



ESTHETIC DENTISTRY

The injectable composite resin technique: minimally invasive reconstruction of esthetics and function. Clinical case report with 2-year follow-up

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The injectable composite resin technique is an indirect/direct method that uses a transparent silicone index for accurate and predictable translation of a diagnostic wax-up into composite restorations without the need for tooth preparation. This case report involves a 22-year-old man who presented with esthetic and functional problems associated with diastemas and insufficient tooth visibility. Clinical examination revealed inadequate canine guidance in lateral excursion. The treatment plan included the fabrication of composite veneers for the maxillary incisors and canines. A wax-up was prepared by simulation of functional movements on an articulator, and a transparent silicone index was prepared after checking a mock-up in the oral cavity. The teeth were restored with flowable composite injected and polymerized through the transparent silicone index. The conventional technique was modified by cutting the sili-

cone index at the gingival margin, using individual mock-ups as space holders, and the use of gingival retraction cords. The final outcomes were elongated teeth for increased visibility, closed diastemas, and reshaped canines for adequate guidance in lateral excursion. A protective splint for night-time wear was fabricated and delivered to ensure long-term stability. The patient did not exhibit any soft tissue inflammation or significant wear during a 24-month follow-up period. The technique described is minimally invasive and inexpensive, and it can be used for definitive as well as translational restorations. The treatment goals are to establish adequate function and esthetics, with advantages including minimal tooth structure loss and cost-effectiveness. Stable and predictable results can be achieved with proper planning and a careful workflow. (*Quintessence Int* 2019;50:712–719; doi: 10.3290/j.qi.a43089)

Key words: composite resin injection, composite veneer, esthetic rehabilitation, functional rehabilitation, transparent silicone index

In modern dentistry, silicone indices are extremely useful for restorative procedures, from the planning phase through the tooth preparation and final restorative phases.

The injectable composite resin technique is an indirect/direct method that uses a transparent silicone index for accurate and predictable translation of a diagnostic wax-up into composite restorations. It can be used for definitive restorations as well as transitional restorations for evaluating changes in occlusal

parameters over time. Furthermore, it can be used to establish new vertical dimensions, restore fractured or worn dentitions, and fabricate provisional restorations.¹⁻³ Owing to their consistency, flowable composites are preferred over conventional composites for use with this technique, because they can fill the mold under the silicone index without the need for external pressure on the index. Consequently, the problems of index distortion and unsatisfactory final outcomes are eliminated.



Figs 1a and 1b Pretreatment findings for a 22-year-old man with diastemas and limited tooth visibility. (a) Intraoral view. (b) Forced smile.

Both flowable and conventional composites have shown clinically acceptable physical properties, with recent studies showing no statistical or clinical differences in all evaluated outcomes during follow-up periods of up to 3 years.⁴⁻⁷ Compared with conventional ceramic veneer procedures, the injectable composite resin technique is minimally invasive and relatively inexpensive. The present report describes the successful use of this technique, with certain modifications, in a case involving a 22-year-old man with esthetic and function problems associated with multiple diastemas and limited tooth visibility. Technical modifications included the use of individual mock-ups as space holders, gingival retraction cords, and cutting of the silicone index at the gingival margin.

Case presentation

A 22-year-old male nonsmoker visited the clinic with complaints of diastemas and inadequate tooth visibility, which resulted in functional and esthetic problems. The patient was unhappy with the appearance of his smile (Fig 1), and his anterior teeth exhibited wear. Clinical examination revealed inadequate canine guidance during lateral mandibular excursion (Fig 2). Esthetic and functional rehabilitation treatment was recommended and three treatment options were presented.^{8,9} The first option involved the fabrication and placement of ceramic veneers, which would possibly offer the best esthetics with superior precision and shade stability. The second option involved the fabrication and placement of composite veneers, which would be more affordable. However, this was inferior to the first option in terms of esthetics and longevity. The third option involved stabilization of occlusion using an occlusal splint. This would decrease harmful forces during parafunctional movements and prevent further tooth wear and temporomandibular joint problems.¹⁰⁻¹³

