

CASE STUDY

Digital and analog techniques for cemento-enamel junction reconstruction: A case study

Juan Carlos Durán¹  | Valeria Gómez¹  | Cristian Aguilera¹  | Rodrigo Pino¹  |
Vasco Sáiz¹  | Nicolás González¹  | Yuri Cataldo¹  | Murir Gauro¹  |
Iván Urzúa¹  | Fernando Solanes^{1,2}  | Catalina Madariaga^{1,2} 

¹Escuela de Odontología, Facultad de Medicina
Clínica Alemana Universidad del Desarrollo,
Santiago, Chile

²Private Practice

Correspondence

Juan Carlos Durán, Escuela de Odontología,
Facultad de Medicina Clínica Alemana
Universidad del Desarrollo, Avenida Las Condes
9792, 703 Santiago, Chile.
Email: drjcduran@gmail.com

Abstract

Background: Non-carious cervical lesions (NCCLs) refer to the loss of dental hard tissue in the cervical region due to physical and/or chemical factors, often associated with the disappearance of the cemento-enamel junction (CEJ), posing challenges in both diagnosis and treatment of gingival recessions (GR). This case study introduces two protocols for multidisciplinary CEJ reconstruction prior to the root coverage therapy (RCT).

Methods: Two patients with GR and NCCLs were treated using two CEJ reconstruction techniques: both, analogically and digitally guided. For each case, the position of the therapeutic CEJ was predetermined using a combination of the methods described by Zucchelli and Cairo. Then, an analog or digital diagnostic wax-up was performed accordingly. In the analogically guided technique, a transparent silicone guide matrix was used to transfer information from the dental wax-up. In contrast, the digitally guided technique employed a rigid, translucent resin prosthetic guide matrix that was designed and printed. Restorations were fabricated using direct composite resin and RCT was performed 1 week later in both techniques.

Results: At 6 months, both cases demonstrated complete root coverage and effective healing of the soft tissues surrounding the restorations.

Conclusions: Dimensional changes in materials and precise guide adjustment in the analog technique are operator-dependent and can affect the outcomes. Digital procedures, though effective, are costly and may limit their use. The usage of these two CEJ reconstruction techniques enhances communication within the multidisciplinary team and ensures optimal aesthetic outcomes and precise placement of the gingival margin.

KEYWORDS

CEJ reconstruction, non-carious cervical lesion, gingival recession, tooth cervix

Key points

- There are no established clinical protocols described in the literature for reconstructing the cemento-enamel junction (CEJ) once the position of a therapeutic CEJ has been predetermined and prior root coverage therapy (RCT).
- Performing a diagnostic wax-up (analogically or digitally) to reconstruct the therapeutic CEJ is crucial and facilitates the creation of a prosthetic guide that accurately reproduces the defined CEJ position.
- The reconstruction of the CEJ may improve the prognosis of RCT.

Plain language summary

This study looked at a dental issue called non-carious cervical lesions, which happens when the hard tissue near the gum line of a tooth wears away, making it harder to treat gum recession. Two different approaches were tested to rebuild the lost tissue in the gum area before performing a procedure to cover the exposed roots. One approach used traditional methods with physical guides to help place the new tissue, while the other used advanced digital techniques to create a precise guide using 3D printing. After 6 months, both methods successfully covered the exposed roots and helped the gums heal properly. However, the traditional method's results can vary depending on the dentist's skill, while the digital method, although more accurate, can be expensive. Using these methods can improve teamwork among dental specialists and lead to better-looking results by ensuring the gum line is placed exactly where it should be.

INTRODUCTION

Non-carious cervical lesions (NCCLs) result from the loss of dental mineral tissue due to physical and/or chemical factors which affect the cervical surface, typically extending to the cemento-enamel junction (CEJ). These lesions are unrelated to dental caries.¹ Occasionally, the CEJ may disappear to the point of being unrecognizable. Pini-Prato et al. examined 1010 exposed root surfaces associated with gingival recessions (GR) and classified them according to the presence or the absence of the CEJ, in addition to the presence or the absence of any defect on the tooth's cervical surface or cervical step and four possibilities were identified: identifiable CEJ in the absence of any associated step or defect (Class A–); an identifiable CEJ alongside to a cervical step (Class A+); an unidentifiable CEJ without any association to cervical steps or dental surface defects (Class B–); an unidentifiable CEJ in combination to a cervical step (Class B+).²

Classes B– and B+ constitute a significant challenge for periodontists because the CEJ serves as the primary anatomical reference for diagnosing GR and performing surgical root coverage therapy (RCT). In such cases, the combination of restorative and periodontal treatments offers a superior solution for addressing GR with NCCL better than either single restorative or mucogingival therapy alone, enhancing both aesthetics and hygiene.³

Allen and Winter proposed guidelines suggesting that for the treatment of NCCLs located in aesthetic areas, RCT should preferably be performed first.⁴ This approach allows a more precise quantification of the area to be restored. In contrast, Zucchelli suggested that in class B+ lesions, the displacement of the soft tissue into the concave area of the lesion can complicate the patient's plaque control and hinder the placement of a composite restoration with proper emergence profile and marginal adaptation.³ Therefore, it is recommended to perform the restoration first, as this simplifies the development of RCT. Restoring the CEJ provides a surgical reference point and a stable, smooth, and convex emergence profile in the hard tissue for coronal flap reposi-

tioning. Additionally, performing the restoration before RCT aids with the positioning of the rubber dam during absolute isolation and ensures a proper finishing and polishing of the restoration.³

Zucchelli et al. and Cairo et al. have proposed methods for predetermining the location of the therapeutic CEJ (T-CEJ) for its subsequent reconstruction as predictably and closely as possible to the anatomic CEJ.^{3,5} The method proposed by Zucchelli involves clinically identifying the angular points where the facial CEJ meets the interproximal CEJ, at the neck of the tooth. At these points, the tip of a periodontal probe is positioned. Subsequently, a second probe is placed perpendicularly to the first one, passing through the ideal position of the papilla tip at the proximal contact point. This method allows the precise measurement of papillary height from the angular point. Using these mesial and distal references, a curve is drawn connecting both points, with its contour influenced by the patient's phenotype and gingival scalloping. In cases of partial loss of the papilla, the T-CEJ will be positioned parallel and more apically compared to the anatomical CEJ. The distance between them will match the distance between the papilla tip and the contact point (Figure 1).⁶

The Cairo method involves obtaining two measurements on the contralateral tooth using defined reference points. First, the mesiodistal width across the CEJ of the anatomical crown is measured with a periodontal probe from mesial point (A) to distal point (B) at the base of the interdental papillae. Next, vertically aligned with the tooth's axis at its center, the length of the anatomical crown is measured from the incisal edge to the CEJ (point C) using a second periodontal probe. These established reference points and measurements are then transferred to the affected tooth, and points A–C are connected to replicate a scalloped line resembling the one on the contralateral homologous tooth (Figure 2).⁵

Analog methods for reconstructing the previously defined T-CEJ are described in the literature.^{7–10} However, a standardized protocol for transferring the new T-CEJ location to the teeth during restorative procedures is lacking.

