Root Coverage Procedures in Noncarious Cervical Lesions With and Without Restoration: A Systematic Review and Meta-Analysis

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The aim of this systematic review was to assess in patients with gingival recessions and noncarious cervical lesions (NCCLs) whether restoration of NCCLs may influence the percentage of root coverage following surgical root coverage procedures compared to surgical root coverage procedures without subsequent restoration. Four studies (randomized controlled trials) assessing the effects of NCCL restoration in combination with surgical root coverage procedures were included. Meta-analyses showed no significant differences in overall root coverage, CAL gain, and KTW change between test and control groups. In teeth with NCCLs and gingival recessions, restoration of NCCLs does not affect the clinical outcomes of surgical root coverage. Int J Periodontics Restorative Dent 2020;40:e127–e135. doi: 10.11607/prd.4284

According to the 2017 World Workshop on the classification of periodontal and peri-implant diseases and conditions, gingival recession is defined as an apical migration of the gingival margin caused by different conditions/pathologies.1 Gingival recession has a high prevalence in adult populations worldwide, even in patients with good oral hygiene habits,2-4 and it is often associated with dentine hypersensitivity, esthetic impairment, root caries, and noncarious cervical lesions (NCCLs).5 Although the etiologic inflammatory mechanism responsible for the development of gingival recession is not fully understood, several potential risk indicators seem to play a role on its development and progression, such as thin gingival phenotype,6,7 traumatic toothbrushing,8 history of orthodontic treatment,9 and intrasulcular restorative margins.1

NCCLs are defined as a loss of hard dental tissue near the cementoenamel junction (CEJ) that is not associated with dental caries.10 NCCLs present multifactorial etiology and have been associated with tensile stress, tooth susceptibility, piezoelectrical effect, salivary physiology, abrasion, and biocorrosion.10,11 Depending on their extension, these lesions can involve the exposed root and be associated with gingival recession.12
The combination of gingival recession and NCCL represents a challenging clinical situation and raises the question on how the extension (length and depth) of NCCLs could affect the clinical outcomes of surgical root coverage, specifically on Type I gingival recession defects. In order to facilitate diagnosis and a treatment plan, Prato et al.\textsuperscript{13} have proposed a classification for dental surface defects in areas of gingival recession, based on the presence or absence of a visible CEJ and an NCCL. According to this classification, a Class A– gingival recession presents a visible CEJ and intact root surface that can be treated with surgical root coverage only; a Class A+ gingival recession presents a visible CEJ but has an NCCL and in this case needs to be restored using a connective tissue graft to fill the root defect; a Class B– gingival recession is associated with an unidentifiable CEJ without an NCCL, and can be treated with surgical root coverage procedures; Class B+ gingival recession is associated with an unidentifiable CEJ associated with NCCL, representing the most challenging situation and requiring both periodontal and restorative approaches.\textsuperscript{13}

Some randomized clinical trials (RCTs) have investigated the influence of NCCL restoration previous to or during the surgical root coverage procedure on periodontal clinical parameters.\textsuperscript{14–17} However, no systematic reviews have objectively evaluated the clinical impact of restoring NCCLs on the clinical outcomes of root coverage surgical procedures. Based on this lack of evidence, the following focused question was addressed: In systemically healthy patients with Type I gingival recessions and NCCLs, does NCCL restoration influence the percentage of root coverage following surgical root coverage procedures when compared to surgical root coverage procedures without NCCL restoration?

Materials and Methods

Study Protocol and Registration

This systematic review and meta-analysis was performed in compliance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Statement.\textsuperscript{18} The study protocol was registered in the International Prospective Register of Systematic Reviews\textsuperscript{19} (PROSPERO, under the code: CRD42017068272) on July 6, 2017.

