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Clinical Periodontal Outcomes Following Deep Margin Elevation in Posterior Teeth: A Systematic Review and Meta-Analysis

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Abstract

Deep margin elevation (DME), also termed cervical margin relocation (CMR) or proximal box elevation (PBE), is a conservative alternative to surgical crown lengthening for managing deep proximal subgingival defects. However, its periodontal consequences are uncertain, particularly when restorative margins approach the supracrestal tissue attachment (STA). This systematic review and meta-analysis aimed to evaluate the periodontal effects of DME/CMR/PBE in posterior teeth compared with non-elevated margins or surgical crown lengthening, with emphasis on bleeding on probing (BoP), probing pocket depth (PPD), plaque index (PI), gingival inflammation, clinical attachment level (CAL), and radiographic bone level.

The review was conducted in accordance with PRISMA 2020. Electronic searches of MEDLINE/PubMed, Embase, CENTRAL, Scopus, and Google Scholar were conducted to identify clinical studies evaluating periodontal outcomes of DME-type procedures with at least 12 months of follow-up. Randomized trials were appraised using RoB 2 and non-randomized studies using ROBINS-I, while random-effects meta-analyses were performed where sufficient methodological homogeneity existed. The qualitative synthesis included 13 clinical studies, and four studies contributed to at least one meta-analysis.

From the findings, DME/CMR/PBE was associated with significantly higher odds of BoP than control margins (OR 2.14; 95% CI 1.27 to 3.61), with negligible heterogeneity. In contrast, no statistically or clinically meaningful difference was observed for PPD, and sensitivity analysis confirmed the robustness of this finding after excluding analytically non-standard data. Pooled PI data likewise showed no significant difference between elevated and control margins.

Even though CAL and radiographic bone outcomes were reported too infrequently and heterogeneously to permit quantitative pooling, the available studies did not suggest progressive periodontal breakdown when case selection, margin finishing, and plaque control were adequate. Inter-material comparisons revealed no clinically meaningful superiority when resin composite, resin-modified glass ionomer (RMGI), high-viscosity glass ionomer, or bioactive ionic resin were used as DME base materials. Overall, DME appears periodontally acceptable in appropriately selected posterior teeth when STA is respected and meticulous plaque control is maintained, although confidence in this conclusion is limited by the small and methodologically weak evidence base.

Categories: Dentistry
Keywords: bleeding on probing, cervical margin relocation, deep margin elevation, probing pocket depth, proximal box elevation

Introduction And Background

The latest advancements in restorative dentistry involve minimally invasive techniques that focus on tissue preservation and the application of biomimetic materials, such as composite resins, adhesive systems, and ceramics, to restore physiological function [1,2]. These materials and adhesive techniques aim to preserve tooth structure while providing adequate function and marginal integrity [1,2]. However, teeth with subgingival defects pose significant challenges in clinical practice due to the complexities of supracrestal tissue attachment (STA), which can lead to plaque accumulation, gingival inflammation, alveolar bone resorption, and, ultimately, tooth loss [3,4]. Furthermore, subgingival margins are frequently contaminated with saliva, blood, and gingival crevicular fluid; such contamination can compromise adhesive bonding. Consequently, these factors undermine bonding protocols, leading to compromised marginal seals, an increased risk of recurrent caries, and diminished restoration longevity [1,5].

The presence of subgingival margins and overhanging restorations can promote biofilm accumulation, increasing the risk of periodontal sequelae such as bleeding on probing (BoP), probing pocket depth (PPD), clinical attachment loss, and radiographic bone loss. Deep intracrevicular margins may be associated with increased gingival inflammation and are technically difficult to isolate and finish adequately [1,2]. Therefore, to achieve periodontal stability, it is crucial to maintain the STA. Historically known as "biological width", impairments in this dimension may trigger a cascade of periodontal breakdown and bone resorption. When the STA is encroached upon by carious lesions or restorative margins, periodontal inflammation and tissue remodeling may occur. This may manifest clinically as persistent gingivitis, pathological pocketing, and marginal recession [6]. The conceptual framework for this biological dimension is described in the seminal morphometric research of Gargiulo et al. (1961), who first codified the supracrestal tissue parameters [7]. Essentially, this dimension, which represents the critical soft tissue volume extending from the base of the gingival sulcus to the alveolar crest, serves as an essential protective barrier for the underlying periodontium [2].

As described by Samartzi et al. (2022), Dietschi and Spreafico introduced the margin relocation approach in 1998 [8]. Magne and Spreafico subsequently described it as "deep margin elevation" (DME) in 2012 [9]. The procedure involves applying a composite resin base over a preexisting cervical margin to facilitate its coronal relocation. This technique, also referred to as cervical margin relocation (CMR) or proximal box elevation (PBE), is executed under stringent rubber dam isolation and matrix adaptation to optimize moisture control and bonding efficacy while precluding the need for invasive tissue sacrifice [10]. Other conceptually related approaches have long been used to manage deep proximal boxes, including open-sandwich restorative strategies with glass ionomer-based materials. While these methodologies share similarities, DME was originally conceptualized as a prerequisite for indirect restorations. In contemporary practice, DME is frequently utilized in synergy with immediate dentin sealing (IDS) to augment the bond strength and marginal seal of indirect adhesive restorations. The application of adhesive resin, combined with the supragingival elevation of the margin, serves to seal the dentinal tubules, optimize preparation geometry, reinforce undermined cusps, and eliminate cervical undercuts [8-11].

However, the intracrevicular placement of DME interfaces may still infringe upon the supracrestal attachment, potentially inducing plaque accumulation and gingival inflammation. As deep margins complicate essential clinical steps such as isolation, matrix adaptation, and cervical finishing, they may trigger chronic inflammation, pocket formation, and clinical attachment loss [12,13].

Restorative encroachment upon the supracrestal attachment may be associated with inflammation and tissue remodeling [6,10,12]. The nature of tissue attachment to restorative materials remains uncertain, and a smooth restorative surface should not be assumed to reproduce the connective tissue attachment present on natural root surfaces [10,12,13].

Successful DME necessitates a highly polished and adapted interface to minimize the inflammatory response, and superior material adaptation correlates with reduced periodontal distress [8,10,13]. In DME, the irregular carious cavities that harbor bacteria and necrotic tissue are replaced with refined, biomimetic restorative surfaces [9,10]. Therefore, achieving appropriate marginal integrity through DME may optimize the tooth-restoration interface and support periodontal health [10,12,13]. Nevertheless, current literature is inconsistent regarding the long-term interaction between periodontal tissues and modern adhesive materials [12]. Concerns regarding isolation, marginal adaptation, and biological width invasion remain relevant to clinical acceptance of DME [14].

The primary objective of this review was to determine whether DME/CMR/PBE results in different periodontal outcomes than non-elevated margins or surgical crown lengthening in adults with posterior teeth presenting with deep proximal subgingival defects. Consequently, this systematic review consolidates existing data regarding DME and subgingival margins to establish evidence-based clinical recommendations, focusing specifically on longitudinal outcomes of 12 months or more.

Review

Material and methods

Protocol Design and Database Search Strategy

This systematic review and meta-analysis were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines [15].

Eligibility Criteria

The Population, Intervention, Comparison, Outcomes, and Study (PICOS) framework was used to outline the research protocols [16].

Types of Studies

Randomized controlled trials (parallel-group or split-mouth designs) and prospective or retrospective controlled clinical studies that evaluated periodontal outcomes of DME-type procedures in human participants were eligible for inclusion. Non-comparative case series, case reports, purely in-vitro or ex-vivo studies, and animal experiments were excluded from the primary analysis. However, histologic human studies and in vitro investigations were considered solely for qualitative contextualization of mechanistic findings where deemed appropriate.

