



# Deep Margin Elevation: A Paradigm Shift

**Pascal Magne, DMD, PhD**

Don and Sybil Harrington Professor of Esthetic Dentistry, Restorative Sciences, Ostrow School of Dentistry, University of Southern California, Los Angeles, California, USA.

**Roberto C. Spreafico, DM, DMD**

Private Practice, Milan, Italy.

Localized subgingival margins can complicate the use of indirect adhesive restorations (isolation, impression taking, and delivery) and subsequently hinder their durability and relationship with the periodontal tissues. This article proposes a technique involving placement of a modified Tofflemire matrix followed by immediate dentin sealing and coronal elevation of the deep margin to a supra-gingival position using a direct bonded composite resin base. The deep margin elevation technique may be a useful noninvasive alternative to surgical crown lengthening. This technique may also facilitate the placement of large direct composite resin restorations. The fundamental principles of deep margin elevation are presented. (*Am J Esthet Dent* 2012;2:86–96.)



Correspondence to: Dr Pascal Magne

Division of Restorative Sciences, Oral Health Center, Ostrow School of Dentistry of USC,  
3151 S. Hoover St, Los Angeles, CA 90089-7792. Fax: 213-821-5324. Email: magne@usc.edu



Subgingival interdental margins may be encountered when replacing large Class II restorations. The use of direct adhesive restorations for large defects does not represent an ideal solution, even when associated with shrinkage stress–reduction techniques (eg, slow-start curing, flowable liner, and incremental placement). As a result of the spontaneous postcuring that takes place over several days after composite resin insertion,<sup>1</sup> the dentin gingival seal may not be secure. Accordingly, because of their size, such defects usually require restoration with inlays/onlays, especially those fabricated using chairside computer-aided design/computer-assisted manufacturing (CAD/CAM).<sup>2</sup> Such cases generate significant technical and operative challenges during isolation of the operatory field using rubber dam, adhesive procedures, impression taking (traditional or optical), and adhesive luting. When not properly executed, these procedures may affect the longevity of the restoration and its relationship with marginal periodontal tissues.

There are various clinical approaches to such challenges.<sup>3–5</sup> The gingival margins can be surgically exposed by apical displacement of supporting tissues<sup>5</sup>; however, this may lead to attachment loss and anatomical complications such as the proximity of root concavities and furcations. Once exposed to the oral environment, the gingival margins can be difficult to maintain and may generate additional challenges.

Another approach, presented by Dietschi and Spreafico in 1998,<sup>3</sup> is to place a base of composite resin to coronally displace proximal margins underneath indirect bonded restorations (Fig 1). This procedure, known as deep margin elevation (DME) or coronal margin relocation, is performed under rubber dam isolation following the placement of a matrix. Today, the DME concept can be used in synergy with immediate dentin sealing (IDS) to improve the bond and marginal seal of indirect adhesive restorations.<sup>6–9</sup> In addition to the supragingival elevation of the margin, the adhesive composite resin base is used to seal the dentin, reinforce undermined cusps, fill undercuts, and provide the necessary geometry for inlay/onlay restorations.



**Figs 1a and 1b** Radiographs taken (a) before and (b) after placement of a composite resin base to seal the dentin and elevate the distal margin of the mandibular first molar. Following elevation, the margin was easily accessible for final optical impressions and safe delivery of the definitive restoration under rubber dam.

## THE DME TECHNIQUE

The DME concept applies to preparations for semi-direct and indirect adhesive inlay/onlay restorations, especially those fabricated using optical impressions and CAD/CAM, when the gingival margins cannot be isolated with rubber dam alone. Because excess luting composite resin needs to be eliminated prior to curing, there is a substantial risk of hemorrhaging or breaking of the seal necessary for proper isolation when dealing with subgingival margins (even under rubber dam). This is rarely a problem when cementing conventional restorations because excess cement (glass ionomer, zinc phosphate, etc) can be easily removed after setting. For inlays/onlays, this difficulty can be avoided by using DME or, in case of unsuccessful DME (persistent bleeding during and after the procedure or lack of marginal adaptation evident on radiographs), by performing surgical

crown lengthening. Once again, the clinician must consider the risks of involving a furcation or root concavity before planning surgical crown lengthening. DME should be given priority when this risk is present.

