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Review Article

# Navigating the practical-knowledge gap in deep margin elevation: A step towards a structured case selection – a review

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ABSTRACT

The deep margin elevation (DME) technique has gained popularity because of numerous supporting case reports. However, some clinicians are cautious regarding using this technique owing to the lack of clear case selection criteria for DME application. This review aimed to analyze case reports and a series of DME cases to determine pre-/post-operative evaluation methods that could be used to suggest a pre-operative case selection checklist for DME. An electronic database search was conducted in June 2021 and updated by June 2023 using selected terms from PubMed, Cochrane Library, Google Scholar, EBSCO, and Scopus. The search was limited to English-language publications and was not restricted to the date. The inclusion criteria were case reports/series addressing periodontal and restorative outcomes of DME. The search identified 217 articles, 76 of which were pertinent. However, only six case reports and one case series satisfied the inclusion criteria. None of the selected studies followed any reporting guidelines, which led to significant information gaps. While the reviewed studies reported favorable outcomes, standardized protocols for evaluating pre-/post-operative restorative and periodontal status were lacking. The post-operative follow-up period varied from 3 months to 6 years. Designing and implementing pre-/post-operative guidelines hold the potential for ensuring the safe application of the DME technique. This may enhance our understanding of the suitability and efficacy of such non-invasive technique in future clinical trials.

*Clinical significance:* Handling deep cavities and preparing crowns are challenging. However, a lack of understanding of when to perform DME can lead to missed opportunities for conservative treatment, thereby a disservice to the patient. Provision of safe guidelines should be employed by clinicians until further evidence either supports or contradicts this treatment method.

## 1. Introduction

Deep margin elevation (DME) has gained interest in dentistry based on case reports (Dietschi and Spreafico, 1998). To maintain tooth structure, the DME technique is a minimally invasive dental procedure maximizing deep cavity margins. A composite material is used to elevate deep cavity margins, thus simplifying margin isolation for superior impressions or digital scans (Frese et al., 2018; Juloski et al., 2018). This method reduces post-operative discomfort, eliminating the need for crown lengthening or gingival displacement and enhances dental anatomy by conserving original tooth substance to allow precise impressions and leading to accurate prosthetic rehabilitation (Eggmann et al., 2023; Samartzi et al., 2022). Given the method's simplicity and optimal outcomes, the technique is emerging as a progressively pragmatic option for both patients and dental practitioners. However, for most practitioners, there is ambiguity regarding whether this method should replace the