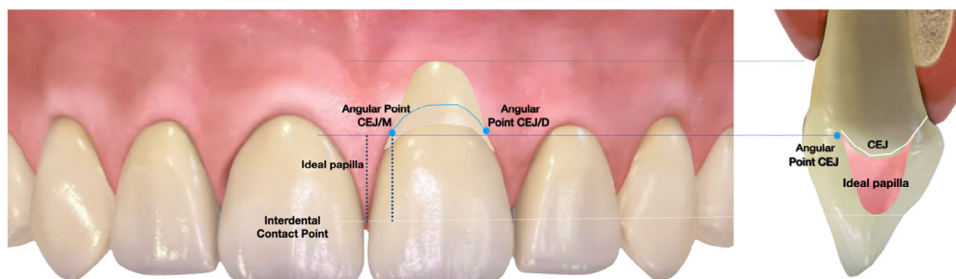


FIGURE 1 Frontal and proximal view of a representation of the Zucchelli method to predetermine the line of root coverage in tooth 9. The height of the ideal papilla is measured between the mesial (CEJ/M) and distal (CEJ/D) angular point and the respective proximal contact point. CEJ, Cemento-enamel junction.

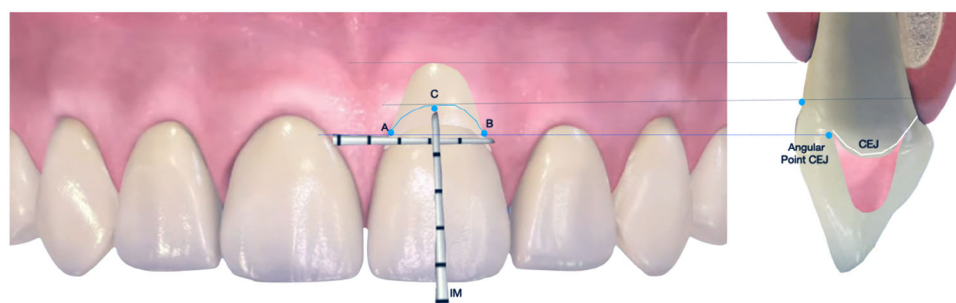


FIGURE 2 Frontal and proximal view of a representation of the Cairo method to predetermine the line of root coverage. A, B, and C points are located, and the curved line is projected by connecting these three points. IM, Incisal margin; CEJ, cemento-enamel junction.

This absence of a standardized approach poses a significant clinical challenge, particularly when collaborating within a multidisciplinary team.

The aim of this case study is to introduce two different protocols proposed by the authors for conducting CEJ reconstruction within a multidisciplinary approach, specifically in patients with Cairo RT-1, Class B prior to RCT.¹¹

The workflows used were as follows:

1. Analogically guided technique
2. Digitally guided technique

CASE STUDIES

Clinical presentation

The CARE guidelines were used for this case study.¹² Two healthy patients ASA I (one man and one woman, ages ranging from 25 to 45 years) were treated at the PDP clinic in Santiago, Chile, in 2023. The patients presented no clinical signs of periodontal disease and showed full-mouth plaque and bleeding scores of <10%. Both patients suffered from Cairo RT-1 GR in correlation to Class B+ that required RCT.^{2,11} Also, both patients had thick gingival phenotype.¹³ The chief complaint for both patients was dentin sensitivity and aesthetics. In the first case, GRsTyp RT-1 and Class B+ NCCLs were observed in teeth #11–14. In the second case, GRs RT-1 and Class B+ NCCLs were observed in teeth

#22–27. Prior to surgery, CEJ reconstruction was planned for both cases, with the cervical border of the restorative material 1 mm apical to the ideal CEJ level, with the aim of reducing the amount of restorative material under the final level of the gingival margin and to trim the possible need for surgical retreatment in the long term.¹⁰

Clinical management

Restorative phase

For diagnostic purposes, intraoral photographs were taken, and impressions of both arches were obtained. For the first case (analogically guided), silicone impressions* were taken followed by the fabrication of stone casts.[†] For the second case (digitally guided), digital impressions were captured using scanner‡ as STL (Standard Tessellation Language) files using Software.§ Subsequently, models of both jaws were printed|| in resin employing a resin 3D printer.¶ Both cases were treated by a multidisciplinary team comprising periodontics and prosthodontics specialists.

* Elite HD+ Zhermack, Germany.

† Elite Rock Zhermack, Germany.

‡ Sirona Dental System, Bensheim, Germany.

§ Cerec SW4.4 Sirona Dental System, Bensheim, Germany.

|| Phrozen Vanilla water resin, PHROZEN TECH CO., LTD., Taiwan.

¶ Phrozen Sonic Mighty 8K, PHROZEN TECH CO., LTD., Taiwan.