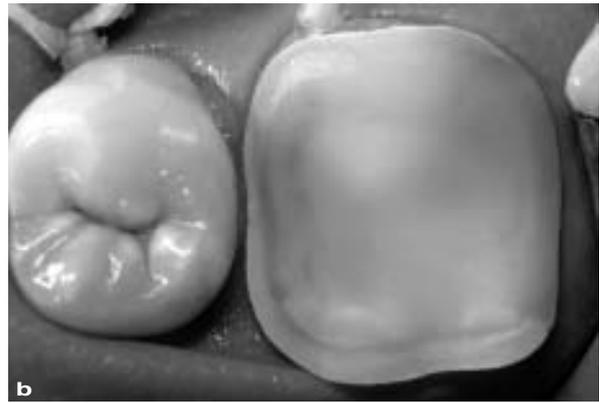
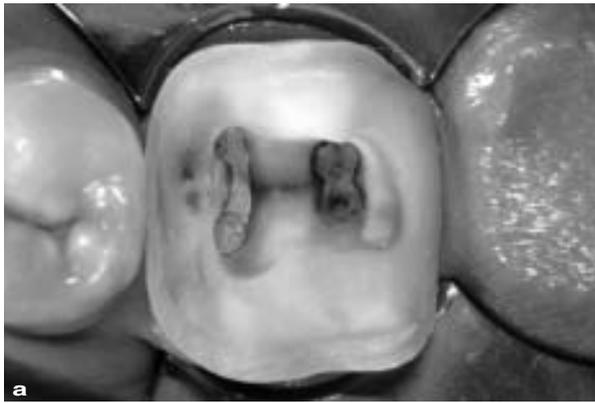
DME is achieved by placing direct composite resin using a modified curved Tofflemire matrix to elevate the gingival margin to a level where it can be sealed with rubber dam during restoration delivery, allowing proper removal of excess luting composite resin before curing. DME should always be achieved directly after IDS, under rubber dam, and only if the margin can be isolated properly with a modified Tofflemire matrix. Otherwise, this technique is contraindicated. A bitewing radiograph should be taken to evaluate the adaptation of the composite resin in the gingival area (absence of gaps or overhangs) before proceeding with the final impression. Careful follow-up is also needed to evaluate soft tissue health and the potential need for surgical



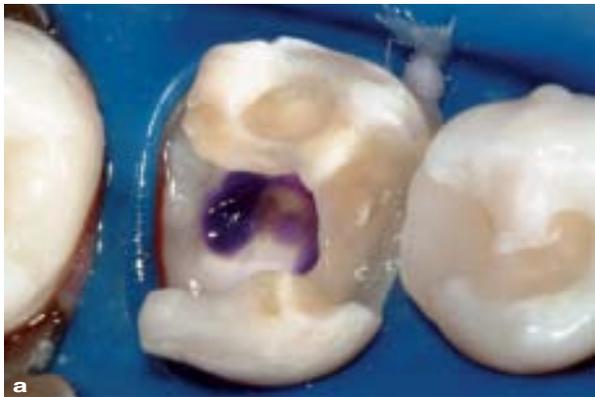
**Figs 2a to 2e** (a) Preoperative periapical radiograph of a clinical case. Margin elevation was used. Situation (b) before endodontic retreatment and (c) after adhesive luting of an indirect composite resin onlay (the arrow indicates the distal margin of the onlay). (d and e) The final postoperative results were successful.

intervention. Whenever possible, DME should be performed before endodontic treatment to benefit from the improved

isolation during root canal therapy (Figs 2 and 3). Figure 4 shows a typical indication for the DME technique.



**Figs 3a and 3b** (a) Elevated distal margin used to facilitate endodontic retreatment. Final preparation was performed following placement of a glass-ionomer barrier and additional composite resin as a base. (b) Clinical photograph taken just before adhesive luting of the indirect ceramic onlay showing perfect isolation and ideal conditions for delivery.



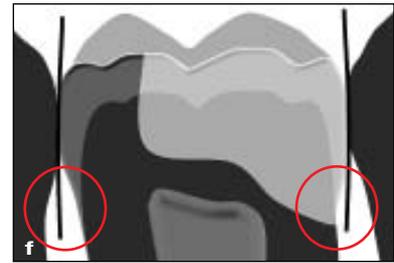
**Figs 4a and 4b** Typical clinical situation demonstrating the difficulty of isolating the deep distal margin on the mandibular first molar due to (a) saliva and blood leakage as well as (b) rubber dam slippage over the margin. This situation is the ideal indication for DME.



