



Evaluation of Pain Following Deep Margin Elevation Versus Surgical Crown Lengthening in Endodontically-treated Posterior Teeth with Deeply Located Proximal Margins Receiving Indirect Restorations: A Randomized Controlled Trial

Ahmed Tarek Farouk¹, Olfat El Sayed Hassanein², Ola Ibrahim Fahmy³, Hani Elnahass⁴

1. Phd Candidate at the Department of Conservative Dentistry, Faculty of Dentistry, Cairo University
Email: a.tarekdental@gmail.com
2. Professor and Head of Department, Conservative dentistry department, Faculty of Dentistry, Cairo University
Email: olfat.hassanein@dentistry.cu.edu.eg
3. Professor of Operative Dentistry Department, Faculty of Dentistry, Misr International University
Email: Ola.fahmy@miuegypt.edu.eg
4. Professor of Periodontics, Faculty of Dentistry, Cairo University
Email: Hani.elnahass@dentistry.cu.edu.eg

Corresponding Authors:

Ahmed Tarek Farouk

Email: a.tarekdental@gmail.com

Abstract

Background:

Adhesive dentistry employing principles of minimal invasiveness considered a game changer when considering restoration of endodontically treated posterior teeth. Deep proximal margins created a challenge during different restorative procedure that could be faced by the clinicians.

Aim:

The current clinical trial was conducted to evaluate the postoperative pain following deep margin elevation in comparison to surgical crown lengthening for indirect restorations in endodontically-treated posterior teeth with deeply located proximal margins.

Methods:

A total of 20 deep proximal cavities in endodontically treated posterior teeth were randomly assigned into two groups (n=10); Deep Margin Elevation (DME) or Crown Lengthening (CL). Pain records were taken from the patients postoperatively immediately after both procedures.

Results:

There was a statistical significant difference was found between the two groups with median pain score for the Deep margin elevation group lower than crown lengthening group.

Conclusion:

Deep margin elevation approach could offer a more conservative solution with predictable results when consider relocating deeply seated proximal margins in a more coronal position. Applying the DME approach resulted in marked reduction in post-operative pain favoring this restorative technique in managing deeply located subgingival margins.

Keywords: Deep margin elevation, Crown lengthening, Indirect restoration, Endodontically treated posterior teeth

Introduction:

Minimal invasive adhesive dentistry has changed the way of dealing with different restorative challenges that faces the clinicians in the daily practice. Endodontic therapy, without a doubt, causes significant tooth structure loss during access cavity preparation and canal instrumentation, leaving endodontically treated posterior teeth structurally compromised with a reduced lifetime prognosis. A wide range of treatment modalities was explained in literature to restore endodontically treated teeth, including direct restorative adhesive restorations, indirect restorative approaches, post and core placement, after that full coverage restoration. Several considerations must be addressed while choosing a final restoration. The amount of dental structure left, the occlusal function, and the tooth's position in the arch are all factors to consider (1).

To achieve greater lifespan of endodontically treated teeth, all proposed restorative procedures should preserve healthy tooth structure which became possible when bonded indirect partial restorations were used (2-5). Deeply located cervical margins could be considered one of the common challenges that faces the clinicians, complicating the restorative procedure from tooth preparation to cementation and excess cement removal (6,7). Surgical crown lengthening is considered the gold standard procedure for many years to overcome such restorative obstacles, especially those violating the biological width, aiming to reestablish a new healthy supra crestal attachments, and bring the proximal margins in to more coronal position (8).

Deep margin elevation procedure offered a more conservative and time saving solution, overcoming this clinical hassle, where the deeply located cervical margins are elevated using adhesive restorations creating a more coronally located margins under strict isolation conditions (7). It was previously believed that placing the proximal margins of restorations deep subgingivally, would have detrimental effect on the surrounding periodontal tissues, causing soft tissue inflammation, loss of attachments and bone resorption (8). Based on a recent review of literature, deep margin elevation could be used safely without any destructive inflammatory response as long as the proximal margins are not violating the connective tissue compartment of the supra crestal attachments (9). Also, favorable clinical and histological responses were

possible when deep margin elevation restorative procedure was used, expanding its uses in reconstructive dentistry (10,11).

Up till now, none of the published articles addressed the impact of both procedures on the postoperative pain perception by the patients, so the aim of the current clinical trial was to evaluate the immediate postoperative pain after both deep margin elevation and surgical crown lengthening.

