

Restoration of Non-Carious Cervical Lesions and Their Effect on Gingival Recession: A Systematic Review

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Abstract

Non-carious cervical lesions (NCCLs) frequently coexist with gingival recession and may compromise esthetics, comfort, plaque control, and periodontal stability. The periodontal implications of restoring NCCLs, such as its influences on recession outcomes, remain uncertain. To evaluate whether restoring NCCLs influences gingival recession and gingival health, and to explore whether different restorative materials lead to different periodontal outcomes. This systematic review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidance. Randomized clinical trials assessing NCCL restoration (alone or combined with periodontal surgery) and reporting periodontal outcomes were included. Risk of bias was assessed using Risk of Bias 2. Eight randomized clinical trials (2008–2021; 241 patients) were included. Materials evaluated included resin composite/flowable resin, resin-modified glass ionomer cement, and giomer; several trials also used root-coverage procedures, such as coronary advance flap with or without connective tissue graft. Mean root coverage commonly ranged from 50% to 97% across groups. Across some of the studies, resin-based restorations showed a positive trend in gingival health parameters, suggesting improved marginal conditions and plaque control. However, changes in gingival recession itself were inconsistent, and material superiority for recession reduction could not be established due to heterogeneity and incomplete outcome reporting in some trials. Restoring NCCLs may support better local gingival health, but no restorative material consistently improves gingival recession outcomes.

Key words: Gingival recession, glass ionomer, non-carious cervical lesions, resin composite, restorative materials, systematic review

INTRODUCTION

Non-carious cervical lesions (NCCLs) are a condition characterized by progressive loss of tooth structure at the cemento-enamel junction (CEJ) due to causes other than dental caries. They can present as shallow or saucer-shaped depressions and are often multifactorial in origin, with several underlying factors, such as abrasion, erosion (biocorrosion), and abfraction forces.^[1,2] While NCCLs are usually asymptomatic in early stages, they may lead to severe clinical complications, including hypersensitivity, esthetic dissatisfaction, plaque accumulation, and in some instances, gingival recession.^[3]

The management of NCCLs remains a topic of debate and uncertainty between restorative dentistry and periodontology experts. One of the reasons for this is the overlapping presentation of NCCLs with gingival recession, a condition associated with apical migration of the gingival margin and exposure of the root surface. While NCCLs may appear

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separate from gingival recession, their co-occurrence in over half of buccal recession defects suggests a potential relationship, justifying the need for further investigation.^[4]

The etiology of NCCLs is complex and multifactorial [Figure 1]. Among mechanical factors, abrasion caused by aggressive toothbrushing, particularly with horizontal brushing patterns, plays a dominant role. In addition, chemical erosion due to dietary acids or gastroesophageal reflux, as well as biomechanical forces, such as occlusal stress and flexure at the cervical region (abfraction), have been implicated in lesion development.^[5] Together, these factors lead to progressive loss of enamel and dentin and formation of NCCLs, particularly in pre-molars and anterior teeth.

Prevalence estimates for NCCLs vary significantly between studies depending on study design, population, and diagnostic criteria. A systematic review by Teixeira *et al.* found a highly variable global prevalence ranging from 9% to 93%, with an estimated mean of approximately 47%.^[6] The likelihood of encountering NCCLs increases with patient age and is further influenced by behavioral and dietary factors. A similar pattern has been reported in studies from the Middle East. A recent study conducted in Saudi Arabia by Zakirulla *et al.* in the Abha region reported an NCCL prevalence of 18.72%.^[7] In contrast, an earlier study conducted at Jouf University reported a higher prevalence rate of 46.67%.^[8] These findings reflect notable regional variation in NCCL prevalence within Saudi Arabia.

Gingival recession is a condition that frequently coexists with NCCLs. The causes of gingival recession have been shown to mirror those of NCCLs in many aspects, with traumatic toothbrushing being reported as a major contributing factor for both conditions.^[3] Moreover, studies suggest that NCCLs – particularly when deep or irregular – may complicate root coverage procedures, such as connective tissue grafts (CTGs). Irregular root surfaces created by these lesions can impair soft tissue adaptation, jeopardize graft stability, and negatively affect overall clinical outcomes.^[4]

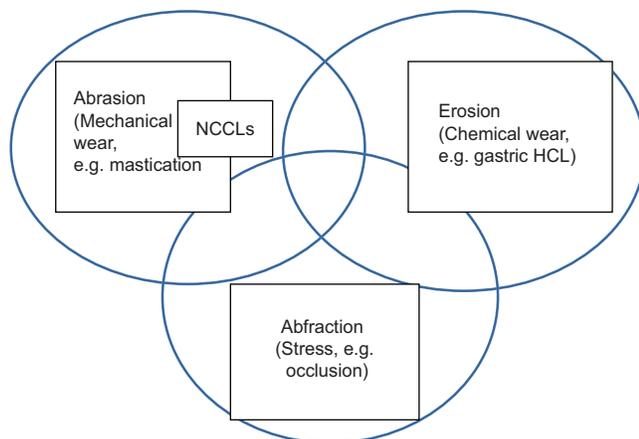


Figure 1: Illustration of the multifactorial causes of non-carious cervical lesions, including abrasion, erosion (biocorrosion), and abfraction. Adapted from Nascimento *et al.*^[2]