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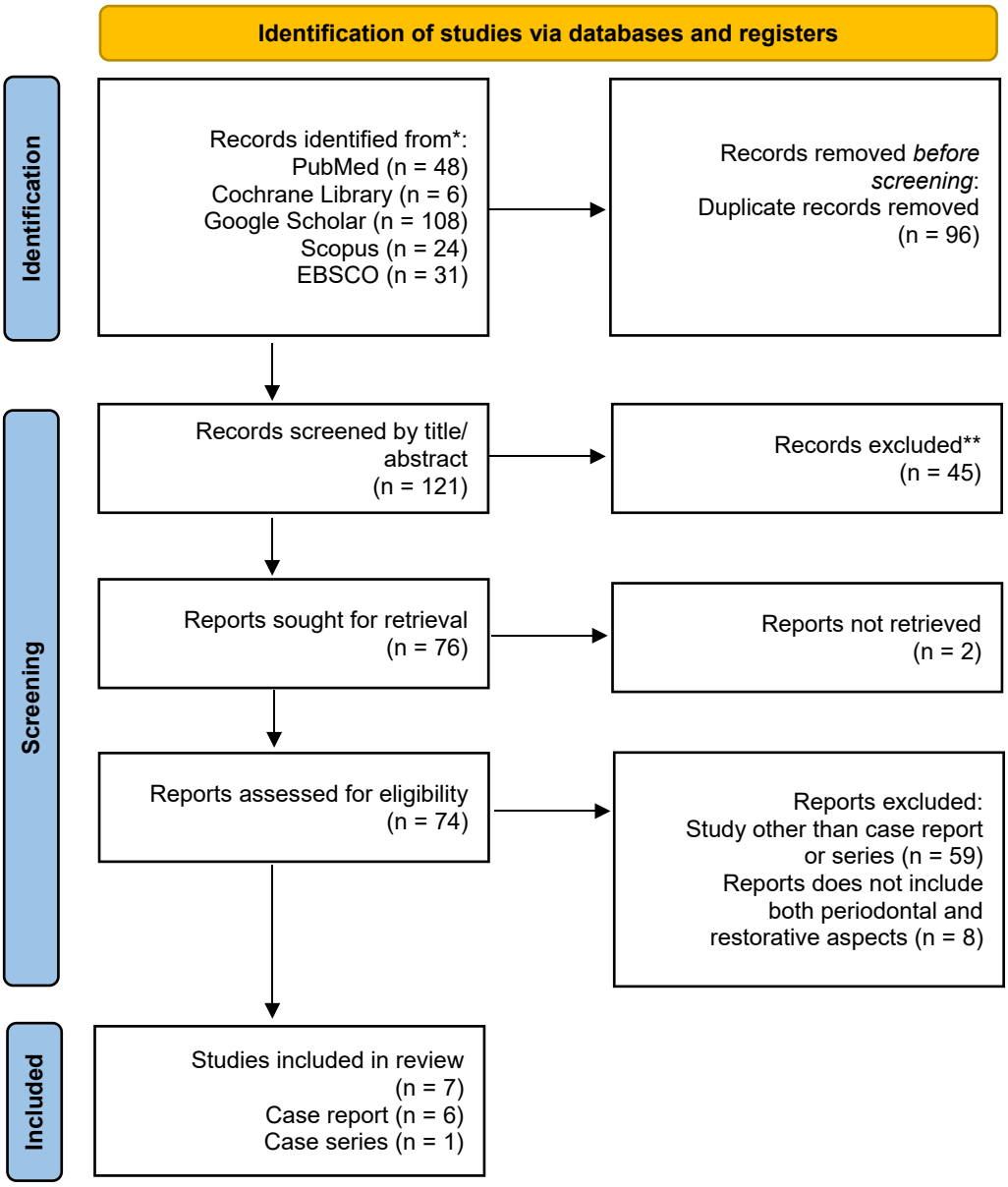


**Fig. 1.** PRISMA Chart. PRISMA flowchart diagram for the selected articles. PRISMA stands for "Preferred Reporting Items for Systematic Review and Meta-analysis."

conventional crown-lengthening procedure including its long-term impact (Binalrimal et al., 2021).

However, the lack of scientific evidence and precise case-selection guidelines raises concerns about the DME's validity and reliability, and this disparity led to a practical knowledge gap (Miles, 2017). Current case reports elucidate the technique's potential through informative visuals and instructional guidance but fall short in outlining the restrictions of indications, contraindications, and long-term implications, impeding clinical decision-making (Ghezzi et al., 2019; Hammond et al., 2019; Ismail and Ali, 2021; Kielbassa and Philipp, 2015; Sarfati and Tirlet, 2018; Veneziani, 2010).

Understanding the interplay between periodontal tissues and restorative dentistry is crucial for achieving optimal dental aesthetics, comfort, and functionality, especially with this technique (Nugala et al., 2012). Thus, decisions to adopt the DME technique should be communicated through comprehensive periodontal examinations to enhance treatment outcomes and restoration longevity.

Few DME-controlled clinical studies (Bertoldi et al., 2018; Bertoldi et al., 2020; Bresser et al., 2019; Ferrari et al., 2018) have largely been attributed to the inherent difficulties associated with the design and execution of randomized clinical trials. Few existing controlled clinical studies overlooked restorative or periodontal outcomes, casting a shadow in understanding DME (Bertoldi et al., 2018; Bertoldi et al., 2020; Bresser et al., 2019; Ferrari et al., 2018). Furthermore, knowledge regarding the restorative success of DME emanate from in-vitro studies which, while informative, fail to fully replicate intra-oral conditions (Ali and Moukarab, 2020; Bresser et al., 2020; da Silva Gonçalves et al., 2016; Dietrich et al., 2000; Frese et al., 2018; Juloski et al., 2018; Köken et al., 2018; Köken et al., 2019).

