International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Clinical Integration of Deep Margin Elevation with Adhesive Lithium Disilicate Restorations in Posterior Teeth: A Case Report

Nikolova N.

Department of Conservative Dentistry, Faculty of Dental Medicine, Medical University Sofia, 1431 Sofia, Bulgaria
Email: *niki.nikolova87[at]gmail.com*

Abstract: ***This article presents a clinical case focused on the adhesive cementation of lithium disilicate press ceramic restorations in distal posterior teeth, emphasizing both the material's intrinsic properties and its clinical implications. Lithium disilicate offers a unique combination of high flexural strength, controlled translucency, and excellent marginal integrity, making it particularly suitable for esthetically demanding and functionally loaded distal restorations. Prior to tooth preparation, the deep margin elevation (DME) technique was employed to reposition subgingival margins to a more accessible supragingival level. This step provided optimal control of the operative field and served as a biologically sound foundation for a minimally invasive preparation of sound dental tissues, preserving enamel and dentine while facilitating adhesive procedures. The article outlines a step-by-step cementation protocol tailored to the optical behaviour and mechanical resilience of lithium disilicate ceramics. It also discusses the comparative use of different ceramic materials in distal regions, highlighting their indications based on structural and esthetic requirements. The microstructural stability and adhesive compatibility of lithium disilicate contribute to predictable long-term performance. By integrating the advantages of the DME technique with evidence-based adhesive protocols, clinicians can achieve durable, esthetic, and biologically harmonious outcomes in posterior adhesive dentistry.***

Keywords: adhesive dentistry, indirect restoration, lithium disilicate, marginal elevation, press ceramic

1. Introduction

The demand for esthetically pleasing and biologically compatible restorative materials has led to significant advancements in ceramic systems [0]. Among these, pressable ceramics, particularly lithium disilicate-based materials, have gained prominence due to their ability to combine high fracture resistance with excellent esthetic integration. These materials are fabricated by heat-pressing, allowing precise adaptation to complex tooth preparations and delivering restorations that closely mimic the optical properties of natural dentition. Indirect restorations, including onlays, veneers and full-coverage crowns, benefit from the mechanical strength and translucency of pressable ceramics. Compared to conventional feldspathic porcelain, pressable systems exhibit superior marginal adaptation and reduced susceptibility to microleakage, especially when bonded using adhesive cementation protocols [[2]]. The combination of controlled surface treatment, adhesive bonding, and optimized preparation design contributes to long-term clinical success. Recent studies have emphasized the importance of isolation, thermocycling resistance, and adhesive interface stability in determining restoration longevity [[3]], [[4]]. In cases where subgingival margins compromise isolation and adhesive control, the application of deep marginal elevation (DME) has emerged as a valuable strategy. By relocating the cervical margin coronally using a flowable or preheated composite, DME facilitates optimal moisture control and enhances the effectiveness of adhesive cementation [[5]]. This technique not only improves access and visibility during bonding procedures but also contributes to better marginal integrity and reduced risk of contamination [[6]]. When integrated into the restorative workflow, DME supports the long-term stability of the adhesive interface and reinforces the biomechanical performance of lithium disilicate restorations [[7]]. Moreover, patient-centered outcomes, such as esthetic satisfaction and functional durability, further support the use of pressable ceramics in both anterior and posterior applications. This case report aims to demonstrate the clinical integration of deep margin elevation with adhesive cementation of lithium disilicate ceramic restorations in posterior teeth. The case highlights the significance of combining DME with lithium disilicate ceramics to enhance the clinical longevity, esthetics, and minimally invasive nature of posterior restorations.

