Optimization of Post-Endodontic Restoration: Strategies for Handling *Deep Subgingival Margin* through DME and *Crown Lengthening*

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ABSTRACT

Background: *Post-endodontic restoration with deep subgingival margins beyond the cementoenamel junction (CEJ) is a challenge in itself. This condition can cause difficulties in insulation with rubber dams, molding, and restoration cementing. The subgingival margin is also at risk of triggering gingival inflammation and invasion of biological width (BW) due to its proximity to the alveolar bone. Surgical crown lengthening (CL) is often recommended to restore the ideal distance of the BW, but the procedure is invasive. As a more conservative alternative, Deep Margin Elevation (DME) allows elevation of the subgingival to supragingiva margin to improve the integrity of the restoration without invading the BW.*

Case report: *The first case on the interproximal teeth 24 and 25 (Bone Sounding: 1mm) was performed CL by the Periodontics department prior to crown preparation, after previously undergoing endodontic and post fiber treatment in the Dental Conservation department. The second case was in 36 previously treated teeth (Bone Sounding: 2mm) with deep subgingival margins, DME was performed using a high-filler composite resin prior to onlay restoration. Both procedures were carried out at RSKGM FKG UI.* ***Conclusion:*** *Proper indication for CL and DME at the deep subgingival margin can improve the optimization of periodontal health and the integrity of post- endodontic restoration.*

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BACKGROUND

Deep subgingival margin is a topic that is often debated in the management of post-endodontic restorative care. The hydrophobic characteristics of composite resin materials pose their own challenges, especially in cavitite restoration with margins located deep in *the cementoenamel junction* (CEJ) line.[1] Difficulty in managing cases with *deep subgingival margins,* caused by limited access, instability of rubber *dam* insulation in the margin area, as well as leakage of saliva, gingival sulcus fluid, and blood that can interfere with the success of restoration procedures.[2] In addition, subgingival preparation also affects various subsequent stages of restoration, such as digital and conventional molding, restoration installation and cementation, and finishing and polishing processes in the cervical area.[1,3,4] Subgingival margins are commonly found in partial indirection restoration in the posterior region, which is often accompanied by biological problems, where margins that are too deep can lead to gingival inflammation and *biological width violation*, potentially interfering with the health of periodontal tissue. [5]

Biological width (BW) is the vertical dimension of soft tissue consisting of *junctional epithelium* and *supracrestal connective tissue attachment*, which as a whole form a biological barrier to the penetration of microorganisms from the oral cavity to periodontal tissue.[6.7] Gargiulo *et al*., 1961 found the dimensions of BW to range from 1.77 to 2.43 mm. This means that there should be an absolute minimum of 2.5 mm between the restoration margin and the apex of the alveolar bone.[8] Violations of this zone, such as *the overextension* of the restoration margin into the supprarestal space, can trigger chronic inflammatory reactions, bone resorption, and the formation of pathological pockets.[7]

Crown Lengthening (CL) is considered the main procedure for maintaining *biological width*. The goal of this procedure is to move the location of the restoration margin and create a more conducive environment for periodontal tissue.[6] The CL procedure is a procedure that has been extensively researched and has high predictability. However, CL has a number of limitations and side effects, including longer treatment times, high costs, patient discomfort, opening the proximal area and forming a '*black triangle*' in the interdental papilla area resulting in impaired dental aesthetics, loss of adhesion, as well as the risk of involvement of complex areas such as root concavities and furcation areas.[7.9]

A minimally invasive approach is the main principle when conducting restoration in the modern era. In this context, *Deep Margin Elevation* (DME) can be used as an alternative to surgical procedures such as *crown lengthening* in subgingival margin cases.[6] DME is a technique that moves the subgingival margin to the supragingiva using restorative materials to improve the strength and integrity of the restoration margin.[7] This procedure can be performed by placing the composite material at a distance of 2 mm from the apex of the alveolar crista, noting that the adaptation and polishing of the composite is optimally carried out. This distance aims to maintain space for connective tissue attachment, so as not to interfere with the integrity of periodontal tissue.[10] DME is indicated for cases with difficulties in isolating but the basic area of the cavity does not enter the *biological area*.[11] *Deep Margin Elevation* (DME) is a technique that relies heavily on operator skill (*technique-sensitive*); failure to execute it can lead to restoration failure. Several technical constraints can be obstacles to the success of this procedure, including the difficulty of isolating the work, the formation of overhangs in restoration, and the varied clinical skills of the operators.