Patients:

The current study was conducted at the Conservative Dentistry Department, Faculty of Dentistry at Cairo University. Patients were recruited from the Out-patient clinic of conservative dentistry department, the research was targeting patients with deeply located proximal margins, only the eligible participants were chosen until reaching the target sample size. The inclusion criteria were as follows: 1. Teeth with successful root canal treatment with absence of any radiographic radiolucency. 2. Teeth having more than half of the remaining sound tooth structure exist. 3. Teeth having gingival seat 1-2 mm away from the crestal bone level. 4. Patients able to tolerate both surgical and restorative procedures. 5. Teeth having thick biotype periodontium. 6. Patients with healthy periodontium 7. Medically free patients. While the exclusion criteria were as follows: 1. Teeth with proximal margins beyond the bone level. 2. Badly broken down endodontically treated teeth. 3. Pregnant women; where radiographs cannot be taken for them. 4. Patients with persistent poor oral hygiene.

All participants signed a written informed consent after being completely aware of the settings of the study regarding: aim of performing the research, procedures expected to be done in details including the number of visits, benefits for the participants and possible side effects that might occur. All consent forms were written in Arabic language to be well understood by all the participants.

Sample Size:

Using alpha (α) level of (5%) and Beta (β) level of (20%) i.e., power = 80%; the minimum estimated sample size was a total of 16 subjects. The sample size was increased to a total of 20 subjects (10 subjects per group) to compensate for a dropout rate of 25%. Sample size calculation was performed using PS Power and Sample Size Calculations Version 3.

Methods:

After completion of the root canal treatment of the offended teeth and comprehensive evaluation of the obtained treatment, the randomly allocated patients in the deep margin elevation group underwent deep margin elevation procedure where rubber dam isolation was accomplished using heavy rubber dam sheets followed by proper matricing and wedging using matrices and wedges especially designed for this procedure followed by selective enamel etching, then universal adhesive application following the manufacturer instructions, light curing followed by application of bulk flowable resin composite for the first 1 mm and light cured for

20 seconds according to the manufacturer recommendations followed by application of packable bulk fill composite to elevate the margins and light cured following the manufacturer instructions.

Participants in the crown lengthening group underwent surgical crown lengthening in which an internal bevel incision was done buccally and lingually followed by full thickness flap reflection using mucoperiosteal elevator, then interproximal bone removal was done using end cutting bur to the planned position away from the margins by 3 mm. The flap was displaced apically with apically positioned sutures. Postoperative instructions were given to the patient aiming to control postsurgical complications including pain and swelling. Suture removal and assessment of the surgical site were done after two weeks.

All endodontically treated teeth in both groups received CAD/CAM indirect composite overlays that were adhesively cemented using light cured resin composite under strict rubber dam isolation. pain records were taken from the patient postoperatively and expressed in the form a scale from 0 to 10 according to pain severity, where 0 means no pain and 10 means intolerable severe pain.

Ethical Approval:

The study was approved by Research Ethics Committee (CREC), Faculty of Dentistry, Cairo University with identification number: 19753.

Statistical Analysis:

Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). Mann-Whitney U test was used to compare between the two groups and data were expressed in the form of median and range. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

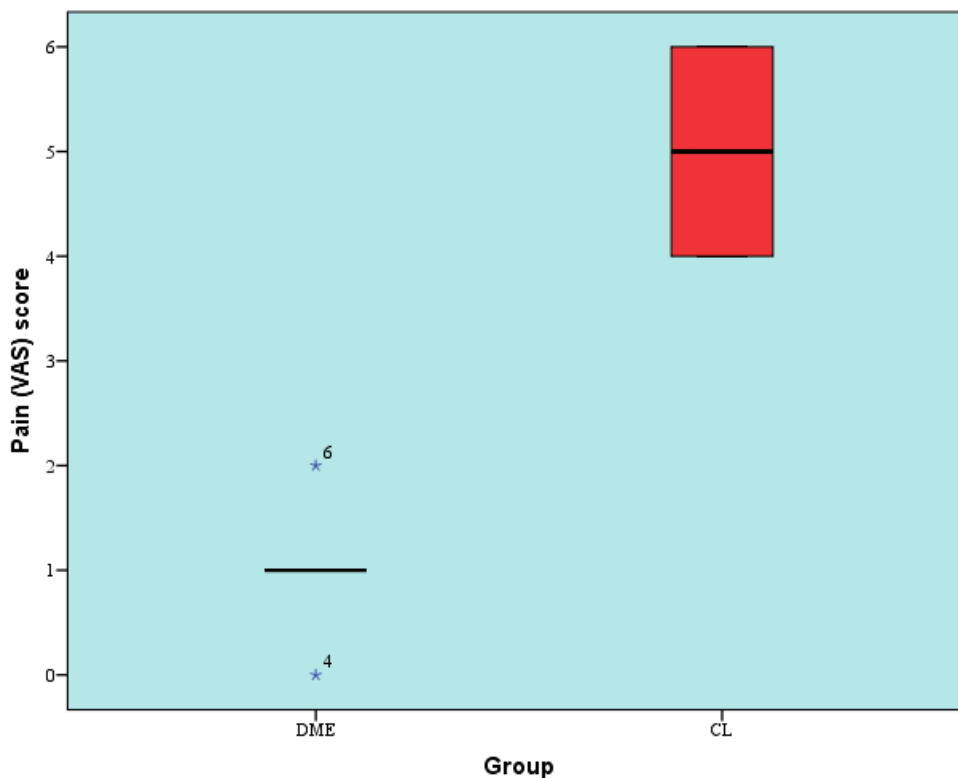
Results:

Deep margin elevation group showed statistically significantly lower median pain scores in comparison to the surgical crown lengthening group.

