

Root Coverage for Gingival Recessions Associated with Non-Carious Cervical Lesions: A Systematic Review

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Abstract

The prevalence rate of Gingival recession (GR) is high affecting many adults globally, irrespective of the oral health of the affected patients. Esthetic impairment, hypersensitivity, dental root caries, and non-cariou cervical lesions (NCCLs) have been reported to be contributing factors to the development of GR. Aiming to discuss the effect and prognosis of root coverage procedure on GR associated with NCCLs, we conducted a systematic electronic database search for suitable studies from inception till 25th October 2020 in nine databases. Following all screening phases, 17 studies found to be relevant for inclusion, with the addition of two extra papers through manual search, we finally included 19 studies. The results showed that the mean root coverage rate was comparable among patients treated with coronally advanced flap (CAF) and those treated with CAF plus resin-modified glass ionomer restoration. Moreover, CAF following natural inlays restoration was effective in achieving root coverage. The connective tissue graft (CTG) showed favorable results in the aspect of root coverage percentage and the results were comparable whether it was used alone or in combination with resin-modified glass ionomer restoration, partial restoration, or nano-ionomer cements. In conclusion, CAF and CTG are both effective in achieving acceptable complete root coverage rates. Moreover, the presence of NCCLs could decrease the rate of achieving complete root coverage over the years as demonstrated by some of the included studies.

Keywords: *Gingival Recession; Non-Cariou Cervical Lesions; Root Coverage*

Introduction

Gingival recession (GR) is a common periodontal disorder that is defined as the occurrence of apical migration of the gingival margins that occurs secondary to many pathologies and disorders as defined by the 2017 world work-shop held on to classify periodontal and peri-implant disorders and conditions [1]. The prevalence rate of GR is high affecting many adults globally, irrespective of the oral health of the affected patients [2-4]. Additionally, esthetic impairment, hypersensitivity, dental root caries, and non-cariou cervical lesions (NCCLs) have been reported to be associated factors with the development of GR [5]. The etiology of GR is not very specific, however, many risk factors have been reported to occur before it. These include forcible toothbrushing, the presence of a thin gingival tissue, the presence

of a previous history of orthodontic installment, and intracellular restorative margins. These factors in addition to plaque retention, tooth sensitivity, dental caries, pulp vitality, and structural integrity that are caused by NCCLs contribute to the development of GR [1,6-13].

NCCLs are defined as the presence of enamel and dentine notches that usually take place at the buccal or labial surfaces of the teeth near the cemento-enamel junction (CEJ), and is not due to the presence of dental caries [14]. They are one of the most important lesions with an increasing prevalence over the past years with an estimated rate of up to 85% [15-18]. Many previous investigations showed that these lesions have no specific etiologies, however, multi factors have been reported to be associated with its occurrence such as tooth-brushing more than once a day as well as cervical stress associated with personal habits of eating [10-13]. On the other hand, factors like tooth susceptibility, abrasions, piezoelectrical effects, biocorrosion, salivary pathology, and tensile stress have been associated with this kind of lesions which can in turn lead to developing GR based on the degree of their extension [19-21].

NCCLs and GRs when occur simultaneously can lead to serious morbidities regarding the clinical outcomes and raises concerns about the association between the severity and extension of NCCLs and its effect on the outcomes and prognosis of the therapeutic approach of surgical root coverage for patients with GR disorder. It has been reported that 50% of GR cases have been secondary to NCCLs [22]. Moreover, extended NCCLs lesions have been associated with serious morbidities as smile esthetics, dentin hypersensitivity, mechanical weakness in the cervical area, and severe pulpal damages. Therefore, the diagnosis and management of these lesions are crucial in avoiding such morbidities and obtaining better outcomes. The therapeutic approach to be used for managing the phenomenon is basically dependant on the proposed classification systems where surgical root coverage can be used alone or in association with other procedures as connective tissue grafting based on the severity of GR [22]. Previous randomized controlled trials (RCTs) investigated the root coverage procedure for GRs associated with NCCLs [23-26]. Rovai, *et al.* [27] conducted the only systematic review on this topic, however, many studies have been published afterward.

Aim of the Study

In this systematic review, we aim to discuss the effect and prognosis of root coverage procedure on GR associated with NCCLs.