Although DME is a conservative alternative to CL, an understanding of the indications, prognosis and techniques of treatment needs to be tailored to the clinical condition of the tooth. Selection of appropriate care management can improve the optimization of periodontal health and the integrity of post-endodontic

restoration. This case report presents two cases with a margin clinical conditionsubgingival procedures involving *Deep Margin Elevation* (DME) and *Crown Lengthening* (CL) procedures, according to clinical indications as a preliminary stage before post-endodontic restoration.

CASE REPORT

Case 1

A 36-year-old female patient came to RSKGM FKU UI with complaints of tooth and left jaw, throbbing pain, and recurrent swollen gums. Objective examination shows teeth 24 and 25 there were tooth-colored fillings with the condition that the fillings had changed color and the marginal edges were not good. Both teeth were found cervical part abfraction was found in the cervical part, vitality check -, percussion + and palpation + (sinus track teeth 24), Bone sounding. The distal part of tooth 24 and the mesial tooth 25 is 1 mm. Radiographic examination found radiopak images of the proximal part of the crown of the two teeth to the pulp horn, loss of the periodontal ligament and lamina dura in apical tooth 24 and thickening of the periodontal ligament in tooth 25. (Figure 1)

Figure 1. a) Early condition of teeth 24 and 25 b) dismantling of old restoration c) Sinus track teeth 24 d) Periapical radiography picture of teeth 24 and 25.

Diagnosis based on AAE, tooth 24 Necrosis Pulp; Chronic Apical Abscess and 25 Necrosis Pulp; Apical periodontitis is symptomatic. The treatment plan for both teeth is carried out root canal treatment with the final restoration of the fiber pegs and crown with Zirconia layering material. The first visit was conducted with rewalling using composite resin (Figures 2a and (Dentsply Sirona®, USA) accompanied by NaOCl 2.5% irrigation and 17% EDTA. Irrigation activation uses Passive Ultrasonic Irrigation (PUI) (Ultra X, Eighteeth). Confirmation of the master apical cone (MAC) and evaluation of apical stop and tug back of tooth 24 (Buccal: F2/19mm, Palatal: F2/17mm) of tooth 25 (Buccal: F1/19mm, Palatal: F1/18mm) (Protaper, Dentsply, USA) using periapical radiography (Figure 2d). Dry the root canal using paper points. Root canal sterilization using CaOH2 (Calcigel, PrevestDentPro, USA) as well as Caviton temporary fillings (GC, japan).

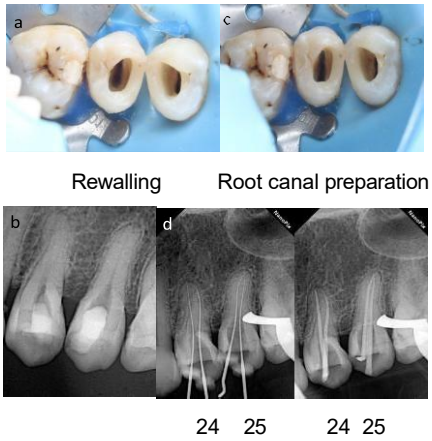
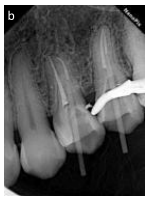


Figure 2. a) Rewalling of teeth 24 and 25 b) Evaluation of rewalling using periapical radiography c) Preparation of root canals of teeth 24 and 25 d) Confirmation of master apical cone (MAC).

Patients control after the last 2 weeks of treatment. The patient did not complain of pain, the temporary patch was still good, percussion test (-) Palpation (-), normal gingiva, then it was decided to perform root canal obturation with the Hydraulic Condensation obturation technique with bioceramic sealer (AH+ Bioceramic, Denstply Sirona®, USA) using MAC (Figure 3a). The next visit was carried out by the numerator 2b), access preparation, and root canal preparation using Protaper Ultimate rotary file. Guta percha on the root canal uses Tip Yellow Fastpack (Eighteeth®, China) to leave a 4 mm guta percha apical and compacted with a Plugger (Denstply Sirona®, USA) to tidy up the surface of the guta percha inside the root canal. Preparation of root channels throughout the stake work with special drills from the stake system (Dentolic, Itena) is then irrigated and drained of the root canal. Try in pegs to confirm the size of the diameter and length of the pegs are correct on the root canal with periapical radiography (Figure 3b). Apply Silane (Silan-It, Itena) to the fiber pegs using a microbrush, let it sit for 20 seconds. Apply OptiBond™ Universal (Kerr®, USA) Bonding to the tooth surface and root canal, light cure for 10 seconds. Cementation of the peg with a dual cure resin (TotalCem, Itena) is applied into the root canal with a syringe. The fiber stakes are inserted into the root canal according to the length of the stake work. Light cure from the occlusal direction for 20 seconds. Core build up (Dentocore, Itena) is applied to the height of the crown and then light cure, the rest of the fiber pegs are cut using bur diamond (Figure 3c). Evaluation of the results of fiber stake cementation with periapical rhygiography (Figure 3d).

