International Journal Dental and Medical Sciences Research
Volume 7, Issue 6, Nov – Dec 2025 pp 47-52 www.ijdmsrjournal.com ISSN: 2582-6018

Comprehensive Management of Gingival Recessions with Non-Carious Cervical Lesions Using the TCAF Technique and Prior Restoration: A Combined Approach to Optimize Esthetics and Function

Itza Anahein Castro Bojorquez[1], Betsabé de la Cruz Corona[2], Francisco Javier de León Vigil[3]

[1] *Student, Universidad Autónoma de Baja California, Faculty of Dentistry, Post graduate Periodontics Clinic, Baja California, Mexico.*

[2] *Professor, Universidad Autónoma de Baja California, Faculty of Dentistry, Baja California, Mexico.*

[3] *Professor, Universidad Autónoma de Baja California, Faculty of Dentistry, Baja California, Mexico.*

Date of Submission: 10-11-2025 Date of Acceptance: 20-11-2025

ABSTRACT: This article presents an interdisciplinary protocol for managing gingival recessions (GR) associated with non-carious cervical lesions (NCCLs), integrating an MRC-guided restorative sequence with the tunneled coronally advanced flap (TCAF). NCCLs arise from synergistic erosion, abrasion, and abfraction; when combined with GR, they impair esthetics and function and heighten dentin hypersensitivity. Diagnosis emphasizes multifactorial etiology control (acid exposure, brushing habits, parafunction, occlusal overload) and careful documentation of lesion morphology relative to the CEJ. Prognosis for root coverage is framed by Cairo's RT classification, with RT1 offering the most favorable expectations.

The protocol begins with a hygiene/behavioral phase and selective occlusal adjustment, followed by pre-surgical restoration that re-establishes cervical anatomy strictly up to the predicted maximum root coverage (MRC), avoiding overcontours that hinder flap adaptation. The surgical phase employs TCAF: a partial-thickness tunnel that preserves papillae, allows passive coronal advancement, and completely covers a subepithelial connective tissue graft (SCTG), enhancing perfusion and soft-tissue thickening. Suturing (e.g., PGA 5-0 for graft fixation and 5-0 nylon sling sutures) positions the flap ~2 mm coronal to the CEJ under minimal tension.

A 58-year-old case (RT1: 22–23; RT2: 24–25) illustrates the sequence: enameloplasty and flowable resin restorations guided by MRC, followed by TCAF with SCTG, achieving stable coronal positioning and improved esthetics at three months. The discussion contrasts CAF, TUN, and their combination (TCAF), underscoring biological advantages of papilla preservation and complete graft coverage. The article concludes that predictable outcomes hinge on etiologic control, MRC-guided restoration, and tissue-preserving surgery, while calling for controlled trials with longer follow-up and 3D volumetric assessments.

KEYWORDS: Non-carious cervical lesion (NCCL),Tunneled coronally advanced flap (TCAF), Cervical restoration, CEJ identification / restorative margin placement

I. INTRODUCTION

Non-carious cervical lesions (NCCLs) are defects of the cervical third that do not arise from caries but from the interaction of physicochemical and mechanical processes—abrasion, erosion, and abfraction—that act synergistically on the dentition. When NCCLs coexist with multiple gingival recessions, the clinical impact increases by simultaneously compromising esthetics, function, and patient comfort (hypersensitivity). This scenario demands an integrated restorative–periodontal approach to re-establish anatomy while preserving the health of soft and hard tissues.[1,2,5]

Although abrasion is frequently associated with traumatic oral hygiene habits, current evidence supports a multifactorial etiology: extrinsic or intrinsic acids reduce the hardness of enamel/dentin (erosion); toothbrushing or parafunctional habits accelerate tissue loss (abrasion); and occlusal stresses concentrated at the cervical area amplify fatigue (abfraction).[2] Accordingly, diagnostic assessment should identify and simultaneously control systemic and behavioral factors (acidic diet, gastroesophageal reflux, brushing technique, bruxism, and occlusal overload), and document NCCL severity and

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Volume 7, Issue 6, Nov – Dec 2025 pp 47-52 www.ijdmsrjournal.com ISSN: 2582-6018

morphology—depth, extent, and location relative to the cemento-enamel junction (CEJ)—to guide therapy.[2,5]