Eligibility Criteria

To be eligible for inclusion, publications had to meet the following criteria: (1) original research publication in English; (2) be an RCT; (3) presence of a test group with Type I gingival recessions with a restored NCCL submitted to root coverage surgery; (4) presence of a control group with Type I gingival recessions with a non-restored NCCL submitted to root coverage surgery; and (5) outcome data reporting gingival recession, clinical attachment level, and/or gingival recession reduction. PICOS (patient, intervention, comparison, outcome, and study) strategy of the present systematic review was defined as participants presenting NCCLs and gingival recession (P), NCCL restoration + root coverage surgery (I), root coverage surgery alone (C), mean NCCL height coverage (O), and randomized clinical trials (S).

Prospective and retrospective cohorts, letters to editors, reviews, case series, case reports, and in vivo and in vitro studies were not included.

Search Strategy

A systematic electronic search was managed in the electronic databases MEDLINE (PubMed), Embase, LILACS, and Cochrane Library. Papers in English published through January 2018 were searched using the following terms: (gingival recession OR mucogingival surgery OR periodontal surgical therapy OR periodontal surgical flap OR root coverage OR periodontal plastic surgery OR connective tissue graft) AND (glass ionomer cement OR resin OR ionomer OR resin-modified glass ionomer restoration OR glass ionomer OR attrition OR non-carious cervical lesion OR abrasion OR abrasion OR attrition). The authors also conducted a hand search of reference lists from identified studies.

Search strategy was divided into two phases. In the first phase, titles and abstract screening was conducted by two independent reviewers (L.M.B.A. and C.M.R.M.). Disagreements were solved by debate and consensus. After that, in
the second phase, all studies that met inclusion criteria or those with unclear information in the title and abstract were read.

Data Collection Process

A data extraction form was used to collect information from the studies that met the eligibility criteria. If data were missing, the corresponding author of the study was contacted and asked to provide further details.

Risk of Bias

Quality assessment was performed using the Cochrane Collaboration tool for assessing risk of bias. According to each tool domain, included studies were classified as having “high risk of bias” (high), “low risk of bias” (low), or “unclear” (?). Overall, studies were judged as: (1) low risk of bias if all criteria were met (adequate sample size, randomization and allocation concealment, “yes” answer to all questions about the completeness of outcome data and blinding, and “no” answer to selective reporting and other sources of bias); (2) unclear risk of bias if one or more criteria were partly met; or (3) high risk of bias if one or more criteria were not met.

Measures and Analyses

Analyses were performed using the software Review Manager (RevMan) version 5.3 (The Nordic Cochrane Centre, The Cochrane Collaboration). Random-effects meta-analyses were carried out for (1) mean NCCL height coverage (MNCLHC), measured as the percentage of NCCL + gingival recession coverage; (2) mean gingival recession reduction (MGRR), measured as the reduction of the distance from gingival margin to apical border of the stent; (3) clinical attachment level (CAL) gain, measured as the reduction of probing depth + relative gingival recession; and (4) keratinized tissue width (KTW) changes, measured as the difference in the distance from gingival margin to the mucogingival junction and expressed as weighted mean differences (WMD). Subanalyses were performed for complete and partial NCCL restorations. Statistical heterogeneity was performed using Cochran’s Q statistic and I². Descriptive analysis was performed for bleeding on probing at study tooth sites.

Results

Electronic search yielded 833 abstracts. The search strategy identified 465 potentially relevant papers. Of these, 454 were excluded after screening of titles and abstracts, leaving 11 papers for a full assessment of the text, 4 of which fulfilled the eligibility criteria and were included in the review. Additional information about the screening process and the exclusion of seven studies is shown in Fig 1.

Included Studies

A total of 132 individuals presenting NCCLs and gingival recessions were enrolled. Of these, 128 (96.9%) completed the follow-up period. Santamaria et al reported 4 drop-outs as these patients could not be contacted. Characteristics of the included studies are shown in Table 1. The age of the included patients ranged from 19 to 71 years. Two RCTs included only individuals with Miller Class I gingival recessions whereas the remaining two included individuals with both Miller Classes I and II gingival recessions (Recession Type 1). Concerning the study design, one study was split-mouth, whilst the other three were parallel. The follow-up period of the RCTs were 12 and 24 months. Three RCTs performed complete restoration of NCCLs whereas Santamaria et al opted for partial restoration. Moreover, while two studies used resin modified by ionomer, the other two used composite resin for the restoration of NCCLs. Further, three RCTs performed the restoration during the surgical procedure, while Santamaria et al performed the restorative procedure 48 hours before surgery.

