BJDOR
BRAZILIAN JOURNAL OF DENTISTRY AND ORAL RADIOLOGY

PCAA
PUBLICAÇÕES CIENTÍFICAS DE ACESSO ABERTO

Case Report

Aesthetic and Functional Rehabilitation Using the Composite Resin Injection Technique Guided by a Digital Workflow: Clinical Case Report

Rodrigo Santos Fernandes [1,*], Sanjana Santhosh Kumar [1], Hans Malmstrom [1], Mohamed R Mahmoud [1]

[1] Eastman Institute for Oral Health, University of Rochester Medical Center, Rochester, New York, USA.

* Correspondence: rodrigo_fernandes@urmc.rochester.edu.

Abstract: Aesthetic and functional rehabilitation of patients with severe dental wear represents a clinical challenge that demands conservative, predictable, and efficient approaches. This case report describes the treatment of a 60-year-old male patient with generalized wear and loss of vertical dimension who underwent rehabilitation of the maxillary teeth using the composite resin injection technique guided by a digital workflow. Intraoral scanning, digital wax-up planning (EXOCAD), 3D model printing, fabrication of a transparent silicone index (EXACLEAR), and application of the injectable composite resin G-ænial Universal (GC) were performed according to the index. At the end, restorations were adjusted and polished, and the 4-month follow-up showed functional stability, satisfactory marginal adaptation, and a stable aesthetic outcome with no reported symptoms. The advantages of this technique, such as precise control of shape, thickness, and esthetics, reduced clinical time, and preservation of dental structure, are discussed considering recent literature demonstrating comparable performance to indirect alternatives and good color and functional stability. It is concluded that the described approach is a safe and conservative option for aesthetic and functional rehabilitation in cases of severe tooth wear.

Keywords: Aesthetic Rehabilitation; Injectable Composite Resin; Digital Workflow; Minimally Invasive Dentistry; Digital Wax-Up.

Citation: Fernandes RS, Kumar SS, Malmstrom H, Mahmoud MR. Aesthetic and Functional Rehabilitation Using the Composite Resin Injection Technique Guided by a Digital Workflow: Clinical Case Report. Brazilian Journal of Dentistry and Oral Radiology. 2026 Jan-Dec;5:bjd68.

doi: https://doi.org/10.52600/2965-8837.bjdor.2026.5.bjd68

Received: 24 October 2025
Accepted: 25 November 2025
Published: 6 December 2025

1. Introduction

The pursuit of restorative solutions that combine esthetics, functionality, and structural preservation of dental tissues has driven the development of minimally invasive techniques in contemporary restorative dentistry. In this context, the composite resin injection technique, when associated with a digital workflow, emerges as a promising and effective alternative, particularly in cases of severe dental wear, anatomical malformations, or anterior aesthetic rehabilitation needs. This approach allows precise reproduction of the diagnostic wax-up directly in the oral cavity, minimizing operational errors and optimizing clinical outcomes [1–3].

The evolution of composite resins, especially highly filled flowable versions, together with the accuracy of digital models and 3D printing, has revolutionized predictability and efficiency in restorative treatments. Unlike traditional direct restorative techniques, which require artistic skill and extended clinical time, the use of transparent silicone indexes derived from digital wax-ups provides superior control of form, contour, and restoration thickness, yielding significant clinical efficiency and fidelity to the initial aesthetic plan [1,2,6].

Recent studies have highlighted that the injectable molding technique not only delivers satisfactory esthetic results but also maintains functional and mechanical stability in the medium term. The possibility of keeping the dental structure almost entirely intact is particularly appealing in situations where conventional approaches would require irreversible removal of enamel and dentin. Additionally, predictability in the construction of functional guides, such as canine guidance, makes this technique especially suitable for rehabilitations requiring occlusal reorganization [3,6].

The choice of this technique must be supported by a careful clinical analysis considering occlusion, extent of tissue loss, aesthetic demands, and patient expectations. Clinical experience accumulated over more than two decades reinforces the importance of interdisciplinary and individualized planning that considers not only technical aspects but also patient comfort, cost, and treatment time. In patients who decline orthodontic or complex indirect rehabilitation procedures, the injectable composite approach offers a pragmatic and highly conservative solution [1–3].

Therefore, this case report aims to present the clinical application of the composite resin injection technique supported by a digital workflow, emphasizing its aesthetic and functional benefits as well as the operative nuances that ensure long-term success. The technique described aligns with the principles of Modern Restorative Dentistry, which values minimal intervention, clinical predictability, and full patient satisfaction as pillars of contemporary practice [1–3,6,7].

2. Case Report

A 60-year-old male patient, non-smoker, sought care at the General Dentistry Clinic of the Eastman Institute for Oral Health, University of Rochester, complaining of severe erosion on the buccal and lingual surfaces of both upper and lower teeth, in addition to a significant loss of vertical dimension. These alterations caused functional discomfort and aesthetic dissatisfaction. The initial examination revealed generalized destruction of the dental structure resulting from severe attrition (Figure 1). Two therapeutic options were proposed for aesthetic and functional rehabilitation. After discussion, a minimally invasive approach was selected to rehabilitate the maxillary teeth using the composite resin injection technique.