2. Clinical Case

36-year-old female patient with no significant medical history presents for a dental visit 2 years after her last check-up. She reported mild sensitivity to hot and cold foods and beverages. Radiographic (Fig.1) and physical (Fig.2) examinations indicate large obturation, marginal discolouration and the presence of secondary carious lesions affecting teeth #27 and #28. The cold test performed on vital dental elements is positive, highlighting the absence of irreversible pulp pathologies. Diagnosis is mesio-occlusal-disto-buccal carious lesions on #27 and #28. Since the patient requested an esthetic restoration, we decided on a treatment plan involving indirect ceramic restorations #27 and #28 cemented by dual-curing cement.

Figure 1: Preoperative radiographic observation

Figure 2: Intraoral preoperative view - teeth #27and #28

The operative field was initially isolated using Optragate (*Ivoclar, Liechtenstein*), followed by the removal of carious tissue and existing restorations on teeth #27 and #28. Upon completion of caries excavation, a rubber dam was placed to ensure optimal isolation. All prepared surfaces were then air-abraded with 50 μm aluminum oxide (Al_2O_3) particles to enhance micromechanical retention (Fig.3).

Figure 3: Prepared surfaces with Al_2O_3

Subsequently, an immediate dentin sealing (*IDS*) protocol was implemented using a total-etch adhesive system, Syntac (Ivoclar, Liechtenstein). This step served to eliminate undercuts, protect freshly exposed dentin, and improve adhesive performance. To facilitate gingival margin relocation, a flowable composite resin, Tetric EvoFlow (*Ivoclar, Liechtenstein*), was applied (Fig. 4).

Figure 4: Immediate sealing protocol with prepared surfaces for adhesive procedure and marginal elevation.

The deep margin elevation (DME) technique employed in this case represents a minimally invasive strategy for managing subgingival margins. By repositioning the margins coronally with a composite layer, DME enhances the feasibility of adhesive procedures, improves accessibility for conventional impression-taking or digital scanning, and ensures reliable isolation throughout the restorative workflow. Elevating the margins to a supragingival or equigingival position contributes to predictable adhesive bonding, conserves healthy tooth structure, and minimizes the need for surgical crown lengthening. These benefits align with the findings reported by Keremedchieva et al., supporting the long-term functional and esthetic success of the approach [[8]], [[9]].

The next step was cavity preparation for indirect restorations with red diamond burr 845KR.FG.016.A2 (Komet, Germany). The vestibular wall and the distal part of the palatal wall of #28 were structurally compromised, therefore, cusp reduction was necessary. The cavity margins were finished with red and yellow ring diamond cutters.

A digital impression was obtained using a Medit i700 Intraoral 3D Scanner (Fig.5). Following verification of impression accuracy, the ceramic shade was determined using the Vita Shade Classic guide, and the impression was subsequently forwarded to the dental laboratory.

Figure 5: Digital impression

For the fabrication of the indirect restorations, IPS e.max Press (Ivoclar, Liechtenstein) was utilized (Fig.6).

Figure 6: Indirect restorations

Upon receipt, the restorations were clinically assessed for marginal fit and proximal contact accuracy, and then conditioned according to the recommended adhesive protocol prior to final cementation (Fig. 7).

Figure 7: Assessment of the marginal fit and proximal contact accuracy of indirect restorations on teeth #27 and #28

The internal surface of the ceramic inlay was gently air-abraded using 50 µm aluminum oxide (Al_2O_3), followed by etching with 10% hydrofluoric acid for the recommended duration. The restoration was then thoroughly rinsed under running water, placed in an ultrasonic bath for decontamination, rinsed again, and air-dried (Fig.8). A silane coupling agent (Monobond Plus; Ivoclar, Liechtenstein) was applied for 60 seconds in accordance with the manufacturer's instructions. Subsequently, a bonding agent (Heliobond; Ivoclar, Liechtenstein) was applied, and the conditioned inlay was stored in a light-protective box until cementation.

Figure 8: Etched and air-dried ceramic surface

With the rubber dam in place, the tooth surface was selectively air-abraded using 29 µm Al_2O_3 particles, taking care to preserve adjacent structures. At this stage, the tooth was ready for adhesive cementation (Fig. 9).