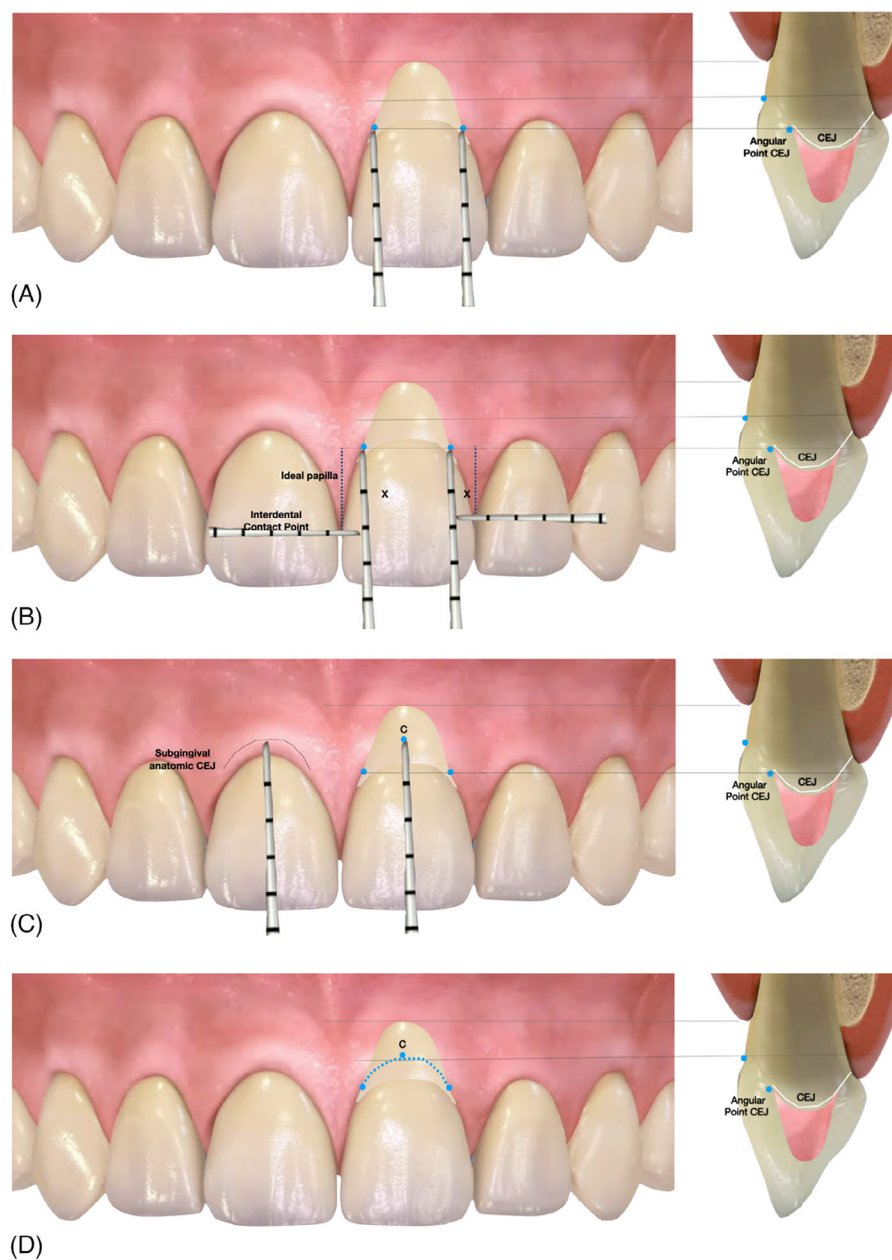


FIGURE 3 Frontal and proximal view of the step-by-step representation of the technique used for the predetermination of the therapeutic CEJ in Case 1. (A) Identification of the mesial and distal angular points of the affected teeth using the Zucchelli method. (B) Measurement of the papilla height using the angular points and the proximal contact point. (C) Measurement of the length of the contralateral teeth, according to the Cairo method. (D) Positioning of point C, which acts as the apical reference for tracing the curved line following the previously established parameters.

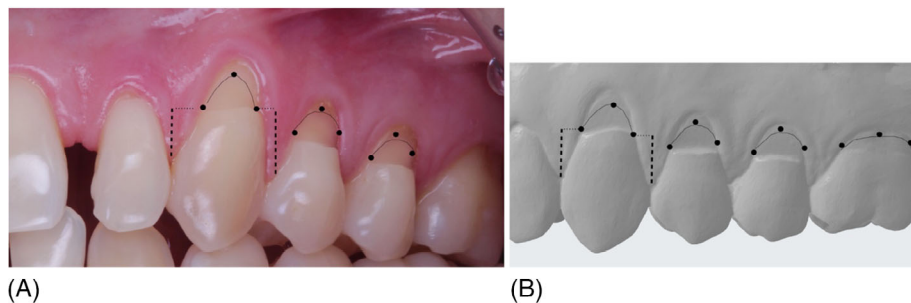


FIGURE 4 Case 1: analogically guided technique. (A) Initial lateral clinical photograph showing gingival recessions RT-1 and Class B+ non-carious cervical lesions in teeth 11–14. The cemento-enamel junction is clinically predetermined. (B) Transfer of clinical information to the stone model.

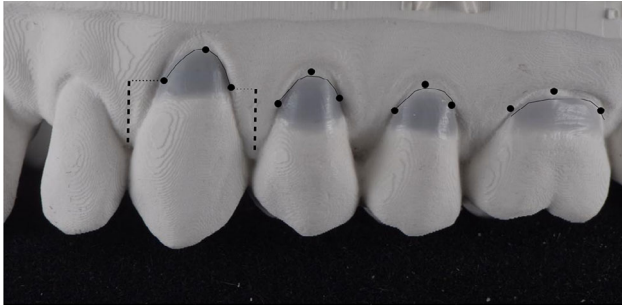


FIGURE 5 Analog wax-up of teeth 11–14 based on the previously predetermined cemento-enamel junction in the stone model.

Predetermination of the T-CEJ

1. Clinical measurements:

- a. To predetermine the position of the T-CEJ in both cases, the periodontist employed the Zucchelli method.³
- b. Initially, the angular points of the affected teeth were identified intraorally (Figure 3A).
- c. Then, the ideal papilla height (mesial and distal) was measured from the angular point to the proximal contact point with a periodontal probe (Figure 3B).

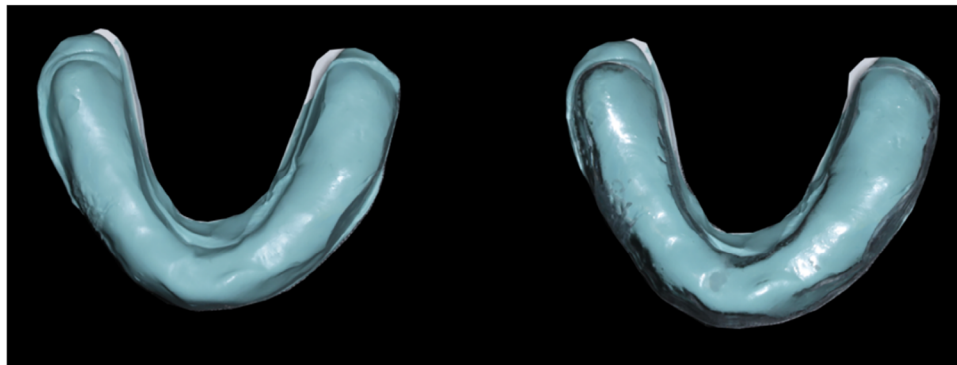


(A)

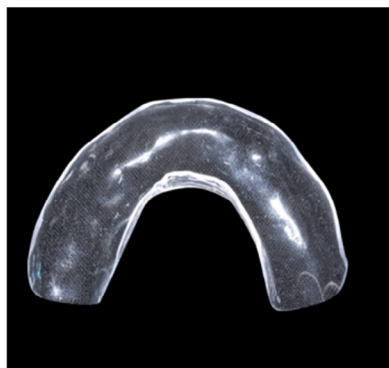


(B)

FIGURE 7 Silicone matrix. (A) Silicone matrix in the transparent tray after polymerization and removal from the model. (B) Removal of the transparent tray.



(A)



(B)

FIGURE 6 Transparent custom tray. (A) Use of heavy silicone spacer for stamping, with sufficient thickness for the transparent silicone. (B) Trimmed transparent custom tray.

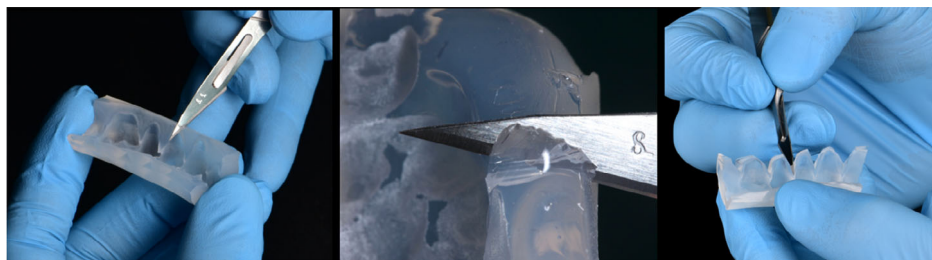


FIGURE 8 Adjustment of the silicone matrix using a scalpel by cutting around the cemento-enamel junction in every affected tooth.