The management of NCCLs requires a careful and individualized approach. Restorative treatment typically involves the use of a wide variety of materials, including resin composite (RC), glass ionomer cement (GIC), and resin-modified GIC (RMGIC), each offering distinct characteristics and advantages. Resin-based composite materials provide superior esthetics and wear resistance, whereas GICs and RMGICs demonstrate improved adhesion to dentin and fluoride release.^[9]

Indications for restoring NCCLs commonly include symptom relief, esthetic demands, and facilitation of plaque control. However, whether restoration of NCCLs promotes gingival health remains controversial. Some clinical trials report that well-sealed restorations may help limit further gingival recession,^[10] whereas others suggest that improper restorations may induce soft tissue inflammation and potentially exacerbate recession.^[11]

This clinical uncertainty is consistently reflected in the literature. A recent systematic review by Chawla and Goyal reported that although NCCL restoration improved dentin hypersensitivity and esthetic outcomes, it did not significantly influence root coverage outcomes when combined with surgical interventions.^[12] Conversely, an earlier controlled clinical trial found no significant difference in mean root coverage between teeth with NCCLs and those without cervical defects.^[13] Given the lack of consensus regarding the periodontal effects of NCCLs and the absence of a focused synthesis of available data, a systematic review is warranted to evaluate periodontal outcomes following NCCL restoration.

Restoring NCCLs in the presence of gingival recession has important implications for long-term oral health and patient satisfaction. Inadequate management may result in continued recession, restoration failure, or unnecessary surgical intervention. Conversely, well-executed restorations may enhance periodontal stability, improve esthetics, and limit disease progression. Therefore, clinicians must carefully balance the benefits and limitations of restorative intervention based on each patient's clinical presentation. The present systematic review critically analyzes the best available evidence to support informed, evidence-based clinical decision-making.

Aim

This systematic review aims to evaluate the impact of restoring NCCLs on gingival health and recession by assessing the clinical outcomes following their restoration.

Objective

Investigating the association between the presence of NCCLs and the progression of gingival recession, and comparing

different restorative materials (such as RC, glass ionomer, and resin–modified glass ionomer) to determine whether there are differences in their effects on periodontal outcomes.

LITERATURE REVIEW

As stated previously and despite advances in restorative dentistry, the effect of restoring NCCLs on gingival health remains controversial. Some clinicians argue in favor of or against the notion of recovery of gingival recession as a consequence of NCCL restorations. The following sections synthesize and critically appraise the present evidence, and highlight emerging insights into how NCCL restoration may influence gingival outcomes.

EPIDEMIOLOGICAL PATTERNS AND DIAGNOSTIC VARIABILITY

Epidemiological data demonstrate that NCCLs are highly prevalent worldwide, with reported rates ranging from <10% to over 90%, depending on the study population and methodology.^[14,15] Considerable inconsistency in prevalence estimates has been observed across studies. For example, Zakirulla *et al.* reported an NCCL prevalence of 18.7% in the Abha region of Saudi Arabia,^[7] whereas Iqbal *et al.* reported a substantially higher prevalence of 46.6% in the Jouf region.^[8] Such variation is unlikely to be explained by biological factors alone and may instead reflect differences in study design, diagnostic criteria, sample size, and population characteristics.^[7,8]

This methodological heterogeneity complicates the interpretation of restorative outcome studies, as previously highlighted by Teixeira *et al.*^[6] Consequently, when comparing studies assessing NCCL restoration and gingival recession outcomes, these underlying inconsistencies must be carefully considered.

Gingival recession, NCCLs, and combined defects

The etiology of gingival recession can be broadly classified into anatomical, physiological, and pathological factors, including traumatic toothbrushing and occlusal trauma.^[16] Gingival recession is also categorized into several classes based on clinical presentation and the presence or absence of the CEJ, with each class requiring different therapeutic approaches.^[16] Among available treatment modalities, the coronally advanced flap (CAF) combined with CTG is currently considered the most frequently employed and predictable approach for root coverage.^[17]

A strong association exists between NCCLs and gingival recession, with some studies reporting their co-occurrence in nearly half of affected cases.^[18] This coexistence complicates

both restorative and periodontal management. Huamán-Mendoza *et al.* observed that untreated cervical lesions may compromise root coverage procedures by impairing graft stability and tissue integration.^[4]

Furthermore, gingival recession exposes root surfaces, thereby increasing the risk of dentin hypersensitivity, root caries, and esthetic dissatisfaction.^[3] Irregular cervical defects may further compromise adhesion and marginal stability of restorations. When NCCLs and gingival recession coexist, effective patient management requires close coordination between restorative and periodontal therapies. However, there is currently no consensus regarding whether restoring NCCLs before or in conjunction with surgical root coverage leads to superior clinical outcomes.