Awareness of the advantages of DME is valuable, but not knowing when to utilize it is a missed opportunity for conservative treatment and a disservice to patients. Supplying clinicians with safety guidelines until further evidence emerges to support or challenge this treatment method is essential. Thus, this review aims to examine the available case reports and case series on DME, aiming to establish a consensus on pre-operative diagnostic methods and post-operative success criteria. Moreover, it introduced a preoperative checklist intended as a decision-making aid for clinicians considering DME application.

**Table 1**
Case reports and case series included in this study from the restorative perspective.

| Study | Year | Rubber dam use | Cavity depth | DME material and technique | Adhesive | Final restoration | Follow up | Outcome |
|---|---|---|---|---|---|---|---|---|
| Veneziani | 2010 | Yes | G1: margin with reduced/absent enamel | Flowable composite 1–1.5 mm at the cervical margin, 0.5 mm to line the cavity. | No mentioned | Onlay/ overlay | G1: NA | G1: NA |
| | | | G2: margin with reduced/absent enamel > 2 mm from CT | | | | G2: 4 months | G2: esthetic and morphological integration |
| | | | G3: NA | | | | G3: 3 weeks (one of the cases in 1 year) | G3: good marginal adaptation, morphology, and esthetics |
| Frese et al. | 2014 | No (Only during final restoration placement) | 0.5–1 mm between the cavity margin and crest | Flowable and viscous composite (Snowplow tech) | Optibond FL, Kerr,Orange, CA, USA (4th generation) | Direct composite | 12 months | Not mentioned |
| Kielbassa and Phillipp | 2015 | No (Only during final restoration cementation) | CBCT revealed propagation of caries toward the CEJ | Flowable and viscous composite (2 layers). | Syntac, Ivoclar Vivadent (4th generation) | CAD/CAM inlay | 3 months | Not mentioned |
| Sarfati and Tirlet | 2018 | Yes | C1: NA | Several intakes of flowable to respect the C factor composite. | Three step etch and rinse adhesive | Overlay/ inlay | C1: NA | Not mentioned |
| | | | C2: on the CEJ | | | | C2: 1 yr | |
| | | | C3: beyond the CEJ | | | | C3: 1.5 yrs | |
| | | | C4: on the CEJ | | | | C4: 2 yrs | |
| Hammond et al. | 2019 | No (Only during final restoration cementation) | Apical to CEJ | Resin-modified glass ionomer (RMGI) | No mentioned | Onlay | 6 years | No evidence of caries, fracture of tooth/ restoration |
| Ghezzi et al. | 2019 | Yes | G1: in the sulcus | Composite, 3 layers each with a maximum of 2 mm. | Clearfil SE Bond; Kuraray Noritake Dental (6th generation) | Indirect composite | G1: 5 yrs | 100 % of the restorations remained functional |
| | | | G2: within the epithelial tissue area | | | | G2: 7 yrs | |
| | | | G3: within the CT tissue area | | | | G3: 3 yrs | |
| Ismail and Ali | 2021 | Yes | Below the CEJ | Bioactive composite on one tooth and flowable on the other | Tetric N-Bond Universal, Ivoclar Vivadent, NY, USA | Direct composite | 6 months | Radiographic assessment of the used bioactive composite was challenging compared to the flowable bulk fill. |

## 2. Methods

This review complies with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines (PRISMA) (Page et al., 2021). The research question aligns with the Patient/Population, Intervention, Comparison, and Outcomes format. The analyzed studies underscored on adult patients who underwent DME technique, specifically on the deep subgingival cavity margins. Our study inclusion criteria included case reports and series which reported both periodontal and restorative examinations or evaluations conducted before and after applying the DME technique. Conversely, our exclusion criteria included literature reviews, clinical trials, case reports, and series that failed to report periodontal or restorative evaluations before and after the DME.