Figure 9: Isolated surfaces ready for the cementing procedure

The tooth was rinsed and lightly dried. For the dental substrate treatment, 37% orthophosphoric acid (N Etch ®, Ivoclar, Liechtenstein) was applied for 20 seconds followed by washing and air drying (Fig 10) three consecutive coats of the adhesive system Syntac (Ivoclar, Liechtenstein) were used for 20 seconds then gently dried after

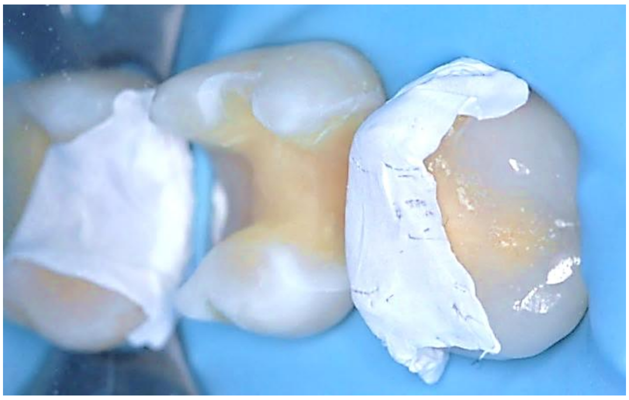

Figure 10: Tooth 27 after etching and protected 26 and 28 with teflon tape

each step. During the cementation process, dual-curing cement Variolink II (Ivoclar, Liechtenstein) is applied to entire surface of ceramic restoration Upon positioning and pressing the restoration into place, cement was extruded from the margins.

Excess luting material was carefully removed using a brush, dental probe, and dental floss. A preliminary light-curing phase of 5 seconds was performed to initiate polymerization and facilitate efficient removal of residual cement, followed by a 20-second light-curing cycle on each surface. As the resin cement began to polymerize, its consistency allowed for clean marginal finishing [[10]], [[11]].

Final polymerization was conducted for 60 seconds on the mesio-buccal, disto-buccal, mesio-lingual, disto-lingual, and occlusal surfaces using a high-intensity LED curing unit (*Bluephase Style; Ivoclar, Liechtenstein*) delivering 1200 mW/cm². To ensure complete polymerization and eliminate the oxygen-inhibited layer, the restoration was coated with a glycerin-based gel and subjected to an additional 20-second light-curing cycle on each surface (Fig. 11, Fig.12).

Figure 11: Final polymerization after replacing the glycerine gel #27

Figure 12: Immediately after final cementation of 27

The same procedure was repeated for #28. The occlusion was checked, and the restoration was finished and polished (post-cementation instructions were given to the patient) (Fig.13, 14, 15). To conclude, the fit and adaptation of the indirect restoration were assessed using a dental radiograph. (Fig. 16)

Figure 13: Tooth 28 after etching and protected 27 with teflon tape

Figure 14: Immediately after final cementation of #28

Figure 15: After removing the rubber dam, an occlusal check of #27 and # 28

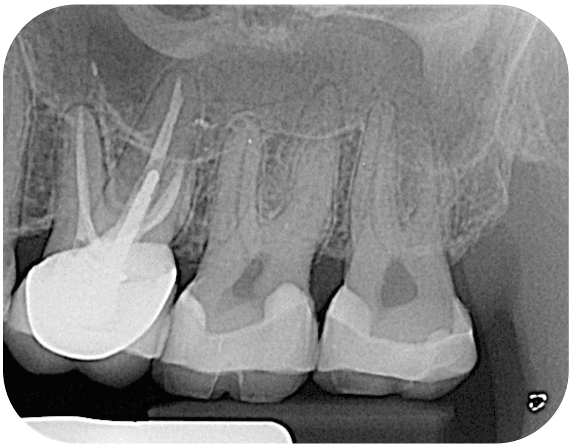

Figure 16: Postoperative radiographic observation

3. Discussion

The clinical performance of pressable ceramic indirect restorations has been extensively validated through both short- and long-term studies [[12]], [[13]]. These materials, particularly lithium disilicate-based ceramics, offer a favorable combination of esthetics, mechanical strength, and marginal integrity. In the present study, the restorations demonstrated high survival rates and minimal marginal discoloration over the observation period, consistent with findings from recent retrospective and randomized trials [[14]], [[15]].