A recent systematic review and meta-analysis by Chawla and Goyal concluded that restoring NCCLs did not significantly influence root coverage percentages.^[12] These findings are consistent with earlier observations by Teixeira *et al.*, who found no clear protective effect of restorations on gingival recession progression in cross-sectional analyses.^[18] In contrast, small clinical trials, such as that conducted by Isler *et al.*, have suggested that well-executed restorations may reduce plaque retention and potentially slow further recession.^[10]

These discrepancies may largely be attributed to study design limitations. Cross-sectional studies cannot establish causality and often fail to control for confounding factors, such as oral hygiene habits. Meanwhile, longitudinal clinical trials are scarce, frequently underpowered, and commonly limited to short follow-up periods (6–12 months), which may be insufficient given the slow progression of gingival recession.

Type of materials and gingival interaction

The choice of restorative material plays an important role in periodontal outcomes, although available evidence remains inconsistent. RC restorations have been shown to reduce dentin hypersensitivity and improve esthetic outcomes.^[9] In contrast, glass ionomer–based materials, despite being more susceptible to surface discoloration, offer advantages, such as chemical adhesion to dentin and fluoride release, which may be beneficial in selected clinical situations.^[11,19]

Overall, patient-reported outcomes tend to favor restoration. A systematic review by de Oliveira *et al.* reported improvements in comfort and patient satisfaction following NCCL restoration; however, these findings were not consistently supported by statistically significant periodontal outcomes, limiting definitive conclusions.^[20]

Bioactive composites and ionomers represent a newer class of restorative materials. Laboratory studies suggest that these materials may provide improved marginal sealing, reduce plaque accumulation, exert anti-demineralizing effects, and

demonstrate favorable tissue compatibility.^[21-23] Nevertheless, high-quality clinical data evaluating their periodontal effects in real-world settings remain limited.

Notably, there is a lack of randomized controlled trials (RCTs) specifically comparing restorative materials with respect to gingival outcomes. Most existing studies focus primarily on material performance indicators, such as retention rates and marginal adaptation rather than periodontal stability, making conclusions regarding material superiority difficult.

Regional evidence from Saudi Arabia

Several studies conducted in the Kingdom of Saudi Arabia have investigated NCCLs and gingival recession, although with varying methodologies and outcomes. Zakirulla *et al.* evaluated 486 patients aged 20–60 years and reported a relatively low NCCL prevalence of 18.72%, predominantly affecting pre-molars and primarily attributed to abrasion.^[7] Similarly, Iqbal *et al.* reported a predominance of NCCLs in pre-molar teeth with mechanical etiologies but observed a higher prevalence rate of 46.67%, potentially related to their larger sample size of 600 patients.^[8]

In addition, Aljohani *et al.* assessed gingival recession prevalence in patients from Makkah and reported a prevalence of 39%, with age identified as a strong associated risk factor.^[24] Interestingly, patient perception of gingival recession was significantly associated with the presence of NCCLs, although this relationship was not explored in depth. Other regional studies have examined gingival recession prevalence and practitioner awareness;^[25,26] however, original research in Saudi Arabia specifically investigating the association between NCCLs and gingival recession remains limited.

Conflicting evidence and possible explanations

As discussed, conflicting evidence persists regarding the relationship between NCCL restoration and gingival recession outcomes. While systematic reviews generally report no measurable benefit of restorations on root coverage, individual clinical studies suggest that well-finished restorative margins may enhance gingival stability by smoothing root surfaces.

Several factors may contribute to these inconsistencies. Operator variability is a significant consideration, as cervical restorations are technique-sensitive, and minor differences in finishing and polishing may substantially influence gingival response. Lesion characteristics also play a role, as deeper wedge-shaped NCCLs may interact differently with gingival tissues compared with shallow saucer-shaped lesions.^[27]

Follow-up duration varies widely among published studies, which may further explain divergent findings, given that periodontal parameters, such as recession depth, probing depth (PD), and clinical

attachment level are strongly time-dependent.^[28,29] In addition, small sample sizes – often fewer than 40 participants – limit the generalizability of many studies in this field.^[17]

Collectively, these limitations indicate that the present evidence base is insufficient to draw firm conclusions, underscoring the need for well-designed RCTs and updated systematic reviews.

MATERIALS AND METHODS

Protocol

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines.