### 2.1. Search strategy

A comprehensive electronic search was conducted for publications in English with no time restrictions using various databases, such as PubMed, Cochrane Library, Google Scholar, EBSCO, and Scopus. The search was conducted using the following medical subject heading terms: deep-margin elevation, cervical margin relocation, coronal margin relocation, and proximal box elevation. To identify additional relevant publications, the reference lists of selected articles were reviewed.

### 2.2. Screening

The research team independently reviewed articles identified during the initial search, with three rounds of elimination. In the first two rounds, the team screened articles according to their titles and abstracts. However, in the third round, they thoroughly examined the full texts of all the abstracts that crossed the first two rounds of exclusion. All authors were involved in this comprehensive review.

### 2.3. Data extraction

The authors compiled the following data: title, first author, year of publication, journal name, specific terms used for the DME technique, patient selection criteria, number and category of teeth involved, cavity depth, rubber dam usage, material(s) used in the DME and their layering, luting agent applied, final restoration type, periodontal examination procedures, methodology for evaluating biological width, follow-up duration, and overall treatment outcome.

### 2.4. Data presentation

Data was presented descriptively due to different metrics and outcomes reported.

## 3. Results

The search commenced in June 2021 and was updated in June 2023. After the initial screening, we identified 217 articles. After excluding duplicates (n = 96) and irrelevant studies (n = 45), a total of 76 articles were included. Unfortunately, two of these articles could not be retrieved. Of the remaining 74 articles, 13 were case reports and two were case series. Of these, only seven fulfilled the inclusion criteria, including six case reports and one case series (Fig. 1). The extracted data were classified into three primary sections: patient-related factors, restorative considerations, and periodontal considerations.

### 3.1. Patient-related factors

The patient history included in the case reports covered several demographic and medical information such as: age (Frese,et al., 2014; Hammond et al., 2019; Ismail and Ali, 2021; Kielbassa and Philipp, 2015; Veneziani, 2010), sex (Frese,et al., 2014; Hammond et al., 2019; Ismail and Ali, 2021; Kielbassa and Philipp, 2015; Veneziani, 2010), medications and smoking history (Frese et al., 2014).

The case series in our study followed clear inclusion criteria (Ghezzi et al., 2019) which required patients to be classified as ASA I or II according to the ASA physical status classification system. These criteria also specified that patients must not be pregnant, should be committed to oral hygiene, and have dental caries affecting the dentogingival unit (Ghezzi et al., 2019). Regarding the post-operative follow-up duration in all the included studies, it varied, ranging from 3 months to 6 years.

### 3.2. Restorative considerations

Table 1 summarizes the DME restoration methods utilized in the documented case studies and individual cases. The technique required rubber dam isolation before employing the DME, as stated in the case series and three individual case reports (Ghezzi et al., 2019; Ismail and Ali, 2021; Sarfati and Tirlet, 2018; Veneziani, 2010). Conversely, three other case studies adopted the DME technique by utilizing the isolation supplied by the matrix, applying rubber dam isolation at a later stage of the composite build-up or while cementing the indirect restoration (Frese et al., 2014; Hammond et al., 2019; Kielbassa and Philipp, 2015).

Details regarding the cavity margin depth have been inconsistently presented, with some authors relating it to the cementoenamel junction (Frese et al., 2014; Ismail and Ali, 2021; Kielbassa and Philipp, 2015), while others related it to periodontal attachment, which includes epithelial, connective tissue, or bone (Ghezzi et al., 2019; Hammond et al., 2019). However, a few case studies failed to specify the cavity margin depth (Sarfati and Tirlet, 2018; Veneziani, 2010).