Gingival recession (GR) is defined as the apical displacement of the gingival margin relative to the CEJ. The Cairo RT classification incorporates the interproximal clinical attachment level as a key prognostic parameter: in RT1 there is no interproximal attachment loss, confirmed by comparing buccal and interproximal measurements; this pattern is often observed even in clinically healthy periodontium and is commonly associated with traumatic brushing.[3]

Surgically, coronally advanced flap (CAF) and tunneling (TUN) are established approaches for treating GR. Traditionally chosen as alternatives, their combination—tunneled coronally advanced flap (TCAF)—has gained prominence because it preserves interdental papillae, enhances graft perfusion within a minimally traumatized bed, and favors stability of the flap–graft complex, all of which contribute to optimized clinical and esthetic outcomes.[4]

A microsurgical, tissue-preserving philosophy is particularly relevant in cases with delicate papillae or when seamless integration of the gingival margin with adjacent cervical restorations is desired.[4,5]

The restorative phase is not ancillary; it must precede or be coordinated with surgery to re-establish cervical anatomy and position the restorative margin so it respects the tissues and does not interfere with root coverage. Clinical reports indicate that a properly planned restorative–periodontal sequence can yield stable gingival margins and esthetic success at 12 months when adhesive restorations reproduce cervical morphology and integrate with the gingival contour achieved surgically.[1,5]

Finally, surgical–restorative planning should be anchored in the concept of maximum root coverage (MRC), which predicts the final position of the gingival margin after surgery. The MRC–NCCL decision framework outlines five morphologic scenarios; in Type 3, the MRC coincides with the deepest portion of the lesion—a criterion that dictates the extent to be restored, margin positioning, and realistic coverage expectations.[5] Systematically integrating etiologic control, MRC-guided adhesive restoration, and mucogingival surgery such as TCAF enables predictable management of NCCLs associated with multiple GR, maximizing root coverage and esthetic–functional harmony of both periodontium and restorations.[1,5]

Aim:

To describe and discuss an interdisciplinary protocol for managing NCCLs concomitant with Cairo RT1 recessions, emphasizing an MRC-guided restorative sequence and the execution of TCAF as a strategy to optimize clinical and esthetic outcomes.

II. CASE DESCRIPTION

A 58-year-old female presented to the Periodontics specialty clinic at the Autonomous University of Baja California. ASA II. She was referred by Endodontics for dentin hypersensitivity. Diagnosis: Gingival and periodontal health with mucogingival deformities. Gingival recession Cairo RT1 on teeth 22–23 and RT2 on 24–25 (Figs. 1–2).

Fig.1 Baseline photograph

Fig.2 Baseline periodontal chart

Hygiene Phase

Before surgery, a hygiene phase was carried out to control local etiologic factors. Brushing technique was reinforced with personalized instruction and chairside demonstration. Measures were prescribed to eliminate noxious habits associated with mechanical trauma. Selective occlusal adjustment was performed to decrease overloads that could compromise the stability of root coverage. This preparation aimed to optimize the biological and mechanical environment for wound healing.

Pre-Surgical Restorative Phase

Enameloplasty/odontoplasty was performed on teeth **24 and 25** to re-establish smooth anatomical transitions and facilitate passive coronal advancement of the flap. Subsequently, NCCLs were restored using flowable resin, strictly respecting the **maximum root coverage (MRC)**. Margins and contours were maintained so as not to interfere with graft sealing or flap adaptation, leaving a root profile free of overcontours and highly polished to support clot stability.

Surgical Phase (Technique)

The procedure was performed under local anesthesia via supraperiosteal infiltrations with articaine, including the donor site (palate).
Using a **15C** blade, a horizontal incision was made at the interdental papilla between **teeth 22–21**, preserving **~1 mm apically** to create a wide-base (trapezoidal) surgical papilla. A **single vertical releasing incision** was added at **tooth 21** to facilitate access and controlled flap mobility. The surgical papilla and flap were elevated **as a partial-thickness flap**, creating a continuous supraperiosteal plane (Fig. 3).

Fig. 3. Incision design and partial-thickness flap.