Eligibility criteria

Inclusion criteria

Studies were selected based on pre-defined inclusion and exclusion criteria that aligned with the review objectives. Eligible studies included clinical involving patients with NCCLs. The review question was structured using the PICO format, that is, patients with NCCLs and gingival recession (Population) who received restorative treatment using different restorative materials (Intervention), compared with other materials, or non-restored teeth (Comparison), and assessing changes in gingival recession or other associated periodontal parameters (Outcome). Therefore, only human studies embodying all these characteristics were included.

Exclusion criteria

Animal or *in vitro* studies, case-control, cohort and case reports, editorials, or narrative reviews. Furthermore, studies of carious lesions or those lacking sufficient clinical outcome data or relevance to NCCL restoration were excluded from the study. No restriction was applied regarding the number or degree of the recessions or the language of the manuscript.

Information sources

A systematic search was conducted across the following electronic databases: PubMed, Cochrane Library, and Google Scholar.

Additional sources were acquired from manual screening of reference lists of included studies to identify any relevant literature not indexed in the databases.

Search strategy

The search strategy used combinations of MeSH terms and free-text keywords, including:

- NCCLs, (restoration), (gingival recession), (periodontal health), (composite resin), (glass ionomer), and (restorative materials).
- Boolean operators (AND/OR) are used to refine search combinations.

The full search strategies used for each database are provided here:

PubMed

The following query was used in the advanced search after choosing title and abstract in the filed box: (“non-carious cervical lesions”[Title/Abstract] OR “NCCLs”[Title/Abstract])

(“non-carious cervical lesions”[Title/Abstract] OR “noncarious cervical lesion”[Title/Abstract])

OR “tooth wear”[Title/Abstract] OR “cervical abrasion”[Title/Abstract] OR “cervical erosion”[Title/Abstract]

OR “tooth surface loss”[Title/Abstract] OR “NCCL”[Title/Abstract] OR “NCCLs”[Title/Abstract]

AND (“restoration”[Title/Abstract] OR “restorative treatment”[Title/Abstract] OR “restorative materials”[Title/Abstract])

OR “dental restoration”[Title/Abstract] OR “tooth restoration”[Title/Abstract] OR “resin composite”[Title/Abstract]

OR “composite resin”[Title/Abstract] OR “glass ionomer”[Title/Abstract] OR “resin-modified glass ionomer”[Title/Abstract]

AND (“gingival recession”[Title/Abstract] OR “gingival margin”[Title/Abstract] OR “gingival attachment”[Title/Abstract])

OR “periodontal health”[Title/Abstract] OR “periodontal status”[Title/Abstract] OR “gingival condition”[Title/Abstract]).

Google scholar

“Non-carious cervical lesions” “NCCLs” “restoration” “resin composite” “glass ionomer” “gingival recession” “clinical trial”

Cochrane

(“Non-carious cervical lesions” OR “non carious cervical lesion” OR “NCCLs”)

AND (“restoration” OR “restorative materials” OR “dental restoration” OR “tooth restoration”)

AND (“gingival recession” OR “periodontal health” OR “periodontal status”)

AND (“composite resin” OR “glass ionomer” OR “resin-modified glass ionomer” OR “GIC”).

Selection process

Titles and abstracts of all retrieved records were independently screened by two reviewers. Full-texts of potentially eligible articles were then reviewed independently by the same reviewers.

Disagreements were resolved through discussion or consultation with a third reviewer.

A PRISMA 2020 flow diagram was used to further illustrate the study selection process.

Data collection process

Here also, two independent reviewers extracted the data using a standardized data extraction form capturing: Study identifiers (author, year), study design, and sample size.

Participant demographics, type of NCCL restoration and material used, clinical outcomes (gingival recession, PD), and any disagreement between the reviewers in data extraction were resolved through consensus. If necessary, study authors will be contacted for clarification or missing data. No automation tools were used for selection or data collection.

Data items

Primary outcome

Improvement in gingival recession following NCCL restoration.

Secondary outcomes

- Gingival health parameters (PD, recession depth, recession reduction)
- Effectiveness of different restorative materials (composite resin, glass ionomer, resin-modified glass ionomer).

Study risk of bias assessment

Risk of bias will be independently assessed by two reviewers: For RCTs: Cochrane Risk of Bias 2 (RoB 2) tool will be used. Each study was then rated as low, moderate, or high risk of bias. Any disagreements during the review were also resolved through discussion or consultation with a senior colleague. Finally, the results of the risk of bias assessment were presented in tabular formats to guide the interpretation of evidence robustness.

Role of the funding source

This review did not receive external funding. No funding body had any influence on study design, data collection, data analysis, interpretation of results, or the decision to submit the manuscript.