The patient chose to receive composite veneers. Because functional rehabilitation was necessary, it was decided to use the injectable composite resin technique. This allowed precise intraoral translation of a diagnostic wax-up into composite restorations.¹

At the first appointment, a set of photographs, videos, impressions, and registrations (facebow and maximum intercuspation) were acquired for further analysis, and dental casts were prepared and fixed on a semiadjustable articulator (Artex, Amann Girrbach). The Vita shade guide (Vita classical A1–D4 shade guide, Vita Zahnfabrik) was used for shade selection in consultation with the patient. The A2 and A3 shades were selected for the incisors and canines, respectively.

After detailed analysis, a wax-up was prepared on the basis of simulated functional movements on the articulator and esthetic principles and parameters (Fig 3a).¹⁴⁻¹⁷ Six composite veneers were planned, with classic vestibular veneers in the A2 shade for the incisors and modified 360-degree or full-coverage veneers in the A3 shade for the canines. For adequate lateral guidance, the canines required reshaping with the addition of material on the vestibular, palatal, and mesial surfaces. The restoration margins were planned and placed at least 0.5 mm supragingivally for the prevention of future soft tissue inflammation. Because the lip line was low and the gingival margins were not visible in a full smile, supragingival margins would not compromise the esthetics (Fig 1b).

After extensive analysis of all functional movements on the articulator, the wax-up was transferred to the oral cavity for a final check. For this purpose, a mock-up was prepared using a silicone index made of polyvinyl siloxane (PVS; Exaflex Putty, GC) and resin-based provisional material in the A2 shade (Protemp, 3M Espe) (Fig 3b). Lateral excursion, protrusion, maximum intercuspation, phonation, tooth shapes, tooth lengths, and veneer thicknesses were evaluated.¹⁸



Figs 2a and 2b Pretreatment evaluation of lateral excursion in a 22-year-old man with diastemas and limited tooth visibility. (a) Right lateral excursion. (b) Left lateral excursion.



Figs 3a and 3b Wax-up and mock-up prepared for treatment with the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility. (a) Wax-up. (b) Mock-up (intraoral view).

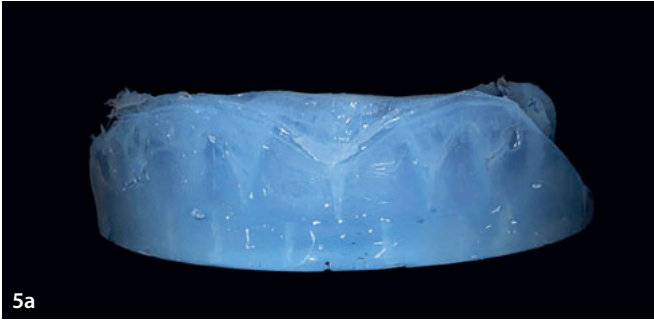


Fig 4 Preparation of a silicone index for treatment with the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility. An impression of a prepared wax-up is recorded using transparent silicone.

The patient and clinician were satisfied with all parameters. Accordingly, a definitive transparent silicone index for intraoral injection of flowable composite was prepared. First, an impression of the wax-up was recorded using transparent PVS (Memosil 2, Heraeus Kulzer) loaded on a nonperforated rimlock metal tray (Fig 4).¹⁹ Two important steps before impression recording included soaking of the wax-up in cold water for 5 minutes for isolation and stabilization of the cast within the tray using three stoppers made of condensation silicone (Optosil, Heraeus Kulzer); this ensured adequate space for the transparent silicone

(5 mm). Two stoppers were placed in the molar region and one in the palatal region. The transparent silicone was placed over the wax-up and also loaded on the tray. The cast was placed into the tray with stoppers, and after polymerization of the transparent silicone, excess material was removed by following the sulcus margins with a scalpel. Rotary burs were used to drill holes for injection of the flowable composite on the incisal edges (Fig 5a).