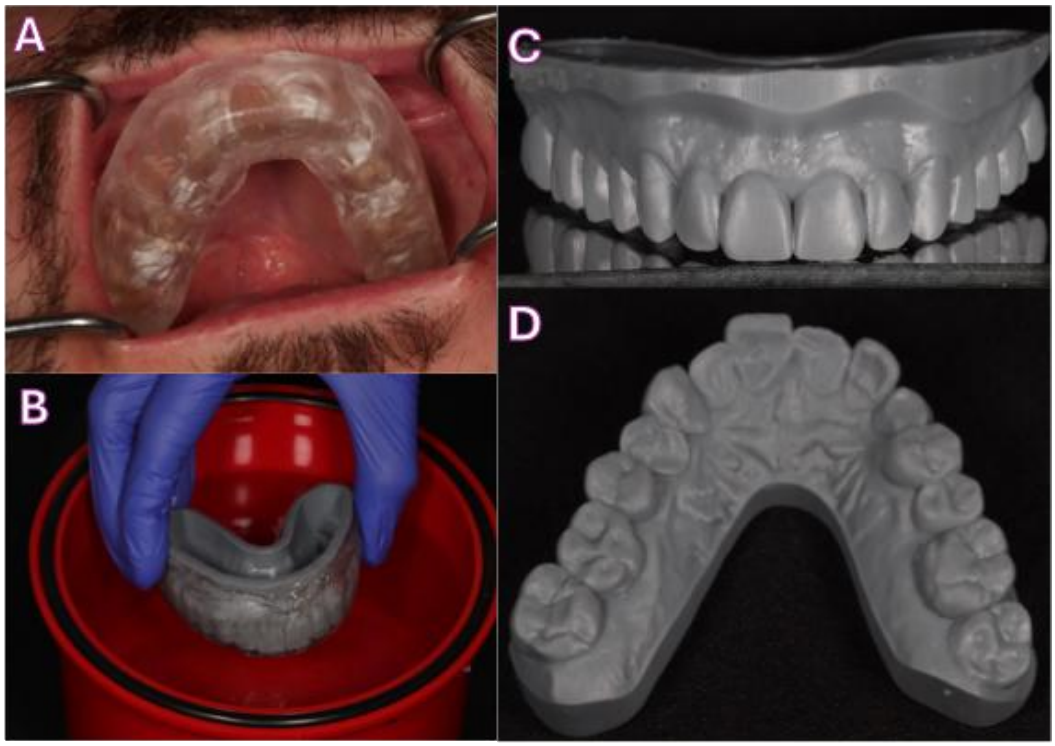
Figure 1: Frontal view showing severe incisal edge and buccal surface wear of the maxillary anterior teeth, associated with enamel loss and significant aesthetic impairment.

During the first visit, photographic and video documentation as well as intraoral scanning of both arches were performed. A freehand aesthetic mock-up with composite resin was carried out directly in the mouth, extending from the upper left second molar to the upper right second molar, to evaluate vertical dimension increase and general esthetics. The occlusal height was adjusted according to canine guidance

principles. Based on the approved aesthetic mock-up, digital impressions and bite registration were performed, followed by the digital planning of the diagnostic wax-up using EXOCAD software. The models generated from this planning were then 3D printed, allowing for the fabrication of a silicone index using putty-type impression material. With this index, provisional restorations were created using temporary material and subsequently adjusted according to functional movements and aesthetic parameters.

Digital planning and the fabrication of models and the transparent guide are shown in the clinical images (Figures 2A to D). After functional and aesthetic approval of the provisional restorations, a new digital impression was taken with the provisionals in position. A final digital wax-up was produced, followed by printing of definitive models. From these models, a transparent silicone index (PVS – EXACLEAR, GC) was fabricated.

Figure 2: Digital planning and fabrication of the transparent guide for the composite resin injection technique. A. Transparent silicone index positioned intraorally to assess adaptation and extent. B. Guide fabrication using transparent PVS material (EXACLEAR, GC). C. 3D-printed model obtained from the digital wax-up showing vestibular anatomical details. D. Occlusal view of the printed model illustrating morphological precision and contour definition.



The definitive restoration was performed using injectable composite resin G-ænial Universal Injectable (GC Corporation), shade A01, injected through the silicone index according to the manufacturer's instructions (Figure 3). After injection and light-curing, the restorations were verified for occlusion, adjusted, and polished. At the 4-month follow-up, the restorations showed functional stability, excellent marginal adaptation, and a satisfactory aesthetic result, with no reports of discomfort by the patient (Figure 4).

Figure 3: Clinical stage of resin injection through the transparent silicone guide, demonstrating precise control of G-ænial Universal Injectable (GC) application on the dental substrate according to the digital plan.

Figure 4: Frontal view at the 4-month follow-up showing functional stability, excellent marginal adaptation, and maintenance of aesthetic harmony and restoration integrity.