Methods

Search strategy and study selection

The study process was conducted following the accepted methodology recommendations of the PRISMA checklist for systematic review and meta-analysis where registration of the protocol is not mandated (28). We conducted a systematic electronic database search for suitable studies from inception till 25th October 2020 in nine databases including Google Scholar, System for Information on Grey Literature in Europe (SIGLE), Scopus, Web of Science (ISI), PubMed, Virtual Health Library (VHL), Clinical trials.gov, metaRegister of Controlled Trials (mRCT) and The WHO International Clinical Trials Registry Platform (ICTRP) databases using the following search term: (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-cariou cervical lesion OR abrasion OR abfraction OR attrition). In databases not supporting boolean operators or those not supporting many search terms, we searched the following two terms: “gingival recession” and “non-cariou cervical lesion”, then combined the search results.

We included original studies reporting the effect and prognosis of root coverage procedure on GR associated with NCCLs. There were no restrictions on study design, country, language or publication date. Papers were excluded if there were one of the following exclusion criteria: 1) Non-original studies 2) *in vitro* or animal studies; 3) data duplication, unreliably extracted or incomplete data; 4) abstract only articles, reviews, thesis, books, conference papers or articles without available full texts (conferences, editorials, author response, letters,

and comments. Three independent reviewers screened titles and abstracts for selecting eligible papers. The further full-text screening was performed to ensure the inclusion of relevant papers in our systematic review. Any disagreement was done by discussion and consulting the senior member when necessary.

Data extraction

The data extraction form was developed by two authors, using a Microsoft Excel file. Three reviewers independently extracted data from included studies using the excel sheet. Data checking was performed through a fourth reviewer. All the disagreements and discrepancies were resolved by discussion and consultation with a senior member when necessary.

Quality assessment

Three independent reviewers evaluated the risk of bias in included studies. For randomized controlled trials (RCTs), the Cochrane’s revised quality assessment tool (RoB 2) was used to assess the quality of each included study (29). For non-randomized designs, the risk of bias in non-randomized studies - of interventions tool (ROBINS-I) was used (30). Any discrepancy between the reviewers was solved by discussion.

Results

Search results

Systematic search resulted in 3,372 records; of these 2,853 records were screened using title and abstract after exclusion of duplicates. Title and abstract screening yielded 93 papers eligible for full-text screening. Following all screening phases, 17 studies found to be relevant for inclusion. Following the addition of two extra papers through manual search method, we finally included 19 studies (Figure 1).

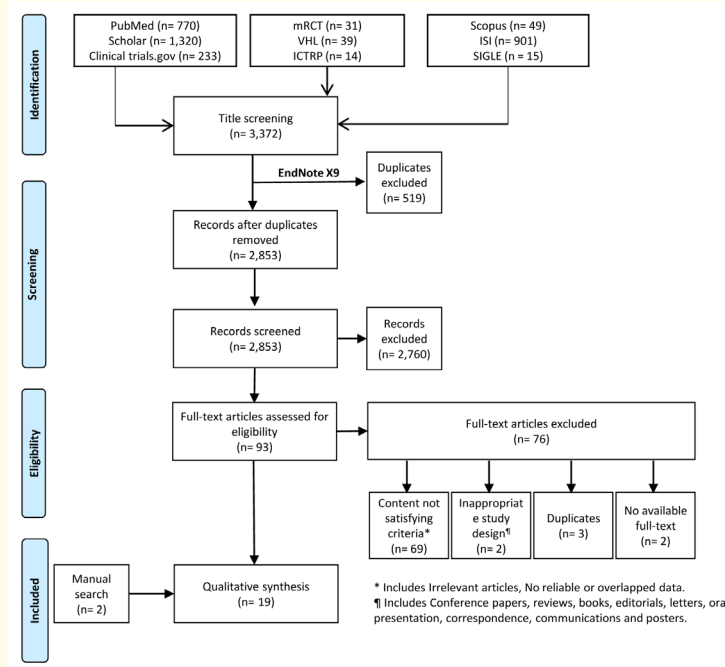


Figure 1: PRISMA flow diagram showing the process of the review.

Characteristics and bias of the included studies

Out of the included studies, ten were RCTs/RTs while the other nine ones were either non-randomized trials, cohorts, or case series. Sample sizes of the included studies were highly variable ranging from only seven patient [31] to 386 gingival recessions [32]. The same variation was noticed with mean ages of the patients among the included studies ranging from 25.6 years [33] and up to 59.5 years [31]. The patients’ final assessment points ranged from 6 months [31,33-38] and up to 20 years [38,39]. The detailed characteristics of the included studies are summarized in table 1.