At this stage, the conventional technique was modified. The original mock-up was extraorally separated into single tooth



Figs 5a and 5b (a) Frontal view of a transparent silicone index with holes at the incisal edges, prepared for treatment with the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility. (b) Separated mock-ups (space holders) prepared for treatment.

Figs 6a and 6b Use of individual mock-ups (space holders) and gingival retraction cords during treatment with the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility. (a) Placement of the space holder on the adjacent tooth (maxillary left central incisor) and a retraction cord in the sulcus. The maxillary right lateral incisor has already been injected. (b) Isolation of adjacent teeth with polytetrafluoroethylene tape.



Fig 7 Injection of flowable composite into a transparent silicone index prepared for treatment with the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility.



veneers using a separating disk. These individual mock-ups, hereafter referred to as space holders, would be fitted on the teeth on either side of the one being injected in order to prevent flow of the injected composite onto the neighboring teeth (Fig 5b).

Following the removal of all surface stains and plaques, each tooth was individually restored for the establishment of satisfactory contact points. Following etching and rinsing, the tooth was dried and a dental cord (Ultrapak, Ultradent) was packed into the sulcus for mechanical prevention of subgingival composite flow. The prepared space holders were placed on

the adjacent teeth and isolated with polytetrafluoroethylene tape (Fig 6). A single-component adhesive (G-aenial Bond, GC) was used.

The transparent silicone index was placed in the correct intraoral position, and a syringe filled with flowable composite (Beautiful Flow Plus F03, Medium Viscosity, Shofu Dental) was inserted through the hole on the incisal edge.²⁰ The material was injected into the space between the tooth and silicone index (Fig 7) and flash-polymerized with an LED curing light for 3 seconds. Excess material was removed from the sulcular area



Figs 8a and 8b Final outcomes of the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility. (a) Intraoral view. (b) Forced smile.



Figs 9a and 9b Final outcomes in terms of lateral excursion after treatment with the injectable composite resin technique in a 22-year-old man with diastemas and limited tooth visibility. (a) Right lateral excursion at 6 months after treatment. (b) Left lateral excursion at 6 months after treatment.

using a scalpel and a dental probe. Definitive light curing from the buccal and incisal surfaces was performed through the silicone index for 40 seconds. Because of the formation of an oxygen-inhibited layer, all surfaces should be covered with glycerin gel and subjected to additional light curing for 20 seconds after removal of the silicone index; this facilitates polymerization of the oxygen-inhibited layer.²¹⁻²³

Once polymerization was completed, the polytetrafluoroethylene tapes, space holders, and dental cords were removed and the veneers were polished to a glossy finish using an EVA handpiece, interproximal strips, and polishing rubbers and brushes with polishing paste, in order to prevent plaque accumulation and staining.²³ The margins of the restorations were in the planned supragingival positions (Fig 8a). The teeth were elongated and reshaped according to the treatment plan (Fig 8b).

Finally, the new occlusal scheme was checked. Anterior movement and guidance of the mandible were simultaneously supported by all four incisors. Lateral excursion on both sides was supported by stable canine guidance (Fig 9). The anterior teeth showed no heavy contacts in maximum intercuspation

(checked using 8- μ m-thick foil). Interproximal contacts were checked using dental floss.

At the next visit, impressions and the centric relation of the temporomandibular joint were recorded and a facebow registration was obtained. New casts were prepared and mounted on the articulator for the preparation of a Michigan stabilization splint for night-time wear.

The patient was recalled every 6 months for the next 24 months. No soft tissue inflammation, bleeding on probing, or significant wear were detected (Fig 10).

