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Direct Injection Technique with Flowable Composites: Imitation of Nature

K.E. Jabrane[1*]; M. Elhaouidag[2*]; H. El Merini[3]

[1] Resident, department of Conservative Dentistry and Endodontics, School of Dentistry, Hassan II University of Casablanca, Morocco
katrennadajabrane@gmail.com
[2] Resident, department of Conservative Dentistry and Endodontics, School of Dentistry, Hassan II University of Casablanca, Morocco
elhaouidagmouna@gmail.com
[3] University Professor, department of Conservative Dentistry and Endodontics, School of Dentistry, Hassan II University of Casablanca, Morocco
drhafsaelmerini@gmail.com

ABSTRACT:

Introduction: Aesthetic-guided smile enhancement is a technique that aims to rejuvenate and metamorphose a smile. This technique requires a deep knowledge of smile design, an eye for detail, a form of artistic expression and manual clinical precision to get as close as possible to a perfect smile. The injectable composite resin technique is an indirect/direct method that uses a transparent silicone mold for precise and predictable translation of a diagnostic wax-up into composite restorations without resorting to coronal preparations.

The aim of this work is to detail the injection molding technique its advantages as well as its disadvantages through a clinical case.

Case report : Two clinical cases will explain the direct veneering technique using fluid composite injection, while covering the conventional impression and wax-up method and the digital method respectively.

Discussion: This work is a step-by-step description of the injectable composite resin technique.The significant advantages of the injectable composite resin technique are its predictability, repeatability, simplicity, minimally invasive nature and affordability for patients.

Conclusion : Recent studies demonstrate significant improvements in the physical, mechanical and optical properties of specific flowable composite resins, reinforcing the rationale for their implementation in various restorative procedures.

INTRODUCTION

Aesthetically guided smile enhancement is a technique designed to rejuvenate and transform a smile. It requires an in-depth understanding of smile design, meticulous attention to detail, an artistic sense of expression, and clinical precision to achieve an ideal smile (1).

A clinician's choice of composite resin should consider its reported durability, aesthetic qualities, and ease of handling. Over the years, composite resins have seen significant advancements in both their visual appeal and strength, rendering them more versatile within certain constraints. Additionally, novel application techniques have emerged, further refining their usage. Techniques such as using bis-acryl mockups or injecting flowable composite through transparent matrices have become popular for temporarily restoring front teeth. The fact that it suggests a quick and easy way of restoring the contours and shape of worn/defective teeth. (2)

The injectable composite resin technique is a direct method, utilizing a transparent silicone mold to accurately and predictably translate a diagnostic wax-up into composite restorations without any coronal preparations (3).

The purpose of this work is to detail the injection molding technique, highlighting its advantages and disadvantages through clinical case studies.

CLINICAL CASES :

Case 1:

A 35 years old female patient in good general condition came for consultation to have her composite veneers redone, and to restore her fluorosis.

The patient was unhappy with the appearence of her smile.

According to Dean's classification, the patient presents a moderate fluorosis.

Figure 1 : Clinical photos taken during the initial consultation

On clinical examination, the patient showed normal sensitivity on all 4 maxillary incisors, with moderate caries. (fig1)

Decay on the mesial an distal free margins and buccal surface of teeth 12 / 11 / 21 and unsightly composite on teeth : 22 / 21 / 11

The Retroalveolar radiograph (fig2) confirms the clinical data: the presence of a deep dentinal damage without pulpal involvement.

