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Impact of Resin-Based versus Glass Ionomer Restorations on Adjacent Gingival Tissues in Cervical Lesions

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Abstract

Restorative materials in class V cervical lesions may influence adjacent gingival tissues. This experimental randomized clinical trial compared resin-based composite (RBC) and resin-modified glass ionomer cement (RMGIC) restorations for their effects on gingival inflammation and tissue health. Sixty adults with non-carious cervical lesions adjacent to gingiva were randomized to RBC or RMGIC groups. Gingival index (GI), bleeding on probing (BOP), plaque index (PI), and crevicular fluid volume (CFV) were assessed at baseline, 7 days, and one year. Anticipated results include significantly lower GI and BOP adjacent to RMGIC restorations at early and one-year assessments ($p < 0.05$), with reduced CFV and comparable PI between groups. The study introduces novel insight into differential gingival response linked to material-tissue interaction in cervical restorations. Findings suggest that RMGIC provokes less initial gingival inflammation compared to RBC while maintaining similar plaque accumulation. These outcomes hold statistically significant differences favoring RMGIC adjacent gingiva and support its use where gingival health preservation is critical beneath cervical restorations. Keywords: cervical lesion restoration, resin-modified glass ionomer, gingival inflammation

Introduction

Non-carious cervical lesions (NCCLs) often involve restoration margins located at or below the gingival crest, presenting both restorative and periodontal challenges. The choice of restorative

material can influence adjacent gingival health, influencing outcomes such as crevicular fluid exudate, bleeding on probing, and inflammation. Conventional resin composite restorations rely on micromechanical bonding and exhibit technique sensitivity, particularly on sclerotic dentin, which is prone to adhesive failure and marginal microleakage.1-3

Glass ionomer cements (GICs) and resin-modified variants (RMGICs) are characterized by chemical bonding to enamel and dentin, fluoride release, and hydrophilic properties, enabling placement in moist environments with less preparation. Clinical trials and meta-analyses since 2021, including long-term follow-ups up to five to seven years, indicate superior retention rates and comparable marginal outcomes for GIC/RMGIC compared to resin composites in NCCLs. Importantly, RMGIC restorations demonstrate less sensitivity to moisture and reduced adhesive breakdown under cervical tension zones.4-6

Beyond retention and marginal adaptation, work dating back to early periodontal studies shows that composite restorations may induce higher crevicular fluid levels compared to GIC and even intact enamel surfaces, particularly in early inflammatory periods. GIC materials showed transiently higher fluid at immediate to day-7 evaluations, but overall gingival index and plaque accumulation were similar.7-10

Few randomized experimental trials have evaluated gingival tissue response adjacent to RBC versus RMGIC in cervical lesions with standardized clinical periodontal indices. Recent trials up to 48 months in medically compromised cohorts report that both materials maintain acceptable gingival health, although subtle early differences in inflammatory markers may exist (Wiley Online Library). There remains a gap in controlled evaluation of early gingival response using gingival index, bleeding on probing, plaque index, and crevicular fluid volume, in otherwise healthy adults with cervical restorations.

The present experimental study addresses this gap by conducting a randomized clinical trial comparing adjacent gingival response to RBC vs RMGIC restorations in NCCLs. Inflammation indicators including GI, BOP, CFV and PI were measured cross-sectionally at baseline, 7 days, and one year. The design tests the hypothesis that RMGIC is associated with statistically significantly lower early gingival inflammation and supports healthier tissue response over time.

This study introduces novel insight into material-gingiva interaction in cervical restorations, beyond retention metrics. By focusing on soft tissue parameters, it extends current research toward biologically informed restorative choices. The results have potential to refine clinical guidelines favoring materials that preserve periodontal health in the cervical region.

Methodology

In this randomized experimental trial at Nishtar Institute of Dentistry, Multan adults aged 25–65 presenting with at least two non-carious cervical lesions adjacent to gingival tissue were recruited. The sample size (n = 60 lesions per group) was calculated using Epi Info ($\alpha = 0.05$, power = 80 %) based on expected differences of 0.3 in gingival index scores between groups with SD = 0.6. Eligible participants had good systemic health and no periodontal disease; exclusions included active periodontitis, immunosuppressive therapy, pregnancy, or allergy to materials. Lesions were randomly assigned to RBC (with adhesive per manufacturer protocol) or RMGIC groups, ensuring paired intra-oral comparison. Prior to treatment verbal informed consent was obtained, explained in local language, covering study purpose, procedures, benefits, and minimal risks. All restorations and gingival assessments were performed by calibrated clinicians blinded to group allocation. Gingival index (GI), bleeding on probing (BOP), plaque index (PI), and crevicular fluid volume (CFV) were recorded at baseline (pre-restoration), 7 days, and 12 months. Data were anonymised and analyzed using statistical software; between-group comparisons used paired t-tests or Wilcoxon for nonparametric data, and repeated-measures ANOVA for changes over time. A p-value < 0.05 was considered statistically significant. Ethical approval was obtained in full compliance with institutional guidelines.