Types of Participants

Eligible studies involved adolescents or adults with permanent dentitions, with a minimum participant age of 18 years required for the quantitative synthesis. Participants were required to have at least one premolar or molar exhibiting a deep proximal carious lesion or restoration margin extending subgingivally beyond the cemento-enamel junction, rendering conventional isolation and adhesive procedures technically challenging. Baseline periodontal status was required to be either clinically healthy or periodontally stabilised prior to intervention, operationally defined by the absence of untreated periodontitis, PPDs generally not exceeding 4-5 mm, and no uncontrolled plaque-induced inflammation at the tooth under study. Studies that enrolled exclusively primary teeth, mixed-dentition subjects, teeth with a hopeless periodontal prognosis, or patients with systemic conditions known to profoundly impair periodontal wound-healing, such as uncontrolled diabetes mellitus or pharmacological immunosuppression, were excluded when these constituted explicit exclusion criteria in the original trial.

Interventions

The intervention of interest comprised clinical techniques intended to coronally relocate a deep subgingival cervical or proximal margin prior to definitive restoration, described in the literature as DME, CMR, or PBE [3,8,10]. Eligible adhesive base materials used to achieve margin relocation included flowable or packable resin composites (encompassing conventional, bulk-fill, and highly filled injectable formulations), resin-modified glass ionomer (RMGI) cements, high-viscosity glass ionomer cements, and bioactive ionic restorative resins, applied according to standardized adhesive bonding protocols. These procedures were accepted irrespective of the type of subsequent definitive restoration, including laboratory-processed or CAD/CAM lithium disilicate and resin-matrix ceramic partial crowns and onlays, CAD/CAM composite overlays, and complex multi-increment direct composite build-ups. Studies that performed DME as an integral component of multi-step pre-endodontic build-up therapy were considered eligible, provided that periodontal outcomes were reported at or after the final restorative stage.

Comparators

Three categories of eligible comparators were pre-specified. First, non-elevated margins on the same tooth or in the same patient were accepted, including supragingival or equigingival margins prepared without DME, and sound contralateral proximal surfaces used as periodontal reference controls. This encompassed split-tooth designs in which one proximal surface received DME/CMR/PBE while the contralateral surface was restored with a conventional shoulder or chamfer margin directly luted to tooth structure, as well as designs in which the opposing proximal surface was left unrestored. Second, surgical crown lengthening was an eligible active comparator, defined as an apically repositioned full-thickness flap procedure with interproximal osseous recontouring to re-establish a physiological STA zone prior to indirect restoration placement. Third, head-to-head comparisons between different DME materials, conducted under otherwise clinically equivalent conditions, were accepted as eligible inter-material comparisons. For example, flowable resin composite versus RMGI, or high-viscosity glass ionomer versus injectable composite versus bioactive ionic resin. Studies lacking an explicit comparator group, such as single-arm cohorts without internal periodontal controls, were not included in the primary quantitative comparisons but were utilized in narrative synthesis for their clinically informative periodontal data.

Primary Outcomes

The primary outcomes of this review were periodontal parameters assessed at or in direct proximity to the restored deep margin. Studies were eligible for the quantitative synthesis if they reported at least one of the following pre-specified primary outcomes. BoP was defined as the presence, absence, or proportion of sites demonstrating gingival hemorrhage upon standardized sulcular probing at the deep-margin-elevated surface relative to the designated comparator surface or tooth. PPD was defined as the linear distance in millimeters from the free gingival margin to the base of the clinical sulcus or pocket at sites adjacent to the DME, reported as a group mean with a measure of dispersion and/or categorical frequency distribution. Gingival inflammation indices were primarily the gingival index (GI) according to Löe and Silness [17] or a formally equivalent ordinal scoring system. These were recorded at test and comparator surfaces as measures of soft tissue inflammatory status. Clinical attachment level (CAL) was defined as the linear distance in millimeters from a fixed reference point, either the restoration margin or the cemento-enamel junction, to the base of the periodontal pocket or sulcus, as a measure of connective tissue attachment. Radiographic crestal bone level or bone loss was expressed as the linear distance between the restoration margin and the radiographically visible alveolar bone crest measured on standardized periapical or bitewing radiographs, or as the categorical presence or absence of radiographically detectable bone loss across designated follow-up

intervals. In studies reporting multiple periodontal parameters or data across several follow-up time points, all available data were extracted. For meta-analysis purposes, a pre-specified analytical hierarchy was applied: data from the 12-24-month follow-up interval were preferred over shorter-term assessments where both were available, and BoP and PPD were prioritized as the most consistently reported outcomes across the included evidence base.

Secondary Outcomes

Secondary outcomes comprised restorative and biological endpoints that served to contextualize the primary periodontal findings without governing study eligibility. These outcomes, including restoration survival, marginal adaptation, and inter-material comparisons, were not treated as formal review endpoints but synthesized only narratively. Eligibility, quantitative synthesis, and certainty assessment were driven exclusively by the pre-specified periodontal outcomes.

Database Selection and Search Strategy

Search strategy: A systematic electronic search was conducted independently by two researchers in the following databases: MEDLINE via PubMed, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, and Google Scholar, for articles published from January 1, 2010, to March 2026. The search strategy was constructed using controlled vocabulary terms (MeSH for MEDLINE, Emtree for Embase) and free-text keywords, combining terms related to the intervention (DME, CMR, PBE, subgingival margin elevation, deep margin relocation), the tooth type and pathology (posterior teeth, proximal caries, subgingival defect, subgingival restoration margin, cervical caries), and the outcomes of interest (periodontal health, BoP, probing depth, GI, CAL, and alveolar bone level). The search strategies used for each database are presented in Table *1*.

Database	Search string
PubMed/MEDLINE	(("deep margin elevation"[Title/Abstract]) OR ("cervical margin relocation"[Title/Abstract]) OR ("coronal margin relocation"[Title/Abstract]) OR ("proximal box elevation"[Title/Abstract]) OR ((deep[Title/Abstract]) AND (margin[Title/Abstract]) AND (elevation[Title/Abstract]))) AND (("composite resins"[MeSH Terms] OR ("resin-modified glass ionomer"[Title/Abstract] OR (periodontal[Title/Abstract] OR gingival[Title/Abstract] OR plaque[Title/Abstract] OR probing[Title/Abstract] OR "bleeding on probing"[Title/Abstract]) OR "clinical performance"[Title/Abstract]))
Embase (Ovid)	('deep margin elevation'/exp OR 'deep margin elevation':ti,ab OR 'cervical margin relocation':ti,ab OR 'proximal box elevation':ti,ab) AND ('composite resin'/exp OR composite:ti,ab OR 'resin modified glass ionomer':ti,ab) AND ('periodontal disease'/exp OR periodontal:ti,ab OR gingival:ti,ab OR plaque:ti,ab OR 'bleeding on probing':ti,ab OR adaptation:ti,ab)
Scopus (Elsevier)	TITLE-ABS-KEY("deep margin elevation" OR "cervical margin relocation" OR "coronal margin relocation" OR "proximal box elevation") AND TITLE-ABS-KEY("composite" OR "resin composite" OR "adhesive" OR "resin-modified glass ionomer") AND TITLE-ABS-KEY(periodontal OR gingival OR "bleeding on probing" OR "clinical performance")
Cochrane Central Register of Controlled Trials (CENTRAL) (via Cochrane Library)	"deep margin elevation" OR "cervical margin relocation" OR "coronal margin relocation" OR "proximal box elevation" AND (composite OR adhesive OR "resin modified glass ionomer") AND (periodontal OR gingival OR probing OR adaptation)
Google Scholar	"deep margin elevation" OR "cervical margin relocation" OR "proximal box elevation" composite OR "resin-modified glass ionomer" OR periodontal

TABLE 1: Database-specific search strings.