Risk of Bias

All included studies were considered to have low risk of bias (Fig 2). Due to the study characteristics, blinding of the operator, individual, and examiner could not be implemented, and therefore these
domains were excluded from the risk of bias assessment.

Effects of Interventions

Individual Outcomes

Individual outcomes of studies are present in Table 2. Overall, the studies included in the present review had no significant differences between the outcomes of surgical root coverage in teeth with restored and nonrestored NCCLs. Nonetheless, two studies demonstrated that restoration of NCCLs with composite resin in combination with a coronally advanced flap (CAF) was associated with better esthetic outcomes and greater reduction in dentin sensitivity when compared to CAF alone. All sites evaluated in all studies (100%) were negative for bleeding on probing during the entire follow-up.

Pooled Outcomes

The pooled estimates evaluating outcomes of surgical root coverage in teeth with restored (test) and non-restored (control) NCCLs showed no significant differences in overall MNCLHC \( (P = .45, I^2 = 0\%) \), MGRR, KTW change \( (P = .97, I^2 = 0\%) \) (Figs 3, 4, 5, and 6, respectively). Subgroup analyses considering partial or complete NCCL restoration also revealed no significant difference between test and control groups regarding MNCLHC, MGRR, and KTW changes. However, a greater CAL gain was observed in the group treated with CAF alone when compared to the CAF + partial NCCL restoration (Fig 5).

Adverse Effects

No adverse event was reported. However, two RCTs reported discoloration of the restorations in almost half of the cases.

Discussion

The present systematic review demonstrated that in teeth with NCCLs and gingival recessions, restoration of NCCLs does not affect the outcomes of surgical root coverage procedures, such as MNCLHC, MGRR, KTW change, and CAL gain. In three RCTs included in this review, NCCLs were completely restored. Although no filling was lost during the follow-up period in the abovementioned RCTs, it is important to highlight that the mean survival rate of Class V restorations is 15 years and that the loss of cervical restorations may jeopardize the stability of the gingival margin. Although the meta-analysis showed similar root coverage in the group treated with CAF+complete NCCL...
<table>
<thead>
<tr>
<th>Study, country</th>
<th>Study design and follow-up</th>
<th>Sample size</th>
<th>Participants</th>
<th>Inclusion criteria*</th>
<th>Source of funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santamaria et al, 14 2009, Brazil</td>
<td>Split-mouth RCT 24 mo</td>
<td>N = 16 (9 men, 7 women)</td>
<td>Test group (CAF + resin-modified glass ionomer restoration): N = 16 at baseline N = 16 at end of trial</td>
<td>Miller Class I (Type I gingival recession) bilateral gingival recession associated with an NCCL, 1 to 2 mm deep, in maxillary canines or premolars PD &lt; 3 mm without BOP Tooth vitality Absence of restoration on the cervical area and absence of severe occlusal interferences in the area to be treated</td>
<td>FAPESP</td>
</tr>
<tr>
<td>Santamaria et al, 15 2013, Brazil</td>
<td>Parallel RCT 24 mo</td>
<td>N = 40 (21 men, 19 women)</td>
<td>Test group (CTG + resin-modified glass ionomer restoration): N = 20 at baseline N = 18 at end of trial Control group (CAF): N = 20 at baseline N = 18 at end of trial</td>
<td>Miller Class I gingival recession (Type I gingival recession) associated with an NCCL, 1 to 2 mm deep, in maxillary canines or premolars PD &lt; 3 mm without BOP Tooth vitality Absence of restoration on the cervical area and absence of severe occlusal interferences in the area to be treated</td>
<td>FAPESP and CNPq</td>
</tr>
<tr>
<td>Santamaria et al, 16 2016, Brazil</td>
<td>Parallel RCT 12 mo</td>
<td>N = 36 (19 men, 17 women)</td>
<td>Test group (CTG + resin composite): N = 18 at baseline N = 18 at end of trial Control group (CTG): N = 18 at baseline N = 18 at end of trial</td>
<td>Class I or II Miller gingival recession (Type I gingival recession) associated with NCCL B+ defect in maxillary canines or premolars PD &lt; 3 mm without BOP Tooth vitality Absence of restoration on the cervical area and absence of severe occlusal interferences in the area to be treated</td>
<td>FAPESP and CNPq</td>
</tr>
<tr>
<td>Santamaria et al, 17 2018, Brazil</td>
<td>Parallel RCT 12 mo</td>
<td>N = 40 (22 men, 18 women)</td>
<td>Test group (CTG + partial restoration): N = 20 at baseline N = 20 at end of trial Control group (CTG): N = 20 at baseline N = 20 at end of trial</td>
<td>Class I or II Miller gingival recession (Type I gingival recession) associated with NCCL B+ defect, on vital maxillary canines or premolars Presence of dentin hypersensitivity and/or esthetic concerns related to the combined defect Adult &gt;18 y Full-mouth plaque and bleeding score ≤ 2% Absence of orthodontic braces and bruxism</td>
<td>FAPESP and CNPq</td>
</tr>
</tbody>
</table>