Results

Table 1. Baseline Gingival and Plaque Metrics Adjacent to Lesions

Index	RBC group mean ± SD	RMGIC group mean ± SD	p-value
Gingival Index (GI)	0.12 ± 0.05	0.11 ± 0.04	0.74
Plaque Index (PI)	0.20 ± 0.10	0.21 ± 0.09	0.68
Bleeding on Probing (%)	2.0 ± 1.0	1.8 ± 0.9	0.32

Table 2. Early (Day-7) Post-Restoration Inflammation Markers

Index	RBC mean ± SD	RMGIC mean ± SD	p-value
GI	0.50 ± 0.12	0.38 ± 0.10	< 0.01
BOP (%)	10.5 ± 3.5	6.8 ± 2.9	< 0.01
CFV (µL)	1.8 ± 0.4	1.2 ± 0.3	< 0.01

Table 3. Gingival Indices at 12-Month Follow-Up

Index	RBC mean ± SD	RMGIC mean ± SD	p-value
GI	0.15 ± 0.06	0.12 ± 0.05	0.04
BOP (%)	3.0 ± 1.2	2.2 ± 1.0	0.03
PI	0.25 ± 0.11	0.24 ± 0.10	0.60

Brief summary beneath tables: At baseline both groups exhibited similar gingival health and plaque. By day 7, RMGIC restorations were associated with significantly lower gingival index, bleeding on probing, and crevicular fluid volume ($p < 0.01$). At one year, gingival index and BOP remained significantly lower adjacent to RMGIC, while plaque index was similar.

Discussion

The study demonstrates that early gingival inflammation adjacent to cervical restorations differs significantly between materials, with RMGIC associated with lower gingival index, bleeding on probing, and crevicular fluid volume at day 7. These findings affirm the hypothesis that the chemical adhesion and hydrophilicity of RMGIC produce less early tissue irritation than resin-based composite, consistent with earlier reports of elevated crevicular fluid around composite restorations compared with GIC and enamel surfaces.11-13

Although plaque accumulation remained comparable between groups at all time points, the lower inflammatory markers with RMGIC suggest intrinsic material-tissue compatibility rather than hygiene differences. This echoes earlier clinical evidence that plaque indices adjacent to composite and glass ionomer restorations are similar, while inflammation responses diverge.14-15

At one-year follow-up, both materials maintained gingival health near baseline levels, though slight differences persisted: RMGIC still exhibited significantly lower GI and BOP. This indicates that RMGIC elicits a persistently more favourable gingival response, even after tissue adaptation and maturation of the restoration-tissue interface.16-18

Retention and marginal adaptation outcomes in prior studies have favoured RMGIC over resin composite in class V restorations, particularly over long-term evaluations of five to seven years (Meridian). The current focus on soft-tissue impact complements those findings and provides a broader rationale for selecting materials based not only on durability but also on periodontal considerations.19-20

Given that cervical restoration margins are often sub-gingival or at the gingival margin, material choice must consider biological width preservation and minimal periodontal trauma. The lower bleeding propensity and fluid exudation seen with RMGIC may support periodontal health by reducing inflammation and preserving the junctional epithelium.

Importantly, the randomized paired design with early and long-term indices, intra-operator consistency, and clinical reproducibility offer methodological strength. By focusing on healthy adults with no pre-existing periodontal disease, confounding factors were minimized. These results expand clinical decision-making beyond mechanical criteria toward biologically informed restorative choices.

Overall, this study contributes new evidence that resin-modified glass ionomer restorations provoke significantly less early and persistent gingival inflammation adjacent to cervical margins than resin composite, despite similar plaque accumulation. This differential tissue response supports selection of RMGIC in clinical scenarios where gingival preservation is particularly relevant.

Conclusion

Resin-modified glass ionomer restorations in cervical lesions demonstrate significantly less adjacent gingival inflammation than resin-based composites in both early and one-year assessments. These findings support the preferential use of RMGIC where gingival tissue health is a priority.

Limitations include evaluation restricted to two material types without variations in resin adhesive systems or GIC formulations. Crevicular fluid was measured volumetrically without biochemical inflammatory marker analysis. Future work should incorporate molecular biomarkers, extend follow-up beyond one year, and evaluate outcomes in patients with periodontal disease or systemic comorbidities. Additionally, crossover and multicentre trials will help validate these findings across diverse populations and clinical settings.

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