RESULTS

Selection of studies

The electronic and manual search strategy yielded 239 articles. After removing 29 articles for duplication [Figure 2], 210 were screened for title and abstract, where 184 articles were excluded. Three additional studies were included through reference search, resulting in 26 RCTs that met the eligibility criteria for full-text analysis.

During the full-text screening process, 18 reports were excluded for several reasons (patients with systemic disease, irrelevant interventions, or outcomes).

Inter-reviewer agreement

Inter-reviewer agreement for study selection across the three databases was evaluated using Cohen's Kappa coefficient. For the title and abstract screening, the reviewers showed almost perfect agreement ($\kappa = 0.89$), with any discrepancies resolved through discussion. Moreover, for the full-text screening, agreement was substantial ($\kappa = 0.88$), reflecting also a high level of agreement between reviewers.

Characteristics of included studies

The 8 included randomized clinical trials, published between 2008 and 2021, comprised a total of 241 patients. Individual study sample sizes ranged from 8 to 50 patients, and follow-up periods ranged from 3 months to 3 years [Table 1].

Interventions included RC, flowable resin, RMGIC, giomer, and different adhesive strategies. Five studies evaluated combined restorative and periodontal surgical approaches (CAF/MCAF with or without CTG), while three studies

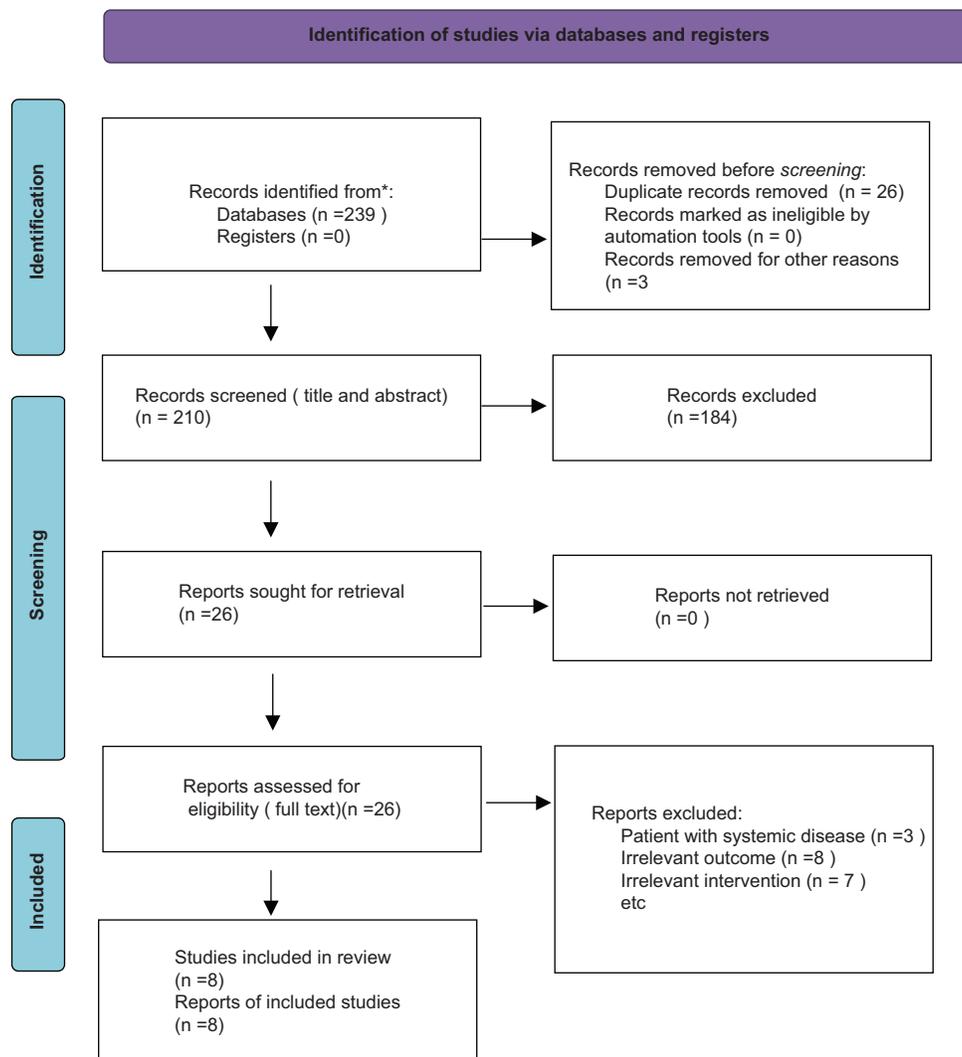


Figure 2: Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart of systemic review