One of the key factors influencing restoration longevity is the cementation protocol. Dual-cure resin cements paired with contemporary adhesive systems—especially eighth-generation adhesives—have shown superior bonding performance, enhancing retention and resistance to functional stresses [[16]]. The adhesive interface plays a critical role in preventing microleakage and debonding, particularly in posterior restorations subjected to high occlusal loads [[17]].

Marginal adaptation and fracture resistance were also positively influenced by precise preparation design and controlled occlusal reduction [[18]]. Studies have shown that pressable ceramics exhibit higher fracture toughness compared to feldspathic ceramics, making them suitable for onlays and full-coverage restorations in molar regions [[2]]. Table 1 presents the mechanical properties of different ceramics, indications, and limitations for their application in indirect restorations [0], [[19]], [[20]]. Failures, when present, were predominantly linked to parafunctional habits or inadequate bonding protocols.

Table 1: Types of ceramics, indications, and limitations for their application in indirect restorations.

Material / Criterion	Press Ceramic	Felspathic porcelain	Zirconia	Hybrid ceramics
Strength (MPa)	400	100	>900	150-200
Esthetics	High translucency and enamel-like appearance	Excellent for layering and esthetic customization.	Opaque; newer translucent variants improve appearance	Good translucency; mimics dentin elasticity.
Bonding	Requires adhesive cementation with hydrofluoric acid etching and silanization.	Requires adhesive cementation; fragile during handling.	Can be conventionally cemented or adhesively bonded with MDP-containing primers.	Adhesive cementation; easier to mill and polish.
Indications	Ideal for posterior crowns and onlays in patients with normal occlusion.	Best for anterior veneers, rarely used in posterior zone.	Suitable for full-coverage crowns and bridges in high-stress areas	Minimally invasive onlays and inlays in low-stress posterior areas.
Limitations	Technique-sensitive bonding; not recommended for bruxism cases.	Not recommended for distal restorations due to brittleness.	Lower bond strength compared to etched ceramics; limited translucency.	Limited long-term data; lower wear resistance than pure ceramics.

Esthetic outcomes were consistently rated highly by patients, with pressable ceramics offering translucency and shade matching comparable to natural dentition. Their ability to mimic the optical properties of enamel and dentin contributes to their acceptance in both anterior and posterior applications.

In addition to optical and mechanical properties, the tribological behavior of dental ceramics plays a critical role in their long-term clinical performance, particularly in distal regions subjected to high occlusal loads. Tribological characterization—encompassing wear resistance, frictional response, and surface degradation—provides insight into how materials interact with antagonistic dentition over time [[21]]. Lithium disilicate ceramics demonstrate favorable tribological profiles, offering a balance between sufficient hardness and low abrasiveness to opposing enamel. Kuaw et al. reported that the glassy matrix of lithium disilicate ceramics exhibits low fracture toughness and suboptimal microstructural properties, making it susceptible to degradation during wear cycling. This deterioration facilitates the release of embedded crystalline particles, which in turn elevates surface roughness, intensifies friction, and contributes to increased wear of the opposing dentition [[22]]. Their microstructural stability under cyclic loading contributes to sustained surface integrity and reduced wear of both the restoration and antagonist. In contrast, materials such as zirconia, while superior in fracture toughness, may exhibit higher wear potential against natural teeth if not properly polished or glazed [[23]]. Understanding these tribological distinctions supports informed material selection and enhances the predictability of adhesive restorations in functionally demanding distal zones.