Author, Year	Study design	Sample size	Age - Years; mean (SD)	Male (%)	Aim	Follow-up duration	Conclusion
Cairo, 2019 [43]	RCT	30 Patients	40.5 (10.3) and 37.7 (9.4)	25.0% and 29.0%	To compare coronally advanced flap and composite restoration of the cement–enamel junction with or without connective tissue graft for treatment of single maxillary gingival recession with non-carious cervical lesion.	1 Year	Both procedures were effective for root coverage at single recession. Adding a connective tissue graft under coronally advanced flap should be considered.
de Sanctis, 2020 [44]	Prospective cohort	23 Patients (93 gingival recessions)	46.2 (10.6)	52.2%	To evaluate the outcomes of the multiple coronally advanced flap with a site-specific application of connective tissue graft for the treatment of multiple gingival recession defects with or without the presence of non-carious cervical lesions.	1 Year	Proposed treatment modality does not produce a negative effect on periodontal condition resulting in a satisfactory esthetic result.
Dursun, 2018 [40]	RCT	36 Patients (54 Gingival recessions)	41.65 (12.26)	22.2%	To evaluate the root coverage of subepithelial connective tissue grafts performed on teeth with gingival recessions and non-carious cervical lesions and compare the results of resin-modified glass ionomer and nanoionomer cements.	1 Year	Successful root coverage with connective tissue grafts may be achieved on teeth restored with resin-modified glass ionomer or nanoionomer cements cervical fillings.
Isler, 2018 [41]	RCT	23 Patients (69 Gingival recessions)	45 (9.5)	43.5%	To evaluate the treatment of gingival recessions associated with non-carious cervical lesions using a modified coronally advanced flap in combination with a connective tissue graft on restored root surfaces.	1 Year	The combined surgical/ restorative treatments provided successful clinical results. Giomer + connective tissue graft may be less effective compared to other groups.

Koseoglu, 2019 [31]	Case-series	7 Patients	59.5 (range: 48-67)	57.1%	To evaluate the clinical effectiveness of an autologous dental restoration in the combined restorative/periodontal treatment of non-carious cervical lesions associated with gingival recessions.	6 months	Application of natural inlay restoration materials with computer-aided design can be a promising procedure for the restoration of non-carious cervical lesions defects before periodontal surgery.
Lucchesi, 2007 [36]	RCT	59 Patients	44.66 (13)	25.4%	To evaluate clinically the treatment of gingival recession associated with non-carious cervical lesions by resin modified glass ionomer cement or microfilled resin composite and coronally positioned flap at 6 months following surgery.	6 months	All treatments showed root coverage improvement without damage to periodontal tissues, supporting the use of coronally positioned flap for treatment of root surfaces restored with resin modified glass ionomer cement or microfilled resin composite as being effective over the 6-month period.
Pini-Prato, 2015 [32]	Retrospective cohort	386 Gingival recessions	38.6 (11.2)	37.3%	To explore the influence of inter-dental tissues and root surface condition on complete root coverage following surgical treatment of gingival recessions.	1 Year	Non-carious cervical lesions, just like interdental tissue loss, are significant negative prognostic factors in achieving complete root coverage following root coverage procedures.
Pini-Prato, 2018a [39]	Retrospective cohort	72 Patients	38.9 (range: 19-67)	32.9%	To evaluate the long-term outcomes following coronally advanced flap in the treatment of gingival recession and to explore the influence of several tooth/patient-related factors on the stability of gingival margin at 5, 10, and 20 years after surgery.	20 Years	The aging process, the condition of the interdental periodontal tissue, and the presence of an attached keratinized tissue band < 2 mm seem to be negative factors influencing the stability of the gingival margin during the 20-year observation period.