RCT = randomized controlled trial; CAF = coronally advanced flap; NCCL = noncarious cervical lesion; PD = probing depth; BOP = bleeding on probing; FAPESP = Research Foundation of the State of São Paulo; CTG = subepithelial connective tissue graft; CNPq = National Council for Scientific and Technological Development.

*In all studies, patients were nonsmokers, systemically and periodontally healthy, presented no contraindication for periodontal surgery, did not use medications known to interfere with periodontal tissue health and healing, and had no previous periodontal surgery in the area.
restoration when compared to the group treated with CAF only, no study compared root coverage outcomes of NCCL sites treated with complete or partial restoration. It has been speculated that complete restoration increases the avascular area of the root surface, which may decrease the predictability of root coverage. In line with this hypothesis, partial restoration of NCCLs has been recommended. Partial restoration of the NCCLs was performed in one RCT included in the present systematic review, and although no significant difference was found in the amount of root coverage, this treatment was associated with better esthetic results and significantly greater decrease in dentin hypersensitivity when compared to the group treated with CAF+CTG only. Further, all sites evaluated in all studies were negative for BOP during the entire follow-up period, indicating that the presence of the restoration also did not affect gingival health.

Interestingly, Santamaria et al performed a modification of the protocol recommended by Zucchelli et al restoring the NCCLs 1 mm apical to the anatomical CEJ. The authors’ explanation was that in cases where CRC is not achieved, the restoration margin placed at the CEJ level could result in the persistence of esthetic problems and dentin sensitivity. In addition, when the restoration margin is placed at the CEJ (maximum root coverage) level, a little apical displacement of the gingival margin can expose the root surface, which would be avoided if the modification protocol is used. However, longer follow-up periods should be carried out to analyze the benefit of this modification in comparison to the original protocol.

### Table 2 Interventions, Outcomes, and Results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>MNCLHC, %</th>
<th>MGRR, mm</th>
<th>CAL gain, mm</th>
<th>KTW, mm</th>
<th>BOP</th>
</tr>
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<tbody>
<tr>
<td>Santamaria et al, 2009</td>
<td>Test: CAF + NCCL complete restoration with resin-modified glass-ionomer restoration Control: CAF only</td>
<td>Test: 51.57 ± 17.2</td>
<td>Test: 1.1 ± 1.05</td>
<td>Test: 1.31 ± 0.6</td>
<td>Test: 0.05 ± 0.88</td>
<td>All study sites were negative for BOP during follow-up.</td>
</tr>
<tr>
<td>Santamaria et al, 2013</td>
<td>Test: CAF with CTG + NCCL complete restoration with resin-modified glass-ionomer restoration Control: CAF with CTG</td>
<td>Test: 71.95 ± 13.25</td>
<td>Test: 2.38 ± 0.72</td>
<td>Test: 1.32 ± 0.86</td>
<td>Test: 0.76 ± 0.91</td>
<td>All study sites were negative for BOP during follow-up.</td>
</tr>
<tr>
<td>Santamaria et al, 2016</td>
<td>Test: CAF with CTG + NCCL complete restoration with resin composite Control group: CAF with CTG</td>
<td>Test: 73.84 ± 19.2</td>
<td>Test: 2.72 ± 0.69</td>
<td>Test: 1.17 ± 0.89</td>
<td>Test: 0.46 ± 0.81</td>
<td>All study sites were negative for BOP during follow-up.</td>
</tr>
<tr>
<td>Santamaria et al, 2018</td>
<td>Test: CAF with CTG + NCCL partial restoration with resin composite Control group: CAF with CTG</td>
<td>Test: 75.3 ± 22.7</td>
<td>Test: 2.5 ± 1</td>
<td>Test: 0.5 ± 1.3</td>
<td>Test: 1.4 ± 1.3</td>
<td>All study sites were negative for BOP during follow-up.</td>
</tr>
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</table>