Table 1: Baseline characteristics of selected studies

Publication year	Author	Study type	Follow-up period	Patient characteristics	Treatment groups	Conclusions
2021	Gonçalves <i>et al.</i>	Prospective, randomized, double-blind, split-mouth study	3-year.	200 restoration and 50 patients, (34 male vs. 16 female). Mean age=61 years	SBU+(E-SBU) versus SBU+RMGIC versus SBU+E-RMGIC	Adhesion using EDTA and resin-modified glass-ionomer cements can delay marginal defects over time.
2018	Isler <i>et al.</i>	Prospective randomized clinical trial	12 months	23 patients aged (mean 45)	NRC+CTG+MCAF versus RMGIC+CTG+MCAF versus Giomer+CTG+MCAF	NCR and RMGI showed similar clinical results, while Giomeris less effective in gingival recession associated with NCCL
2014	Leybovich <i>et al.</i>	Prospective randomized clinical trial	3 month	24 sites and 8 patients	CTG versus CRR	CTG treatment is superior to the CRR treatment in terms of periodontal health parameters
2008	Santamaria <i>et al.</i>	Randomized Controlled Clinical Trial	6 Months	19 patients (nine males vs. 10 females) mean age=36.26 years	CAF with or without resin	Relatively less reduction in GR was observed after CAF+R at 6 months
2009	Kim <i>et al.</i>	Randomized clinical trial split-mouth	6 months	50 subjects (25 male, mean age 52±7 with 450 teeth with NCCL	Flowable resin versus no restorations	Gingival recession, attachment level, BOP, and plaque in the flowable resin group were lower than in the control group.
2018	Santamaria <i>et al.</i>	Parallel arm, open-label randomized clinical trial	12 month	40 patients (18 women and 22 men), mean age: 44.5	CTG versus RC (partial restoration)+CTG	CTG alone and CTG+PR result in similar clinical outcomes to treat cervical defects with better
2019	Cairo <i>et al.</i>	Parallel randomized controlled clinical trial	12 months	30 patients: (22 women and 8 men, ages between 26 and 63)	RC+CAF versus RC+CAF+CTG	Both procedures were effective for recession with no significant difference for RecRed and CRC between the two groups.
2018	Carvalho <i>et al.</i>	Randomized split-mouth clinical trial	6 months	21 patients, 11 male versus 10 (47.6%) were female, age: (22–76 years).	(RM-GIC) versus composite resin	Slight improvement of rGR in the RM-GIC group in the short term, but no significance difference between the groups after 6 months.

SBU: Self-etch bonding universal, E-SBU: Etch+self-etch bonding universal, RMGIC: Resin-modified glass ionomer cement, E-RMGIC: Etched+resin-modified glass ionomer cement, NCR: Nanofilled composite resin, CTG: Connective tissue graft, MCAF/CAF: Modified coronally advanced flap/coronally advanced flap, CRR: Composite resin restoration, PR: Partial restoration, RC: Resin composite, GR: Gingival recession

evaluated restorative treatment alone, with an overall range of mean root coverage ranging from 50% to 97%.

Risk of bias and quality assessment

Using the Cochrane RoB 2 tool, five studies were judged to have an overall low risk of bias: Kim *et al.*,

Santamaria *et al.*, Santamaria *et al.*, Cairo *et al.*, and Gonçalves *et al.*^[30-34] Some concerns were identified in three studies. Isler *et al.* (2018) presented concerns related to the randomization process,^[10] Leybovich *et al.* showed concerns regarding selective outcome reporting,^[35] and Carvalho *et al.* demonstrated concerns associated with allocation concealment and blinding.^[36] No study was

classified as having a high risk of bias across any domain [Figure 3].

Outcome reporting

Gingival recession outcomes

The included studies reported a measure of gingival recession, expressed as recession depth (GR/Rec) or relative gingival recession (rGR).

Kim *et al.* reported no change in recession depth following flowable resin restoration (1.36 mm at baseline and follow-up), with a slight increase in the non-restored group. Carvalho *et al.* reported rGR outcomes, with minimal short-term improvement in the RC group (6.15 vs. 5.6), and no change in the RMGIC group at 6 months.

Leybovich *et al.* reported minimal change in recession in the composite resin restoration group (mean change 0.08 mm).

Surgical studies and root coverage

Periodontal surgical outcomes

Five studies reported clinical outcomes following periodontal surgical intervention. Santamaria *et al.* reported reductions in recession depth following CAF or CTG-based procedures.^[31,32]

Isler *et al.* observed recession reduction with mean root coverage ranging from 65.7% to 71.3%, depending on the restorative material used in combination with CTG.^[10]

Cairo *et al.* reported a mean root coverage of 50% for RC combined with CAF and 71% for RC combined with CAF and CTG.^[33]

Leybovich *et al.* reported a mean root coverage of 82% in the CTG group; however, root coverage outcomes were not reported for the composite restoration-only group.^[35]

Other periodontal parameters

Secondary periodontal outcomes, including PD, were reported inconsistently across studies, with follow-up durations ranging from 3 months to 5 years. The largest changes in PD were observed in the study by Santamaria *et al.*, which reported baseline and follow-up PD values of 1.3 mm and 2.0 mm for the CTG group, and 1.2 mm and 2.6 mm for the partial RC plus CTG group, respectively^[32] [Table 2].