Descriptive statistics and results of Mann-Whitney U test for comparison between pain (VAS) scores in the two groups.

DME (n = 10)				CL (n = 10)				P-value	Effect size (d)
Median	Range	Mean	SD	Median	Range	Mean	SD		
1	0 – 2	1	0.47	5	4 – 6	5	0.87	<0.001*	3.133

*: Significant at $P \leq 0.05$



Box plot representing median and range values for pain scores in the two groups (Stars represent outliers).

Discussion:

Nowadays, minimal invasive dentistry has occupied a paramount position among different treatment modalities in managing severely damaged teeth aiming to improving the long-term survival of such compromised teeth. Practicing additive dentistry rather than the subtractive one offers added benefits in conserving as much as possible of the remaining tooth structure improving its overall mechanical behavior. In modern restorative dentistry, employing the adhesive approaches in the daily practice has provided many privileges to the clinicians and has led to methodological revolution. Additionally, the evolution of the adhesive systems and current restorative materials has changed many approaches in restoring badly destructed posterior teeth. Such adhesive solutions are not only linked to having esthetic posterior restoration, but also offering biomechanical strengthening of the remaining tooth structure (12).

Deeply seated proximal margins can complicate indirect restorative procedures starting from cavity preparation, ending by isolation and cementation of the indirect restoration. Many years ago, Cervical Margin Relocation was proposed which was later renamed into Deep Margin Elevation, as an approach to tackle deeply seated margins using resin-based material. In the current clinical trial, all deep margin elevation procedures were done under strict rubber dam isolation fulfilling the first criteria where this approach could be applied safely (6,7,9).

Furthermore, matricing was achieved using severely curved circumferential matrix which allows convergence and maximizes the fitting with the subgingival margins, fulfilling the second criteria.

Regarding the crown lengthening procedure, each case met the inclusion criteria, had intrasulcular and/or internal bevel incisions, followed by elevation of full-thickness flaps on the buccal and lingual aspects. Bone level correction was accomplished via ostectomy using end-cutting rotary burs and refined using hand cutting instruments to adjust the alveolar bone at a level of 3 mm from the gingival seat of the planned restorative margin. These procedures were done as described by many authors in published data in literature, which is considered a gold standard procedure (13-16). Sutures were removed 2 weeks after undisturbed healing to guarantee wound stabilization during the initial healing phase, giving time for the flap attachments to reach to a clinically acceptable strength level (15).

Pain is considered one of the patient related outcomes that was not addressed in previous clinical studies when the two approaches were compared. In the current clinical trial, pain was assessed using a visual analogue scale in which records were taken from all patients after both treatments were provided. The data was collected from patients through a phone call and represented in a form of a scale from 0 to 10 based on pain severity where 0 was expressing no pain at all after the procedure, while 10 was representing the highest degree of intolerable pain.

In the present study, deep margin elevation showed lower statistically significant pain score values in comparison to the surgical crown lengthening which would be attributed to the nature of both procedures. The deep margin elevation did not require any aggressive or invasive approach in dealing with deeply located margins where the procedure was done simply by applying rubber dam under local anesthesia followed by matricing with minimal impact on the soft tissue and finalized by the application of the restorative material. Meanwhile, crown lengthening is considered a surgical exposure of deeply located gingival margins in which the supporting tissues are apically displaced to access the deep cervical margins (17).

Surgical margin exposure necessitates intrasulcular and/or internal bevel incisions, followed by elevation of full-thickness flap, osseous correction and ending by suturing. All previously mentioned procedures would possibly initiate higher degrees of pain in comparison to the less invasive deep margin elevation approach. Worth mentioning is that pain resulted from the crown lengthening procedure was tolerated to a great extent by the participants and it was not considered a major complication after those procedures. Additionally, it was controlled by analgesics and anti-inflammatory medications which was necessary from ethical point of view to control the resultant pain.

Limitation within the study:

The limitations of the present clinical trial are the relatively small sample size, which requires a clinical trial with larger sample size, targeting to identify any differences between both techniques.

Conclusions

- Deep margin elevation approach could offer a more conservative solution with predictable results when consider relocating deeply seated proximal margins in a more coronal position.
- Applying the DME approach resulted in marked reduction in post-operative pain favoring this restorative technique in managing deeply located subgingival margins.

Conflict of interest

There were no conflicts of interest to disclose.

Authorship statement:

We confirm that all listed authors meet the authorship criteria and that all authors agree with the manuscript's content.

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