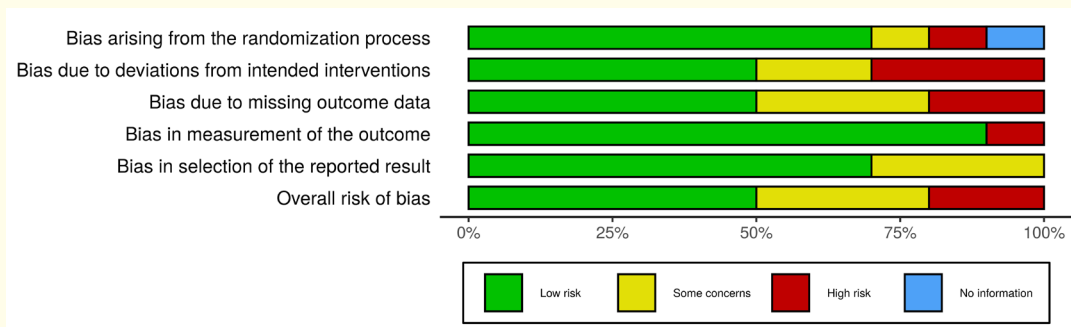
Pini-Prato, 2018b [42]	Prospective cohort	45 Patients	42.22	22.2%	To evaluate the long-term outcomes following Subepithelial connective tissue graft with coronally advanced flap in the treatment of gingival recessions and to explore the influence of several tooth/patient related factors on the stability of gingival margin at 1 year and 5, 10, 15, 20 years after surgery.	20 Years	Positive recession depth reduction and keratinized tissue improvements achieved by Subepithelial connective tissue graft with coronally advanced flap at short-term may be preserved long-term with the majority of the treated sites not displaying relapse of the gingival margin.
Ramireddy, 2018 [35]	RCT	20 Patients (78 Gingival recessions)	range: 24-58	NA	To compare the outcome of coronally advanced flap along with the use of plateletrich fibrin versus coronally advanced flap in conjunction with a resin-modified glassionomer cement for the management of Millers Class I and Class II gingival recession coupled with non-carious cervical lesions.	6 months	The use of plateletrich fibrin along with coronally advanced flap showed increased thickness of the keratinized tissue and the utilization of resin-modified glassionomer cement resulted in decreased dentin sensitivity. Hence, the combination of coronally advanced flap and plateletrich fibrin or coronally advanced flap and resinmodified glassionomer cement could provide a better treatment option in the management of gingival recession that is of esthetic concern.

Rasperini, 2018 [38]	RCT	25 Gingival recessions	47.4 (7.4) and 51.1 (7.5)	41.7% and 38.5%	To assess the clinical outcomes 9 years after the surgical treatment of single maxillary gingival recessions and identify predictors for long-term gingival margin stability.	9 Years	Both treatment modalities demonstrated stability over time. Additional use of connective tissue graft provided a greater increase in keratinized tissue. The presence of non-carious cervical lesions negatively affected complete root coverage and recession reduction.
Reis, 2020 [34]	Non-randomized controlled trial	17 Patients	40.9 (10.7)	13.3%	To investigate the root coverage and the increase in keratinized tissue when comparing root coverage of non-cervical lesions with recession with intact roots using an extended coronally advanced flap associated with a connective tissue replacement graft.	6 months	Gingival recession associated with non-carious cervical lesions can be successfully treated with the extended coronally advanced flap and acellular dermal matrix graft.
Santamaria, 2008 [37]	RCT	19 Patients	36.26 (9.2)	47.4%	To evaluate the treatment of gingival recession associated with non-carious cervical lesions by a coronally advanced flap alone or in combination with a resin-modified glass ionomer restoration.	6 months	Both procedures provided similar soft tissue coverage after 6 months. Despite the fact that a greater reduction in dentin sensitivity was observed after a coronally advanced flap in combination with a resin-modified glass ionomer restoration, longitudinal observations are necessary to confirm these results.
Santamaria, 2009 [23]	RCT	16 Patients	37.4 (8.8)	56.3%	To evaluate the 2-year follow-up success of the treatment of gingival recession associated with non-carious cervical lesions by a coronally advanced flap alone or in combination with a resin-modified glass ionomer restoration.	2 Years	Within the limits of the present study, it can be concluded that both procedures provide acceptable soft tissue coverage after 2 years, with no significant differences between the two approaches