MEDLINE: Medical Literature Analysis and Retrieval System Online; MeSH: Medical Subject Headings

Study selection: All retrieved citations were imported into a reference management platform (Zotero, Corporation for Digital Scholarship, Vienna, Virginia, US), and duplicate records were removed prior to screening. Two researchers independently screened titles and abstracts against the pre-specified eligibility criteria in the first stage, followed by independent full-text assessment of all potentially eligible reports in the second stage. Disagreements at either stage were resolved through discussion and, where consensus could not be reached, by adjudication from a third reviewer. The reasons for exclusion at full-text screening were documented for each excluded study. Multiple publications describing the same clinical cohort at different follow-up intervals were treated as a single study and linked accordingly to preclude double-counting of participants.

Data extraction: A standardized, pilot-tested data extraction form was used by two independent reviewers to collect the information from each included study. For split-mouth and within-tooth designs, data from the intervention and control surfaces were extracted separately. All discrepancies in extracted data were reconciled by discussion or by referral to a third reviewer.

Risk of bias assessment: The methodological quality of included randomized controlled trials was assessed independently by two reviewers using the revised Cochrane Risk of Bias tool (RoB 2), which evaluates five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result [18]. Non-randomized and observational studies were assessed using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool, which evaluates bias arising from confounding, participant selection, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes, and selective reporting [19]. Disagreements were resolved by discussion and, if required, by a third reviewer. The ratings were imported into the robvis package to generate risk-of-bias traffic-light plots and summary bar plots for the non-randomized evidence [20].

Data synthesis and statistical analysis: Where sufficient clinical and methodological homogeneity existed across studies, random-effects meta-analyses were performed in RevMan using inverse-variance methods for both dichotomous and continuous outcomes [21]. Statistical heterogeneity was quantified using the I^2 statistic and the Cochran Q test, with I^2 values of 25%, 50%, and 75% interpreted as low, moderate, and substantial heterogeneity, respectively [22]. Sensitivity analyses were prespecified for studies requiring transformed or derived variance estimates. Where heterogeneity was substantial or pooling was not suitable due to methodological diversity, results were presented as a narrative synthesis. All statistical analyses were performed using Review Manager (RevMan) (RevMan Web, Version 10.5.0; The Cochrane Collaboration, London, United Kingdom).

Certainty of evidence: The certainty of the body of evidence for each primary periodontal outcome was assessed using the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework, which considers study design, risk of bias, inconsistency, indirectness, imprecision, and publication bias [23]. Evidence was rated as high, moderate, low, or very low certainty, and the summary of findings tables were constructed accordingly.

Results

Database Search Yields

Database searches identified 998 records, comprising 417 from PubMed/MEDLINE, 274 from Scopus, 96 from Embase, 11 from Cochrane CENTRAL, and 200 from Google Scholar. Before screening, 585 records were removed, including 538 duplicate records, 30 records marked as ineligible by automation tools, and 17 records removed for other reasons. This left 413 records for title and abstract screening, out of which 247 records were excluded and 166 reports were sought for retrieval. Thirty-two reports could not be retrieved, leaving 134 full-text reports for eligibility assessment. A total of 121 reports were excluded because of different outcomes (n = 103), ineligible study design (n = 15), or case reports/series (n = 3). Thirteen studies were included in the review, of which four contributed to at least one meta-analysis. The study selection process is shown in Figure *1*.

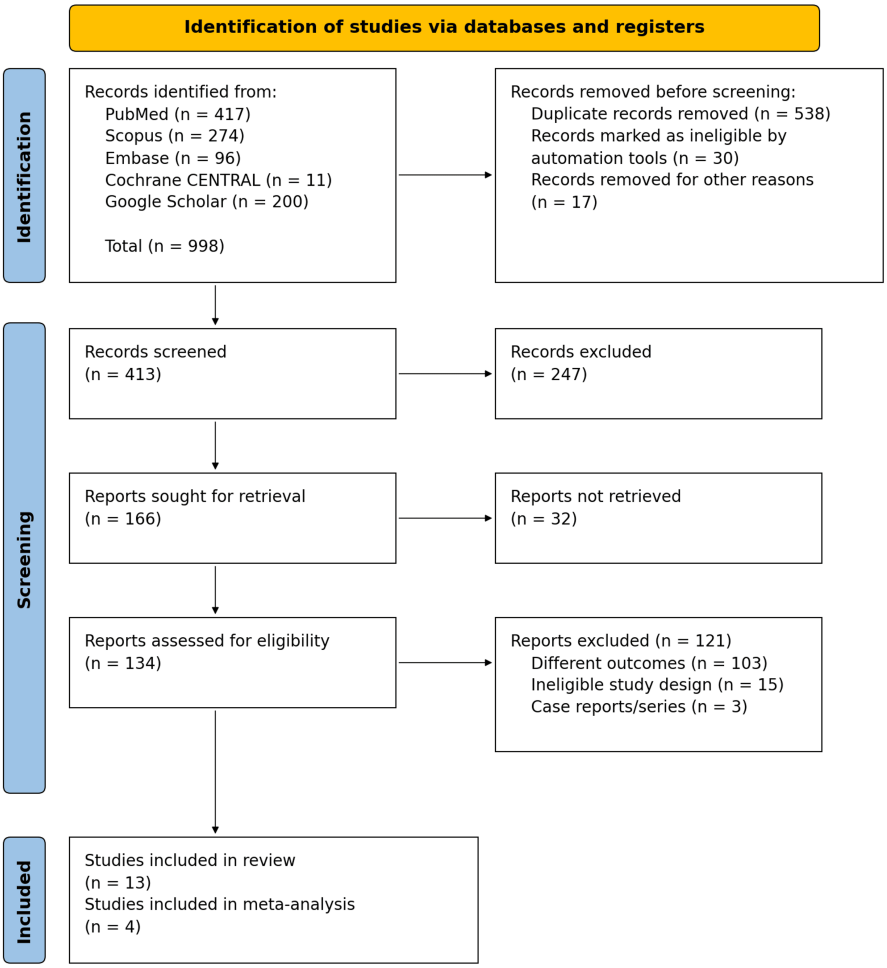


FIGURE 1: PRISMA 2020 flow diagram of database search and article selection process.

Data Synthesis

Study selection and characteristics: Thirteen clinical studies evaluating DME, CMR, or PBE in posterior teeth met the inclusion criteria and were qualitatively synthesised [24-36]. These comprised randomized controlled trials, prospective split-mouth or controlled cohort studies, and retrospective clinical series, with follow-up ranging from 12 to 36 months for periodontal outcomes and up to 12 years for restorative survival [24-36]. Studies were categorized as comparative periodontal studies, inter-material comparisons, or qualitative-only contextual studies. Quantitative meta-analyses were performed when outcomes, time-points, and effect measures were sufficiently homogeneous; otherwise, results were summarized narratively. Included study characteristics are summarized in Table *2*.