The following dental materials have been mentioned in reference to the choice of restorative material for the DME technique: flowable resin composite (Kielbassa and Philipp, 2015; Sarfati and Tirlet, 2018; Veneziani, 2010.), resin-modified glass ionomer (RMGI) (Hammond et al., 2019), conventional resin composite (Ghezzi et al., 2019), and a combination of both flowable and conventional resin composites (Frese et al., 2014). A single case study investigated numerous types of resin composite such as bioactive and flowable bulk fill using the same subject but applied to different teeth attempting to test the periodontal reaction each kind (Ismail and Ali, 2021). Additionally, regarding the DME application, authors of the case reports employed it in varying layer quantities: in one (Hammond et al., 2019; Sarfati and Tirlet, 2018; Veneziani, 2010), two (Frese et al., 2014; Ismail and Ali, 2021), and three layers (Ghezzi et al., 2019).

Regarding the choice of the final restorative material, four case reports and one series utilized indirect restorations, employing various designs including onlays and inlays and materials such as ceramics and composites (Ghezzi et al., 2019; Hammond et al., 2019; Kielbassa and Philipp, 2015; Sarfati and Tirlet, 2018; Veneziani, 2010). However, two case reports opted for direct composite restorations due to patients' financial constraints (Frese et al., 2014; Ismail and Ali, 2021).

**Table 2**
Case reports and case series included in this study from the periodontal perspective. PD, pocket depth; PI, plaque index; GI, gingival inflammation index; BOP, bleeding upon probing; BW, bitewing radiograph; PA, periapical radiograph. G group, C case.

| Study | Year | Preoperative diagnosis | Post-operative diagnosis | Follow up | Outcome |
|---|---|---|---|---|---|
| Veneziani | 2010 | G1: not mentioned | Not mentioned | G1: NA | G1: NA |
| | | G2: not mentioned | | G2: 4 months | G2: rapid and favorable tissue healing and maturation |
| | | G3: BW | | G3: 3 weeks (one of the cases in 1 year) | G3: good soft tissue healing after 20 days |
| Frese et al. | 2014 | Mobility, PD, PA | PD, BOP, PA | 12 months | No signs of inflammation, minimal loss of alveolar bone |
| Kielbassa and Phillipp | 2015 | PD, BOP, BW | PD, BOP | 3 months | No increase in PD, no sign of papillary inflammation, no BOP |
| Sarfati and Tirlet | 2018 | C1: PA | C1: not mentioned | C1: NA | C1: NA. |
| | | C2: not mentioned | C2: PD, BOP, PA | C2: 1 yr | C2: No swelling, no PD > 3 mm, no BOP, no calculus |
| | | C3: not mentioned | C3: PA | C3: 1.5 yrs | C3: no bone loss |
| | | C4: not mentioned | C4: PD, PA | C4: 2 yrs | C4: ideal periodontal integration of the restoration |
| Hammond et al. | 2019 | Not mentioned | BW | 6 yrs | No periodontal inflammation |
| Ghezzi et al. | 2019 | PD, BOP, BW/PA | PD, BOP, BW/PA | G1: 5 yrs<br>G2: 7 yrs<br>G3: 3 yrs | After 1 year, the PD decreased, and the BOP decreased in all-groups from 100 % at baseline to 40 % after 1 year; no significant differences were found among the groups regarding the PD or BOP at any timepoint |
| Ismail and Ali | 2021 | Not mentioned | PD, PI, GI, PBI | 6 months | Improvement in periodontal index scores |

### 3.3. Periodontal considerations

Table 2 summarizes the periodontal considerations in the case reports and case series. Three studies performed a baseline periodontal examination prior to DME, in addition to radiographic examination, which included probing depth and mobility (Frese et al., 2014) or

probing depth and bleeding upon probing (Ghezzi et al., 2019; Kielbassa and Philipp, 2015). One case report performed a periodontal examination using four indices immediately after performing the DME procedure and considered it as a baseline finding. The following indices were used: probing depth, plaque, gingival, and papillary bleeding indices (Ismail and Ali, 2021). The other three studies obtained pre-operative radiographs to assess the cavity-margin-to-bone proximity, the possibility of biological width violation, and to detect the carious lesion and its extent (Hammond et al., 2019; Sarfati and Tirlet, 2018; Veneziani, 2010).