A tunneling procedure was then carried out extending to **tooth 26**, carefully releasing muscular insertions to allow **passive coronal advancement** (Fig. 4).

Fig. 4. Tunnel preparation extending ~2 mm coronal to the CEJ.

Exposed root surfaces were meticulously **scaled and root-planed** to remove irregularities and prepare the site for clot insertion and tissue integration (Fig. 5).

Fig. 5. Hand instrumentation (scaling/root planing) on roots to receive the graft.

At the palate, a **free gingival graft** (25 × 5 mm) was harvested and **extraorally de-epithelialized** to obtain a **subepithelial connective tissue graft (SCTG)** (Fig. 6). The donor site received a **fast-resorbing collagen membrane** secured with **liquid cyanoacrylate adhesive** (Fig. 7).

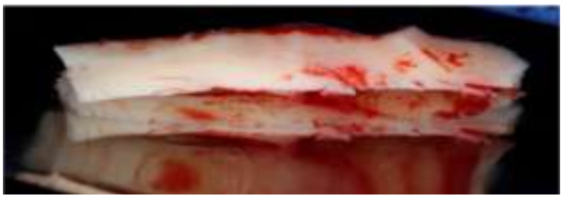

Fig. 6. Free gingival graft harvest (25 mm × 5 mm) for subsequent extraoral de-epithelialization.

Fig. 7. Donor site after harvesting the connective tissue graft.

At the recipient site, the anatomical papilla was **de-epithelialized**, and the opposite papilla was **mobilized** with a tunneling instrument to create a well-vascularized compartment for the

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SCTG without compromising papillary architecture. The **SCTG** was inserted into the tunnel and positioned to homogeneously cover the target root surfaces. **Primary graft fixation** was achieved to the de-epithelialized papilla with **simple interrupted resorbable sutures (PGA 5-0)**, ensuring intimate graft–bed contact and minimizing micromovements (Fig. 8).

Fig. 8. Connective tissue graft fixation at the recipient site.

To stabilize and obtain the planned coronal displacement, **sling/suspensory sutures** with **monofilament nylon 5-0** were placed around each involved tooth. These sutures were adjusted to position the flap margin **passively ~2 mm coronal to the CEJ**, promoting predictable root coverage. The absence of tension, proper flap support over the graft, and tissue adaptation without folds or ischemic areas were verified (Figs. 9–10).

Fig. 9. Placement of 5-0 nylon sutures for flap fixation.

Fig. 10. Three-month postoperative view.

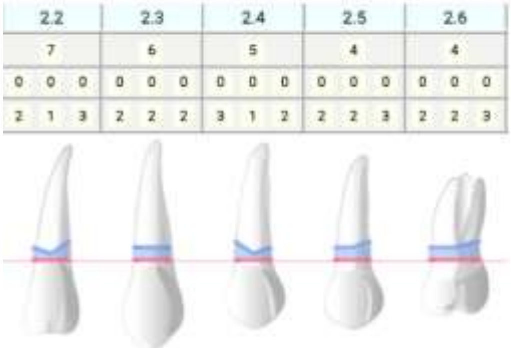

Fig. 11. Final periodontal charting.

III. DISCUSSION

Bartlett and Shah argue that NCCLs have a **multifactorial etiology** wherein erosion, abrasion, and abfraction interact synergistically, and they caution against attributing lesions solely or primarily to abfraction, given the lack of conclusive human evidence. This perspective mandates a diagnosis that not only describes the defect but also investigates chemical determinants (extrinsic/intrinsic acids), mechanical factors (brushing technique, parafunction), and occlusal stress distribution. Clinically, **restoration and surgery will only remain stable if the underlying etiology driving tissue loss is first controlled**.[2]

In contrast, clinical reports focused on esthetic/functional resolution—such as Allegri et al.—assume that habit modification and **morphologic reconfiguration of the cervical third** through adhesive restorations reduce hypersensitivity and stabilize the gingival margin at **12-month** follow-up.[1]

The Cairo classification incorporates interproximal clinical attachment level for **prognosis of root coverage**: **RT1** (no interproximal loss) offers the best expectations; **RT2/RT3** anticipate lower predictability.[3] This prognostic tool facilitates case selection and patient-expectation management. However, in **NCCL + GR**, two nuances apply: lesion morphology can **confound clinical identification of the CEJ and restorative margin**, altering measurements; and **cervical contouring via restoration can influence surgical outcomes**.