Name/year	Design	Location	Participants/sample	Control	Intervention	Results	Key findings
Al-Aggan et al. (2025) [24]	Randomized clinical trial	Cairo, Egypt (Al-Azhar University)	42 participants (42 proximal defects)	RMGI group vs. Flowable Composite group	CMR using flowable resin composite vs. resin-modified glass ionomer (RMGI)	No significant difference between materials at any time interval; significant variation from baseline to 6/12 months in both	Both flowable composite and RMGI are effective for CMR over one year.
Aksaka et al. (2025) [25]	Prospective controlled trial (3-yr follow-up)	Turkey (Istanbul Medipol University)	39 patients (42 restorations)	Natural intact opposite proximal surfaces	Indirect resin composite (IRC) with PBE	No significant differences in PI, GI, or BoP vs. control at any time point up to 3 years	High technical precision and patient hygiene facilitate 3-year periodontal stability.
		UAE				10-year survival: 95.8% (DME)	

Aziz et al. (2024) [26]	Retrospective multicentre study	(University of Sharjah/7 practices)	380 patients (426 crowns)	CAD-CAM crowns without DME	CAD-CAM lithium disilicate (LD) crowns with DME	vs. 94.7% (Control); no significant difference in periodontal parameters	Periodontal tissue integrity is not affected by DME even after 10 years.
Bertoldi et al. (2018) [27]	Prospective clinical and histological study	Italy (Univ. of Modena and Reggio Emilia)	8 healthy patients (residual teeth)	Gingiva close to hard dental tissue on the same tooth	Gingiva close to subgingival composite (DME)	No statistically significant difference in inflammation level (p=0.11)	Human histological evidence shows composite restorations are biocompatible in subgingival areas.
Bresser et al. (2019) [28]	Retrospective clinical study (up to 12 years)	Switzerland (Montreux)	120 patients (197 restorations)	Ceramic vs. Composite	Partial indirect restorations with DME	Cumulative survival rate of 95.9% up to 12 years; composite showed more degradation than ceramic	Twelve-year survival is high; endodontic treatment may increase fracture risk.
El-Ma'aita et al. (2024) [29]	Retrospective clinical study	Jordan (Jordan University Hospital)	25 patients (28 teeth)	Non-DME sites on the same teeth	DME with resin composite + indirect restorations	Success rate 96.6%; no significant difference in Gingival Index (GI) between DME and non-DME sites	Distance to bone (DME margin) did not correlate with inflammation or pockets.
Farouk et al. (2023) [30]	Randomized controlled trial	Egypt (Cairo University)	20 proximal cavities	Surgical Crown Lengthening (CL)	Deep Margin Elevation (DME)	DME group showed significantly lower CAL and Probing Depth (PD) at 9/12 months vs. CL	DME is more conservative, reducing visits and time while maintaining attachment stability.
Ferrari et al. (2018) [31]	Controlled clinical trial (prospective)	Italy (University of Siena)	35 patients (35 restorations)	Shoulder preparations (luted to natural tooth)	Cervical Margin Relocation (CMR)	CMR associated with significantly higher Bleeding on Probing (BoP) at 12 months (53% vs. 31.5%)	CMR is a sensitive technique; deep subgingival margins may impact biological width.
Gözetici-Çil et al. (2024) [32]	Prospective clinical trial	Turkey (Istanbul Medipol University)	63 patients (80 restorations)	Evaluated quality of restorations over 3 years	PIRC restorations with PBE	Success 87.5%, survival 93.8% at 3 years; main failure reason was fracture	Overlay restorations have 8x higher risk of failure than onlays; PBE may enhance adhesion.
Hausdörfer et al. (2024) [33]	Prospective controlled trial	Germany (UMC Göttingen)	68 patients (77 restorations)	Supragingival/equigingival margins on opposite tooth surface	Proximal DME + CAD/CAM ceramic restorations	1-year: BoP significantly increased for DME (73.8%) compared to control (44.3%)	Gingival inflammation should be expected with DME treatment.
Hausdörfer et al. (2025) [34]	Prospective Controlled Trial (2-yr follow-up)	Germany (UMC Göttingen)	51 patients (57 restorations)	Supragingival/equigingival margins on opposite tooth surface	DME + CAD/CAM lithium disilicate partial restorations	BoP at DME sites remained high (70.2%); PPD was significantly greater at DME vs. control (2.78 vs. 2.54mm)	Periodontal status remains stable after the first year; PD differences were small.
Muscholl et al. (2022) [35]	Retrospective clinical evaluation	Germany (Heidelberg & Tübingen Hospitals)	63 patients	Sound tooth	Subgingival composite resin restorations with DME	No significant difference in BoP, GBI, or PCR vs. control; 70% rated excellent or good	Smooth, well-finished margins are tolerated without inflammatory irritation.
Roshdy et al. (2026) [36]	Randomized clinical trial	Egypt (Mansoura University)	64 patients (4 groups of 16)	Comparative study of 4 DME materials	DME with injectable materials (HVGI, ICR, RMGI, BAIR) + CAD/CAM onlays	100% survival at 3 years; significant increase in GI over time for all groups, but no difference between materials	All tested injectable materials were successful over 3 years; bioactivity is a promising factor.

TABLE 2: Characteristics and key outcomes of included studies.

Abbreviations: BAIR, bioactive ionic resin; BoP, bleeding on probing; CAD-CAM, computer-aided design and computer-aided manufacturing; CAL, clinical attachment level; CL, crown lengthening; CMR, cervical margin relocation; DME, deep margin elevation; GBI, gingival bleeding index; GI, gingival index; HVGI, highly viscous glass ionomer; ICR, high-filled injectable composite resin; IRC, indirect resin composite; LD, lithium disilicate; PBE, proximal box elevation; PCR, plaque control record; PD, probing depth; PI, plaque index; PIRC, partial indirect resin composite; PPD, probing pocket depth; RMGI, resin-modified glass ionomer; UAE, United Arab Emirates; UMC, University Medical Center; Univ., university; vs., versus; yr, year; mm, millimeters.

Risk of Bias Within Studies

Risk of Bias in Randomized Trials (RoB 2.0): Four randomized controlled trials were assessed with the RoB 2.0 tool [18]. One trial was judged at low risk of bias across all domains, and three trials were rated as having some concerns, mainly related to the randomization process or incomplete information about it.

In the multi-arm trial by Roshdy et al. (2026) [36], random sequence generation and allocation concealment were clearly described, deviations from intended interventions were unlikely, follow-up was complete, and outcome assessment appeared unlikely to be materially influenced by lack of blinding. Therefore, all RoB 2.0 domains, including the overall judgment, were rated as low risk. Farouk et al. (2023) [30] also described appropriate sequence generation and concealment, standardized surgical and restorative protocols, and blinded outcome assessment, but some loss to follow-up without detailed reasons led to a judgment of some concerns for the "missing outcome data" domain and overall. In Al-Aggan et al. (2025) [24], treatment was allocated using sealed envelopes, but the process of sequence generation was not fully detailed, resulting in some concerns for bias arising from the randomization process; all other domains were considered low risk. Ferrari et al. (2018) [31] employed a split-mouth coin-flip allocation at the proximal-surface level without clear allocation concealment, and blinding of outcome assessors was unlikely because restoration margin designs were clinically visible. Accordingly, the randomization and outcome-measurement domains were both rated as some concerns, and the overall risk of bias was judged as some concerns. The risk-of-bias assessments for randomized trials are shown in Figure 2.