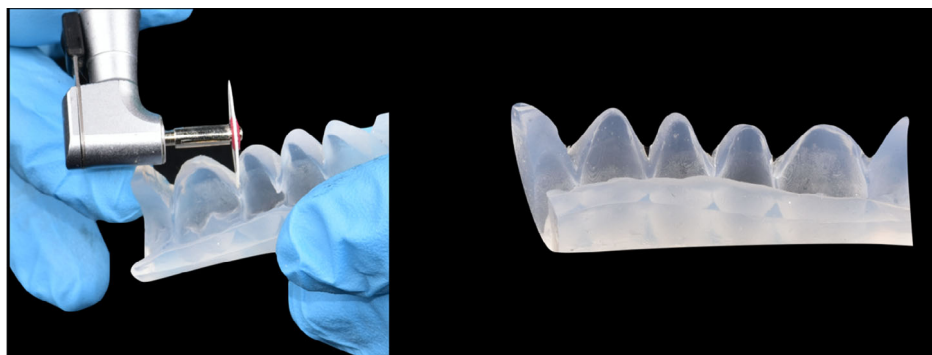


FIGURE 9 Matrix trimming and polishing at the therapeutic cemento-enamel junction.

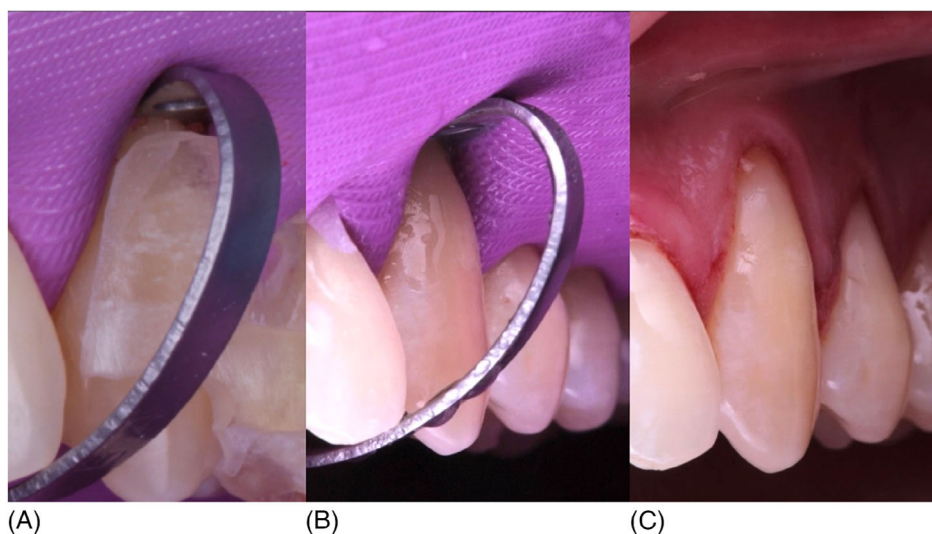


FIGURE 10 Composite resin restoration using the silicone matrix, lateral clinical photograph. (A) To properly fit the silicone matrix with the isolated field, a cut is made in the incisal area of tooth 11, leaving space for the clamp. (B) Removal of the matrix after polymerizing the composite resin restorations. (C) Removal of the isolation.

- d. Point C was located according to the Cairo method measuring the height of the anatomical crown of contralateral teeth (Figure 3C,D).⁵
2. Transfer of reference points to the working (analog/digital) model.
 - a. The ideal papilla height was transferred to the analogical working model using a periodontal probe starting from the proximal contact point. The digital

- working model (STL file) was exported to software,[#] where ruler tools were used for the same purpose.
- b. Next, angular points were marked with a pencil on the analog model and with corresponding software tools on the digital model.
- c. Subsequently, measuring from the incisal/occlusal edge toward the apex, at the center of the teeth, point C was transferred. In the analog model, a

[#] Meshmixer, Autodesk, SF, USA.

periodontal probe was employed, and point C was marked with a pencil, whereas in the digital model, design software tools were handled and digitally positioned.

- d. A curve connecting mesial and distal angular points and point C was drawn with pencil on the analog model and using the corresponding software tools on the digital model. This was done considering the patient's phenotype and gingival scalloping.
- e. Given the absence of papilla height loss in either case, the predetermined apico-coronal position of the T-CEJ was maintained.

Case 1: T-CEJ reconstruction with analogically guided technique

1. RT-1, GR, and Class B+ NCCLs were observed in teeth #11–14 (Figure 4A).
2. Taking into consideration the points of reference described and the T-CEJ outlined in the analogical working model (Figure 4B), an analogical dental wax-up of the treatment areas was crafted on the model (Figure 5).
3. The prosthodontist fabricated a spacer of 4–6 mm thickness on the working model using silicone** (Figure 6A) which was then stamped with a 1 mm thick thermoplastic foil to produce a transparent custom tray (Figure 6B).
4. Using the custom tray, an impression of the waxed model was taken with clear lightweight silicone†† (Figure 7A). After polymerization, the impression was removed from the model and separated from the custom tray to obtain a transparent silicone matrix (Figure 7B).¹⁴
5. Using a No. 11 surgical scalpel,‡‡ an incision was made in the matrix along the line of the T-CEJ, as defined in the wax-up for all affected areas (Figures 8 and 9).
6. The clear silicone matrix was tested and adjusted intraorally to serve as a guide for transferring the T-CEJ from the model to the teeth during the placement and photopolymerization of the composite resin, an adapted technique described by Ammannato et al.¹⁴
7. An absolute isolation technique with rubber dam was employed, ensuring the correct positioning of the guide. A total-etch adhesive technique was performed according to the manufacturer's instructions§§ on all lesions. Direct composite resin was applied to the silicone guide and positioned intraorally||| (Figure 10A–C). Excess material was removed with a probe, and each tooth was polymerized for 60 s with the guide matrix in place.



FIGURE 11 Lateral clinical photograph of the restorations completed and polished.



FIGURE 12 Lateral clinical photograph of immediate postoperative phase following root coverage therapy surgery.

8. The restorations were finished and polished using a polishing protocol¶¶ at a low speed according to the manufacturer's instructions (Figure 11).
9. One week later, the periodontist performed RCT (Figure 12).

Case 2: T-CEJ reconstruction with digitally guided technique

1. GRs RT-1 and Class B+ NCCLs are observed in teeth #22–27 (Figure 13).
2. Considering the points of reference and the T-CEJ outlined previously in the digital working model, a digital dental wax-up was designed using software's sculpting tools# within the original file (Figure 14A).
3. A prosthetic guide tailored for CEJ reconstruction was designed and projected onto the digital dental wax-up (Figure 14B).¹⁵
4. The prosthetic guide was printed using a dental 3D printer## in clear autoclavable resin*** (Figure 14C).

** Elite HD+ Zhermack, Germany.

†† Elite Glass Zhermack, Germany.