The radiographic examination type used was as follows: three case reports used periapical radiographs preoperatively and during follow-up (Frese et al., 2014; Ismail and Ali, 2021; Sarfati and Tirlet, 2018); one case report only used periapical radiographs preoperatively with bitewing and periapical radiographs obtained at follow-up (Hammond et al., 2019). Additionally, one case report used cone-beam computed tomography in addition to the bitewing radiographs in their examination (Kielbassa and Philipp, 2015). Another case report described the use of bitewing radiograph for only one case; however, information regarding the type of radiographs taken for the other two cases was missing (Veneziani, 2010). For the case series, an inconsistency was present in the types of radiographic examinations performed among the participants (Ghezzi et al., 2019).

Regarding periodontal surgical intervention, four studies included soft or osseous tissue removal, which facilitated rubber dam application prior to DME in cases where isolation without surgery was not possible (Frese et al., 2014; Ghezzi et al., 2019; Ismail and Ali, 2021; Veneziani, 2010).

## 4. Discussion

This study reviewed case reports focusing on DME, to define preoperative diagnostic methodologies and to establish uniform criteria for evaluating post-operative success. Case reports offer a foundation for detailed research on novel treatments, contribute to education, share best practices, and affordably and quickly identify innovations (Murad et al., 2018; Ortega-Loubon et al., 2017; Sayre et al., 2017; Vandenbroucke, 2001). Furthermore, case reports can highlight unseen effects of new procedures, guiding clinical decisions (Ganesh et al., 2020; Ypei Gia et al., 2021). However, their evidence value tends to be underestimated compared to other research methods.

Current published case reports follow a narrative style that often omits or obscures important data. In some reports, details, such as age, sex, smoking habits, and medical history, which are crucial for evaluating technique compatibility and success, were absent. Thus, the decision to use a DME procedure should not be based solely on localized factors and should be holistic.

Utilizing a standardized reporting framework, such as the CAse Report (CARE) checklist, offers substantial benefits for future case reports (Riley et al., 2017). The checklist, consisting of 30 critical items, serves as a valuable tool for ensuring comprehensive reporting. It encompasses a detailed case presentation, contextual background, clinical decision-making processes, observed outcomes, informed consent, and ethical considerations. Implementing this comprehensive framework considerably enhances the consistency and depth of case report documentation, with meticulous adherence to the detailed reporting structure crucial for comprehensive coverage of all relevant information.

Regarding restorative considerations, the reviewed case reports and case series included various restorative materials and adhesives. However, the restorative result integrity is debatable given the absence of defined success or failure evaluation criteria for the procedures (Hickel et al., 2010). There are universally acceptable criteria for evaluating the success of restorations, such as those of the International Federation of Dental Association (Hickel et al., 2010) and the modified United States Public Health Service (Kim et al., 2013). Such well-established clinical evaluation crtieria should be utilized in cases that involve DME to ensure that the results are comparable across multiple studies (Hickel et al., 2010; Marquillier et al., 2018).

Adhesion to the cementum is one of the challenges in restorative dentistry (Ferrari et al., 1997). The complexity is further accentuated when performing intricate maneuvers such as raising the deep subgingival cavity margin. The tooth structure changes its shape and composition, culminating at the cemento-enamel junction. Traditional three-step adhesives have been demonstrated to provide the surface and interfacial characteristics of the intact cementum, which are more compatible with conventional dentin hybridization (Mountouris and Eliades, 2002). However, other investigative studies offer evidence that two-step and self-etch adhesives could present superior hybridization quality both in the cervical cementum and proximal superficial dentin (Yuan et al., 2008). Another promising approach lies in the proposal of some studies that emphasizes on a “deproteination phase” before any adhesive treatment. This phase aims to clean the high organic content, revealing the untouched inorganic substrate beneath which the tooth surface is conditioned with aqueous solutions of sodium hypochlorite (Hebling et al., 2005; Meiers and Kresin, 1996). Self-adhesive resin composites could be an innovative tool for the DME technique. What sets it apart from traditional resin composites is its reliance on chemical bonding, which is an intriguing alternative to the established methods of chemical and micromechanical adhesion. As such, it possesses huge potential to transform the future of restorative dentistry.