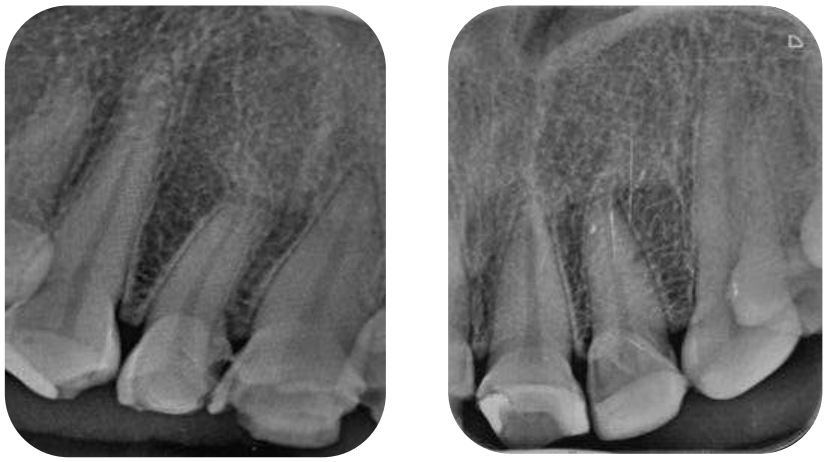

Figure 2 : Retro-alveolar radiographs of the patient consultation

Several therapeutic solutions were proposed to the patient, but the choice fell on injectable composite veneers due to the patient's financial problems.

Before starting the esthetic phase, the patient received periodontal treatment. (Fig3)

Figure 3 : Improved gingival condition after periodontal treatment

Alginate impressions were sent to the laboratory for freehand wax-ups of the teeth to be restored (Fig 4). After receiving the models, the first clinical step was to eliminate the defective restorations, remove the caries and prepare the teeth to be restored (0,7) using a medium diamond bur. (Fig5)

Figure 4 : Wax-up of the 4 anterior teeth after impression

Figure 5 : Minimal tooth prepration

A silicone index was made from the wax-ups using the Zhermack® Elite Glass, and self-polymerization by digital pressure to avoid the development of air bubbles. (Fig6)

To restore teeth, a chemical preparation was carried out using a Universal Adhesive in its etch-and-rinse mode. The adjacent teeth were isolated using split Teflon. (Fig 7)

Figure 6 : Transparent silicone index (Zhermack® Elite Glass).

Figure 7 : Teflon protection of the 2nd set of teeth to be restored

Access holes the size of the fluid composite (G-aenial Universal Injectble®) tip were made through the impression index slightly in front of the incisal edge of each tooth to be restored, and polymerized using light-curing unit through the silicone key. (Fig 8) the excess composite was removed employing finishing burs, followed by polishing procedures using polishing cups. (Fig 9). The injection technique minimized procedural adjustments and substantially decreased the duration required for chairside finishing and polishing.

Figure 8 : Flowable resin composite injection process and Light-curing.

Figure 9 : Final restored teeth after polishing

Case 2:

An 18 years old female patient presented for the consultation, victim of trauma and defective restorations, she wanted to restore the aesthetics of her front teeth. On clinical examination, the tooth 11 was necrotic. (Fig 10) The treatment plan therefore includes first endodontic treatment of the tooth before aesthetic restorations. (Fig 11) After the case study, composite veneers using the direct injectable associated to digital workflow was the technique of choice.(Fig 12) The aim of the treatment was to redefine the correct anatomy of the two maxillary central incisors (teeth 11and 21).

Figure 10 : Initial presentation of the clinical case

Figure 11 : Carrying out endodontic treatment of the tooth 11

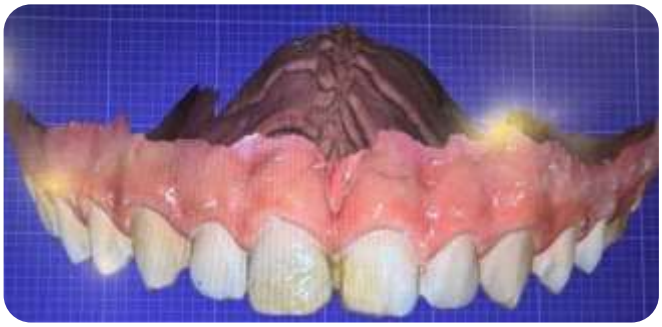

Figure 12 : To represent the initial dentition and the desired simulated result, Digital wax-up of teeth 11 / 12 was produced by an intraoral scanner (Trios3 3Shape).

3D printed model was created from a digital wax-up that was designed using CAD application (3 Shape Dental System).(Fig 13) The wax-up model was also used for the creation of a transparent silicone index for the injectable resin composite technique. The index was fabricated using a transparent silicone (Zhermack® Elite Glass) that self-polymerises when pressed with the finger to avoid the development of air bubbles.(Fig 14)

Figure 13 : 3D printed model designed from the digital model

Figure 14 : Transparent silicone index (Zhermack® Elite Glass).