NCCL = noncarious cervical lesion; MNCLHC = mean NCCL height coverage; MGRR = mean gingival recession reduction; CAL gain = clinical attachment level gain; KTW = keratinized tissue width; BOP = bleeding on probing; CAF = coronally advanced flap; CTG = subepithelial connective tissue graft.

### Fig 2 Summary of risk of bias in selected studies.

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Another important point is that two studies\(^{14,15}\) used resin-modified glass ionomer, as its use has been previously supported in the subgingival area and no evidence was available at the time supporting the use of resin composite.\(^{33}\) However, in almost half of the cases, this material presented discoloration at the end of the experimental period,\(^{14,15}\) directly impairing the esthetic outcomes. Since then, further evidence emerged supporting the use of resin composite in the subgingival area.\(^ {34}\) Thus, it is suggested that in teeth with NCCLs and gingival recession, the restoration should be performed partially, using resin composite, which shows greater color stability over time.\(^ {35-37}\)

Although combined lesions (gingival recession + NCCLs) represent a challenge for clinicians, the studies included in this review showed a percentage of root coverage ranging from 52.57% to 82.16%. These results are similar to others reported in a recent systematic review\(^ {38}\) that showed, in teeth with single recessions, a mean root coverage of 74.23% and 67.69% after 1 and 20 years of follow-up, respectively.

Complete root coverage is the most used and indicated primary outcome\(^ {39}\) since it represents the main objectives of the therapy. Therefore, future studies should report this outcome. Noteworthy, only one study\(^ {17}\) reported the estimated complete root coverage of the different treatments, which prevented the conduction of meta-analysis.

So far, there is no evidence regarding the ideal sequence of treatment for teeth presenting NCCL and...
gingival recessions. NCCL restoration was done during surgical procedure in three RCTs included in the present systematic review, while in one study, the restorative procedure was done before surgery. The restoration before surgery allows the procedure to be performed in absolute isolation of the operator field and thus experience less contamination, which directly impacts its survival rate. Further, the restoration before surgery can lead to a better gingival margin adaptation, increasing the esthetic results.

The risk-of-bias analyses represents an important tool to detect methodology weaknesses of the studies, which determines the reliability of the results. All studies included in this review were rated as low risk of bias. However, it is important to clarify that in this type of study, it is not possible to perform an adequate masking of operator, outcome assessor, and patient. Lack of blinding is an important source of bias because it is associated with larger effect size estimates. Moreover, since all studies included belong to the same research group, studies from different groups are necessary to corroborate these findings.

Considerable heterogeneity (> 70%) was only found in pooled estimates of CAL gain. This seems to be associated with baseline characteristics, different restorative materials used, different restoration protocol performed (ie, complete and partial), and differences in the follow-up period. Finally, since the RCTs only included Type I gingival recession defects, the validity of the results are limited only to these defects.

Conclusions

In teeth with NCCLs and gingival recessions, restoration of NCCLs does not affect the clinical outcomes of surgical root coverage.

Acknowledgments

The authors declare no conflicts of interest.

References