practitioners who had received structured teaching on DME reported using the technique more often, whereas those without similar training tended to use it rarely or not at all. This likely reflects both increased technical competence and greater confidence in the scientific rationale underlying the technique [12,13].From a clinical education perspective, these results support the integration of DME into undergraduate curricula, postgraduate programs, and continuing professional development. Previous studies have demonstrated that formal instruction in adhesive and conservative restorative techniques positively influences clinical implementation [13,17]. When dentists understand the indications, step-by-step protocol, and limitations of DME, they appear more willing to apply it in everyday practice, particularly in challenging subgingival cases where conventional isolation and margin relocation are difficult [12,14].

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4.2. Awareness and Recommendation Behavior

Awareness of DME was also significantly associated with willingness to recommend the procedure. Practitioners who were familiar with DME were more likely to endorse it as a feasible option, while those who had not heard of it or had limited exposure were less inclined to recommend it. This finding suggests that even limited exposure through lectures, workshops, scientific literature, or peer discussion may positively influence attitudes toward DME [12,18]. It also underscores the importance of knowledge dissemination: clinicians cannot meaningfully evaluate or recommend a technique they are unfamiliar with, regardless of its potential clinical benefits. Increasing access to high-quality educational resources and clinical demonstrations may therefore broaden acceptance of the procedure.

4.3. Role of Professional Qualification

Advanced training and specialization were associated with greater integration of DME into clinical practice, as indicated by the substantial correlation between qualification level and DME use. Specialists and dentists with postgraduate training reported more frequent use compared with interns and general practitioners. Several factors may explain this trend. Specialists are typically more familiar with current evidence, advanced adhesive strategies, and complex restorative cases in which DME is particularly advantageous [13,14]. Moreover, specialist practice environments commonly include magnification, rubber dam isolation, and modern adhesive systems, all of which facilitate the technical application of DME [15,16]. In contrast, interns and general practitioners may feel less confident performing DME or may lack the necessary training and equipment for its routine use. These findings highlight a potential disparity in care, whereby patients treated by less experienced practitioners may be less likely to benefit from DME even when clinically indicated. Targeted educational initiatives for general practitioners and early-career dentists could help reduce this gap.

4.4. Clinical and Educational Implications

Overall, the results suggest that DME remains a technique whose adoption is strongly driven by education and specialization rather than being evenly distributed across all levels of practice. As DME enables conservative management of deep proximal lesions by relocating restoration margins coronally, limited adoption may lead to missed opportunities for tooth preservation or premature resort to more invasive options such as surgical crown lengthening [12,13,19]. Strengthening DME education could therefore provide several practical benefits, including improved management of deep subgingival margins, greater standardization of clinical protocols and material selection, and increased practitioner confidence, an important factor closely associated with both use and recommendation of the technique [15,17]. At the same time, educational efforts should emphasize appropriate case selection, strict adherence to adhesive principles, and careful consideration of periodontal health to avoid biologically unfavorable or inappropriate use of DME [14,18].

4.5. Limitations

This study has several limitations that should be taken into account when interpreting the results. The data are based on self-reported behavior and attitudes, which are subject to recall bias and social desirability bias and may result in overestimation of contemporary technique usage. The sample may not be fully representative of the broader dental population, particularly since participation was voluntary and attracted respondents with a specific interest in restorative dentistry. Additionally, due to the use of convenience sampling, the findings may not be fully generalizable to all dentists practicing in Libya. Additionally, the study evaluated associations between practitioner characteristics and reported behavior but did not assess clinical outcomes of DME, such as restoration survival, secondary caries, or periodontal changes. As a result, while practitioner attitudes and behaviors can be described, direct conclusions regarding patient-level outcomes cannot be drawn [14,17].

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4.6. Future Directions

Future research should build on these findings through prospective clinical studies correlating practitioner-related factors such as training level, experience, and adherence to established protocols with objective outcomes of DME, including restoration longevity and periodontal parameters [14,16,20]. Intervention studies evaluating the effect of targeted workshops and hands-on training on knowledge acquisition, confidence, and clinical implementation of DME among general practitioners and interns would also be valuable. In addition, qualitative research methods, such as interviews or focus groups, may help identify specific barriers faced by low-use groups, including concerns about biological width violation, challenges with isolation, or uncertainty regarding material selection [15,18]. Addressing these barriers through tailored educational programs may further support the appropriate and wider integration of DME into routine restorative practice.

5. Conclusion

The present study clearly demonstrates a correlation between the educational exposure to DME among dentists and their practice and perception of DME. Those with formal education in DME reported higher use of DME compared to those without formal education. This suggests that education in a structured manner leads to adoption. In addition, better awareness of DME was associated with a greater interest in recommending the technique.

Professional qualifications also played an important part: specialists and postgraduate dentists reported using DME more often than general practitioners and interns, highlighting the influence of advanced training and specialization on the integration of newer restorative techniques. Overall, these findings suggest that underuse of DME is probably linked less to rejection of the concept and more to gaps in knowledge, confidence, and training. Expanding high-quality teaching on DME at undergraduate, postgraduate, and continuing education levels may therefore promote more evidence-based management of deep subgingival margins. While the survey design captures self-reported behaviors rather than clinical outcomes, the strong associations observed support the need for further clinical research to evaluate how practitioner training and adherence to DME protocols impact restoration longevity, periodontal health, and patient-centered outcomes.

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