The application of the deep margin elevation (DME) technique relocates subgingival margins to a supragingival position, allowing minimally invasive preparation without encroaching upon proximal retention zone. By eliminating the need for extensive mechanical exposure of deep margins, DME preserves sound enamel and dentine, providing a stable substrate for adhesive bonding and maintaining the biological integrity of the restored tooth, following the biomimetic strategy [[24]], [[25]]. A retrospective study by El-Ma'aita et al. followed 28 teeth treated with DME and indirect adhesive restorations over a mean of 25.4 months. The results showed stable marginal adaptation, minimal recurrent caries, and no significant discoloration, suggesting that DME can maintain restorative integrity over the short to mid-term [[26]]. Similarly, a systematic review by Sadeghnezhad et al. found that DME significantly reduces microleakage compared to restorations placed directly at subgingival margins, enhancing the seal and longevity of adhesive restorations [[27]]. This approach supports a conservative restorative philosophy, where margin relocation facilitates access, enhances adhesive control, and minimises unnecessary removal of healthy dental structure during the preparation for indirect restorations.

Despite these advantages, limitations remain. The technique sensitivity of adhesive cementation and the need for precise isolation during bonding can pose clinical challenges. Additionally, while pressable ceramics perform well under controlled conditions, their behavior in compromised substrates [[28]] or high-risk patients warrants further investigation.

The search for an optimal, minimally invasive, and efficient cavity preparation design remains an ongoing focus in restorative dentistry. Scientific investigations continue to explore how cavity geometry can be optimised to balance structural preservation and adhesive performance. With the aid of advanced digital technologies, simulations of various cavity configurations are being developed, enabling the creation of analytical models for stress distribution and biomechanical evaluation [[29]], [[30]], [[31]]. In 2017, Marco Veneziani introduced updated clinical indications and a morphology-driven preparation technique for posterior indirect adhesive restorations, which prioritizes anatomical preservation and functional integrity [[32]].

4. Conclusion

The clinical case demonstrates that the application of the deep margin elevation (DME) technique provides a predictable and biologically sound approach for managing subgingival margins prior to indirect adhesive restoration. By relocating the cervical margin to a more accessible supragingival position, DME allows subsequent tissue preparation to be carried out with minimal removal of sound dental structure. This conservative approach eliminates the need for extensive extension into retentive zones that would otherwise compromise tooth integrity during preparation for a lithium disilicate ceramic restoration. The technique enables optimal field control, improved adhesive conditions, and facilitates the design of a stable and durable adhesive interface. Within the presented case, the DME protocol proved to be a valuable minimally invasive alternative to traditional surgical or extensive mechanical exposure of deep margins, ensuring both functional longevity and esthetic satisfaction. The outcomes reaffirm the significance of tissue preservation as a key principle in contemporary adhesive and biomimetic restorative dentistry.

References

[1] Sharma R, Sharma AR, Madathil E, Tayal R. Recent trends in dental ceramics: A comprehensive review. J Academy Dent Educ. 2025;11:61-7. doi: 10.25259/JADE_37_2

[2] Shi HY, Pang R, Yang J, Fan D, Cai H, Jiang HB, Han J, Lee ES, Sun Y. Overview of Several Typical Ceramic Materials for Restorative Dentistry. Biomed Res Int. 2022 Jul 18;2022:8451445. doi: 10.1155/2022/8451445. PMID: 35898679; PMCID: PMC9314004.

[3] Hadilou M, Dolatabadi A, Ghojazadeh M, Hosseinifard H, Alizadeh Oskuee P, Pournaghi Azar F. Effect of Different Surface Treatments on the Long-Term Repair Bond Strength of Aged Methacrylate-Based Resin Composite Restorations: A Systematic Review and Network Meta-analysis. Biomed Res Int. 2022 Sep 5;2022:7708643. doi: 10.1155/2022/7708643. PMID: 37964860; PMCID: PMC10643039.