‡‡ Hu-friedy, Chicago, USA.

§§ Scotchbond, 3M Espe, St. Paul, MN, USA.

||| Filtek Z350XT, 3M Espe, St. Paul, MN, USA.

¶¶ Astropol, Ivoclar Vivadent, Zurich, Switzerland.

Formlabs, OH, USA.

*** Surgical Guide Resin, Formlabs, OH, USA.



FIGURE 13 Case 2: digitally guided technique. Initial frontal clinical photograph of the mandible showing RT-1 gingival recessions and Class B+ non-carious cervical lesions in teeth 22–27.

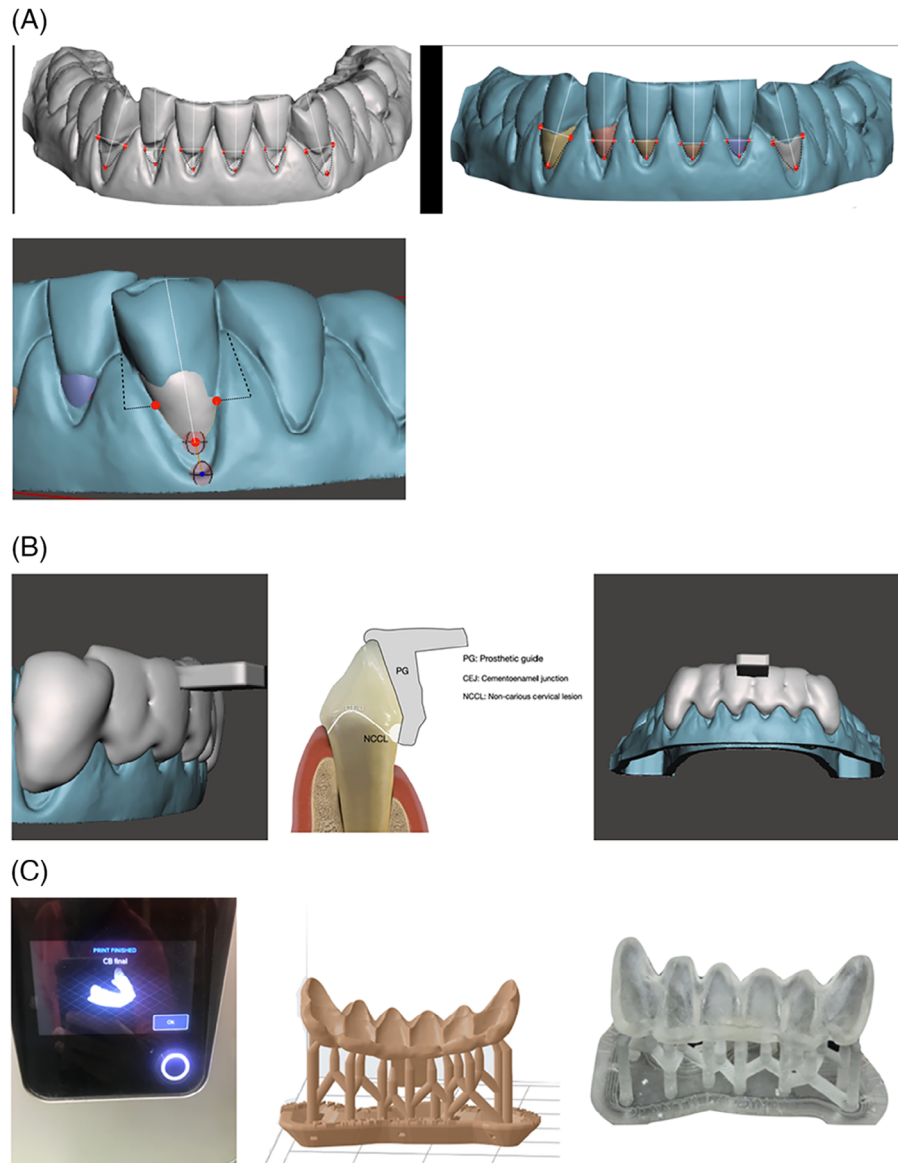
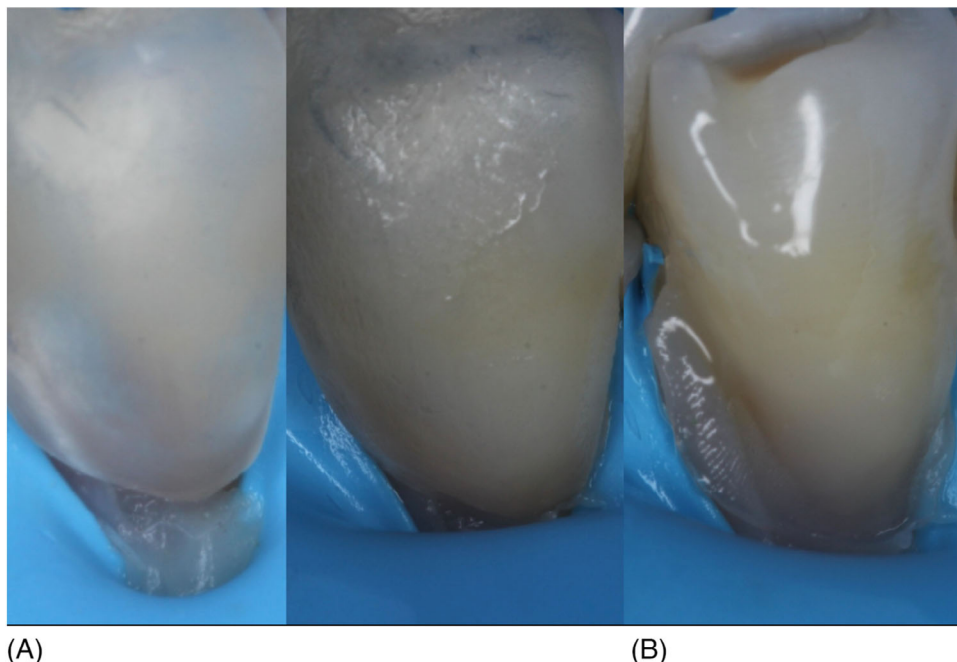


FIGURE 14 Digital design and printing of the prosthetic guide. (A) Predetermination of the cemento-enamel junction in the digital model by positioning the mesial and distal angular points using the Zucchelli method and point C from the Cairo method, followed by a digital wax-up of teeth 22–27 according to the predefined CEJ. (B) Lateral and frontal views of the digitally designed guide in the design software. (C) Process of printing the guide. CEJ, Cemento-enamel junction.



FIGURE 15 Checking the fit of the printed guide intraorally.



(A)

(B)

FIGURE 16 Composite resin restoration using the printed guide. (A) Lateral clinical photograph of tooth 22 with the prosthetic guide in position. (B) Removal of the prosthetic guide after composite polymerization.