Cementation + core build up



Try in scotland

X-ray evaluation

Figure 3. a) Root canal obturation b) Evaluation of fiber stake try in using periapical radiography c) Stake cementation and Core build up d) Evaluation of periapical X-rays.

The composite resin rewalling was removed after the peg and core build up procedure and the patient was referred to the Periodontology department of RSKGM FKG UI to undergo crown lengthening (CL) to obtain a biological widht ±3mm (Figure 4b). The patient was instructed to return to the dental conservation department after 2 months of the crown lengthening (CL) procedure. A 2-month follow-up injective examination showed complete healing of the gingiva, with the gingival condition deteriorating to apical and the gingival black triangle becoming more visible (Figure 4c).

Pre Operative

Follow-up months post CL

Procedure CL

Figure 4. a) Preoperative CL b) CL procedure is carried out by the Periodontology Department of RSKGM FKG UI c) Follow-up results 2 months after CL.

The patient then performs a preparation procedure in accordance with the design of the Zirconia crown preparation with a margin shoulder suffix and an equal gingival position (Figure 5a). Communicate to the laboratory about the teeth to be made, the color, and the type of material (zirconia), instruct to do high polishing and not to glaze the zirconia material (Figure 5b). Visit Next, try in and evaluate occlusion, marginal adaptation, crown anatomy and articulation (Figure 6.1). After evaluating the crown try in is appropriate and ideal, the zirconia crown cementation procedure begins with the application of Cleaning Gel (ZirClean

Extraoral, Bisco, USA) on the intaglio area to clean the surface after the try in. Apply Universal Bonding 10-MDP (Clearfil, Kuraray, Japan) to the intaglio crown area then Light curing for 10 seconds. Then pretreat the teeth with the application of Universal self etch adhesion (SEA) 10-MDP (Clearfil, Kuraray, Japan) bonding on the surface of the teeth with a microbrush. Light curing for 10 seconds. Cement using cement resin (Totalceram, Itena). Tack cure for 5 seconds and clean the cement that comes out of the crown. Then light curing again for 20 seconds on each surface. Apply the remaining cement to the interproximal area using dental floss (Figure 6.2). Re-evaluate occlusion, articulation, and tooth contact points. Crown evaluation using periapical radiography to look at the marginal edge adaptation of the crown and teeth (Figure 6.3).

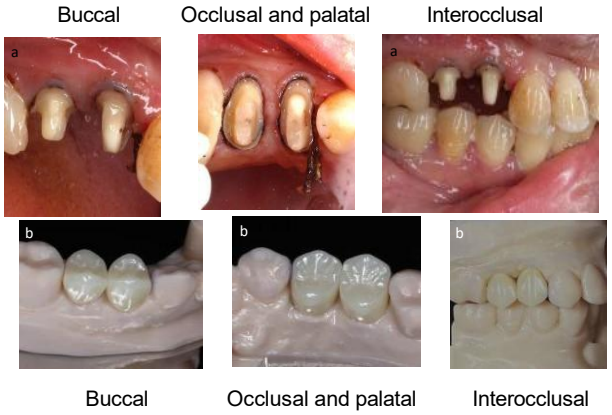


Figure 5. a) Results of Crown Zirconia Preapation Tooth 24 and 25 (Buchacell-occlusal and palatal-interoclusal) b) Crown Zirconia Layering (Buchacell-occlusal and palatal-Interoclusal).

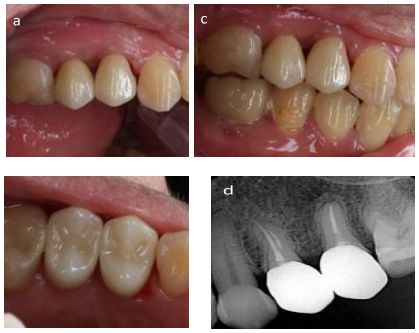


Figure 6.1. Try in crown zirconia teeth 24 and 25 a) buccal b) occlusal and palatal c) interocclusal and d) periapical radiography evaluation.

