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Original Research Paper

Dentistry

DEEP MARGIN ELEVATION CONCEPT: A REVIEW

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ABSTRACT Deep subgingival margins are a much debated topic in adhesive and restorative dentistry. The hydrophobic trait of direct composite resins challenges the restorative procedure of such cases since isolation is difficult. Traditional restorative and surgical approaches are aggressive. In keeping with modern restorative materials and techniques, the deep margin elevation procedure has evolved as a simple and convenient means to manage sub gingival carious defects.

KEYWORDS :

INTRODUCTION

Subgingival cavity margins exceeding cementoenamel junction (CEJ) generate significant technical and operative challenges in direct and indirect restorative dentistry. In such cases often indirect adhesive restorations are favored. However subgingival preparations present major clinical difficulties –

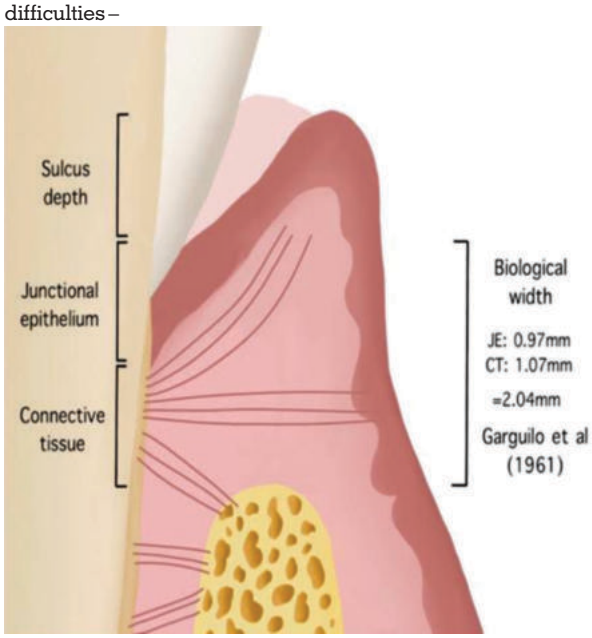

Figure 1

1) Violation of biologic width (Figure 1) – biologic width should be widely respected during restorative procedures otherwise it could lead to an inflammatory response from periodontium due to microbial biofilm on restorations placed in deep areas. A recommended distance of 3mm or more between restorative margins and alveolar crest is necessary to avoid the destructive effects on the surrounding periodontal tissues. If it is not respected the methods to obtain the space are by surgical crown lengthening (SCL) or orthodontic extrusion (OE).

2) Technical operative difficulties includes limited access, isolation, blood leakage, crevicular fluid, persistent saliva, impression taking, its placement, cementation as well as finishing and polishing [1-4].

The above mentioned surgical technique has added risk of bone loss, posterior gingival margin displacement, papilla with poor aesthetics and possible presence of black triangles [1-3].

Over the years , dentistry has seen a paradigm shift towards conservation of healthy tooth structure, thus the alternative, noninvasive approach to above mentioned methods is "Deep margin elevation" (DME) [5]. The other names include "Proximal box elevation" (PBE) and "Coronal margin relocation" (CMR) [1-4].

Deep margin elevation is a procedure used to raise or reposition sub gingival margins into supra gingival margins using an increment of composite to increase marginal integrity and bond strength [1-3]. It was introduced in 1998 by Dietschi and Spreafico and named as cervical margin relocation. In 2012 Magne and Spreafico named this technique as Deep margin elevation [4,5].

History

Formerly open sandwich technique was considered. It overcomes the sealing issues in deep class II composite restorations. It uses glass ionomer or resin modified glass ionomer to restore cervically, which exposes the cement in the oral environment [1].

DME was primarily defined for indirect restorations using composite resin [5].

The difficulty encountered in sub gingival margins is occasional absence of or limited enamel cervically, leaving only dentin and cementum as the main substrates for adhesion. Thus currently it can be integrated with immediate dentin sealing (IDS) to increase bond strength and marginal seal of indirect adhesive restorations' [1-4].