The first clinical step was to eliminate the defective restorations and prepare the teeth to be restored (1mm) using a medium diamond bur. For better cervical adaptation of the veneer afterwards, retraction of the gum (000) was used.(Fig15,16)

Figure 15 : Retraction of the gum for better cervical adaptation of the veneer afterwards

Figure 16 : Peripheral preparation (1mm) and Removal of defective composite

To restore teeth, a chemical preparation was carried out using a Universal Adhesive in its etch-and-rinse mode. The adjacent teeth were isolated using split Teflon.(Fig 17)

Figure 17 : Etching and bonding teeth

Access holes the size of the fluid composite (G-aenial Universal Injectble®): shades A2 (dentin) / JE (enamel) tip were made through the impression index slightly in front of the incisal edge of each tooth to be restored, and polymerized using light-curing unit through the silicone key. (Fig 18,19)

The excess composite was removed employing finishing burs, followed by polishing procedures using polishing cups. (Fig 20,21). The injection technique minimized procedural adjustments and substantially decreased the duration required for chairside finishing and polishing.

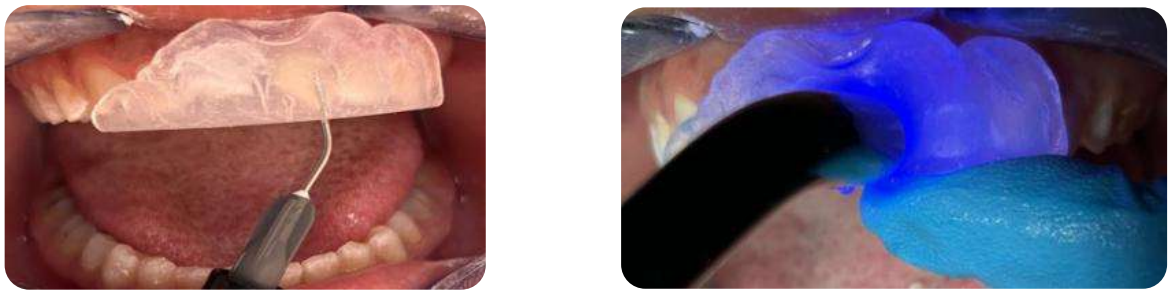

Figure 18 : Flowabel resin composite injection process and Light-curing.

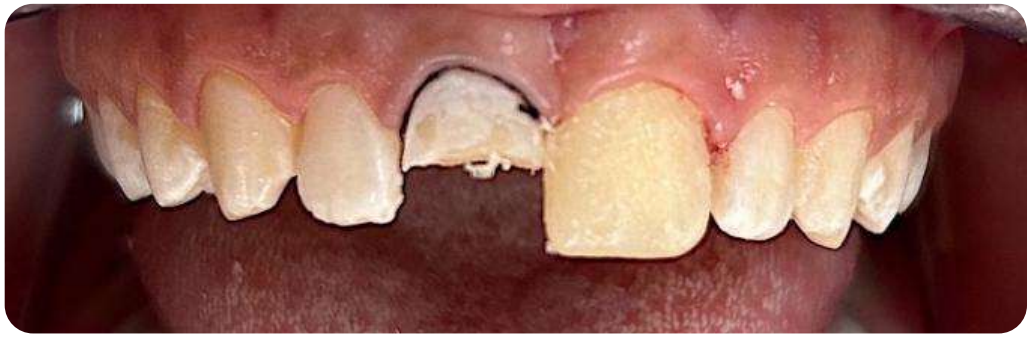

Figure 19 : Result of the 1st tooth

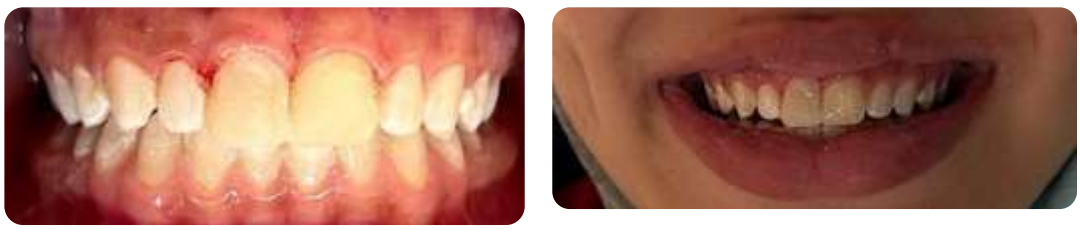

Figure 20 : Result after repeating the same procedure for the second tooth.