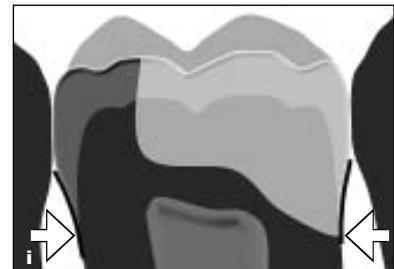
**Figs 4c and 4d** (c) Curved matrix on the matrix holder. (d) The intense curvature allows convergence and a tight subgingival fit.



**Fig 4e** Radiograph showing the mesial margin of the mandibular left second molar elevated with a curved matrix. The distal margin of the left first molar was elevated with a regular matrix. Note the difference in emergence profiles.



**Fig 4f** Traditional matrix at full height. Note the deficient gingival seal due to the high contour of the clinical crown.



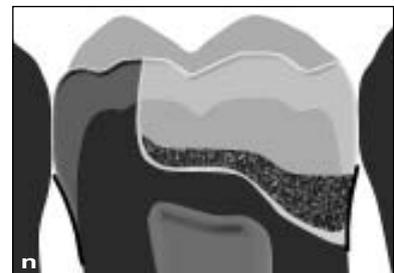
**Figs 4g and 4h** Reduction of matrix height to a maximum of 3 mm.

**Fig 4i** Curved matrix following adaptation. The marginal seal is secured.



**Figs 4j to 4l** Clinical situation (*j*) before and (*k*) after matrix placement and (*l*) margin refining (Prep Ceram Tip, KaVo).

**Figs 4m and 4n** (*m*) Margin refining (Hemisphere Tip, KaVo). (*n*) IDS and base applied.



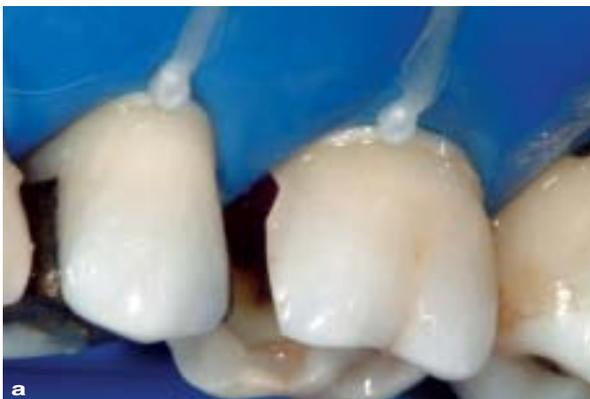


The following elements are fundamental for successful DME:

1. A curved matrix (Greater Curve or similar “banana matrix”) should be favored. A traditional matrix may allow the isolation and elevation of margins located above the cemento-enamel junction (CEJ); however, for margins located in the area of the CEJ, a traditional matrix will usually generate an insufficient gingival emergence profile and contour.
2. Sufficient buccal and lingual walls of the residual tooth structure must be present to support the matrix. Localized elevation is possible, but extended elevation in the buccal and lingual directions will usually be limited by matrix instability and collapse.
3. The matrix height should be reduced to 2 to 3 mm (slightly higher than the desired elevation). The narrowness of the matrix will allow it to slide subgingivally and seal the margin more efficiently. Typically, no wedging is possible.
4. For endodontically treated teeth, the clinician must ensure that successful root canal therapy has been achieved. Further, a glass-ionomer barrier should be placed to cover the access to the canals. DME can also be used to establish proper isolation prior to root canal therapy.
5. After placing the matrix, the gingival margin must be sealed by the matrix, and no gingival tissue or rubber dam should remain between the margin and matrix.
6. Prior to bonding, the margin should be gently re-prepared using a fine diamond bur or oscillating tips (eg, Hemisphere or Prep Ceram tips, KaVo) with abundant water spray. This will ensure the elimination of debris and other contamination of the dentin that may have occurred during matrix placement.
7. IDS<sup>9</sup> should be applied using a three-step, etch-and-rinse dentin adhesive (eg, Optibond FL, Kerr) to the preparation in the presence of the matrix, followed by placement of a composite resin base that will relocate the margin by approximately 2 mm (one to two increments). This part of the procedure is similar to that for a direct composite resin restoration.
8. Various types of composite resin can be used for elevation (traditional restorative or flowable). When a microhybrid or nanohybrid restorative material is used, it is recommended to preheat the material (Calset, AdDent) to facilitate placement and minimize the risk of interlayer gaps. Final polymerization through a layer of glycerin gel (air blocking) is recommended.
9. Once the margin is elevated, the preparation can be completed by careful elimination of excess and composite resin flash around the tooth using a no. 12 blade or a sickle scaler. Interdental flossing is used to check for the absence of overhangs and flash. It is also recommended to re-prepare all enamel margins to remove excess adhesive resin.
10. Finally, a bitewing radiograph should be taken to ensure that no excesses or gaps are present before proceeding to final preparation and impressions. It is interesting to