Indications

1) Cavity margin is at least 2mm above alveolar crest
2) Not needing additional ferrule effect for direct and indirect restorations

Three Crucial Criteria For DME

1) Capability of field isolation
2) Perfect seal of cervical margin provided by the matrix
3) No invasion of connective tissue compartment of biologic width [1,2,4,5]

Technique

Initially examine the extent of carious lesion (Figure 5A), distance from the pulp and alveolar crest margin with periapical radiographs and probing depths [1,3,5].

Once the rubber dam isolation is achieved and the carious lesion is excavated (Figure 5B), circumferential stainless steel matrix (usually Tofflemire matrix) is applied encompassing the tooth in such a manner that it seals the cervical margin impeccably, without interference of gingival tissue and dam, with satisfactory anatomical adaptation without under or over contouring [1,2,3,5]. The matrix must be supported by sufficient buccal and lingual walls, otherwise it will prevent extended elevation in buccal and lingual directions [5]. The Tofflemire matrix band height is cut and reduced 2-3 mm as slenderness with its conical design allows to slide subgingivally (Figure2 and 3) [1,2,5].

Sectional or Anatomical matrices are also preferred because of their curvature profiles, making it easier to reach deep cervical margins (Figure 5C) [4,6].

In severe deep lesions "matrix-in-a matrix" technique is advantageous. A sectional metal matrix is inserted vertically into the subgingival area through a loosened Tofflemire matrix, when reaching the deepest level of the defect, the Tofflemire is secured (Figure 4) [1,5]. Then an anatomic wedge is inserted. If wedge affects the profile of matrix, packing Teflon is a good alternative (Figure 5C) [1].

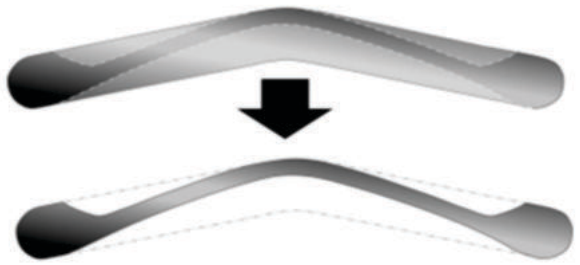

Figure 2

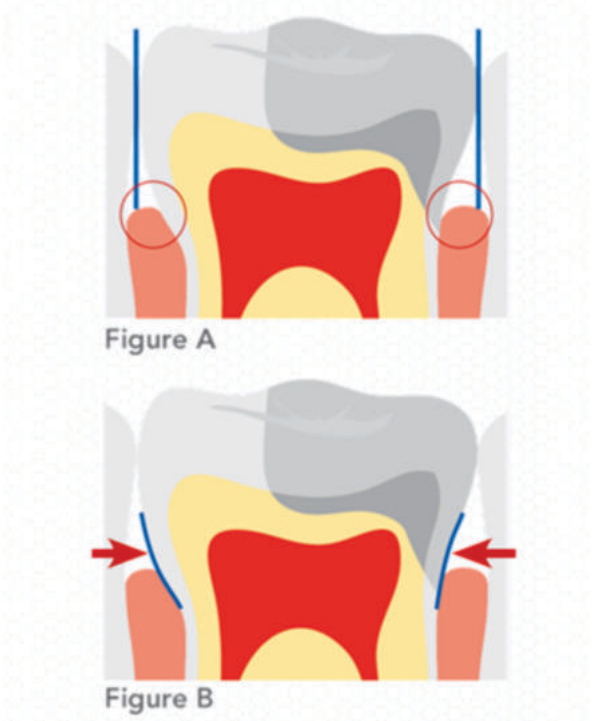

Figure 3A: Tofflemire matrix, **3B:** Modified Tofflemire matrix

Figure 4

Figure 5A – 5F: DME performed using saddle matrix and diamond wedge

Prior to bonding the margin is re-prepared with fine diamond burs or oscillating tips with water spray [1,2,5].