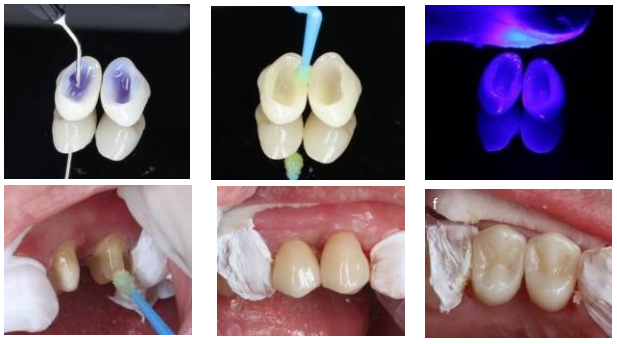


Figure 6.2. Dental Zirconia Crown Cementation Procedure 24 and 25

a) Cleaning Gel Application (ZirClean Extraoral, Bisco,USA) b) Universal 10 MDP Bonding Application

(Clearfil, Kuraray, Japan) on the intaglio crown area c) Light curing for 20 seconds d) Universal 10 MDP Bonding Application (Clearfil, Kuraray, Japan) application on the tooth surface e) Cementation using cement resin (buccal appearance) f) appears occlusal.

Figure 6.3. After cementation and cleaning, the remaining cement a) Buccal appearance b) Palatal c) Occlusal d) Interocclusal e) Evaluation of periapical X-rays after semen.

Case 2

A 25-year-old male patient came to RSKGM FKU UI as a referral from the oral surgery department after 6 months ago a dental odontectomy procedure 38, and was asked to perform a root canal treatment procedure in tooth 37 with caries in the distal proximal part reaching the pulp. Patients complain that their teeth have felt throbbing pain, but now there is no pain, only discomfort when chewing. Objective examination showed that tooth 37 had fillings of the same color as teeth with the condition that the fillings had changed color and the marginal edges were not good. Vitality checks -, percussion + and palpation – (Figure 7a). Radiographic examination found a picture of radiolucentiness of the distal proximal part of the crown of the tooth 37 until it hits the pulp horn, loss of periodontal ligaments and lamina dura in the apical part and radiolusensy with an unclear boundary in the apical (Figure 7b). Diagnosis based on AAE, dental 36 Necrosis of Pulp; Apical periodontitis is symptomatic. The treatment plan is carried out root canal treatment with the final restoration of lithium disilicate onlay.The first visit was carried out to open the cavity using a round diamond bur in the occlusal part and caries was seen in the distal proximal part until it reached the subgingival (Figure 7c). Preparation of access and cleaning of caries involves dystoclusal surfaces. Gingiva in the proximal part of the Covering the base of the cavity is performed gingivectomy using Cautery Electrosurgery (ACTEON,® French) under anesthesia of inphystasis (Figure 7d). Bone sounding was done using a probe and 3 mm was obtained.

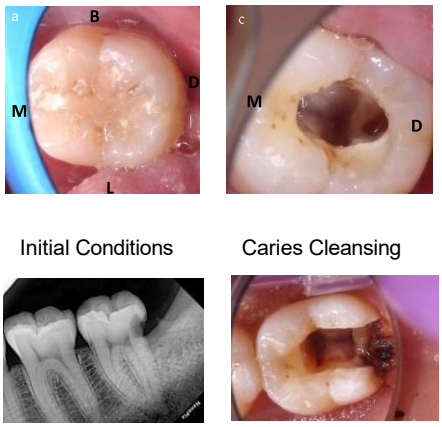


Figure 7. a) Preoperative tooth 37 with tooth-colored fillings b) Periaptic X-ray of dental preperative 37 caries in the distal proximal part and radiolucent in the apical part with unclear boundaries c) Cavity opening through the occlusal and obtained cavity on the distal side (Blue arrow) d) Cavity cleaning and access preparation involving the dystoclusal surface.