[4] Browet S, Gerdolle D. Precision and security in restorative dentistry: the synergy of isolation and magnification. Int J Esthet Dent. 2017;12(2):172-185. PMID: 28653049.

[5] Ferrari M, Koken S, Grandini S, Ferrari Cagidiaco E, Joda T, Discepoli N. Influence of cervical margin relocation (CMR) on periodontal health: 12-month results of a controlled trial. J Dent. 2018 Feb;69:70-76. doi: 10.1016/j.jdent.2017.10.008. Epub 2017 Oct 20. PMID: 29061380.

[6] El-Ma'aita AM, Radwan H, Al-Rabab'ah MA. Deep Margin Elevation - A Retrospective Clinical Study. J Adhes Dent. 2024 Apr 11;26:117-124. doi: 10.3290/j.jad.b5199089. PMID: 38602235; PMCID: PMC11740768.

[7] Caussin, E.; Izart, M.;Ceinos, R.; Attal, J.-P.; Beres, F.;François, P. Advanced Material Strategy for Restoring Damaged Endodontically Treated Teeth: A Comprehensive Review. Materials 2024, 17, 3736. https://doi.org/10.3390/ma17153736

[8] Adel M, Hamdy A, Sabet A, Ebeid K. Effect of cervical margin relocation on marginal adaptation and microleakage of indirect ceramic restorations. J Prosthodont. 2024;33(4):374-381.

[9] Keremedchieva S, Peev S, Gusiyska A, Sabeva E. Cervical margin relocation-basic principles and influence on the periodontal tissues. Scripta Scientifica Medicinae Dentalis 2020; 6(2):12-16.

[10] Spyropoulou N, Diamantopoulou S, Patrinos S, Papazoglou E. Retrospective Clinical Study of Resin Composite and Ceramic Indirect Posterior Restorations up to 11 Years. Prosthesis. 2025; 7(5):108. https://doi.org/10.3390/prosthesis7050108- za srawnitelna

[11] Magne P. Immediate dentin sealing: a fundamental procedure for indirect bonded restorations. J Esthet Restor Dent. 2005;17(3):144-155.

[12] Gusiyska A, Dimova-Gabrovska M, Nikolova N. Biomimetic Capabilities of Lithium Disilicate Glass-Ceramic Restorations on Posterior Teeth: Evaluation of the Long-Term Survival Rate-A 10-Year Follow-Up. *Applied Sciences*. 2024; 14(21):9964.

[13] Mangani F, Marini S, Barabanti N, Preti A, Cerutti A. The success of indirect restorations in posterior teeth: a systematic review of the literature. *Minerva Stomatol*. 2015;64(5):231-240.

[14] Gusiyska A, Vassileva R. Clinical evaluation of ceramic indirect restorations- a 5 years follow-up. International Journal of Recent Scientific Research 2015; 6 (5): 4356-4360.

[15] Yurdagüven GY, Çiftçioğlu E, Kazokoğlu FŞ, Kayahan MB. 5-Year clinical performance of ceramic onlay and overlay restorations luted with light-cured composite resin. *J Dent*. 2024;149:105258.

[16] Gusiyska, A. (2025). Comparative Clinical Evaluation of Indirect Ceramic and Composite Restorations Bonded with Fourth- and Eighth-Generation Adhesives Using Dual-Cure Resin Cement. International Journal of Science and Research (IJSR). 817-823. 10.21275/SR251012190528.

[17] Conejo J. Current adhesive protocols for indirect ceramic restorations. *Compendium*. 2022;43(9)

[18] Ferraris F, Sammarco E, Romano G, Cincera S, Giulio M.** Comparison of posterior indirect adhesive restorations with different preparation designs according to the adhesthetics classification. *Int J Esthet Dent*. 2021;15(2)

[19] Warreth A, Elkareimi Y. All-ceramic restorations: A review of the literature. Saudi Dent J. 2020 Dec;32(8):365-372. doi: 10.1016/j.sdentj.2020.05.004.