Due to substantial heterogeneity in outcome definitions, measurement methods, follow-up periods, and reporting formats, quantitative synthesis was not performed.

DISCUSSION

This systematic review evaluated the effect of restoring NCCLs on gingival recession, with particular emphasis on the role of restorative materials in influencing periodontal outcomes. The findings indicate that while restorative materials may positively affect local gingival health parameters, such as PD, their impact on true gingival recession reduction remains limited and inconsistent. These results suggest that restorative materials primarily contribute to gingival health maintenance rather than inducing coronal soft tissue migration, a distinction that is essential for clinical decision-making.

Across the included randomized clinical trials, restorative materials, including RC, RMGIC, giomer, and flowable resin, demonstrated no consistent ability to induce coronal

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Gonçalves, et al. 2021	+	+	+	+	+	+
Isler et al. 2017	-	+	+	+	+	-
Santamaria MP et al. 2021	-	+	+	+	+	-
Leybovich et al. 2014	+	+	+	+	-	-
Kim et al. 2013	+	+	+	+	+	+
Santamaria MP et al. 2018	+	+	+	+	+	+
Cairo F et al. 2019	+	+	+	+	+	+
Carvalho et al. 2018	-	-	+	+	+	+

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
- Some concerns
+ Low

Figure 3: Risk of bias of eight clinical trials as assessed by risk of bias 2

Table 2: Summary of extracted clinical and periodontal outcome data from the included studies

Author ID	Treatment groups	Recession depth or relative gingival recession mm		Probing depth mm		Relative recession reduction mm	Mean root coverage %
		Base line	Follow-up	Baseline	Follow-up		
(Cairo <i>et al.</i> , 2020)	RC+CAF	3.2	0.5	1.1	1.2	2.7	50
	RC+CAF+CTG	3.4	0.3	1.1	1.1	3.1	71
(Leybovich <i>et al.</i> , 2014)	CTG	NA	NA	NA	NA	-2.04	82
	CRR	NA	NA	NA	NA	0.08	NA
(Kim <i>et al.</i> , 2009)	Flowable resin	1.36	1.36	2.3	2.2	0.00	NA
	No restoration	1.22	1.33	2.4	2.3	-0.11	NA
(Isler <i>et al.</i> , 2018)	NRC+CTG+MCAF	11.3	9.3	1.13	1.43	2.0	71.1
	RMGIC+CTG+MCAF	11.3	9.4	1.13	1.17	1.9	71.3
	GIOMER+CTG+MCAF	11.2	9.5	1.04	1.3	1.7	65.7
(Santamaria <i>et al.</i> , 2018)	CTG	9.2	6.8	1.3	2.0	2.4	92.2
	RC (partial restoration)+CTG	8.7	6.2	1.2	2.6	2.5	93
(Santamaria <i>et al.</i> , 2008)	CAF	10.9	9.5	1.18	1.00	1.5	97.48
	CAF+Resin	10.5	9.01	1.25	1.3	1.39	88.02
(Carvalho <i>et al.</i> , 2018)	Resin composite	6.15 (rGR)	5.6(rGR)	1.3 (median)	1.15 (median)	1.15	NA
	RMGIC	6.3(rGR)	6.3(rGR)	1.0 (median)	1.3 (median)	0.00	NA
(Gonçalves <i>et al.</i> , 2021)	SBU WITH (E-SBU), RMGIC), and EDTA; E-RMGIC).		NA		NA	NA	1 st degree recession

CAF: Coronally advanced flap, MCAF: Modified coronally advanced flap, CTG: Connective tissue graft, RC: Resin composite, NRC: Nanohybrid resin composite, RMGIC: Resin-modified glass ionomer cement, GIOMER: Giomer restorative material, CRR: Composite resin restoration, SBU: Universal bonding system, E-SBU: Etched universal bonding system, EDTA: Ethylenediaminetetraacetic acid, E-RMGIC: Etched resin-modified glass ionomer cement, NA: Not available or not reported

repositioning of the gingival margin when used alone. This observation echoes findings from previous studies indicating that restorative treatment alone is insufficient and that combination with other therapeutic modalities, such as CTGs, is often necessary to improve gingival recession outcomes.^[20]