Then, layer of dentin bonding agent (DBA) is applied on the exposed dentin and light-polymerized according to the manufactures instructions. (IDS) [1-3,5]. Afterwards deep margin is elevated using flowable or condensable or a combination of both (figure 5D). When using a micro-hybrid or nanohybrid restoratives, preheating the material is recommended to simplify the application and to reduce the formation of interlayer gaps [1-3]. The amount of composite should be minimal enough to relocate the margin at least 0.5 mm above the free gingival margin.(up to 1-1.5mm thickness)[4]. Final polymerization through glycerin gel is highly recommended to eliminate oxygen inhibition layer (OIL), as it affects setting of some impression materials [1,2,5]. Once the margin is raised, the preparation is rinsed with air-water spray, enamel margins are re-prepared and the excess and composite resin flash is gradually removed and polished

with a sickle scaler or no. 12 blade. To check the absence of overhangs and flash, interdental flossing is performed [1,2,5,6]. Finally a postoperative bitewing radiograph is important to ensure the absence of gaps or overhangs (Figure 5F) [1,5].

Advantages

1) Minimally invasive procedure alternative to surgical crown lengthening and orthodontic extrusion.
2) Further attachment loss is prevented.
3) Provides necessary geometry for indirect restorations [1-5].

Limitations

A distance greater than 2mm is required to perform DME
1) Removing excess of composite after hardening owes to risk of damaging DME
2) Anatomical coupling between matrix and deep cervical margin can be hard to achieve
3) Difficulty in achieving anatomical proximal profile
4) The risk of capillarity formation due to circular matrices leads to nullification of the seal
5) Highly technique sensitive
6) In Severely destructed coronal cases it poses difficulty in creating ferrule effect [3,6]

Periodontal Outlook

Maintaining a healthy periodontium around sub- gingivally restored teeth demands the existence of ideal restoration that is contoured correctly [7]. During restorative procedure supra-crestal tissue attachment (STA), formerly known as biologic width (BW) must be respected in all cases as invading this area will most probably lead to gingival inflammation, loss of attachment, suppuration and bleeding [1,2,7,8].

DME and subgingival restorations are compatible with periodontal health. Provided that they are well polished and refined, BW is not violated and a strict supportive therapy along with good oral hygiene are followed [1]. The association between DME and increased bleeding on probing, an indicator of compromised periodontal health points to the importance of the distance between the alveolar crest and the restorative margins. This was justified by the histomorphometric study stated that the distance between composite restorations and bone crest should be at least 2mm to prevent apical bone migration[1,7]. Upon the subgingival placement of composite, different patterns of supra-crestal attachment are observed. It is significant that DME does not lead to recreation of BW but a healthy variable instead, consists of a longer Junctional epithelium alongside the material and a smaller connective tissue attachment along the dentin underneath the composite [1,2].

Marginal Adaptation

As discussed in the subgingival areas enamel diminishes gradually and beyond CEJ it consists of dentin and cementum which degrades bonding quality [1,2,4]. However the ideal substrate for bonding of an adhesive restoration is enamel, greater sealing is achieved with enamel irrespective of the type of adhesive (universal or etch and rinse adhesive). Da Silva. et al. stated that universal adhesives achieve better sealing ability with dentin compared to etch and rinse adhesives [2]. Total etch adhesives carry a risk of over etching dentin substrate in subgingival cavity margins and so, self-etch or universal adhesives are preferred instead [1].

For DME several materials are acceptable like microhybrid, nanohybrid bulk-filled composites, siloranes, ormocers, self-adhesive resin cements, glass ionomers, resin modified glass ionomers at different viscosities (condensable, flowable, preheated) in or more layers. They do not affect the margin quality [1-4].

