Scholastic Dental Sciences (ISSN: 3107-1657) Review Article

Volume 2 Issue 2 February 2026

Elevating the margins using Deep Margin Elevation - A Subgingival Saviour

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Received: February 25, 2026; **Published:** February 28, 2026

Abstract

Deep margin elevation (DME), also known as cervical margin relocation, is a conservative restorative technique used to manage subgingival proximal margins in posterior teeth. The procedure involves placement of a direct composite resin layer to coronally relocate deep cervical margins to a supragingival or equigingival position, thereby facilitating isolation, adhesive procedures, and indirect restoration placement. DME has gained popularity as an alternative to surgical crown lengthening or orthodontic extrusion, as it preserves periodontal architecture and reduces treatment time and morbidity. Contemporary adhesive systems and resin composites play a critical role in ensuring marginal integrity, fracture resistance, and long-term clinical success. However, factors such as proper case selection, periodontal health, isolation, matrix adaptation, and bonding protocol significantly influence outcomes. Current evidence suggests favorable short- to medium-term results, although long-term randomized clinical trials remain limited. This review article aims to critically analyze the biological rationale, clinical protocols, material considerations, advantages, limitations, and available evidence supporting deep margin elevation in restorative dentistry.

Introduction

Deep subgingival carious lesions and defective restorations continue to present a significant challenge in restorative dentistry.[1] As cervical lesions extend apically, the thickness of gingival marginal enamel gradually decreases until the cemento-enamel junction (CEJ) is reached, beyond which reliable bonding to enamel is no longer possible.[1] Restoration margins located apical to the CEJ on dentin are more susceptible to microleakage as a result of polymerization shrinkage, differences between the coefficient of thermal expansion of restorative materials and tooth structure,[2] and incomplete hybridization of adhesive systems caused by residual moisture within interfibrillar dentin spaces.[3]

In such clinical conditions, indirect adhesive restorations are often preferred because they provide improved anatomical form, esthetics, and mechanical properties with reduced polymerization shrinkage due to extraoral fabrication.[4] Ideally, restoration margins for all-ceramic restorations should be located on sound enamel to ensure predictable bonding.[1] However, margins positioned too close to the alveolar bone may violate the biologic width (BW), generally considered to be approximately 3 mm coronal to the bone crest, leading to gingival inflammation, attachment loss, and bone resorption. It has been suggested that deep margin elevation (DME) can be safely performed when the restorative margin is maintained at least 2.04 mm coronal to the alveolar bone crest, provided adequate plaque control and regular maintenance are ensured.[5]

Conventional management of deep cervical margins includes orthodontic extrusion, surgical exposure of the margin, or surgical crown lengthening, which aim to provide sufficient space for the re-establishment of biologic width.[4] However, modern restorative dentistry emphasizes on minimally invasive approaches, and in many clinical situations DME (Deep Margin Elevation) may serve as a conservative alternative to surgical crown lengthening.[6] The DME technique involves coronal relocation of the cervical margin by placing an adhesive restorative material to elevate the gingival seat and facilitate subsequent indirect restoration placement, thereby reducing the need for invasive surgical procedures.[7] Nevertheless, when the restorative margin extends beyond the sulcular epithelium, DME may need to be combined with surgical crown lengthening procedures.[8]

Deep margin elevation, also described as cervical margin relocation, proximal box elevation, or coronal margin relocation, provides several clinical advantages including improved rubber dam isolation, better moisture control, simplified impression procedures, enhanced bonding conditions, and easier removal of excess restorative material.[1,4] The

concept evolved from the open-sandwich technique, in which glass ionomer or resin-modified glass ionomer is placed in the cervical portion of the proximal box with partial exposure to the oral environment.[4] In addition, DME can be combined with immediate dentin sealing (IDS) to improve bond strength and marginal sealing of indirect adhesive restorations.[4]

The aim of this review is to summarize the current concepts, indications, clinical procedures, and available evidence regarding DME while evaluating its clinical applicability in the management of teeth with deep cervical margins.

Classification of Deep Cervical/Subgingival Margins[9]

A clinically oriented classification of teeth with deep cervical or subgingival margins can be established based on two fundamental parameters:

1. Technical–Operative Parameter

Ability to achieve adequate isolation with rubber dam.

2. Biological Parameter

Relationship of the cervical margin to the supracrestal tissue attachment (STA) / biologic width.

Based on these criteria, three clinical situations and corresponding treatment approaches can be identified:

Type	Margin position	Isolation	Treatment
Type I	Above STA	Possible	DME
Type II	Deep subgingival	Difficult	Surgical exposure
Type III	Within STA	Impossible	Crown lengthening

Materials Used in Deep Margin Elevation

The following materials and armamentarium have been described for deep margin elevation:

Matrix Systems

Modified Tofflemire matrix bands may be used alone or in combination with sectional matrices and polytetrafluoroethylene (PTFE) tape to improve cervical adaptation (matrix-in-a-matrix technique).[10]

Stick bands, Reel Matrix systems, and sectional matrices adapted with PTFE tape have also been recommended for stabilization in deep cervical margins.[5]

Composite Resins

Composite resins are the most commonly used materials for margin elevation.