Ceramic and resin composites are both successful options as final restoration materials. Indirect and semi-direct resin restorations following DME have been proven durable for 6–21 years (Dietschi and Spreafico, 2019). Studies reveal that a DME resin composite layer would not compromise the ceramic inlays or onlays’ fracture strength (Bresser et al., 2020). Therefore, the DME technique success depends on correctly selecting the material based on the tooth’s condition and position.

Most included studies did not explicitly explain or report the preoperative examination methods used (Hammond et al., 2019; Ismail and Ali, 2021; Sarfati and Tirlet, 2018; Veneziani, 2010). An issue is that these studies often use periapical radiographs to measure deep margins close to the bone, although bitewing radiographs provide a better bone level visualization near cavity margins (Nugala et al., 2012). Also, none of these studies utilized bone sounding, the most accurate method for determining the distance between the cavity margin and bone (Nugala et al., 2012). Consequently, potential violations of biological width with DME could not be ascertained (Ghezzi et al., 2019; Frese et al., 2018; Nugala et al., 2012).

Biological width, initially termed the “attached epithelial cuff,” includes the junctional epithelium and connective tissue attachment (Cohen, 1962; Gargiulo et al.,1961). Their attachment types differ at the histological level, with junctional epithelium attaching to tooth surfaces via hemidesmosomes and connective tissue attaching perpendicularly via periodontal ligaments to the cementum (Kobayashi et al., 1976; Sicher, 1959; Stern, 1981; Waerhaug, 1952). The epithelial attachment differs in measurements, making the connective tissue attachment the most reliable (Kobayashi et al., 1976; Sicher, 1959; Stern, 1981; Waerhaug, 1952). Clinically, violating biological width can result to gingival inflammation, epithelial attachment migration, pocket depth, recession, or bone loss (de Waal and Castellucci, 1994; Newcomb, 1974; Nugala et al., 2012; Tal et al., 1989). In the case reports and series scrutinized in this paper, the connective tissue attachment likely remains preserved in most instances. However, no bone sounding was performed during the preoperative evaluations to substantiate these findings. Discussing the gingival response to DME can potentially mirror those observed with all other restorative materials, provided the margin of restoration stays confined within the sulcus and local variables that might incite plaque retention are absent, such as an open margin, over-contour, and open contact. Thus, most instances involving DME result in partial or complete violation of the biological width.

Biological width varies from site to site and tooth to tooth, within or among patients (Perez et al., 2008). However, the width of the supracrestal connective tissue fibers that attach to the cementum are

**Table 3**
Suggested checklist for the clinician to review before performing the DME. If any of the following items is checked (present), please refer to a periodontist for a consult. If none of these items is checked, proceed with DME.

| # | Item | √ |
|---|---|---|
| 1 | Systemic condition and/or smoking | |
| 2 | Distance from the restoration margin to bone (vertical biological width) < 1 | |
| 3 | Bone sounding < 2 mm | |
| 4 | Signs of gingival inflammation | |
| 5 | Pocket depth > 4 mm | |
| 6 | Periodontal prognosis (unfavorable) | |

approximately 1 mm and do not seem to vary (Gargiulo et al., 1961; Vacek et al., 1994). Various measurements for biological width were reported in the literature (Hamasni and El Hajj, 2021). However, in the case of DME, the least distance of connective tissue attachment that should be left is 1 mm.