Rewalling uses composite resin on the distal part. Access repair using an endodontic ultrasonic Cap 2 tip (ACTEON,® French). Root canal preparation used a combination of Protaper Ultimate (Dentsply Sirona®, USA) rotary file on the distal root and Trunatomy rotary file (Dentsply Sirona®, USA) on the mesiaobuccal and mesiolingual root (Figure 8a). Root canal irrigation uses 2.5% NaOCl and 17% EDTA activated using Passive Ultrasonic Irrigation (PUI) (Ultra X, Eighteeth). Confirmed the master apical cone (MAC) and evaluated the apical stop and tug back gear 36 (Distal: F2/22.5 mm; Mesiobuccal : Small /18mm; Mesiolingual: Small/23mm). MAC evaluation using periapical radiography (Figure 8b). Dry the root canal using paper points. Root canal sterilization using CaOH2 (Calcigel, PrevestDentPro, USA) as well as Caviton temporary fillings (GC, japan). Control patients after 1 week of the last treatment. The patient did not complain of pain, the temporary patch was still good, percussion test (-) Palpation (-), normal gingiva then root canal obturation was carried out with the technique of Hydraulic Condensation obturation with bioceramic sealer (AH+ Bioceramic, Denstply Sirona®, USA) using MAC (Figure 8c). Evaluation of root canal obtuation results using periapical radiography showed hermetic filling and no sealerpuff on the apical (Figure d). After cleaning the remaining sealer in the pulp chamber, do the base using Bulkfill flowable composite resin (Palfique Bulkflow Tokuyama,Japan).

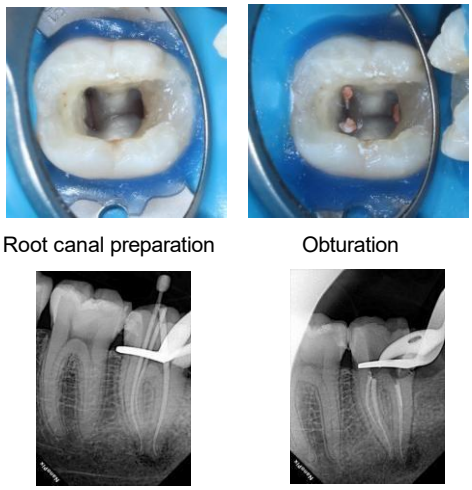


Figure 8. a) Root canal preparation using a combination of Protapper Ultimate and Trunatomy. b) MAC evaluation using periapical X-rays c) Root canal obturature d) Evaluation of root canal obstruction results using periapical X-ray.

The next visit was carried out to dismantle the rewalling of composite resins that had been exposed to irrigation solutions in preparation for the final restoration (Figure 9a). It appears that the base of the cavity is located below the subgingiva so that the rubber sheet cannot fit under the base of the cavity (Figure 9b). This will make it difficult at the time of final restoration printing and final restoration cementation procedures. So it was decided to conduct DME (Deep Margin Elevation) to elevate the margin towards the corona so that the end of the preparation margin is easier to obtain. The DME procedure begins with the application of the Matrix, this case uses the combination technique of M-i-M (Matrix in Matrix) and copper band matrix to create the contour of the subgingival margin. This combination of techniques requires 3 types of matrices to be used, namely circumferential matrices (Palodent 360, Dentsply, USA), sectional band matrices (Palodent 360, Dentsply, USA), and copper band matrices (Figure 9c). The circumferential matrix is first applied around the shape contour the tooth 36 with a loose bond, then insert the sectional band matrix between the margin and the circumferential matrix, reinsert the copper band matrix that has been formed between the sectional matrix and the circumferential matrix. Tighten the bond from the circumferential matrix until the margin area has no gaps with the matrix (Figure 9d).

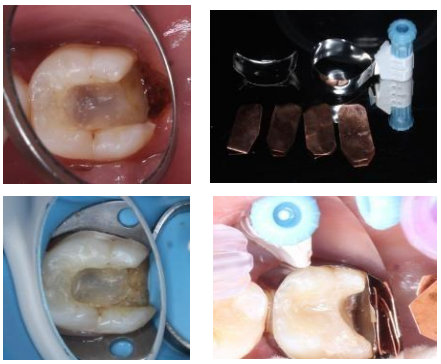
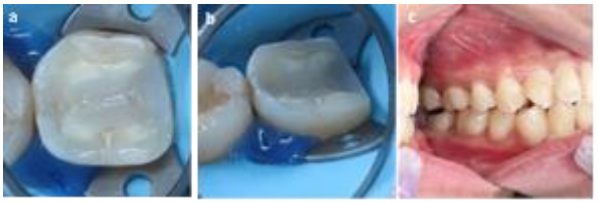


Figure 9. a) The base of the Subgingiva cavity after the disassembly of the rewalling b) Rubber sheet that does not fit at the base of the cavity and covers the edges of the cavity indicated by the red arrow c) Type of matrix used d) Application of the matrix system, blue color: circumferential matrix, green: sectional matrix, and yellow: copper band.