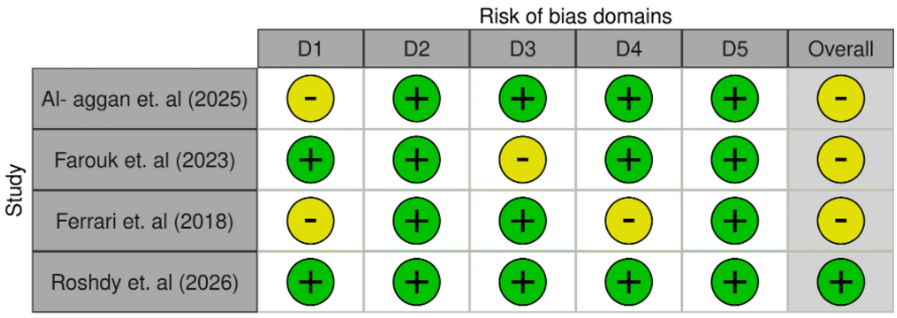


FIGURE 2: Risk of bias in randomized controlled trials (RoB 2 traffic-light plot), assessed with the revised Cochrane RoB 2.0 tool.

Colors indicate low risk (green) and some concerns (yellow). Domains assessed were as follows; D1: Bias arising from the randomization process, D2: Bias due to deviation from the intended intervention, D3: Bias due to missing outcome data, D4: Bias in the measurement of Outcome, D5: Bias in the selection of reported results.

Risk of Bias in Non-randomized Studies (ROBINS-I): Nine non-randomized studies (prospective controlled studies, retrospective cohorts, and a histologic clinical study) were assessed with ROBINS-I [19]. None of these studies were judged to be at low overall risk of bias; one was rated at critical risk, and the remaining eight at serious risk of bias overall, driven predominantly by confounding, selection processes, and missing data.

All studies were judged to be at least serious risk of bias due to confounding (D1) because DME or crown margin position was allocated based on defect anatomy, treatment indication, or restorative planning, rather than randomization. Additionally, important prognostic factors such as baseline periodontal status, defect depth, and patient-level plaque control could not be fully controlled. Selection of participants (D2) was commonly rated moderate or serious. As most cohorts were assembled from university or specialist practices and required attendance at recall, more compliant patients were potentially selected, with possible survivor bias for long-term series. Across all non-randomized studies, classification of interventions (D3) and deviations from intended interventions (D4) were consistently judged at low risk, as DME or margin status was clearly defined a priori, and restorative and surgical protocols were standardized. In contrast, missing data (D5) and measurement of outcomes (D6) contributed substantially to overall risk: several cohorts had substantial loss to follow-up or inclusion restricted to patients returning for recall, and periodontal outcomes were usually assessed by examiners who could not be blinded to the presence and position of DME or crown margins. Risk of bias in selection of the reported result (D7) was generally considered low, as studies reported the main periodontal and restorative outcomes specified in their methods.

The long-term retrospective survival study by Bresser et al. (2019) [28] was judged at critical overall risk because of unmeasured confounding, survivor bias, and limited periodontal outcome detail, despite clearly classified interventions and consistent operative protocols. The remaining observational studies, namely, Aksaka et al. (2025) [25], Aziz et al. (2024) [26], Bertoldi et al. (2018) [27], El-Ma'aita et al. (2024) [29], Gözetici-Çil et al. (2024) [32], Hausdörfer et al. (2024) [33], Hausdörfer et al. (2025) [34], and Muscholl et al. (2022) [35], were all judged at serious overall risk, largely due to non-randomized treatment allocation, clinic-based or convenience sampling, incomplete follow-up, and the impossibility of fully blinded periodontal assessment. The risk-of-bias assessments for non-randomized studies are shown in Figure 3.

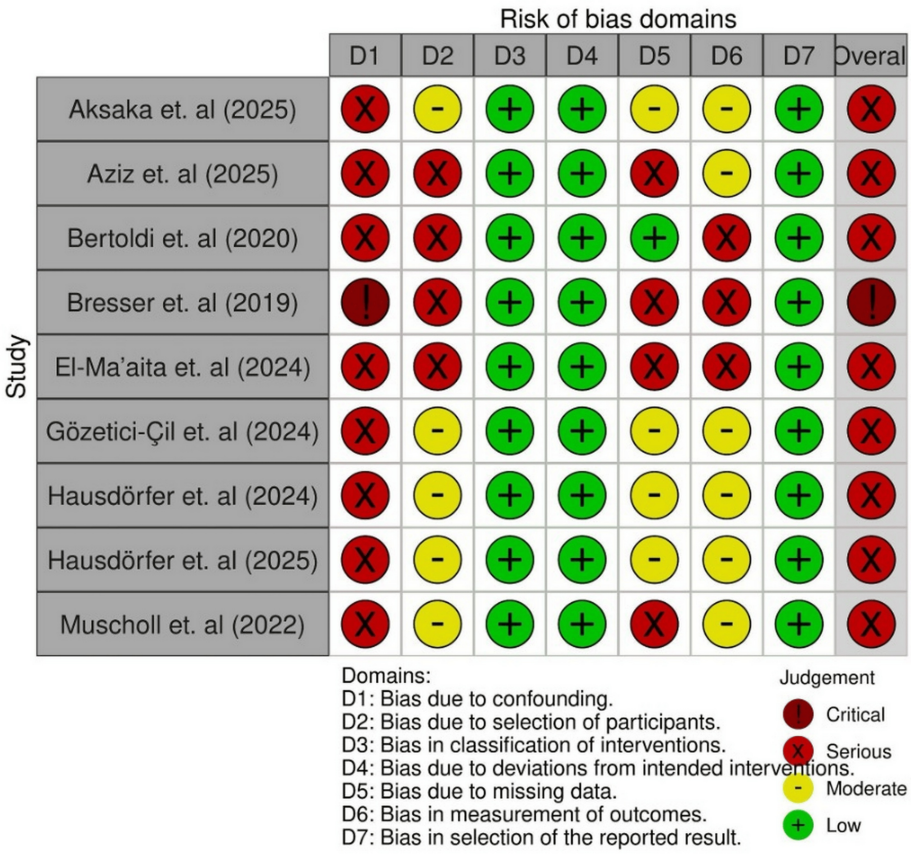


FIGURE 3: Risk of bias in non-randomized studies (ROBINS-I traffic-light plot).

Meta-Analysis of Periodontal Outcomes

Across the included clinical studies, meta-analysis focused on three prespecified periodontal outcomes: BoP, PPD, and plaque index (PI), with PPD additionally subjected to sensitivity analysis.

Bleeding on Probing (BoP): The prospective controlled trials done by Aksaka et al. (2025) [25], Ferrari et al. (2018) [31], and Hausdörfer et al. (2025) [34] provided dichotomous BoP data at the longest available follow-up, contributing 122 proximal sites in each arm. All three trials compared DME or related techniques (DME/CMR/PBE) with non-elevated margins on the same tooth or contralateral tooth surface, under otherwise comparable restorative conditions. When pooled using a random-effects model with BoP-positive sites as events, DME/CMR/PBE was associated with significantly higher odds of bleeding compared with control margins (odds ratio 2.14; 95% CI 1.27 to 3.61; p = 0.004). The pooled results for BoP are shown in Figure *4*.

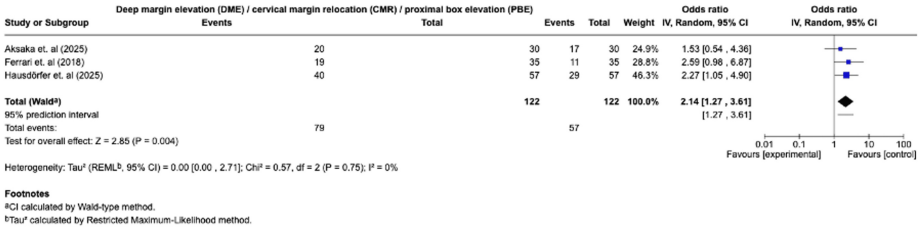


FIGURE 4: Forest plot of bleeding on probing for DME/CMR/PBE versus control margins.