4. Discussion

The composite resin injection technique supported by a digital workflow represents one of the most significant innovations in minimally invasive restorative dentistry, especially in cases requiring functional and aesthetic rehabilitation of multiple teeth. This clinical case demonstrates how the approach provides predictability, tissue conservation, and aesthetic excellence with a significant reduction in chair time, attributes that make it increasingly relevant in contemporary practice [1,2,6]. From a functional standpoint, the patient presented severe dental wear that compromised vertical dimension and canine guidance, both critical for occlusal stability and restoration longevity. Traditionally, such cases would be rehabilitated with indirect restorations such as veneers or full crowns. However, these approaches require substantial tooth reduction and entail higher costs. The injectable technique, on the

other hand, allows additive restoration of form, function, and esthetics with minimal removal of dental substrates [2,3].

Rathod et al. [2] demonstrated that using a transparent silicone index allows faithful reproduction of the diagnostic wax-up, offering precise control of shape, proportion, and anatomy, especially in aesthetic areas. This type of planning is crucial to ensure predictability of the result, particularly in cases involving diastema closure, incisal lengthening, and smile harmonization. In addition, transparent molding materials such as EXACLEAR (GC), combined with injectable composites like G-ænial Universal Injectable, provide suitable translucency, optimal handling, and superior adaptation to dental surfaces [6]. Moreover, advances in the digital workflow have further optimized this technique. The integration of intraoral scanning, planning software (such as EXOCAD), and 3D-printed wax-up models allows clinicians to work with millimetric precision. Studies such as Utsumi et al. [3] confirm that this digital approach, by simulating mandibular movements virtually, ensures occlusal balance, reduces adjustment time, and enhances restoration longevity.

Regarding clinical performance and durability, the randomized study by Ashraf et al. [4] showed that indirect restorations cemented with injectable composite resin presented similar performance to those using conventional resin cements after 18 months, with a lower incidence of marginal discoloration, demonstrating the aesthetic and functional reliability of injectable materials even in indirect protocols. Aesthetic stability also remains a key factor in this technique. As reported by Çarıkçıoğlu et al. [5], injectable resins exhibit color stability comparable to bulk-fill and flowable composites even after continuous exposure to staining agents such as coffee and soft drinks, an essential aspect for anterior restorations.

Finally, the success of this technique depends on careful planning and meticulous execution, respecting the principles of adhesive and contemporary aesthetic dentistry. As highlighted by Muslimah et al. [1], combining the injectable molding technique with selective cut-back in high-esthetic-demand areas can be decisive for achieving natural appearance and harmony with adjacent teeth. In summary, the presented case demonstrates that the composite resin injection technique, when integrated with digital workflows and appropriate material selection, can restore esthetics, function, and comfort with high predictability and minimal invasiveness, aligning with the principles of modern oral rehabilitation.

5. Conclusion

The composite resin injection technique supported by a digital workflow is a safe, efficient, and highly aesthetic approach for the rehabilitation of cases with dental wear or morphological alteration. Its application allows restoration of form, function, and smile harmony in a minimally invasive way, with reduced clinical time and predictable results. This case report demonstrates that, with proper planning and technical proficiency, functional and aesthetic excellence can be achieved using modern adhesive materials and digital tools. The technique should be considered part of the clinical repertoire of professionals working in aesthetic and conservative rehabilitation.

Funding: None.

Research Ethics Committee Approval: We affirm that the participant consented to the research by endorsing a clear consent document, and the investigation adhered to the ethical standards outlined in the Helsinki Declaration.

Acknowledgments: None.

Conflicts of Interest: None.

Supplementary Materials: None.

References

1. Perdigão J. Current perspectives on dental adhesion: Dentin adhesion – not there yet. Jpn Dent Sci Rev. 2020 Nov 1;56(1):190–207.
2. Muslimah DF, Tichy A, et al. Composite injection technique with a digital workflow: a pragmatic approach for a protruding central incisor restoration. Cureus. 2024;16(4):e58712.
3. Rathod P, Mehta A, et al. Enhancing aesthetics and functionality of the teeth using injectable composite resin technique. Cureus. 2024;16(5):e59974.
4. Utsumi Y, Nakajima M, et al. Resin composite injection technique with a digital workflow to reconstruct canine guidance: a two-year follow-up. J Adhes Dent. 2025;27(2):155–161.
5. Ashraf H, Khan S, et al. Clinical performance of indirect hybrid ceramic onlay restorations cemented with injectable resin composite versus dual-cure resin cement. BMC Oral Health. 2025;25(1):18.
6. Çarıkçıoğlu B, Yildirim E, et al. Color stability of a novel self-cure bulk-fill composite compared to light-cure bulk-fill and injectable composite resins. BMC Oral Health. 2025;25:1478.
7. Geštakovski D. The injectable composite resin technique: minimally invasive reconstruction of esthetics and function. Quintessence Int. 2019;50(9):712–719.
8. Hosaka K, Tichy A, Motoyama Y, Mizutani K, Lai WJ, Kanno Z, Tagami J, Nakajima M. Post-orthodontic recontouring of anterior teeth using composite injection technique with a digital workflow. J Esthet Restor Dent. 2020;32(7):638–644.