Once a good marginal edge adaptation is formed, isolate the area using cottonroll and suction to ensure the area is dry and minimize saliva contamination. Apply Etching to the enamel, rinse and dry. Then apply the bonding OptiBond™ Universal (Kerr®, USA) to the enamel surface and bonding with scrubbing movements using a microbrush, light cure for 10 seconds. SDR Plus Bulk Fill Flowable composite resin (Dentsply Sirona®, USA) is applied from the lowest point of the cavity towards the corona, each layer with a thickness of ±2mm is lightly cured for 20 seconds, up to occlusal height. Remove the entire matrix, then finish and polish the surface (Figure 10a). Evaluation of DME results using periapical radiography, showed good edge adaptation and no void areas around the DME (Figure 10b).

Figure 10. a) DME results in the distal proximal section b) Evaluation of DME results using periapical radiography, showing good edge adaptation and no void.

Tooth preparation 36 with Posterior Indirect Adhesive Restoration (PIAR) onlay preparation design, lithium disilicate material. The buccal and lingual cups are reduced by 2 mm to form a butt joint without involving the mesial part (maintaining the mesial contact point). The distal part is formed a proximal box with a shoulder-shaped cavity base. Smooth the rough and sharp areas then print and send them to the laboratory for onlay processing (Figure 11).



Occlusal Lingual and buccal Interocclusal

Figure 11. Results of preparation of tooth onlay 36 with lithium disilicate material a) Occlusal view b) Buccal and lingual view c) Interocclusal view with occlusal space of 2 mm.

Existing onlays (Figure 12a) were conducted Try In and evaluation of occlusion, marginal adaptation, crown anatomy, proximal and color (Figure 12b). Evaluation of the results of the try-in with periapical X-rays (Figure 12c). After the results of the clinical evaluation and X-rays are good, perform a semenation procedure under anesthesia and rubber dam isolation. Treatment of the onlay material begins by applying porcelain etching (Hydroflouric acid, Ultradent) to the onlay and let it sit for 90 seconds then rinse and dry (Figure 13a). Apply silane (Ultradent) for 60 seconds, wait for it to dry (Figure 13b). On teeth that have been insulated with a rubber dam, etching is applied to the tooth for 15 seconds (Figure 13c), then rinsed with water and dried with syringe water while still allowing the cavity to remain moist. Apply bonding (Single Bondä Universal Adhesive, 3M ESPE, Germany) with a microbrush on a thin cavity with a clean and shining microbrush with the light curing unit for 20 seconds (Figure 13d). Apply dual cured self adhesive (Totalcem, Itena, France) to the restoration and cavity intaglios. Insert the onlay on the cavity, tack cure for 3 seconds then remove the excess cement with a probe and dental floss in the proximal. Then shine it back for 20 seconds on each side (Figure 13e). After that, clean the tooth area again and polish using the Eve Porcelain kit (DIAPOL®, Germany). Evaluation of semen results using periapical X-rays (Figure 13f). The results of the occlusion and articulation check in the patient showed that the patient was comfortable and able to perform mastectomy (Figure 13g). Crown evaluation using bitewing radiography to look at the marginal edge adaptation of the crown and teeth (Figure 13h).

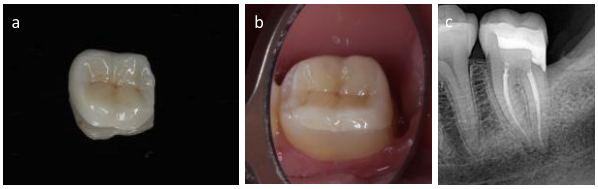


Figure 12. a) Lithium disilicate onlay b) Results of try in c) evaluation of results of try in by periapical radiography.

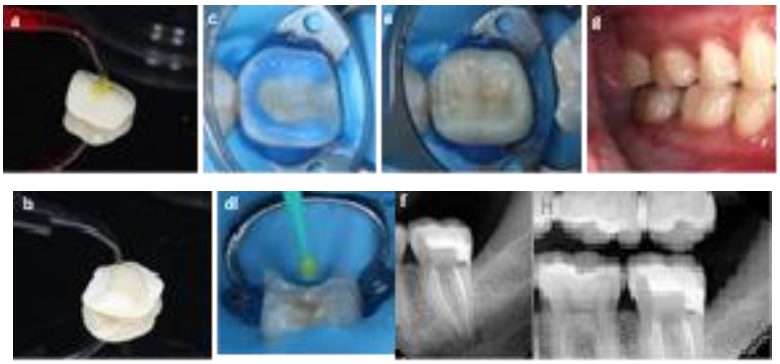


Figure 13. a) Application of HF porcelain etching b) Silane c) Selective etching on enamel d) Bonding e) Onlay cementation f) Periapical radiography evaluation g) Articulation and occlusion check h) Bitewing radiography evaluation.