5. Upon fabrication, the prosthodontist assessed the fitting of the prosthetic guide intraorally (Figure 15).
6. Then, the area was completely isolated for the CEJ and NCCL reconstructions. For the restoration procedure, a total etch technique was employed^{†††} on all lesions, following the manufacturer's instructions. Direct composite resin was applied onto the printed guide and positioned intraorally (Figure 16).¹¹ All resin excesses were removed using a probe, and each tooth was polymerized for 60 s with the guide in place.
7. Meticulously, finishing and polishing protocol were followed at low speed using a polishing protocol following the manufacturer's instructions (Figure 17).
8. One week later, the periodontist performed RCT (Figure 18).



FIGURE 17 Frontal view. The restorations were completed and polished in teeth 22–27.

^{†††} 3M Espe, St. Paul, MN, USA.



FIGURE 18 Frontal clinical photograph of immediate postsurgical phase following root coverage therapy surgery.

Surgical phase

The periodontist performed RCT surgery on both cases. Local anesthesia was administered, and a microblade^{†††} was used to create a mucogingival tunnel and release all muscle attachments, facilitating coronal advancement of the soft tissue. A connective tissue graft (CTG) was obtained from the palate using a single-incision approach. The palatal donor site was then sutured with 5-0 expanded polytetrafluoroethylene^{§§§} using the cross-mattress technique.

The subepithelial CTG was inserted into the mucogingival tunnel, and its coronal limit was secured at the level of the therapeutic CEJ using a vertical mattress suture and 6-0^{|||||} suspensory sutures. The previously released soft tissues were then displaced coronally, and the gingival margin was fixed 2 mm above the level of the therapeutic CEJ. Final anchorage of the flap to the palatal aspect was achieved using 6-0 or 7-0 polypropylene sutures.^{¶¶¶}

Postoperative care included the administration of 100 mg of ketoprofen twice daily for 72 h; 875 mg of amoxicillin twice a day for 7 days; and mouthwash with 0.12% chlorhexidine twice a day for 7 days. Patients were advised not to brush the surgical area for 2 weeks.

Clinical outcomes

One week, 1 month, and 6 months post-procedure follow-up sessions were carried out. In both cases, complete root coverage was achieved, with good healing of the soft tissues surrounding the restorations, which has remained stable throughout the observation period. No hypersensitivity was reported. The adaptation and polishing of the restorations were evaluated using a 20× surgical microscope^{###} and clinical photographs were taken at each session (Figure 19A,B).

DISCUSSION

In this clinical case study, two different techniques are proposed for the reconstruction of the CEJ in a multidisciplinary approach prior to RCT in patients with Class B+ lesions. Previous reports have shown that in patients with GR and NCCLs, the combined therapy involving restorative and surgical approaches is as safe, predictable, and effective as surgical procedures alone.^{16–19} Additionally, enhances patient satisfaction, by reducing dentin sensitivity and improving aesthetic outcomes, including natural size of the clinical anatomical crown, contour of the emergence profile and positioning of the gingival margin at the level of adjacent teeth.⁹

The first case employed an analogically guided technique, which is advantageous due to its low cost as it does not require the use of any scanner or printer. However, its disadvantages include multiple sessions and extended laboratory time, particularly in the creation and trimming of the silicone guide, and the potential for dimensional changes in the impression materials and stone casting.¹⁵

In the second case, a digital technique with a guide was employed.²⁰ Some advantages are the ability to digitally design and print a guide in a more rigid material than silicone as employed in the analog technique. This rigidity eases the manipulation of the composite resin and enhances the precision in replicating the cervical anatomy. Another advantage is the efficiency of information transmission among the multidisciplinary team. The primary drawbacks of this technique include higher cost, the requirement for more than one session, and the need for training in digital workflow (scanner, printer, and design software usage).

In 2021, another technique for CEJ reconstruction was published, involving a chairside Computer Aided Design–Computer Aided Manufacturing (CAD–CAM) system, providing fast and efficient completion within a single session.²¹ Nevertheless, challenges of this technique include the high cost of the complete chairside CAD–CAM system, ongoing indirect restoration expenses, and the necessary tooth preparation to achieve the minimum thickness required for the chosen ceramic restoration material (Table 1).²²

Currently, there is no consensus on the material to be used for CEJ reconstruction. Various reports have described the use of glass ionomer, composite resin, and feldspathic ceramics.^{16,17,21} When selecting a material, factors such as polishing properties, adhesion, elastic modulus, low polymerization contraction, aesthetics, and biocompatibility must be considered.²³ Based on the authors' experience, the use of composite resin is recommended for both the analogically guided and digitally guided techniques due to its properties, especially longevity and it does not affect periodontal health.^{23,24} Furthermore, in Class B lesions, either shallow Step– or Step+ can be advantageous as they require a minimal thickness of restorative material, thus, excessive tooth preparation is avoided (Figure 20).

††† Microblade Tunnel, Keydent ADS System, Munich, Germany.

§§§ PTFE, Ad Surgical, Sunnyvale, CA, USA.

||||| PGA, Ad Surgical, Sunnyvale, CA, USA.

¶¶¶ AD Surgical, Sunnyvale, CA, USA.

Zeiss Opmi Pico, Jena, Germany.

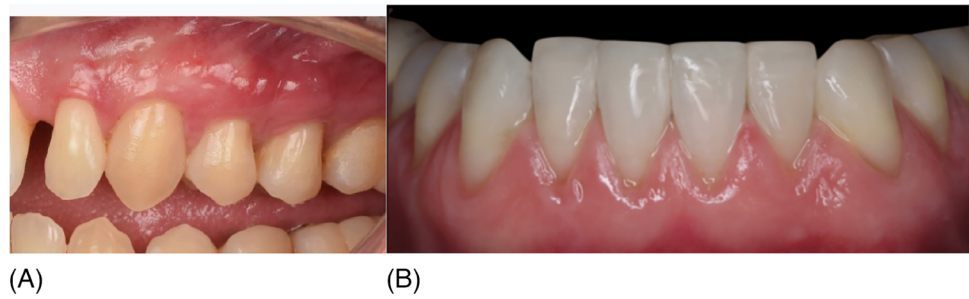


FIGURE 19 6 months after the surgical procedure. (A) Case 1: lateral view of teeth 11–14. (B) Case 2: frontal view teeth 22–27.

TABLE 1 Comparative table of analogically and digitally guided protocols introduced in this article, and digital CAD-CAM for performing the treatment of non-carious cervical lesions prior to root coverage therapy.

	Analogically guided	Digitally guided	Digital CAD-CAM
Type cast	Stone	Resin printed	STL* file
Predetermination CEJ	In the clinic transferred to the stone cast with analog wax-up	In the clinic transferred to the STL* with digital wax-up	In the clinic transferred to the design to the definitive resaturation
Guide type	Flexible transparent silicone	Rigid transparent resin	Unguided
Restoration material	Composite resin	Composite resin	Feldspathic milled ceramic

*STL, Standard tessellation language.