Dietschi et al. stated that presence of intermediate elastic modulus as a base (flowable composite) delivered better internal adaptation in comparison to rigid materials. It acts as a stress absorbing layer under hybrid composite resin restoration. It absorbs stress during polymerization shrinkage as well as functional loading. The efficacy of stress absorption is directly proportional to the layer thickness (Figure 6) [2].

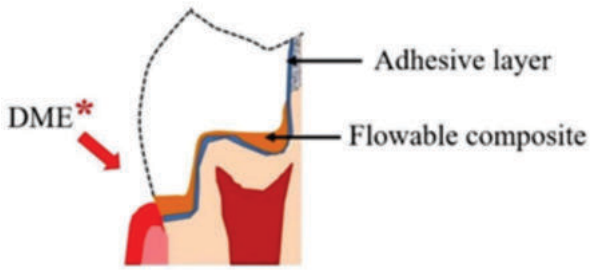

Figure 6

The incremental technique positively influences marginal integrity, thus consecutive increments of thickness up to 1-1.5 mm exhibits fewer gaps than a single increment [1-4].

Scotti et al. reported that flowable composites provide better marginal seal than nanohybrid and bulk filled composites but they are more prone to wearing after thermomechanical loading and therefore it is contradicted. Therefore preheated microhybrid or nanohybrid restoratives are indicated [1].

Mechanical Factors

Studies suggest irrespective of the type of material used DME has no effect on the fracture resistance, fatigue behavior and bond strength [1,2,4]. In addition, performing DME for ceramic endocrowns it increases the fracture resistance [1,2]. Greater height usually results in bulk fracture of the restoration, so if it goes beyond 5 mm DME should be considered [1]. It should be noted that failures usually occurs at the dentin-composite interface than composite-restoration interface [1].

DME Against Surgical Crown Lengthening (SCL)

Crown lengthening is a surgical procedure done to expose the cavity margins by apical displacement of the supporting periodontal tissues, thus facilitating access and adequate isolation with the aim of achieving optimum position of deep margins to avoid violating the biologic width [9]. It is usually indicated in cases where distance between the margin and alveolar crest is equal to or less than 3 mm [2]. It is debatable whether it reproduces biologic width or produces gingival rebound. The approaches are -
1) Gingivectomy
2) Apically positioned flap with or without bone resection [2]

A sufficient amount of time must be given after the procedure for healing and stabilization of periodontal tissues. (At least 5-6 months in aesthetic zone) [2,7,9].

SCL should be considered last resort due to following reasons-
1) Risk of exposing furcation areas
2) Increase of crown to root ratio
3) Exposure of the root concavities into oral cavity
4) Dentin hypersensitivity
5) Compromised aesthetics
6) Delays the delivery of final restoration [3,6]

Most studies suggest DME as safe technique with no or minimal side effects with positive periodontal health status with better survival ratio, if properly performed [2,8,9].

DME Against Orthodontic Extrusion

Orthodontic extrusion also known as forced orthodontic

extrusion or forced orthodontic eruption. It is defined as tooth movement caused by coronally directed orthodontic forces. It is performed to change tooth position or induce therapeutic changes on the surrounding alveolar bone and soft tissue. It is considered the easiest among the orthodontic movements as it simulates the physiologic dental eruption [10]. It is contraindicated in ankylosis, hypercementosis cases (as extra load causes intrusion of the anchoring tooth), furcation involvement and short roots. [2,10]

Compared to SCL it shows increase in volume of supporting tissues and in highly aesthetic cases it is particularly advantageous when combined with fiberotomy [10].

The main downsides include longer treatment durations, compromised oral hygiene, higher cost and higher chances of relapse [2,10].

DME Against Direct Cementation Of Indirect Restoration

In cases of direct restorations like ceramic inlays requires adhesive cementation to improve over time. Thus isolation is considered a key component. DME using flowable composite might be effectively used beneath such restorations to facilitate isolation and cementation, minimize stress concentration and greater gingival margin visibility [1-3,11]. Hence DME simplifies optical and conventional impression taking procedures by raising the margins. Also during the luting process it makes rubber dam isolation easier, removing excess luting composite (one of the most significant step) is better managed. Additionally due to proximal composite base the stress brought on by insertion, polymerization shrinkage or functional loading is greatly reduced. Thus DME technique preserves and minimizes subject time, cost and surrounding biological tissues [11].