DISCUSSION

Post-endodontic dental final restoration with deep subgingival margin conditions is more ideal if indirect restoration is used because it can provide better aesthetic results, anatomical shape, physical and mechanical properties, and reduce the possibility of material polymerization shrinkage.12 Nevertheless, the subgingival margin remains a challenge due to difficulties in access, no rubber dam entry in the margin area, and leakage of saliva, sulcus fluid, and blood.2 Both cases in this study show subgingival margin conditions that may affect the success of post-endodontic end-to-end restoration treatment. Crown Lengthening (CL) and Deep Margin Elevation (DME) are two different approaches used to treat teeth that have suffered severe damage due to caries with the basic condition of the cavity having reached cementoenamel juntion (CEJ) or even more apical than CEJ.[13]

The first case in teeth 24 and 25 was CL performed before the final post-endodontic restoration with consideration that the basic cavity is almost parallel to the alveolar bone which can be evaluated from periapical radiography images and 1 mm bone sounding examination in the interproximal area of teeth 24 and 25. This condition can cause trauma to the biological widht (BW) so that it can cause damage to periodontal tissue and have a bruising impact on the final restoration and continuity of teeth after treatment. According to Grossman (2021) BW is considered important for maintaining gingival health, especially in the case of teeth that require restoration. Biological width will be protected when the restoration is placed approximately 2 mm in the area of connective tissue and jungal epithelium and 1 mm for the sulcus. If BW is violated, chronic gingival inflammation can occur, or the gingiva will try to improve its attachment structure by means of alveolar bone resorption. [8]

Conventional approaches such as crown lengthening (CL) are performed with the aim of apical displacement of periodontal tissue to access the subgingival margin and obtain adequate space to form BW.14 The CL procedure in teeth 24 and 25 requires interdisciplinary discussion and cooperation with the periodontology department of RSKGM FKG UI to determine how much bone reduction will be taken by the periodontology department team. Request from the department Periodonization before the CL procedure is to first disassemble the composite resin rewalling made for the purpose of previous endodontic treatment. This is done to gain good access and visibility at the base of the original cavity of the tooth that was previously

covered by composite resin. Instructions from the periodonization department to be able to proceed with the final restoration treatment plan after 2 months of follow-up after the CL procedure. When the control returned to the dental conservation department, it was found that the postoperative wound had healed and a 4 mm bone sounding and periapical radiography evaluation found that there was enough biological space to accommodate the restoration where the alveolar bone boundary was more apical from the base of the cavity. However, the condition of the gingival margin has slightly contracted towards the apical and the black triangle of gingiva appears clearer and firmer than before CL. In addition, patients also complained about the longer treatment time when the CL procedure was performed. This condition is in line with the statement of Alizadeh et al., (2024) that CL has several weaknesses, such as further loss of attachment, opening of root concavities and furcation, opening of proximal contact, formation of black triangles, papilla atrophy, dentin hypersensitivity, discomfort in patients, non-ideal ratio of crown to root, compromise of aesthetic problems, and increased treatment time and costs.14 The selection of crowns with zirconia material because there are indications of heavy bites in the area of teeth 24 and 25 which are characterized by abfraction in the cervical part of the tooth. Zirconia-made restorations have much higher mechanical properties compared to other restorative materials, such as ceramics.15 Most zirconia-based prosthetic structures are made of yttrium stabilized zirconium polycrystals (3Y-TZP). The main advantages of this stabilizer material are its resistance to fracture and high flexural strength.[16]

The results of crown cementation in the first case show the marginal adaptation and good anatomical shape of the zirconia crown. Radiography evaluation showed that the marginal edge of the restoration did not touch the BW area so that periodontal health was maintained. However, the black triangle on the interproximal teeth appears more pronounced which has an impact on the poor aesthetics of the restoration.14 This is a The lack of invasive procedures from CL results in the loss of bone support in adjacent teeth, leading to aesthetic problems such as a longer looking clinical crown, horizontal papillae, and the formation of black triangles.17 These conditions have been conveyed to the patient and the patient feels that this is still acceptable and does not make them less confident.