**Fig 5** Matrix-in-a-matrix technique for an extremely deep but localized lesion (*left*) in which the curved Tofflemire matrix is placed and left slightly loose to slide in a sectioned rectangular piece of metal matrix deeper into the defect (*center*). The Tofflemire matrix is then secured (*right*).



**Figs 6a and 6b** (a) Deep margin associated with severe undercut. (b) Suppression of undercut by DME allows for a more conservative inlay preparation.

note that the presence of a deep subgingival adhesive margin may not affect the periodontal status of the restored tooth.<sup>10</sup>

11. The matrix-in-a-matrix technique represents the final option in case of an extremely deep and localized lesion (Fig 5). This technique consists of sliding a sectioned fragment of metal matrix between the margin and existing matrix.

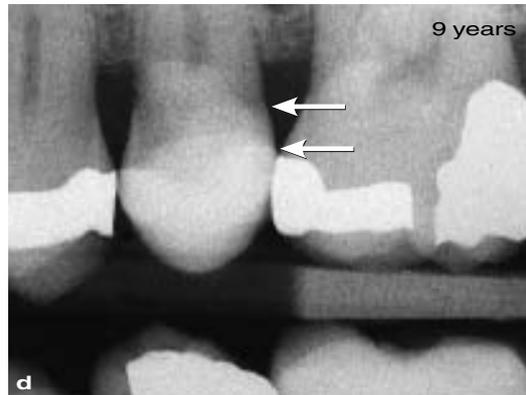
Margin relocation also permits the removal of severe undercuts from an existing amalgam preparation, allowing for

a more conservative inlay preparation (Fig 6). Figures 7 and 8 show the long-term follow-up of two sample cases at 9 and 12 years.

As when using the IDS technique, delivery of the restoration on an elevated margin requires careful cleaning of the existing composite resin base using airborne-particle abrasion followed by etching/rinsing (enamel) and application of adhesive resin.<sup>9</sup> Gresnigt et al<sup>11</sup> showed that placement of an indirect restoration on an existing and even aged composite resin restoration does not affect the longevity.



**Figs 7a to 7d** Buccal cusp fracture of the maxillary second premolar with a mesio-occlusodistal amalgam. (a) Amalgam removed. Note the secondary caries at the distal subgingival margin. (b) Composite resin base used for elevation of the distal margin and dentin protection. (c) Postoperative clinical view and (d) corresponding radiograph 9 years after treatment (top arrow indicates the tooth margin; bottom arrow indicates the elevated margin).





**Figs 8a and 8b** (a) Postoperative clinical view and (b) corresponding radiograph 12 years after treatment with DME and a Belleglass (Kerr) onlay.



## DME and direct composite resin restorations

Although the DME technique was originally intended for semi-direct (including CAD/CAM) or indirect restorations, it may also represent a useful preliminary tool before placement of a large direct composite resin restoration. In such cases, DME may further facilitate the positioning of separation rings and generate improved contours and tight

proximal contacts. For socioeconomic reasons, three-, four-, and five-surface direct composite resin restorations are increasingly used.<sup>12</sup> The use of IDS and DME in combination with a delayed placement technique<sup>13</sup> may improve the quality and performance of large direct restorations. As always, patient, operator, and material factors must be taken into account during treatment planning and execution.<sup>14</sup>



## CONCLUSIONS

More research is needed to validate the deep margin elevation technique. Nonetheless, this approach represents a useful option for patients who cannot afford more invasive procedures. Deep margin elevation conforms to the main goal of restorative dentistry: the con-

servation of tooth structure. This technique could have a major impact on digital dentistry due to its facilitation of optical impressions of the subgingival margins. Deep margin elevation may also facilitate the placement of large direct composite resin restorations.

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