Discussion

The present case report describes the successful use of the injectable composite resin technique, with certain modifications, for the correction of diastemas and limited tooth visibility in a young adult patient.

Compared with the conventional ceramic veneer procedures, the injectable composite resin technique results in minimal healthy tooth structure loss, is considerably economic, and



Figs 10a and 10b Intraoral findings after treatment with the injectable resin composite technique in a 22-year-old man with diastemas and limited tooth visibility. (a) 12 months after treatment. (b) 24 months after treatment.

requires less clinical time. Thus, it can be used as a purely additive treatment. Moreover, it exhibits reversibility and involves a relatively easy adhesive protocol for the restoration of chipped and worn teeth.²⁴

The esthetic outcomes of the injectable composite resin technique may be inferior to those of ceramic veneers; however, the technique is extremely useful for cases like the present one. Although one of the objectives was improved esthetics, the main goal was the achievement of stable function and occlusion.^{8,9} Therefore, the right canine slightly exceeded the length that would be established if only esthetic parameters were followed.

The mechanical properties, wear resistance, strength, polishability, translucency, and other characteristics of flowable composites have considerably improved in the last few years. Flowable and conventional composites were found to show no statistical or clinical differences in any outcome assessed in recent meta-analyses.^{4,6}

Because of good wettability on any substrate, flowable composites exhibit better placement characteristics and marginal adaptation, with fewer voids. They also exhibit a lower elastic modulus and stress-buffering capacity, thus showing better results than conventional composites in the treatment of noncarious cervical lesions. Cervical restorations are affected by high compression forces produced by tooth flexure, and flowable composites can absorb these forces. These properties can also be applied to composite veneers that cover the entire tooth surface, which have a similar physical configuration.^{4,7}

Flowable composite resin is considered more suitable for use with a transparent silicone index because of the ease of precise intraoral replication of the prepared wax-up. In some studies that used conventional composite material the clinicians were required to apply strong external pressure on the index for accurate reproduction of the tooth morphology.^{3,24} More-

over, the index was segmentally cut for each tooth. Because these segmental indices had smaller fitting surfaces and were subjected to strong external pressure, their stability and the precision of the final restoration relative to the wax-up would be questionable. Adequate stabilization of a complete index without segments and passive injection of flowable composite without external pressure reduces the possibility of index and restoration distortion. Good marginal adaptation, improved physical properties relative to those of conventional composites, and favorable consistency for injection through the index are properties that make flowable composite the material of choice for the injectable composite resin technique.^{4,9}

In the present case, the protocol for the original injectable composite resin technique was modified as follows.^{1,2} First, the mock-up was separated for the preparation of so-called space holders, which were used to block the teeth adjacent to the one being injected. This prevented the flow of resin onto the adjacent teeth and alleviated the need for interproximal adjustments and removal of excess material after polymerization, which is very time consuming. These space holders also helped stabilize the index in the correct position and prevent deformation. Second, gingival retraction cords were used to prevent the flowable composite from flowing into the gingival sulcus. Supragingival margins were maintained on the wax-up, so the use of retraction cords and cutting of the silicone index at the gingival margin facilitated successful treatment with little risk of subgingival composite flow and future soft tissue inflammation.

This is a single case report, and unique conclusions about the longevity of this type of restoration cannot be made because of the lack of evidence in the literature and long-term follow-up data. However, it is suggested that stable and predictable results can be achieved if this technique is implemented with thorough planning, appropriate case selection, and a careful workflow. ■■



Conclusions

Esthetic rehabilitation alone may not always be sufficient for stable long-term results, and functional improvements may be equally necessary. Composite veneers fabricated using the injectable composite resin technique may be useful, effective, and more affordable than ceramic veneers in cases such as the present one. Good functional outcomes can be achieved with detailed planning and preparation of a wax-up, which can be precisely translated into intraoral restorations with the help of a transparent index.

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Declaration

The author declares that there are no conflicts of interest regarding the publication of this paper.

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