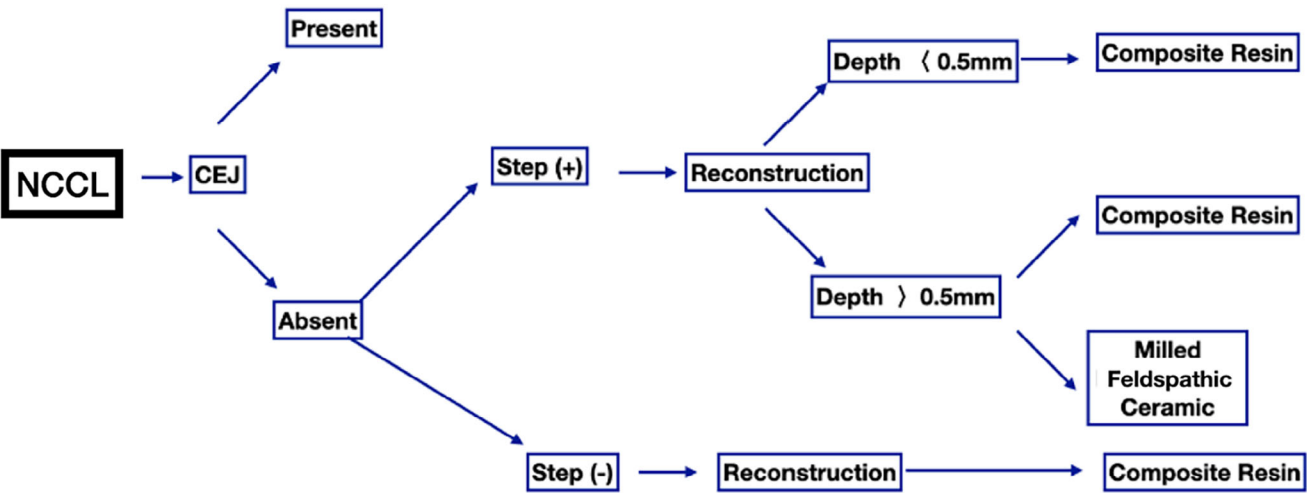


FIGURE 20 Decision-making flowchart for selecting the optimal treatment protocol for a non-carious cervical lesion (NCCL) prior to root coverage therapy (RCT), based on the following parameters: presence or absence of the cemento-enamel junction (CEJ) and presence or absence of a step. When the CEJ is present, no restorative procedures are necessary before RCT. If the CEJ is absent, CEJ reconstruction is recommended, and the chosen restorative technique will depend on the presence or absence of a step. If a step is present, the treatment decision will be based on the depth of the defect, with options including composite resin or feldspathic ceramic. For cases with a negative step, composite resin is recommended as the restorative material.

In state of the art, where high aesthetic standards are often required, effective communication among various specialists involved in treatment is crucial. Using either of these two techniques discussed in this case study promotes strong communication between the prosthodontist and the periodontist, ensuring that the treatment process is both efficient and predictable (Figure 21).

CONCLUSION

This case study introduces two CEJ reconstruction techniques that improve communication within a multidisciplinary team caring for patients. In both cases, the combination of periodontal and restorative techniques yielded stable results for the final position of the gingival margin

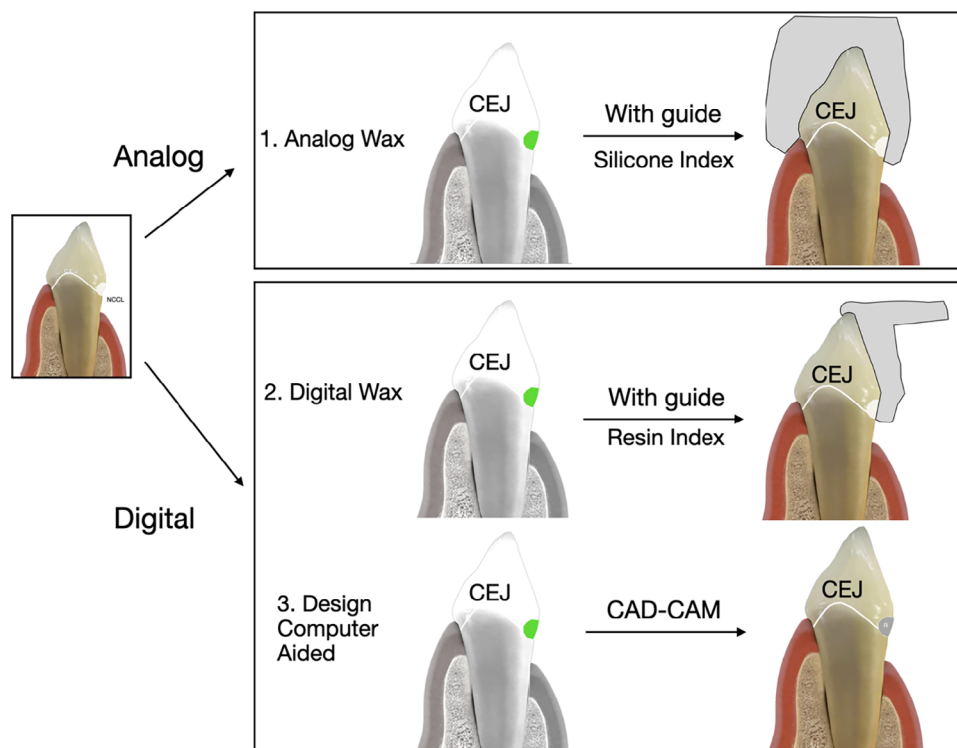


FIGURE 21 Diagram of protocols for the three compared techniques. Technique 1 corresponds to the analogically guided approach, where an analogical wax-up is performed, and a silicon matrix is fabricated based on the wax-up. In technique 2, a digital wax-up is conducted, followed by the design of a prosthetic guide, which is then 3D printed. Technique 3 summarizes the fully chairside procedure, which includes scanning the preparation and designing the restoration simultaneously, followed by milling. CEJ, Cemento-enamel junction.

and aesthetic outcomes. Choosing the most appropriate technique will depend on factors such as step depth, technical availability, and the proficiency in managing digital tools available to the multidisciplinary team (Figure 21).

AUTHOR CONTRIBUTIONS

Dr. Duran and Dr. Gomez contributed substantially to study conception and design, conceptualization, original draft preparation, critical review, and editing of this case study. Dr. Cataldo, Dr. Gonzalez, and Dr. Gauro contributed substantially to original draft preparation, critical review, and editing of this case study. Dr. Aguilera, Dr. Saiz, Dr. Urzua, and Dr. Madariaga contributed substantially to analog design of the prosthetic guide matrix and photo and figure editing, and critical review and editing of this case study. Dr. Pino and Dr. Solanes contributed substantially to digital design of the prosthetic guide matrix, critical review, and editing of this case study. All authors gave their final approval and agreed to be accountable for all aspects of the work.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Maria Ignacia Vallejo for her contributions in translating and editing of this case study.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Our case study did not generate any new data and no data were analyzed in our case study. Therefore, data sharing is not applicable.

INFORMED CONSENT

The patients signed written consents.