The snowplow technique, combining flowable and packable composite polymerized simultaneously, may improve marginal adaptation.[11]

Flowable composite thickness should generally be limited to 1–1.5 mm, or up to 2 mm when bulk-fill composites are used.[5]

When margins extend onto dentin or cementum, preheated composite resins may be preferred due to the increased risk of microleakage with thicker flowable layers.[5]

Surface Treatment

Air abrasion (sandblasting) of the cavity surface has been recommended to improve bonding effectiveness.[5]

Adhesive Systems

Self-etch or universal adhesive systems, applied in self-etch or selective enamel etch mode, are generally preferred to reduce the risk of dentin over-etching associated with total-etch systems.[5]

Margin Positioning

The cervical margin should ideally be relocated to an equigingival or supragingival level to allow proper isolation and restoration contour.[5]

Clinical Technique

The following steps are recommended for a successful deep margin elevation :

1. Case Selection and Isolation

DME is indicated for semi-direct or indirect adhesive restorations when cervical margins cannot be adequately isolated. The procedure should be performed under rubber dam isolation, preferably after immediate dentin sealing.[7]

2. Matrix Selection

A curved matrix or banana band is preferred because it provides better emergence profile and contour near the CEJ.[6]

3. Matrix Adaptation

The matrix should be supported by adequate buccal and lingual walls. Reducing the matrix height by approximately 2–3 mm improves subgingival adaptation.[6]

4. Cervical Seal

The matrix must closely adapt to the cervical margin without entrapment of gingival tissue or rubber dam.[6]

5. Matrix-in-Matrix Technique

In deep lesions, a sectional matrix fragment may be inserted between the cervical margin and the main matrix band to improve adaptation.[7]

6. Timing of Procedure

Whenever possible, DME should be performed before endodontic treatment. In endodontically treated teeth, a glass ionomer barrier should be placed over canal orifices.[6]

7. Margin Preparation

The cervical margin should be finished using fine diamond instruments or oscillating tips under water irrigation to remove debris.[6]

Immediate Dentin Sealing and Margin Elevation Immediate dentin sealing using a three-step etch-and-rinse adhesive system is recommended, followed by placement of composite resin to elevate the margin by approximately 2 mm. Preheating composite may improve adaptation and reduce interlayer gaps.[6]

8. Polymerization

Application of glycerin gel during final curing reduces the oxygen-inhibited layer (OIL).[6]

9. Finishing and Polishing

Finishing should be performed using abrasive strips and flexible discs to obtain smooth margins.[6]

10. Removal of Excess Material

Composite excess should be removed with hand instruments and interdental floss to detect overhangs.[6]

11. Radiographic Evaluation

Bitewing radiographs should be taken to confirm marginal adaptation and absence of overhangs before final impression.[7]

Indications

Deep margin elevation (DME) is indicated in the following clinical situations:[12]

1. Subgingival Cervical Margins

Teeth with proximal cervical margins extending subgingivally without invading the supracrestal tissue attachment (STA).

Restorative margins should preferably be located ≥2 mm coronal to the alveolar bone crest.

2. Indirect Adhesive Restorations

Teeth planned for bonded indirect restorations such as inlays, onlays, overlays, and endocrowns, where margin relocation improves bonding and marginal adaptation.

3. **Improved Isolation Requirements**

Cases in which subgingival margins compromise rubber dam isolation and margin relocation allows improved moisture control and more predictable adhesive procedures.

4. **Deep Proximal Caries Lesions**

Teeth with extensive proximal caries extending subgingivally where margin elevation allows restoration without surgical intervention.

5. **Replacement of Deep Defective Restorations**

Teeth requiring replacement of restorations with subgingival margins where DME allows relocation of margins to a more accessible level.

6. **When Crown Lengthening is Undesirable**

Situations in which surgical crown lengthening (SCL) may result in excessive bone removal, unfavorable crown–root ratio, esthetic compromise, or root sensitivity.

7. **Minimally Invasive Treatment Approach**

Patients in whom a conservative alternative to surgical or orthodontic procedures is preferred.

8. **Adequate Periodontal Health**

Teeth with healthy periodontal tissues and controlled gingival conditions.

9. **Adequate Remaining Tooth Structure**

Cases with sufficient coronal tooth structure to support indirect restorations.

10. **Adequate Rubber Dam Isolation**

Teeth in which stable rubber dam isolation can be achieved to ensure contamination-free bonding.