Forest plot shows odds ratios for BoP-positive sites comparing deep margin elevation/cervical margin relocation/proximal box elevation (experimental) with non-elevated or sound proximal surfaces (control) across three prospective controlled trials (Aksaka et al., 2025 [25], Ferrari et al., 2018 [31], Hausdörfer et al., 2025 [34]) at the longest available follow-up.

Squares represent individual study estimates, horizontal lines indicate 95% CIs, and the diamond represents the pooled estimate.

Abbreviations: CI, confidence interval; IV, inverse variance; REML, restricted maximum likelihood; df, degrees of freedom; BoP, bleeding on probing; DME, deep margin elevation; CMR, cervical margin relocation; PBE, proximal box elevation.

Probing pocket depth (PPD): The controlled clinical studies done by Farouk et al. (2023) [30], Ferrari et al. (2018) [31], Hausdörfer et al. (2025) [34], and Aksaka et al. (2025) [25] reported continuous PPD data and were included in the primary PPD meta-analysis. The pooled random-effects analysis demonstrated no statistically significant or clinically relevant difference in PPD between DME and control margins (mean difference -0.05; 95% CI -0.33 to 0.23; p = 0.73). Although heterogeneity was moderate in magnitude, visual inspection of the forest plot showed that all trial-level effects were small and clustered around the line of no effect. This suggests that between-study variability is due to minor design and comparator differences rather than conflicting biological signals. Differences in comparator types, particularly surgical crown lengthening versus non-elevated margins, may have contributed to the observed heterogeneity and should be considered when interpreting the pooled estimate. The pooled results for PPD are shown in Figure *5*.

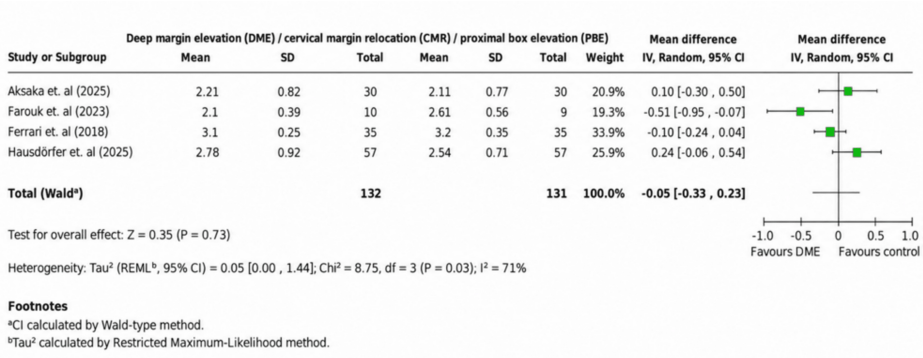


FIGURE 5: Forest plot of probing pocket depth (PPD) for DME/CMR/PBE versus control margins.

Forest plot presents mean differences in PPD (mm) between teeth restored with deep margin elevation (experimental) and those with supragingival/equigingival or sound proximal surfaces (control), based on controlled clinical studies by Farouk et al. (2023) [30], Ferrari et al. (2018) [31], Hausdörfer et al. (2025) [34], and Aksaka et al. (2025) [25]. Squares represent individual study estimates, horizontal lines indicate 95% CIs, and the diamond represents the pooled estimate.

Abbreviations: DME, deep margin elevation; CMR, cervical margin relocation; PBE, proximal box elevation; mm, millimeters; SD, standard deviation; CI, confidence interval; IV, inverse variance; REML, restricted maximum likelihood; df, degrees of freedom.

A prespecified sensitivity analysis excluded the Aksaka et al. (2025) [25] trial, which reported trimmed means and standard errors rather than raw means and standard deviations, thereby avoiding reliance on derived dispersion parameters. In this three-study model comprising Farouk et al. (2023) [30], Ferrari et al. (2018) [31], and Hausdörfer et al. (2025) [34], the pooled mean difference in PPD remained very close to zero,

with confidence intervals again easily encompassing no effect. Heterogeneity increased from 71% to 82%, while the pooled effect remained non-significant (mean difference -0.10 mm; 95% CI -0.48 to 0.28; p = 0.62). The inclusion or exclusion of Aksaka et al. (2025) [25] therefore did not alter the finding of no statistically significant difference in PPD. The sensitivity analysis is shown in Figure *6*.

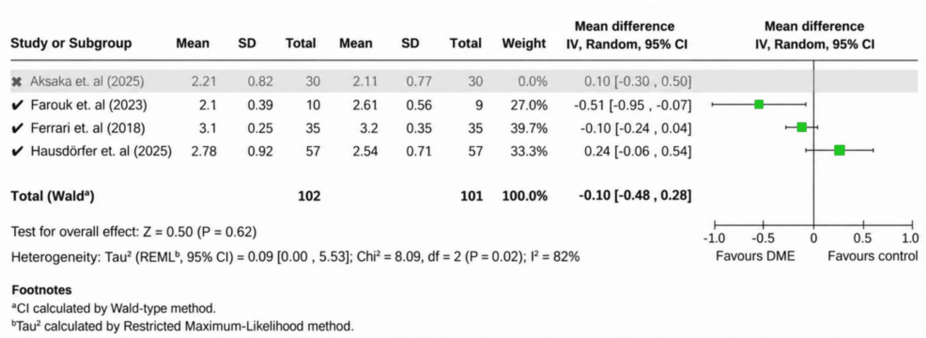


FIGURE 6: Sensitivity analysis forest plot of probing pocket depth.

Forest plot displays a sensitivity meta-analysis of PPD that includes only studies reporting conventional mean ± standard deviation, namely, Farouk et al. (2023) [30], Ferrari et al. (2018) [31], and Hausdörfer et al. (2025) [34]. Aksaka et al. (2025) [25] was excluded because it reported trimmed means with standard errors. The shaded row identifies the excluded study with zero weight. Squares represent individual study estimates, horizontal lines indicate 95% CIs, and the diamond represents the pooled estimate.

Abbreviations: DME, deep margin elevation; SD, standard deviation; CI, confidence interval; IV, inverse variance; REML, restricted maximum likelihood; df, degrees of freedom.

Two split-mouth trials, Aksaka et al. (2025) [25] and Hausdörfer et al. (2025) [34], contributed data on PI, measured as a continuous outcome at 24-36 months. In both studies, mean PI scores were low in absolute terms and differed only minimally between DME and control sites. The pooled random-effects meta-analysis showed no significant difference in PI (mean difference -0.05; 95% CI -0.28 to 0.18; p = 0.68), with low heterogeneity (I^2 ≈13%). These findings indicate that subgingival composite or elevated margins, when meticulously finished and maintained in patients with adequate oral hygiene, do not intrinsically promote plaque accumulation. The pooled results for PI are shown in Figure *7*.

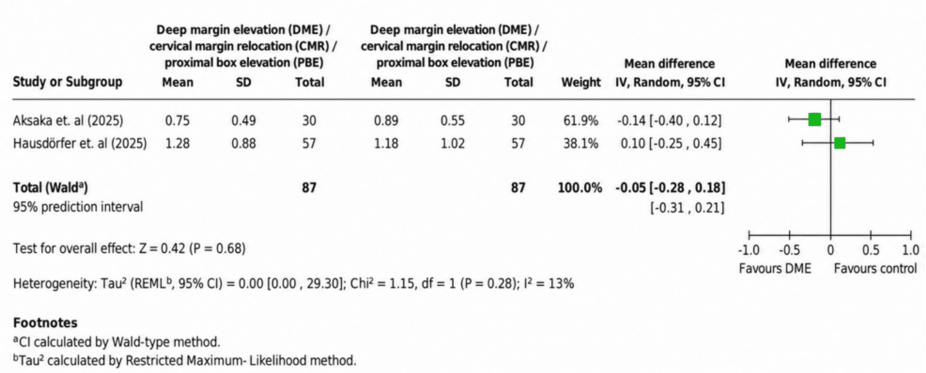


FIGURE 7: Forest plot of plaque index for DME/CMR/PBE versus control margins.