The second case was carried out by DME as a treatment for post-endodontic restoration cases with deep subgingival margins. This treatment allows the repositioning of the subgingival margin to the supragingival position without the need for a surgical procedure, thus avoiding recovery time as well as the risks and complications associated with the procedure.18 Restoration with supragingival margins has been shown to provide better periodontal condition and controlled oral hygiene.19 Bone sounding examination of teeth 37 in the second case showed 3 mm so it was ideal for DME without damaging the BW area. According to Castelo et al., (2021) DME can be applied at a distance of 2 mm from the alveolar crystal using composite materials, as long as the adaptation and polishing of the material is carried out optimally. This distance is important to maintain space for the connective tissue to be biologically attached.20 The basic principles of DME are good insulation, proper matrix placement, correct use of adhesive techniques, and optimal polishing. All of these steps can be done more easily and accurately if you use magnification.[18]

The management of DME in the second case uses a matrix with a combination technique of M-i-M (Matrix in Matrix) and copper band matrix to create a subgingival margin contour. The M-i-M matrix technique is a conceptual development of a modified circumferential matrix technique. This technique facilitates the isolation and adaptation of the subgingival matrix by adding a sectional matrix inside the circumferential

matrix, and then further adjusting the shape by inserting a Teflon band between the two matrices.21 The application of Teflon tape in the second case is still not enough to close the gap between the edge of the cavity and the matrix, so a copper band matrix is used, which has more rigid properties and sufficient thickness, but is easy to form and more stable in maintaining its shape during application.

The adhesive system used is universal bonding Self Etch Adhesive (SEA). The use of the system in this case is because it considers that the coated surface is dentin-dominant so that later a better sealing ability can be formed. The results of the research of Da Silva et al. (2021) reported that in cases where cavitation margins are on dentin, SEA universal adhesive exhibits better sealing ability compared to etch-and-rinse (ERA) adhesives, especially when used in DME procedures or when margins are located on subgingival dentin.22 High filler composites are used in this case to reduce the shrinkage properties of the material which can form microleackedges on restoration. Zhang H et al. (2021) said bulk-fill SDR as a new resin monomer with high filler loading with a low polymerization shrinkage rate and can overcome the problem of microleakage. This is likely due to the thermal expansion coefficient of the bulk-fill SDR similar to that of dental tissue, so that after experiencing the temperature cycle, the level of microleakage in the dentin margin becomes lower.[23]

Based on clinical and histological studies in humans, DME techniques and subgingival restoration may be compatible with periodontal tissue health, noting that the restoration is well polished, the biological width is not disturbed, and the patient undergoes routine supportive care and maintains oral hygiene. Recent histomorphometric studies also suggest that the distance between restoration and bone krista should be at least 2 mm to prevent bone shifts in the apical direction.

The disadvantage of this procedure is that it is highly sensitive to techniques, including adhesive types, restoration materials, and incremental layering techniques during composite applications of restoration. Therefore, it is important to evaluate using a radiography to ensure proper contouring and polishing, in order to prevent periodontal damage or the possibility of microleaking in the restoration.

Both cases demonstrate a treatment strategy in deep subgingiva margin conditions to optimize post-endodontic final restoration. Determining case selection criteria is an important aspect that needs to be emphasized in choosing a deep handling strategy subgingival margin. Case reports from Sarfati and Tirlet (2018) compare crown lengthening (CL) and deep margin elevation (DME) as strategies in handling subgingival margin cases, concluding that DME is superior in deep subgingival margin cases.7 However, this conclusion is based more on consideration of biological aspects of the wetlands, rather than on the resilience of restoration or the success of its retention in long-term follow-up. Both cases in this case series report also have drawbacks where the study only focuses on indications and procedures of treatment strategies, there is no short, medium and long term evaluation of treatment success.

CONCLUSION

Treatment of deep subgingival margin in post-endodontic restoration requires selecting the right strategy according to the patient's clinical condition. Crown lengthening (CL) and deep margin elevation (DME) are two key approaches that can be used to improve the optimization of periodontal health and the integrity of post-endodontic restoration. DME shows more conservative results on periodontal tissue and is clinically more aesthetically pleasing than CL, although it is highly dependent on the technique used. This

case series report shows that case selection is an important factor in the success of the final restoration. However, further research with long-term evaluation is needed to assess the effectiveness and predictability of both techniques as a whole.

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