Santamaria, 2013 [24]	RCT	36 Patients	31.8 (12.2) and 39.4 (20.4)	52.5%	To present the 2-year follow-up results of a randomized controlled clinical trial in which gingival recession associated with non-carious cervical lesions was treated by connective tissue graft combined with resin-glass ionomer restoration or not.	2 Years	The presence of a resin-modified glass ionomer restoration may not negatively interfere with the percentage of soft tissue coverage when connective tissue graft is performed for the treatment of Miller Class I gingival recessions associated with non-carious cervical lesions.
Santamaria, 2014 [45]	Retrospective cohort	78 Gingival recessions	36.25 (14.2)	NA	To evaluate the esthetic outcome of four different approaches to treat gingival recession, associated with non-carious cervical lesion (combined defects) and the possible roles of patient related factors in this esthetic outcome.	2 Years	The approaches that did not use the restoration of the cervical lesions presented a better final esthetic outcome after 2 years, compared to the same techniques associated with resin-modified glass-ionomer restoration. Studies evaluating other restorative materials are needed.
Santamaria, 2018 [26]	RCT	40 Patients	45.3 (11.3) and 44.3 (10.4)	55.0%	To evaluate a new multidisciplinary protocol for combined defects for gingival recession is frequently associated with non-carious cervical lesion.	1 Year	Connective tissue graft and connective tissue graft + partial restoration were effective to treat a combined defect. Use of partial restoration resulted in better gingival margin contour and dentin hypersensitivity reduction, without effect on a combined defect coverage by connective tissue graft.
Xuan, 2019 [33]	Non-randomized controlled trial	31 Patients (42 Gingival recessions)	25.6	48.4%	To investigate the clinical effect of modified tunnel technique in the treatment of gingival recession with non-carious cervical lesion	6 months	Modified tunnel technique can effectively improve gingival recession, and the presence of shallow non-carious cervical lesions (≤ 1 mm) will not affect the surgical effect of modified tunnel technique.
Zucchelli, 2011 [21]	Case-series	94 Patients	34.6 (9)	47.9%	To suggest a decision-making process for treating non-carious cervical lesions associated with gingival recessions based upon the topographic relationship between the maximum root coverage level and non-carious cervical lesions and to assess patient and independent-periodontist esthetic evaluations.	1 Year	The proposed approaches provided good esthetic appearance and correct emergence profile for the great majority of non-carious cervical lesions associated with gingival recessions.

Table 1: Characteristics of the included studies.

Regarding the overall risk of bias in RCTs, only less than 25% of all domains showed a high risk of bias. In contrast, the domains with the highest detected risk of bias were deviation from the intended interventions, missing outcome data, and the randomization process (Figure 2). For other study designs, about half of the studies showed a critical risk of bias, serious risk of bias, or some concerns of bias. The domains of the most risk of bias were the deviation from the intended interventions, selective reporting of the results, confounding bias, and missing data (Figure 3).



Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Cairo, 2019	+	+	+	+	+	+
Dursun, 2018	-	+	+	+	+	+
Isler, 2018	?	+	-	+	+	-
Lucchesi, 2007	+	+	X	+	-	X
Ramireddy, 2018	X	X	+	+	-	+
Rasperini, 2018	+	X	-	+	+	-
Santamaria, 2008	+	-	-	X	+	-
Santamaria, 2009	+	-	+	+	+	+
Santamaria, 2013	+	+	X	+	+	X
Santamaria, 2018	+	X	+	+	-	+

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
X High
- Some concerns
+ Low
? No information

Figure 2: Cochrane’s revised quality assessment tool (RoB 2). A: Risk of bias graph: review authors’ judgements about each risk of bias item presented as percentages across all included studies; B: Risk of bias summary: review authors’ judgements about each risk of bias item for each included study.

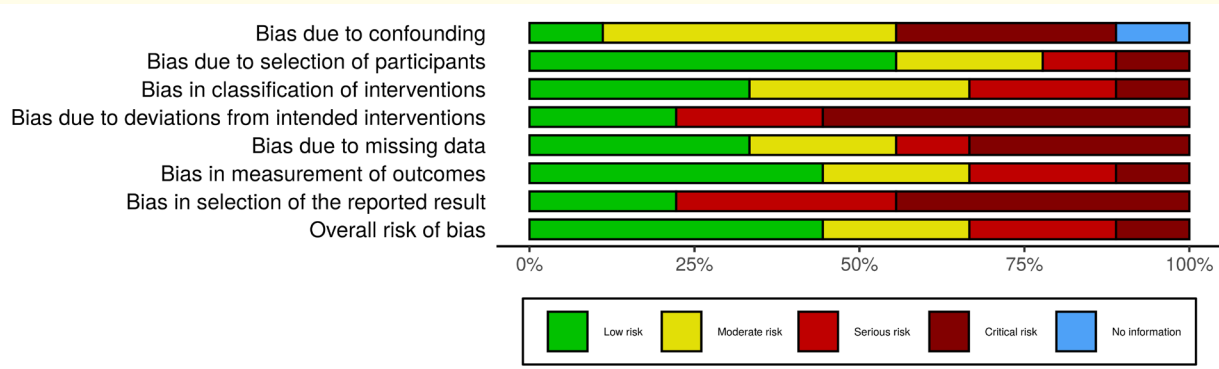


Figure 3: Risk of bias in non-randomized studies - of interventions tool (ROBINS-I). A: Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies; B: Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