Therefore, **Zucchelli et al.** propose an algorithm in which **Maximum Root Coverage (MRC)** and **NCCL morphology** determine the order and extent of restoration as well as the surgical target. Their **MRC–NCCL** (five-scenario) framework is especially useful when the depth of the defect coincides with the MRC, because it precisely dictates how much tooth structure to "reconstruct," where to place margins, and what coverage is reasonable to anticipate.[5] In practice, this closes a gap not addressed by GR classifications: the interaction between "**how far the gingiva can be advanced**" and "**what cervical contour the restoration needs so the gingiva can reach and remain there**." It creates a traceable link from diagnostic measurement to clinical execution.

CAF and **TUN** are both standard approaches for root coverage. **CAF** is praised for simplicity, robust evidence, and color blending—especially in RT1—though it may require releasing incisions and can leave partial graft exposure if tension-free coronally advancement is not achieved.[6] **TUN** avoids vertical incisions, **preserves papillae**, and maintains a continuous "envelope" completely covering the **SCTG**, favoring vascularization, **phenotype thickening**, and superior esthetic camouflage in anterior segments—at the cost of demanding greater skill to achieve a broad, uniform undermining plane.[7]

Although CAF and TUN are well-established, **Barootchi and Tavelli** argue that their combination (**TCAF**) preserves papillae, **enhances graft perfusion**, and stabilizes the flap–graft complex, achieving consistent esthetic results even with compromised papillae—at least in **isolated recessions**.[4] For clinicians, this offers clear advantages when vascularization and papillary integrity are critical, as commonly occurs in **NCCL + GR**. That said, evidence is largely from isolated cases; applying TCAF to **multiple recessions** requires clinical judgment, and operator dependence (need for microsurgical instruments and experience) affects reproducibility.

Beyond root coverage in **RT2**, the **TCAF** concept also extends to scenarios of **peri-implant soft-tissue dehiscence (PSTD)** with papilla loss in the anterior zone. In the consecutive series by **Tavelli et al.**, the approach combines a widely mobilizable tunnel with SCTG to seek **vertical soft-tissue reconstruction and papilla augmentation** with minimal morbidity. The technique preserves papillae and vascular supply while keeping the graft completely covered and enabling stable coronal advancement, thus favoring phenotype thickening and esthetic camouflage in high-demand regions. The limitation is that evidence remains early (case series); while clinical and patient-reported outcomes are encouraging, controlled comparisons and longer follow-up are needed to confirm **volumetric stability** and **papillary contour durability**.[8]

For **NCCL + GR**, current evidence supports a **microsurgical, interdisciplinary sequence**; however, gaps persist: few controlled trials directly compare CAF, TUN, and TCAF in the context of NCCLs; longer follow-up beyond 12 months is needed to confirm stability and marginal behavior around restorations; and diagnostic calibration protocols harmonizing RT with the MRC–NCCL morphologic reading deserve further study. Meanwhile, best practice is to **systematically integrate** etiologic control, **MRC-guided adhesive restoration**, and **tissue-preserving surgery**, with root-coverage expectations modulated by RT and with **standardized documentation** of outcomes.

IV. CONCLUSION

In the management of NCCLs associated with gingival recessions, evidence converges on two pillars: (1) **stable outcomes depend first on etiologic control**, and (2) the surgical–restorative strategy should be planned using **Cairo's RT prognosis** to modulate expectations and the **MRC–NCCL** framework to define precisely how much and how to restore before/with surgery. Among surgical options, the **tunneled coronally advanced flap (TCAF)**—and its **verTCAF** variant in peri-implant papilla-loss scenarios—offers biological advantages (papilla preservation, improved perfusion, complete SCTG coverage) that translate into soft-tissue thickening and superior esthetic camouflage, particularly in anterior segments. Nevertheless, evidence remains limited and operator skill can impact reproducibility; thus, **more RCTs** with **3D volumetric metrics** and prolonged follow-up comparing **CAF, TUN, and TCAF** in the specific context of NCCLs are warranted.

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