Original Research

NO.01

Poster number

Er,Cr:YSGG Laser Troughing for the Elimination of Restorative Plaque-Retentive Factors



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Introduction

Subgingival restoration margins and iatrogenic factors can compromise the supracrestal tissue attachment and promote biofilm accumulation, potentially leading to chronic marginal gingivitis and periodontitis (Saluja et al., 2024). The lack of direct visual access to the subgingival area during conventional mechanical correction of restoration overhangs may compromise the precision and quality of subgingival polishing, particularly in patients with a history of periodontitis. In the pursuit of esthetic outcomes, preserving the integrity of the dentogingival complex remains essential. This study aims to evaluate the clinical efficacy of the Er,Cr:YSGG laser (2780 nm) for minimally invasive gingival troughing to provide a blood-free field and direct visual access, enabling precise mechanical removal of restorative plaque-retentive factors within the gingival sulcus in the anterior esthetic zone in patients with a history of periodontitis.

Materials and methods

A total of 62 maxillary anterior restorations in 13 female patients aged 37–47 years (n=8: 4 restorations; n=5: 6 restorations) with plaque-induced marginal gingivitis associated with subgingival composite restorative overhangs were treated.
All patients had a history of periodontitis and were currently periodontally stable on a reduced periodontium. Er,Cr:YSGG laser (2780 nm; MZ6-9 tip; 60 µs; 1.5 W; 40 Hz; 80% water/40% air) was used for marginal gingival micro-ablation and sulcular troughing to provide direct visual access and achieve hemostasis. Subgingival restorative plaque-retentive factors were then mechanically removed and polished under magnification of up to 21× using a dental operating microscope. Follow-ups were conducted at 1 and 3 weeks and at 6 and 12 months.




Immediate post-laser troughing: direct visualization following overhang removal and polishing


1-week post-operative view

Results

Er,Cr:YSGG laser ablation provided precise, blood-free sulcular troughing, creating optimal conditions for direct visualization and controlled mechanical removal of restorative defects across all treated teeth (n = 62). At one week, complete resolution of marginal gingival inflammation, tight soft-tissue adaptation, and absence of subjective discomfort were observed in 12/13 patients (92.3%). Dental operating microscope evaluation demonstrated complete re-epithelialization by week 3 and sustained periodontal health at 6 months. At 12 months, long-term clinical stability was maintained in 77.4% of treated teeth (n = 48/62), whereas recurrence occurred in 22.6% (n = 14/62), associated with poor oral hygiene compliance. In the three patients with recurrent inflammation (14 teeth), the mean Full-Mouth Plaque Score (FMPS) was 64%, and the mean bleeding-on-probing (BOP) index was 40%. In the 10 clinically stable patients, FMPS remained ≤15%, while BOP remained ≤10%.


Historical baseline: status before restoration


12-month follow-up

Discussion

Subgingival restorative overhangs promote biofilm retention and may compromise the supracrestal tissue attachment. Conventional instrumentation without direct visualization may increase the risk of soft-tissue trauma and incomplete restorative correction. Er,Cr:YSGG laser troughing provided hemostasis and visual access, creating optimal conditions for precise mechanical correction and polishing of subgingival composite restorations. The potential bactericidal, lipopolysaccharide-inactivating, and photobiomodulatory effects of Er,Cr laser irradiation may provide additional biological benefits for periodontal tissue healing (Zhao et al., 2021).
The marked differences in plaque accumulation and BOP between clinically stable and recurrent cases underscore the critical role of meticulous plaque control in patients with a history of periodontitis. Long-term periodontal and esthetic stability depends not only on advanced technology and restorative quality but also on complete elimination of plaque-retentive factors and sustained maintenance of effective oral hygiene.

Conclusion

Er,Cr:YSGG laser troughing combined with optical magnification provides a precise, minimally traumatic, and blood-free field for the mechanical correction of subgingival iatrogenic overhangs, facilitating direct visualization and thorough elimination of plaque-retentive factors. This approach may contribute to favorable soft-tissue healing and maintenance of periodontal stability, particularly in patients with a history of periodontitis, in whom preservation of the dentogingival complex is essential for long-term periodontal and esthetic outcomes.

14th World Congress of Esthetic Dentistry in Seoul 2026