Discussion

In this systematic review, we aimed to investigate the clinical outcomes that occur secondary to root coverage surgeries for the correction of GRs with NCCLs. Many treatment modalities have been used in the included studies with different comparisons and approaches.

Coronary advanced flap

Among the included studies were the clinical trials conducted by Santamaria, *et al.* at different time points in 2008 [37], 2009 [23], 2013 [24] and 2018 [26] with a total of 132 included patients with GRs and NCCLs lesions. In 2008 [37], 19 patients with bilateral buccal GRs and NCCLs were randomized to receive coronally advanced flap (CAF) alone or combined with a resin-modified glass ionomer restoration (CAF+R). Although the mean root coverage rate was better with the CAF group (97.48% ± 15.36%) than the CAF+R one (88.02% ± 19.45%), the results were not statistically significant (P > 0.05). In 2009 [23], the obtained mean root coverage rate in this trial was less than the previous one as 16 patients were randomized to receive the same modalities applied in 2008 with no statistical significance either. CAF was also applied by Ramireddy, *et al.* [35] where patients were divided into two groups including CAF with platelet-rich fibrin (PRF) and CAF with a resin-modified glass-ionomer cement (RmGIC). The authors reported that they obtained an optimal root coverage by both modalities. Moreover, PRF showed significant results in the thickness of keratinized gingiva more than the other group. Koseoglu, *et al.* [31] conducted a case series of seven patients with GRs and NCCLs and treated them with CAF and previous restoration using natural inlays by the patients' previously extracted teeth. The authors reported that a 91.67% mean root coverage rate was found with a 1.98-mm attachment gain. Therefore, the authors concluded that CAF following natural inlays restoration was effective in achieving root coverage. Besides, Zucchelli, *et al.* [21] divided their patients into five groups including (1) CAF, (2) bilaminar procedure, (3) coronal odontoplasty plus restoration plus root odontoplasty plus CAF (4) restoration plus CAF, and (5) restorative therapy. The mean root coverages were 3.06 ± 0.79, 3.33 ± 0.59, 1.92 ± 0.54, 1.47 ± 0.51, and 0.6 ± 0.73 for groups from 1 to 5, respectively. Pini Prato, *et al.* [38] conducted a long-term follow-up study of CAF application and found that mean root coverage was reduced from 68.59% to 56.11% after a 20-year follow-up period. Moreover, NCCLs and the presence of interdental tissue loss significantly reduced the risk of achieving complete root coverage.

Connective tissue grafting

Santamaria, *et al.* [24] in 2013, 36 patients were randomized to receive either connective tissue graft (CTG) alone or combined with a resin-modified glass ionomer restoration (CTG+R). Similar to the previous studies, no statistical significance was noticed between the two modalities. However, the mean rate of root coverage achieved with CTG+R modality ($93.29 \pm 7.97\%$) was higher than that with CTG only ($91.56 \pm 11.74\%$). Santamaria, *et al.* [26] in 2018, the authors divided their patients into two groups with two different modalities including partial restoration of the NCCL with connective tissue grafting (CTG+PR), and odontoplasty of the NCCL with connective tissue grafting (CTG). Again, there was no statistical significance between the two groups, however, root coverage was 70% in the CTG group and 60% with the CTG+PR one. Rovai, *et al.* [27] conducted a meta-analysis of the four trials and the results showed no statistical significance in root coverage. Dursun, *et al.* [40] applied subepithelial CTG (SCTG) in their RCT to compare two groups of GRs with NCCLs where two different filling materials were used including resin-modified glass ionomer (RMGIC) and nano-ionomer cements (NIC) and a control group with no associated NCCLs. Successful root coverage was obtained in all the study groups (RMGIC = 89.5%, NIC = 90.1%, Control = 96.2%) when compared to the baseline ($p < 0.05$), however, no significant difference was found between the three groups ($p = 0.13$).