CONCLUSION

Deep margin elevation conforms to the main goal of restorative dentistry – the conservation of tooth structure. It is relatively non-invasive and less time consuming approach and should be considered when applicable. It serves as reliable technique to manage subgingival defects, when performed with meticulous attention to detail to ensure a smooth, well-polished and sealed restorative surface against which a healthy periodontium can adapt clinically and histologically.

REFERENCES

1. Samartzi TK, Papalexopoulos D, Ntovas P, Rahiotis C, Blatz MB. Deep Margin Elevation: A Literature Review. Dent J (Basel). 2022 Mar 14;10(3):48. doi: 10.3390/dj10030048. PMID: 35323250; PMCID: PMC8947734.
2. Aldakheel M, Aldosary K, Alnafissah S, Alaamer R, Alqahtani A, Almuhtab N. Deep Margin Elevation: Current Concepts and Clinical Considerations: A Review. Medicina (Kaunas). 2022 Oct 18;58(10):1482. doi: 10.3390/medicina58101482. PMID: 36295642; PMCID: PMC9610387.
3. Zardoni Jesus Leonardo Cobos, Maria Argelia Akemi Nakagoshi Cepeda, Eyra Elvyra Rangel Padilla, Marcela Alejandra Gloria Garza, Fatima Del, Muro Casas, Nelly Alejandra Rodriguez Guajardo, and Mónica Isabel Arvizu. Deep margin elevation, State of the art and future directions. International Journal of Applied Dental Sciences 9, no. 1 (2023): 295-8.
4. Juloski J, Köken S, Ferrari M. Cervical margin relocation in indirect adhesive restorations: A literature review. Journal of prosthodontic research. 2018;62(3):273-80.
5. Magne P,Spreafico RC. Deep margin elevation: A paradigm shift. Amer. J. Esthet. Dent. 2012, 2, 86–96.
6. Pasquale Venuti DD, Eclano M. Rethinking deep marginal extension (DME). International journal of cosmetic dentistry. 2018.
7. Sarfati A, Tirlet G. Deep margin elevation versus crown lengthening: biologic width revisited. Int J Esthet Dent. 2018;13(3):334-356. PMID: 30073217.
8. Mugri, Maryam H., Mohammed E. Sayed, Binoy Mathews Nedumgottil, Shilpa Bhandi, A. Thirumal Raj, Luca Testarelli, Zohaib Khurshid, Saurabh Jain, and Shankargouda Patil. 2021. Treatment Prognosis of Restored Teeth with Crown Lengthening vs. Deep Margin Elevation: A Systematic Review. Materials 14, no. 21: 6733.
9. Alghulikah, Khaled, Nada Abdulrahman Alsulaiman, Haya Saad Al Ibrahim, Rama Mahmoud AlYamany, and Najla Haif Alqahtani. Deep margin elevation for indirect restorations: a systematic review. J Pharm Res Int 33, no. 37B (2021): 23-30.
10. Cordaro M.; Staderini E.; Torsello F.; Grande, N.M.; Turchi M.; Cordaro M. Orthodontic Extrusion vs. Surgical Extrusion to Rehabilitate Severely Damaged Teeth: A Literature Review. Int. J. Environ. Res. Public Health 2021, 18, 9530.
11. Alrabiah A, Alqudrah A, Aljabr N, Alzareei S, Asali W, Alajmi A, Almotairi M, Alazmi M, Alrawili Y, Alqahtani A. DEEP MARGIN ELEVATION: SYSTEMATIC REVIEW AND META-ANALYSIS OF IN-VITRO STUDIES. Annals of Dental Specialty Vol. 2023 Apr;11(2):26.