Figure 22 : Final result after polishing

DISCUSSION:

Esthetics stands as a primary concern motivating individuals to seek dental treatments, and this case report demonstrates the effectiveness of the composite injection technique in achieving enhanced dental esthetics. Restoration using direct composite resin is a compelling alternative when constraints related to time and cost. This strategy aligns seamlessly with the principles of pragmatic esthetics, which prioritize practical considerations and patient satisfaction over theoretical ideals of dental perfection. (4)

The injectable fluid resin technique is classified as a minimally invasive direct/indirect technique that preserves tooth structure. In some cases, it does not require prior or dental preparation and can be performed in one or several teeth in the same session, through analog or digital diagnosis, to optimize aesthetic (shape and contour) and functional (occlusal) parameters. In addition, this technique can be used in both deciduous teeth and permanent teeth. (5)

This treatment concept has been suggested to restore anterior fractured teeth, class III and IV cavities, composite veneers and pediatric composite crowns. Furthermore, the injection technique is useful for space-closing after orthodontic treatment, the fabrication of tooth- and implant-supported provisionals, and the restoration of fractured or missing denture teeth. In addition, the workflow can be used to restore worn occlusal surfaces of the posterior teeth. (6)

Flowable composite is the preferred material for injectable composite resin technology because of its excellent consistency for injection via the index, enhanced physical qualities compared to conventional composites, and good marginal adaption.

The mechanical characteristics, strength, wear resistance, polish ability, translucency, and other qualities of flowable composites have all significantly improved in recent years. Flowable composites have advanced significantly over time, exhibiting superior placement qualities and marginal adaption, reducing voids because of their exceptional wettability on various substrates. Their reduced elastic modulus and stress- buffering capacity further enhance their superiority over traditional composites. Flowable composites effectively absorb significant compressive stresses brought on by tooth flexure, particularly in cervical restorations. These qualities extend their usefulness to composite veneers, which cover the whole tooth surface with a similar physical structure. This adaptability demonstrates how well flowable composites perform in various clinical restorative scenarios. (7)

Nonetheless, important disadvantages regarding this material should be considered when esthetic restorations are done, such as regarding color stability, polishing and maintenance of surface gloss. Discoloration of anterior composite restorations remains a major cause of esthetic failure and can be a reason for retreatments in esthetic areas. (8)

But which resin to use?

One of the key factors in the success of the treatment will be the choice of fluid composite resin, which must meet the following specifications.

- Ease of extrusion: as it will be injected, it must have good thixotropy.

- Have good mechanical properties, in particular flexural strength linked to its modulus of elasticity.

- Good optical properties

- Good aesthetic properties. The composite must be available in several shades, including enamel shades.

G-ænial Universal Injectable® (GUI) now seems to meet these specifications (69% fill rate by weight).

Other manufacturers have also developed resins to meet these requirements. (9)

Matériaux	**Résistance à la flexion (Mpa)**	**Module d'élasticité (GPa)**	**Profondeur de la polymérisation (mm)**	**Conservation de l'état de surface (%)**	**Stress à la polymérisation (mm)**
G-aenial Universal flo (GC)	167	7,9	2,0	65	1,3
Beautiful Flow Plus (Shofu)	118	7,1	1,9	9	1,5
Clearfil Majesty ES Flow Low (kuraray)	142	7,4	2,4	67	1,4
GrandioSO Heavy Flow (voco)	126	10,1	1,8	2	1,7
G-aenial universal injectable (GC)	**173**	**7,9**	**2,5**	**95**	**1,3**

Figure : Table of physical and mechanical properties of nanohybrid fluid composites (9)