The study by Kim *et al.* provides important insight into the biological role of restorative materials. Although flowable resin restorations did not improve recession depth, they were associated with reduced PD, suggesting a favorable effect on gingival inflammation.^[30] Similar findings were reported by Carvalho *et al.*, where both RC and RMGIC restorations resulted in comparable PD outcomes, with slightly greater gingival recession observed in the RC group; however, these differences were not statistically significant.^[36] Furthermore, Leybovich *et al.* reported a positive effect of resin-based restorations on gingival recession reduction; however, the absence of detailed data on mean root coverage limited meaningful comparison across studies.^[35]

RC versus glass ionomer-based materials

RC materials were among the most frequently investigated restorative options in the included trials. Their favorable

esthetic properties and wear resistance make them a common choice in clinical practice.^[15] Evidence from this review suggests that RCs may outperform other materials in certain gingival health parameters. However, studies reporting acceptable recession reduction and high mean root coverage – such as those by Cairo *et al.* and Santamaria *et al.* – largely demonstrated these benefits when resin-based restorations were used in conjunction with surgical therapy rather than as an isolated intervention.^[31-33]

In contrast, Carvalho *et al.* directly compared RC and RMGIC restorations without surgical intervention and reported greater improvements in PD and recession outcomes in the RC group, lending some support to the effectiveness of resin-based materials in non-surgical contexts.^[36]

Glass ionomer-based materials, particularly RMGICs, have been proposed as more periodontal-friendly due to their chemical adhesion, fluoride release, and reduced polymerization shrinkage.^[19] Gonçalves *et al.* reported improved gingival healing and delayed marginal degradation in etched RMGIC groups.^[34] Nevertheless, these advantages did not consistently translate into significant improvements in gingival recession depth or root coverage across studies.

These findings are consistent with Ibrahim *et al.*, who concluded that conventional composite resins may exhibit slightly superior marginal adaptation compared with other materials, potentially supporting gingival healing; however, no statistically significant superiority could be attributed to any specific material.^[37]

Giomers and bioactive restorative materials

Giomers and other bioactive restorative materials offer theoretical periodontal advantages, including sustained fluoride ion release and improved biocompatibility.^[22] In the randomized clinical trial by Isler *et al.*, giomer restorations demonstrated inferior recession outcomes compared with RC and RMGIC when used alongside periodontal surgery.^[10] This may be related to material-specific properties, such as surface roughness or wear behavior.

Although laboratory studies suggest that bioactive materials may reduce plaque accumulation and promote favorable soft tissue responses,^[38] the present review highlights a lack of sufficient clinical evidence to validate these benefits in the management of NCCL-associated gingival recession.

Mechanisms linking restorative materials and gingival health

The influence of restorative materials on gingival outcomes appears to be mediated primarily through indirect mechanisms, including marginal adaptation, surface roughness, and plaque retention, rather than direct effects on soft tissue position. Poorly finished restorations may exacerbate gingival inflammation and contribute to further recession progression,^[11] whereas well-polished restorations with stable margins may facilitate plaque control and promote gingival stability.^[39]

Lesion morphology also plays a critical role. Deep or wedge-shaped NCCLs may compromise marginal adaptation regardless of material selection, thereby limiting potential periodontal benefits.^[40] This factor may partly explain the variability in reported outcomes, as most included studies did not stratify results based on lesion depth or morphology.

Comparison with existing systematic reviews

The findings of this review align with those of de Oliveira *et al.* and Chawla and Goyal, both of whom reported limited periodontal benefit associated with NCCL restoration alone.^[12,20] Similar to these reviews, the present analysis restricted inclusion to randomized clinical trials, offering a more conservative and methodologically robust assessment of material-related effects. Importantly, this review extends previous work by demonstrating that no restorative material can currently be recommended as superior for preventing or reducing gingival recession.

Clinically, these findings suggest that restorative material selection should be guided by the overall treatment strategy. Resin-based restorations may offer advantages in marginal stability and gingival health; however, no material consistently influences gingival recession outcomes. Interpretation of these conclusions is limited by heterogeneity in study design, restorative protocols, and outcome reporting, as well as small sample sizes and short follow-up durations in many trials.

Future randomized clinical trials should prioritize direct material comparisons, standardized periodontal outcome measures, longer follow-up periods, and stratification based on lesion morphology and gingival phenotype to enhance clinical relevance and evidence quality.

CONCLUSION

Based on eight randomized clinical trials, restoring NCCLs does not show a consistent or clinically predictable reduction in gingival recession when compared across materials. Although certain studies reported improvements in gingival health parameters, these benefits were not consistently accompanied by superior recession outcomes. Moreover, high mean root coverage predominantly occurred in the context of periodontal plastic surgery, which suggests that the combined effect of surgical and restorative intervention, rather than restorative material selection, is the primary driver of recession improvement. Given heterogeneity in study designs, outcome definitions, follow-up duration, and occasional limitations in reporting, future trials should prioritize standardized recession measures, transparent reporting of root-coverage outcomes by group, and longer follow-up to clarify any material specific periodontal effects.

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