Forest plot shows the effect of deep margin elevation/cervical margin relocation on plaque accumulation, expressed as mean differences in PI scores between elevated and control proximal surfaces in two split-mouth clinical trials by Aksaka et al. (2025) [25] and Hausdörfer et al. (2025) [34]. Squares represent individual study estimates, horizontal lines indicate 95% CIs, and the diamond represents the pooled estimate.

Abbreviations: DME, deep margin elevation; CMR, cervical margin relocation; PBE, proximal box elevation; SD, standard deviation; CI, confidence interval; IV, inverse variance; REML, restricted maximum likelihood; df, degrees of freedom.

Clinical Attachment Level (CAL)

CAL data were available from a limited number of studies with heterogeneous comparators and were therefore not pooled quantitatively. In the randomized trial by Farouk et al. (2023) [30], the DME arm showed lower CAL values than the crown-lengthening arm at 12 months. Conversely, the retrospective cohort by Muscholl et al. (2022) [35] reported slightly greater CAL at restored DME sites than at the contralateral sound teeth, an expected finding when comparing previously diseased/restored surfaces with untouched controls. GI and gingival bleeding index (GBI) showed patterns consistent with the BoP and PI results-mildly higher inflammation scores adjacent to some DME margins in individual trials but no evidence of progressive periodontal deterioration with adequate plaque control.

Histological Evidence

One small prospective human histological study by Bertoldi et al. (2018) [27] provided mechanistic contextual evidence that was not suitable for quantitative pooling. In eight healthy patients, gingival tissue adjacent to subgingival composite showed inflammation scores similar to tissue adjacent to natural tooth structure within the same tooth, with mean values of 3.75 ± 0.26 and 3.62 ± 0.38, respectively, and no statistically significant difference ($p = 0.11$).

Effects of DME Materials on Periodontal Indices

Two randomized clinical trials compared gingival responses to different cervical base materials used for DME/CMR. In the four-arm RCT by Roshdy et al. (2026) [36], GI increased modestly from baseline in all groups. However, there were no statistically significant differences at any time point between high-viscosity glass ionomer, high-filled injectable composite, RMGI, or bioactive ionic resin, and all groups showed similarly favorable FDI functional and biological scores over three years. In the trial done by Al-Aggan et al. (2025) [24], GI rose slightly over the first year in both the flowable composite and RMGI groups, yet inter-group differences remained non-significant, with most sites confined to no or mild inflammation categories. Collectively, current evidence does not suggest any clinically meaningful periodontal advantage or disadvantage of using one DME base material over another in patients with well-finished margins and adequate plaque control.

Taken together, the meta-analyses indicate that, relative to non-elevated or sound margins, DME/CMR/PBE is associated with a modest and statistically significant increase in BoP but no meaningful changes in PPD or plaque accumulation. Additionally, there is insufficient evidence to demonstrate a consistent adverse effect on clinical attachment.

Certainty of Evidence

The GRADE summary of findings table indicates low certainty of evidence for BoP, PPD, and PI, reflecting limitations related to risk of bias, inconsistency, and imprecision across outcomes. These findings should therefore be interpreted cautiously. The certainty of evidence is summarized in Table *3*.

Outcome	Effect estimate (95% CI)	Sample size (studies)	Certainty of evidence (GRADE)	Reasons for downgrading	Summary of findings
Bleeding on probing	OR 2.14 (1.27 to 3.61)	244 (3 studies)	Low	Risk of bias: non-randomized designs and some concerns in the RCT. Imprecision: modest total sample.	DME/CMR/PBE was associated with increased bleeding compared with non-elevated margins.
Probing pocket depth (PPD)	MD -0.05 mm (-0.33 to 0.23)	263 (4 controlled studies)	Low	Risk of bias: serious risk in non-randomized studies and some concerns in RCTs. Inconsistency: heterogeneity and different comparators.	No statistically significant difference in probing pocket depth was detected between groups.
Plaque index (PI)	MD -0.05 (-0.28 to 0.18)	174 (2 controlled studies)	Low	Risk of bias: serious ROBINS-I ratings and some concerns in RCTs. Imprecision: modest total sample.	No statistically significant difference in plaque accumulation was detected between groups.

TABLE 3: GRADE summary of findings for periodontal outcomes following deep margin elevation.

Population: Adults with posterior teeth exhibiting deep proximal subgingival defects. Setting: University or specialist clinics; follow-up of 12-36 months. Intervention: DME/CMR/PBE. Comparators: Surgical crown lengthening, supragingival/equigingival margins, or sound contralateral surfaces.

Low certainty indicates limited confidence in the effect estimate; the true effect may differ substantially from the estimate. For bleeding on probing, the reported sample size of 244 represents 122 evaluated proximal sites in each group rather than 244 independent participants.

Abbreviations: GRADE, Grading of Recommendations Assessment, Development and Evaluation; DME, deep margin elevation; CMR, cervical margin relocation; PBE, proximal box elevation; PPD, probing pocket depth; PI, plaque index; OR, odds ratio; MD, mean difference; CI, confidence interval; RCT, randomized controlled trial; ROBINS-I, Risk of Bias in Non-randomized Studies of Interventions

Discussion

DME appears periodontally acceptable in many clinical settings when the restorative margin is kept clear of the alveolar crest and plaque control is good, but the evidence does not prove periodontal neutrality with high confidence. The most consistent adverse signal is more BoP around relocated deep margins. Probing depth is usually stable and remains within healthy ranges. Clinical attachment loss and bone effects are the least certain outcomes because they are reported infrequently and inconsistently. Recent reviews have increasingly described DME as biologically compatible when STA is respected, while still emphasizing that the underlying evidence base is small, overlapping, and methodologically weak [1,2,5,37].

Bleeding on Probing (BoP)

BoP is the outcome that most often raises concern across the review set. Three controlled trials that directly compared DME/CMR/PBE with contralateral or supragingival margins demonstrated significantly higher odds of BoP at elevated sites, with a pooled odds ratio of approximately 2 and negligible statistical heterogeneity [25,31,34]. This aligns with several observational series and RCTs that reported higher GI or BoP frequencies around subgingival composite margins, particularly when the restorative margin lies close to the alveolar crest or when patient-level plaque control is suboptimal [24,29,33,35]. Chun et al. (2023) [1] identified increased bleeding as the main recurring periodontal finding, especially when the restorative margin approached about 2 mm from the bone crest. Felemban et al. (2023) [2] reached a similar reading. Although the findings of the systematic review by Srirama et al. (2024) [37] were more reassuring, that review was based on a small body of studies. Priya et al. (2025) [5] stated the clearest cumulative finding: bleeding may rise early around DME sites, but it is usually mild and may stabilize with time and maintenance. The most defensible interpretation is therefore not that DME is periodontally silent, but that its main measurable biological risk is increased localized gingival inflammation, which usually manifests as more BoP rather than as destructive periodontal disease.