Gestakovski, has demonstrated in these studies that integrating digital workflows into this process improves predictability, reduces the sensitivity of the technique and achieves a high level of accuracy in translating the visual representation of the desired result from the digital wax-up to the final form. This approach offers a multitude of advantages, including reduced chairside time, predictable results and simplified maintenance compared to indirect restorations. However, further research is needed to establish its long-term durability and clinical efficacy. Future research efforts, such as randomized controlled trials with larger sample sizes, are essential to validate these findings and assess long-term performance and patient satisfaction. (10,4)

Recommendations:

- One or two aeration ports can be used. If two ports are used for the anterior region, they are placed mesially and distally respectively. This technique eliminates air trapping and reduces excess.
- When taking impressions, care must be taken not to press the silicone too hard, so as to cover all incisal edges with a sufficiently thick layer. This ensures the key's stability and prevents potential tearing or deformation.
- For maximum adhesion, the bond between injectable composite and enamel should be complete, with no more than 0.5 mm of unsupported composite. This reduces the risk of flaking.
- During injection, a slight overflow is necessary to ensure that all small voids on the edges and in the interproximal spaces are filled.
- Use a No. 12 scalpel blade, strips and finishing discs to remove excess.
- Wearing a nightguard is recommended and prescribed to prevent premature composite flaking, particularly in patients suffering from bruxism. (11)

CONCLUSION:

by selecting favorable cases, stable and predictable results can be achieved using an injectable composite resin technique. Compared to ceramic veneer preparation and placement, this method is often more financially accessible for patients, less invasive, and offers the possibility of repair. Additionally, it is less complex, more predictable, and more repeatable than freehand bonding. Depending on the clinical situation, digital planning is feasible, and implementing a digital workflow can offer specific technical advantages to both the clinician and technician.

BIBLIOGRPHIE

1. Moulage par injection : Étude de cas et guide technique Par le Dr Anthony Tay, Singapour par GC Australasia Pty Ltd, octobre 2019.

2. Coachman, L De Arbeloa, G Mahn, TA Sulaiman, E Mahn; An Improved Direct Injection Technique With Flowable Composites. A Digital Workflow Case Report. *Oper Dent* 1 May 2020; 45 (3): 235–242.

3. Terry D. Restoring with flowables. Hanover Park, IL: Quintessence Publishing Co, Inc; 2017.

4. Muslimah, Diana & Hasegawa, Yuichi & Tichy, Antonin & Richard, Foxton & Hosaka, Keiichi. (2024). Composite Injection Technique With a Digital Workflow: A Pragmatic Approach for a Protruding Central Incisor Restoration. Cureus. 16. 10.7759/cureus.58712.

5. Villafuerte KRV, Obeid AT, de Oliveira NA. Injectable Resin Technique as a Restorative Alternative in a Cleft Lip and Palate Patient: A Case Report. *Medicina*. 2023; 59(5):849.

6. Maroulakos, G.; Maroulakos, M.P.; Tsoukala, E.; Angelopoulou, M.V. Dental Reshaping Using the Composite Resin Injection Technique After Dental Trauma and Orthodontic Treatment. *J. Dent. Child.* **2021**, *88*, 144–147.

7. Rathod, Pratik & Patel, Aditya & Mankar, Nikhil & Chandak, Manoj & Ikhar, Anuja. (2024). Enhancing Aesthetics and Functionality of the Teeth Using Injectable Composite Resin Technique. Cureus. 10.7759/cureus.59974.

8. Ypei Gia NR, Sampaio CS, Higashi C, Sakamoto A Jr, Hirata R. The injectable resin composite restorative technique: A case report. *J Esthet Restor Dent*. 2021;33(3):404-414. doi:10.1111/jerd.12650

9. Devictor A, Beyly T. Résines injectées : les nouvelles approches pour réaliser des restaurations antérieures simples et durables. Réalités cliniques 2021. Vol 32

10. Geštakovski D. The injectable composite resin technique: biocopy of a natural tooth - advantages of digital planning. *Int J Esthet Dent*. 2021;16(3):280-299.

11. Moulage par injection:Étude de cas et guide technique Par le Dr Anthony Tay, Singapour,GC get connected 15 your product and innovation update 2020