Clinicians should consider that introducing dental restorations into the dentogingival junction can modify the microbial flora composition, especially in the case of overhanging restorations (Jeffcoat and Howell, 1980; Lang et al., 1983). This change can particularly induce an enlarged sphere of pathogenic influence and provide an environment conducive for plaque growth (Carneiro et al., 2003). Plaque tends to accumulate on the tooth and undergoes accelerated maturation owing to the microbial challenge. Supragingival restorative margins are generally associated with improved periodontal health, while subgingival restorative margins frequently lead to a significant loss of periodontal attachment (Flores-de-Jacoby et al., 1989; Schätzle et al., 2001). As such, dental professionals need to be aware of how dental restorations, particularly in overhanging restorations, can affect the dentogingival junction's microbial flora and therefore increase the likelihood of plaque development. This increased plaque can then expedite plaque maturation.

The cervical margin relocation classification described in the case resires report by (Ghezzi et al., 2019) is noteworthy. However, clarifying that this classification is based on the treatment assigned, without explicit details of how each case was allocated to a specific treatment category, is important. Our study primarily focused on delineating the criteria for selecting class 1, as mentioned in (Ghezzi et al., 2019), which involves nonsurgical cervical margin relocation (CMR). Future studies should distinguish the nuances of each classification.

Histological and clinical responses to DME remain under investigation. It is crucial to develop site-specific and patient-specific measurements from the restorative margin to the bone in patients with DME to establish a stable and healthy periodontium. As we await these metrics and a thorough study on the impact of partial violation of biological width, performing a comprehensive periodontal evaluation prior to attempting DME is recommended. If the suitability of the DME is uncertain, consultation with a periodontist is recommended. The following is a suggested preoperative evaluation criterion for DME.

### *4.1. Suggested pre-operative evaluation checklist for DME*

1. Patient selection for this technique: Patients with poor oral hygiene and uncontrolled diabetes and are smokers should be treated with temporary restoration and referred to a periodontist to control these factors for optimal periodontal health.

2. After caries removal, tooth restorability (e.g., mobility, furcation, and involvement) should be assessed

3. A radiograph (preferably vertical bitewing radiograph) should be obtained and the distance from the cavity margin to the bone level should be measured. If the distance is ≤1 mm, refer the patient for a periodontal consultation.

4. Check periodontal health (deep pockets and bleeding). Perform bone sounding. If it is <2 mm, the patient should be referred to a periodontist for possible crown lengthening

If one of these items is present, do not perform a DME and refer the patient to a periodontist. As such, surgical crown lengthening might be necessary.

Our study identified a practical knowledge gap (Miles, 2017). While the value of the DME technique is evident to the restorative dentist, tooth loss and implant placement could be consequences of overdoing the DME technique. Therefore, a clearer description of the DME and its potential outcomes must be established. Clinicians should be cautious regarding case selection when conducting this technique. When planning a DME, the proposed list could be a useful part of the examination and decision making (Table 3).

The proposed guidelines are intended to act as a direct framework for clinicians to substantiate or challenge the efficacy of this treatment methodology. During this interim period, the suggested approach aims to not only improve the utilization of DME but also to allow a wide and adaptable spectrum of treatment options in patient care. It is imperative to remember that the overarching goal is to deliver the most effective treatment options, tailored to the unique needs of each individual patient.

## 5. Conclusions and future directions

In view of the clinical case reports and series studied, a notable lack of consensus was noted regarding both pre- and post-operative evaluation methods for restorative and periodontal aspects, along with the absence of predefined success criteria for DME. Well-designed, randomized clinical trials to ascertain the long-term risks and benefits of DME are warranted. However, the challenge lies in designing and evaluating the success of these techniques without establishing case selection criteria. The introduction of the proposed preoperative checklist could be instrumental in strengthening the evidence base and determining future applicability of the DME technique.

## CRediT authorship contribution statement

**Eman H. Ismail:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Saba S. Ghazal:** Methodology, Writing – review & editing. **Rahaf D. Alshehri:** Investigation, Visualization, Writing – original draft. **Hajar N. Albisher:** Investigation, Visualization, Writing – original draft. **Rana S. Albishri:** Investigation, Visualization, Writing – original draft. **Abdulrahman A. Balhaddad:** Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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