Probing Pocket Depth (PPD)

The available evidence for PPD suggests no statistically significant pooled difference between DME and control margins, although substantial heterogeneity limits the certainty of this finding. The pooled analysis of four controlled clinical studies showed no statistically or clinically meaningful difference in PPD between DME/CMR/PBE and control margins, with mean values in both groups remaining in the 2-3 mm range that defines periodontal health [25,30,31,34]. A targeted sensitivity analysis excluding the trial reporting trimmed means with standard errors was done. It yielded a similarly non-significant pooled effect estimate, although heterogeneity increased from 71% to 82%, indicating that the absence of a statistically significant

PPD difference was unchanged by exclusion of the trial [30,31,34]. Additional prospective and retrospective cohorts that were not included in the meta-analysis for methodological reasons likewise report stable PPD around DME sites over follow-up periods of up to three years, even when margins are placed in proximity to the bone crest, provided that meticulous finishing and supportive periodontal care are in place [29,32,33,35]. Chun et al. (2023) [1] found limited evidence but no strong pattern of pathologic pocket formation. Similarly, Srirama et al. (2024) [37] reported pocket depths within normal limits. Priya et al. (2025) [5] analyzed the later clinical literature and concluded that probing depth generally remains in a healthy range without progressive worsening. The overall consensus is that DME does not usually create clinically important pocketing in the short to medium term, although this conclusion is more secure for probing depth than for other periodontal outcomes.

Plaque Retention and Gingival Inflammation

The quantitative and qualitative data also suggest that DME does not inevitably impose a plaque penalty. The pooled analysis of PI scores from two split-mouth trials showed no difference in PI between elevated and non-elevated margins, with low absolute plaque levels in both groups and minimal heterogeneity [25,34]. Across the broader clinical literature, GI values often increase modestly over time at both DME and control sites, but these changes are generally small, remain within the “no” to “mild” inflammation categories, and are more closely linked to local plaque control and surface finishing than to the mere presence of a relocated margin [24,36]. Several studies highlight that interdental hygiene and the lack of overhangs, ledges, or roughness influence the gingival response around subgingival composites [2,5,35]. For instance, Felemban et al. (2023) [2] and Priya et al. (2025) [5] both describe mixed but mostly manageable plaque findings, and they place more importance on oral hygiene and margin execution than the mere presence of DME. Findings by Srirama et al. (2024) [37] broadly align with this view. The overall pattern is therefore compatible with the following interpretation: DME may increase the risk of plaque retention if contouring, polishing, or patient hygiene are suboptimal, but there is no consistent evidence of an intrinsic or unavoidable increase in plaque accumulation attributable to DME per se.

Clinical Attachment Loss and Bone Outcomes

By contrast, data on CAL and marginal bone changes remain limited and inconsistently reported. Only a minority of included investigations provide direct CAL measurements or standardized radiographic assessments, and where such data exist, they typically show stability rather than clear gain or loss over follow-up [26,30,35]. While the histological clinical study by Bertoldi et al. (2018) [27] suggested that gingival tissues adjacent to subgingival composite can exhibit inflammatory profiles comparable to those facing natural root surfaces, the study’s small sample size and short observation period preclude definitive conclusions. The single randomized comparison of DME versus surgical crown lengthening reported favorable CAL and bone outcomes in both arms at one year, and DME showed no evidence of biologic inferiority, but sample size and duration again limit generalizability [30]. Chun et al. (2023) [1] explicitly reported that none of its included studies provided usable marginal bone level, recession, or CAL data. Felemban et al. (2023) [2] also treated the evidence as inconclusive. Srirama et al. (2024) [37] and Priya et al. (2025) [5] were more positive overall, but both still relied on a literature in which attachment and bone outcomes were much less frequently studied than bleeding, plaque, and probing depth. The overall conclusion is therefore restrained: there is no clear evidence that DME causes attachment loss or bone loss, but there is also insufficient direct, high-quality evidence to rule those harms out confidently.

Supracrestal Tissue Attachment (STA) and Margin-to-Bone Distance

Finally, the central biological theme that emerges from this review is the importance of respecting STA. The available controlled evidence suggests that periodontal tolerance may be better when the coronal edge of the DME or CMR remains at least 2-3 mm from the alveolar crest [1,2,29,31,33,34]. When this condition is satisfied, subgingival composite margins generally coexist with stable bone levels and shallow probing depths, even though low-grade gingival inflammation is more frequent than around entirely supragingival margins [1,2,5]. This biologically plausible constraint, as well as the requirement for impeccable finishing and rigorous plaque control, forms the primary condition under which DME can be recommended as a periodontally acceptable alternative to surgical crown lengthening for managing deep proximal defects [3,8,10,30].

Study limitations

This review has several limitations. First, the overall evidence base was relatively small, and only a limited number of studies contributed to each meta-analysis, thereby restricting statistical power and the ability to explore publication bias or perform robust subgroup analyses. Second, methodological heterogeneity was substantial across the included studies with respect to study design, comparator choice, restorative protocols, base materials, outcome definitions, and follow-up intervals; this limited pooling for several clinically important endpoints. Third, most of the available evidence was derived from non-randomized or observational studies that were judged at serious or critical risk of bias, primarily because of confounding, selection bias, incomplete follow-up, and the inherent impossibility of full blinding in periodontal assessment around visible restorative margins. Fourth, key outcomes such as CAL and radiographic bone

level were infrequently reported and often measured inconsistently, precluding quantitative synthesis and weakening confidence in long-term biological inferences. Finally, several included comparisons used intra-tooth or split-mouth controls. While these strengthen internal comparability, they may not fully capture patient-level behavioral or anatomical modifiers relevant to long-term periodontal stability. Additionally, this review was not registered in PROSPERO, limiting protocol verification.

Research priorities and future directions

Future research should move towards longer-term periodontal surveillance comprising rigorously designed, adequately powered randomized clinical trials specifically tailored to biological outcomes of DME rather than restorative survival alone. Standardized reporting of BoP, PPD, CAL, GIs, PIs, and radiographic bone level at predefined follow-up intervals is urgently needed to improve comparability across studies and enable more accurate meta-analyses. Where feasible, future histological investigations should also evaluate epithelial and connective tissue attachment at restorative interfaces.

Further work should also clarify the biological threshold at which margin proximity to the alveolar crest becomes clinically consequential, ideally through stratified analyses based on STA and margin-to-bone distance. Comparative trials of DME versus surgical crown lengthening with longer follow-up are needed to determine whether the short-term biological equivalence suggested by current data is sustained over time. In addition, future studies should explore patient-level modifiers that can meaningfully influence gingival response around relocated margins, such as periodontal phenotype, interdental hygiene practices, smoking, and history of periodontitis. Finally, direct head-to-head evaluations of contemporary DME materials should continue, but focus should go beyond restorative performance to include standardized periodontal and patient-centered outcomes to identify materials that confer a genuine biological advantage.

Conclusions

Within the limits of the available clinical evidence, DME/CMR/PBE can be regarded as a biologically acceptable conservative strategy for managing deep proximal subgingival margins in posterior teeth, particularly when adhesive restoration is possible without surgical tissue sacrifice. The pooled findings indicate that compared with non-elevated or sound control margins, DME is associated with a modest but statistically significant increase in BoP, while PPD and PI remain broadly comparable to controls. While clinical attachment loss or radiographic bone loss remain underreported and insufficiently standardized across studies, current evidence does not demonstrate a clear increase in these outcomes.

From a clinical standpoint, the present review supports a restrained and biologically informed indication for DME rather than an unqualified endorsement. To achieve favorable outcomes, it is crucial for clinicians to practice strict case selection, maintenance of an adequate margin-to-bone distance, precise finishing and polishing of the relocated margin, and sustained plaque control during follow-up. Under these conditions, DME may be considered a viable alternative to surgical crown lengthening in selected posterior cases, although clinicians should remain alert to the increased likelihood of localized gingival bleeding around elevated margins.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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