Contraindications

Deep margin elevation is contraindicated in the following situations:[12]

1. Cervical margins located less than 2 mm from the alveolar bone crest, with a risk of supracrestal tissue attachment violation
2. Cases requiring surgical crown lengthening or orthodontic extrusion
3. Teeth planned for full-coverage crown restorations, where margins should be placed on natural tooth structure
4. Inability to achieve adequate rubber dam isolation
5. Presence of active periodontal disease or inflammation
6. Uncontrolled gingival bleeding

Advantages and Limitations of Deep Margin Elevation

Advantages

Deep margin elevation (DME) offers several clinical advantages as a conservative approach for the management of deep cervical margins. It serves as a minimally invasive alternative to surgical crown lengthening, allowing preservation of periodontal tissues and supporting structures.[3] Relocation of the cervical margin to a more accessible position improves rubber dam isolation, moisture control, and adhesive procedures, resulting in more predictable bonding and marginal adaptation.[6,7]

DME also facilitates better marginal control and simplified impression procedures, thereby enhancing the accuracy of indirect restorations and allowing easier removal of excess luting material.

Studies have demonstrated acceptable marginal adaptation and no adverse effect on fracture resistance, indicating that DME is a safe and reliable technique when used with indirect restorations.[3,6] Reliable bonding at deep cervical margins is essential for the success of restorations placed using DME. Studies have shown no significant differences between flowable and packable composites, and variations in the thickness of the elevation layer appear to have minimal influence on mechanical performance. Self-etch and universal adhesive systems are generally recommended, particularly when bonding to dentin or cementum, while preheating adhesive systems may improve dentin bond strength.[6,12] Most studies indicate that DME does not adversely affect fracture resistance regardless of the restorative material used. Comparable fracture strength has been reported with different margin-elevation materials, although some studies have shown improved strength with composite restorations or ceramic endocrowns following DME.[6,12]

Deep margin elevation restorations have demonstrated favorable clinical survival rates, particularly when combined with indirect restorations. Bresser et al.[13] reported a 95.9% five-year survival rate, while Cieplik et al.[14] and Roggendorf et al.[15] reported comparable outcomes between restorations performed with and without DME.

Limitations

Despite its advantages, DME presents certain limitations.

Periodontal inflammation may occur, particularly when restorative margins approach or violate the supracrestal tissue attachment.[8] Maintenance of periodontal health is essential for the long-term success of restorations with subgingival margins. Although supragingival

margins are preferred, subgingival margins may be unavoidable in certain clinical situations. The periodontal response depends on restoration contour, marginal adaptation, material characteristics, and plaque accumulation, with overhangs and marginal discrepancies increasing the risk of inflammation. Subgingival restorations have been associated with increased plaque accumulation, bleeding on probing, attachment loss, and gingival recession compared with supragingival margins.

Preservation of the supracrestal tissue attachment (STA) is critical, as violation may result in periodontal inflammation and tissue breakdown. When STA is respected and restorations are properly contoured and finished, DME may be compatible with periodontal health. Periodontal attachment to restorative materials occurs primarily through formation of a long junctional epithelium rather than connective tissue attachment.[6,12]

Bonding to deep dentin margins may result in gap formation and increased microleakage, which may affect long-term restoration performance. Microleakage and marginal adaptation remain important concerns in deep margin elevation (DME) because bonding is performed in deep cervical areas where isolation and matrix adaptation may be difficult. A reliable marginal seal is essential for the long-term success of indirect adhesive restorations. Thermomechanical loading studies have shown that marginal integrity may deteriorate over time despite initially acceptable adaptation. Flowable composites demonstrate improved marginal adaptation and may function as stress-absorbing intermediate layers; however, excessive thickness may increase polymerization shrinkage. Bulk-fill composites show marginal sealing comparable to conventional composites, whereas glass ionomer cements and self-curing resin cements exhibit inferior marginal performance. Multi-layer margin elevation has been associated with improved marginal integrity, and polymerization strategies such as soft-start or delayed curing may further reduce shrinkage stress.[6,12]

In addition, DME is a technique-sensitive procedure that requires careful matrix adaptation and strict isolation to achieve predictable outcomes.

The most common causes of failure include secondary caries, restoration fracture, and pulpal complications. Although short- and medium-term outcomes are encouraging, differences in study design and follow-up periods limit definitive conclusions. In addition, many studies evaluated direct composite restorations despite DME being primarily intended for indirect restorations. Further long-term clinical trials are required to confirm the longevity of DME restorations.[6,12]

Conclusion

Deep margin elevation (DME) is a minimally invasive and predictable technique for managing teeth with deep cervical margins. By relocating subgingival margins to a more accessible level, DME improves isolation, bonding conditions, and restorative procedures while preserving periodontal tissues. Current evidence indicates that DME provides acceptable marginal integrity, bond strength, and fracture resistance, with favorable clinical survival rates when proper case selection and isolation are achieved. However, DME remains a technique-sensitive procedure, and long-term clinical studies are required to further validate its durability and periodontal safety.

Abbreviations used -

DME Deep margin elevation

CEJ Cemento-enamel junction

IDS Immediate dentin sealing

SCL Surgical crown lengthening

BW BiologicalWidth

OIL Oxygen inhibition layer

STA Supracrestal tissue attachment

PTFE Polytetrafluoroethylene

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