Applying CAF and CTG was also investigated by Isler, *et al.* [41] in patients with GRs and associated NCCLs in three groups with three different filling materials. All of the groups showed favorable outcomes regarding root coverage percentage. In their 20-year case series, Pini Prato, *et al.* [42] showed that mean root coverage decreased from 74.23% to 67.69% after 20 years from the application of SCTG+CAF. The authors also showed that mean and complete root coverage over the years was greatly dependant on the severity and class of GR and interdental tissue loss. Achievement of root coverage in CAF with and without CTG was also compared in some of the included RCTs. Cairo, *et al.* [43] conducted an RCT of 30 patients with single GR and with previously restoration of NCCLs where those patients were randomized into two groups including CAF only and CAF with CTG groups. At 12-months follow-up, no significant difference was noticed among the two groups ($P = 0.28$). However, CAF+CTG restored a mean rate of 71% root coverage, while CAF only restored only 50%. No statistical significance was also found in a 9-year follow-up study by Giulio, *et al.* [38] that compared the same approaches, too. Similarly, Sanctis, *et al.* [44] in a prospective study used multiple CAF with and without CTG at 93 multiple GR sites and found no statistical significance between the two groups (MCAF+CTG= 94.7 ± 14.83 Vs MCAF= 97.86 ± 9.5 , $p = 0.24$).

Moreover, Santamaria, *et al.* [45] conducted an RCT to compare between CAF and CAF+R in addition to comparing CTG with CTG+R in patients with combined GRs and NCCLs using the modified Root Coverage Esthetic Score (MRES) that was first proposed by Cairo, *et al.* [46]. The results showed that both the CAF and CTG scores were statistically significant than the other two groups ($p < 0.05$) at the end of a 2-year follow-up. Pini-Prato, *et al.* [32] conducted a 1-year prospective study and compared free gingival graft (FGG), CAF, CAF+CTG, and guided tissue regeneration (GTR). Complete root coverage percentages were 18.1%, 35.5%, 35.1%, and 18.8% for the aforementioned groups, respectively. Moreover, CAF+CTG were significantly better in achieving complete root coverage than FGG ($p = 0.0012$; OR = 0.32).

Comparing between root coverage in NCCLs and intact sites

Among the included studies, some of them compared NCCL and others that were not. Reis, *et al.* [34] conducted a clinical trial of 17 patients with bilateral GR with one side having NCCL while the other one was not. The authors applied extended coronally advanced flap (ECAAF) associated with the acellular dermal matrix graft (ADMG) for all lesions and compared between the two sides. No statistical significance was noticed among the two groups, however, GR associated with NCCLs showed better root coverage rates (72.2 ± 16.5) than the intact group (69.5 ± 19). Moreover, Lucchesi, *et al.* [36] divided their patients into three groups including GRs without NCCLs treated with CAF, GRs with NCCLs treated with CAF plus resin-modified glass ionomer cement (RMGI), and GRs with NCCLs treated with CAF plus micro filled resin composite (MRC). Percentage root coverage was $80.83\% \pm 21.08\%$ for the first group while the percentage of restored root coverage was $71.99\% \pm 18.69\%$, and $74.18\% \pm 15.02\%$ for the second and third groups, respectively. Moreover, no statistical significance was found between the groups at any follow-up point. Moreover, Xuan, *et al.* [33] divided their patients based on the presence of NCCLs

and performed a modified tunnel technique (MTUN) for all patients. No significant difference was found between the NCCLs group and the other one (mean root coverage = 63.40% ± 28.02% Vs 67% ± 21.72%). In the prospective study by Pini-Prato., *et al.* [32], they reported a statistical significance in achieving root coverage between the presence and absence of NCCLs with an estimated odds ratio (OR) for the presence of NCCLs of 0.28. Giulio., *et al.* [38] also reported that the presence of NCCLs increases the risk of not achieving complete root coverage over the years (OR = 0.12, p = 0.022).

Conclusion

The results of this study indicate that CAF and CTG are both effective in achieving acceptable complete root coverage rates. However, no significance was noticed neither between the two modalities nor between a single modality and a modification to it in obtaining better outcomes. Moreover, the presence of NCCLs could decrease the rate of achieving complete root coverage over the years as demonstrated by some of the included studies. Lastly, restoring non-cariou lesions won't have any significant effect on outcomes.

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