ORCID

Juan Carlos Durán <https://orcid.org/0000-0002-8837-2540>

Valeria Gómez <https://orcid.org/0009-0001-6450-7412>

Cristian Aguilera <https://orcid.org/0009-0003-5504-2419>

Rodrigo Pino <https://orcid.org/0009-0005-6626-1064>

Vasco Sáiz <https://orcid.org/0009-0008-4543-612X>

Nicolás González <https://orcid.org/0009-0005-3120-027X>

Yuri Cataldo <https://orcid.org/0009-0001-1878-8313>

Murir Gauro <https://orcid.org/0009-0004-4000-0432>

Iván Urzúa <https://orcid.org/0000-0002-6367-0592>

Fernando Solanes <https://orcid.org/0000-0002-1557-4846>

Catalina Madariaga  <https://orcid.org/0009-0005-8614-6784>

REFERENCES

- Goodacre CJ, Eugene Roberts W, Munoz CA. Noncarious cervical lesions: morphology and progression, prevalence, etiology, pathophysiology, and clinical guidelines for restoration. *J Prosthodont*. 2023;32(2):e1-e18. doi:10.1111/jopr.13585
- Pini-Prato G, Franceschi D, Cairo F, Nieri M, Rotundo R. Classification of dental surface defects in areas of gingival recession. *J Periodontol*. 2010;81(6):885-890. doi:10.1902/jop.2010.090631
- Zucchelli G, Testori T, De Sanctis M. Clinical and anatomical factors limiting treatment outcomes of gingival recession: a new method to predetermine the line of root coverage. *J Periodontol*. 2006;77(4):714-721. doi:10.1902/jop.2006.050038
- Allen EP, Winter RR. Interdisciplinary treatment of cervical lesions. *Compend Contin Educ Dent*. 2011;32(5):16-20.
- Cairo F, Pini-Prato GP. A technique to identify and reconstruct the cemento-enamel junction level using combined periodontal and restorative treatment of gingival recession. A prospective clinical study. *Int J Periodontics Restorative Dent*. 2010;30(6):573-581.
- Zucchelli G, Mazzotti C. *Mucogingival Esthetic Surgery*. Quintessenza Edizioni; 2013:97-100
- Santamaria MP, Silveira CA, Mathias IF, et al. Treatment of single maxillary gingival recession associated with non-carious cervical lesion: randomized clinical trial comparing connective tissue graft alone to graft plus partial restoration. *J Clin Periodontol*. 2018;45(8):968-976. doi:10.1111/jcpe.12907
- Mathias-Santamaria IF, Silveira CA, Rossato A, Sampaio de Melo MA, Bresciani E, Santamaria MP. Single gingival recession associated with non-carious cervical lesion treated by partial restoration and coronally advanced flap with or without xenogenous collagen matrix: a randomized clinical trial evaluating the coverage procedures and restorative protocol. *J Periodontol*. 2022;93(4):504-514. doi:10.1002/JPER.21-0358
- Mathias-Santamaria IF, Santamaria MP, Silveira CA, et al. Evaluation of a novel restorative protocol to treat non-carious cervical lesion associated with gingival recession: a 2-year follow-up randomized clinical trial. *Clin Oral Investig*. 2023;27(4):1781-1792. doi:10.1007/s00784-022-04806-1
- Allegri MA, Corica F, Cairo F. Restoration of the CEJ level and root coverage after gingival augmentation procedure on mandibular teeth: a case presentation. *Int J Esthet Dent*. 2016;11(2):220-232.
- Cairo F, Nieri M, Cincinelli S, et al. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: an explorative and reliability study. *J Clin Periodontol*. 2011;38(7):661-666. doi:10.1111/j.1600-051X.2011.01732.x
- Riley DS, Barber MS, Kienle GS, et al. CARE guidelines for case reports: explanation and elaboration document. *J Clin Epidemiol*. 2017;89:218-235. doi:10.1016/j.jclinepi.2017.04.026
- Kan JY, Morimoto T, Rungcharassaeng K, et al. Gingival biotype assessment in the esthetic zone: visual versus direct measurement. *Int J Periodontics Restorative Dent*. 2010;30(3):237-243.
- Ammannato R, Ferraris F, Marchesi G. The "index technique" in worn dentition: a new and conservative approach. *Int J Esthet Dent*. 2015;10(1):68-99.
- Corzo M, Abdulhadi A, Di Canzio J. The effect of temperature changes on the dimensional stability of polyvinyl siloxane and polyether impression materials. *J Prosthet Dent*. 1998;79(6):626-631.
- Santamaria MP, Ambrosano GMB, Casati MZ, et al. Connective tissue graft plus resin-modified glass ionomer restoration for the treatment of gingival recession associated with non-carious cervical lesion: a randomized-controlled clinical trial. *J Clin Periodontol*. 2009;36:791-798.
- Lucchesi JA, Santos VR, Amaral CM, Peruzzo DC, Duarte PM. Coronally positioned flap for treatment of restored root surfaces: a 6-month clinical evaluation. *J Periodontol*. 2007;78:615-623.
- Santamaria MP, Suaid FF, Casati MZ, Nociti FH, Sallum AW, Sallum EA. Coronally positioned flap plus resin-modified glass ionomer restoration for the treatment of gingival recession associated with non-carious cervical lesions: a randomized controlled clinical trial. *J Periodontol*. 2008;79:621-628.
- Santamaria MP, da Silva Feitosa D, Nociti FH Jr, Casati MZ, Sallum AW, Sallum EA. Cervical restoration and the amount of soft tissue coverage achieved by coronally advanced flap: a 2-year follow-up randomized-controlled clinical trial. *J Clin Periodontol*. 2009;36:434.
- Duran J. Microscope-assisted periodontal and peri-implant plastic surgery. *Microsurgery in Periodontal and Implant Dentistry*. Springer; 2022:221-241. doi:10.1007/978-3-030-96874-8
- Durán JC, Alarcón C, De la Jara D, Pino R, et al. Multidisciplinary treatment of deep non-carious cervical lesion with a CAD/CAM chair-side restoration in combination with periodontal surgery: a 60-month follow-up technique report. *Clin Adv Periodontics*. 2021;11:8792. doi:10.1002/cap.10152
- Miyazaki T, Hotta Y, Kunii J, Kuriyama S, Tamaki Y. A review of dental CAD/CAM: current status and future perspectives from 20 years of experience. *Dent Mat J*. 2009;28:44-56.
- De Santis M, Domenico G. The influence of cemento-enamel restorations in the treatment of multiple gingival recession defects associated with noncarious cervical lesions: a prospective study. *Int J Periodontics Restorative Dent*. 2020;40:333-342. doi:10.11607/prd.4639
- Fahl N Jr. Direct-indirect Class V restorations: a novel approach for treating noncarious cervical lesions. *J Esthet Restor Dent*. 2025;27(5):267-284.

How to cite this article: Durán JC, Gómez V, Aguilera C, et al. Digital and analog techniques for cemento-enamel junction reconstruction: A case study. *Clin Adv Periodontics*. 2024;1-13. <https://doi.org/10.1002/cap.10315>