Epub 2020 May 29. PMID: 34588757; PMCID: PMC8461086.

[20] Cuzic C, Rominu M, Pricop A, Urechescu H, Pricop MO, Rotar R, Cuzic OS, Sinescu C, Jivanescu A. Clinician's Guide to Material Selection for All-Ceramics in Modern Digital Dentistry. Materials (Basel). 2025 May 12;18(10):2235. doi: 10.3390/ma18102235. PMID: 40428971; PMCID: PMC12113582.

[21] Yadav, Ramkumar & Meena, Anoj & Lee, Hae-Hyoung & Lee, Seul-Yi & Park, Seong-Ju. (2023). Tribological behavior of dental resin composites: A comprehensive review. Tribology International. 190. 109017. 10.1016/j.triboint.2023.109017.

[22] Okkar Kyaw, Inokoshi M, Kanazawa M. Tribological aspects of enamel wear caused by zirconia and lithium disilicate: A meta-narrative review. Jpn Dent Sci Rev. 2024 Dec; 60: 258-270. doi: 10.1016/j.jdsr.2024.11.001. Epub 2024 Nov 30. PMID: 39687636; PMCID: PMC11647087.

[23] Rady, Ibrahim & Anwar, Eman & Elsharkawy, Amira & Rabie, Karim. (2025). Wear of Enamel Antagonist to Polished vs Glazed Zirconia-reinforced Lithium Silicate Crowns (Randomized Clinical Trial). The Journal of Contemporary Dental Practice. 26. 18-24. 10.5005/jp-journals-10024-3804.

[24] Nikolova N, Raykovska M, Koytchev E, Gusiyska A. Biomimetic Strategies and Adhesive Protocols in the Restoration of Severely Compromised Posterior Teeth - A Contemporary Review. J of IMAB. 2025 OctDec;31(3):6542-6554.

[25] Gusiyska A. Indirect Biomimetic Restorations in Posterior Teeth- A Clinical Study of Main Principles - Case Series. International Journal Science and Research 2015; 4(6):497-503.

[26] EL-Ma'aita, Ahmad & Radwan, Heba & AL-Rabab'ah, Mohammad. (2024). Deep Margin Elevation - A Retrospective Clinical Study. The journal of adhesive dentistry. 26. 117-124. 10.3290/j.jad.b5199089.

[27] Sadeghnezhad, P., Sarraf Shirazi, A., Borouziniat, A. et al. Enhancing subgingival margin restoration: a comprehensive review and meta-analysis of deep margin elevation's impact on microleakage. Evid Based Dent 25, 212 (2024). https://doi.org/10.1038/s41432-024-01028-0

[28] Althaqafi KA. Performance of direct and indirect onlay restorations for structurally compromised teeth. J Prosthet Dent. 2025;133(6):1513-1519.

[29] Nikolova N, Raykovska M, Petkov N, Tsvetkov M, Georgiev I, Koytchev E, Iankov R, Dimova-Gabrovska M, Gusiyska A. The Integration of Micro-CT Imaging and Finite Element Simulations for Modelling Tooth-Inlay Systems for Mechanical Stress Analysis: A Preliminary Study. Journal of Functional Biomaterials. 2025; 16(7):267.

[30] Ausiello P, Rengo S, Davidson CL, Watts DC. Stress distributions in adhesively cemented ceramic and resin-composite Class II inlay restorations: a 3D-FEA study. Dent Mater. 2004;20(9):862-872.

[31] Kintopp CCA, Diógenes AN, Lopes RT, et al. Effect of different preparations and restorative materials on partial posterior restorations: A 3D FEA study using µCT data. *J Prosthet Dent*. 2025;133(4):1056.e1-1056.e7.

[32] Veneziani M. Posterior indirect adhesive restorations: updated indications and the Morphology Driven Preparation Technique. *Int J Esthet Dent*. 2017;12(2):204-230.