

# Injection moulding technique: A case study

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## Introduction

Direct composite resin restorations now have more applications and indications than ever before. Advances in adhesive dentistry have allowed clinical problems that would once necessitate a more aggressive indirect restoration to be managed in a minimally invasive, additive, direct technique. Moreover, the aesthetic outcomes that direct restorative materials can achieve can be comparable to those of indirect.

Patient awareness is also changing with time and those seeking cosmetic improvements are now more reluctant to opt for materials that require some sort of tooth preparation. The injection moulding technique (IMT) involves injecting a low viscosity resin composite in a pressurised, transparent silicone index made from a diagnostic wax-up, aiming to replicate an already performed mock-up and an approved tooth form arrangement.

## Injectable composite resins

Flowable composites have traditionally been considered too weak to be used as a restorative material and were merely used as lining materials under a composite paste. Their main advantage over restorative pastes is the level of adaptation on the tooth surface.

In the IMT, their 'flowable' nature allows for filling the space within a silicone index with a resin under compression. Modern injectable resins, such as G-aenial Universal Injectable (GC), have a high filler content, wear resistance and gloss retention as well as full coverage silane coating of filler particles using FSC technology.

The IMT has the advantage of replicating the excellent anatomy defined by a lab-made diagnostic wax-up whereby it would be used for the fabrication of indirect restorations.

Indirect restorations nevertheless are more time consuming and costly. Direct composite restorations require significant chair time, good operator skills and knowledge of the material used.

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Figure 1: Preoperative photographs

Compared to freehand indirect restorations, the IMT provides quicker, more consistent results with less adjustments required. Table 1 outlines the advantages and limitations of the IMT.

The following case report outlines the steps in restoring an aesthetically-driven case with G-aenial Universal Injectable based on a wax-up.

### Case report

A 45-year-old male presented complaining of the appearance of his front teeth. Severe multifactorial, localised tooth surface loss led to short clinical crowns. Worn teeth in occlusion due to dentoalveolar compensation has the restorative disadvantage of lack of interocclusal space.

Due to localised and mainly erosive nature of his tooth wear, the patient decided to proceed with additive resin composites on the affected teeth using the Dahl concept.

All primary disease was controlled, including the intrinsic acid erosion prior to the restorative phase. A full set of preoperative pictures (Figure 1) were taken to carry out an aesthetic assessment. Intraoral optical scans were used to do an occlusal analysis and prescribe a diagnostic wax-up for the six upper anterior teeth (Figure 2).

A mock-up was carried by using bis-acryl resin (Luxatemp, DMG) and a putty/wash matrix (Exaflex, GC) of the diagnostic wax-up. This was done to verify the aesthetic outcome as well as verify the occlusal changes as the occlusal vertical dimension was increased by 2mm (Figure 3).

The approved mock-up provided the patient with the reassurance about his new bite and also the emotional excitement about the final smile.

A clear silicone matrix (Exaclear, GC) of the diagnostic wax-up was made in the dental laboratory and pressurised

**Table 1 :** The advantages and limitations of the IMT

Advantages	Disadvantages
Excellent anatomy	More visits needed
Verify aesthetics, occlusion, phonetics	Polychromatic teeth not suitable
Smooth, predictable workflow	Lack of long-term survival data
Avoid misunderstandings	
Easy to implement and teach	
Easy to repair with clear stent	

in a hydro-flask for five minutes at two-bar pressure. The clear silicone was compressed against the wax-up using a spaced, Essix-style tray (Figure 4).

The upper anterior teeth were cleaned and roughened with particle abrasion of 50-micron alumina powder (Etchmaster, Groman Dental) and isolated with rubber dam (Isodam, Four D Rubber).

The teeth were etched using 35% phosphoric acid (Ultra Etch, Ultradent) and hybridised with a universal adhesive resin (G Premio Bond, GC) and a dental curing unit (D-Light Pro, GC).

The alternate tooth technique was used to carry out the IMT. PTFE tape was used to protect the teeth that were not to be etched and bonded (Figure 5).

Holes were made through the clear silicone stent at the incisal edge level to allow the tip of the injectable composite through. The syringe of the composite was inserted and injected through the holes in the clear stent once that was seated fully in the mouth.

The space to be filled in with the resin was visually inspected through the clear stent for any voids or bubbles and the resin was polymerised for 30 seconds through the



Figure 2: Diagnostic wax-up on printed models



Figure 3: Mock-up carried out in bis-acryl resin



Figure 4: Exaclear stent made on diagnostic wax-up

stent and 30 seconds without the stent. A further 10 second cure was carried out after applying an oxygen inhibition layer gel (Oxygone gel, Cosmedent).

The excess from the first three restorations was managed with proximal strips (Komet strips, West One Dental) and a number 12 surgical blade (Swallow Dental) before the

other three were done. The restored teeth were covered with Teflon tape to facilitate excess removal on completion.

Once proximal and gingival excess was removed on all six restorations there would be minimal finishing as the anatomy was wax driven and not freehand.

There may be a need for fine grit diamonds or discs on the cervical junction to avoid any ledges while a natural emergence is maintained. Finishing and polishing spirals (Eve Polishers, Trycare) are usually enough to achieve a high surface lustre.

An additional step would involve a nylon brush (Goat hair brush, Micerium) and a felt wheel (Shiny felt wheels, Micerium) at 5,000rpm.

The final result exhibited good surface texture and lustre while anterior guidance was maintained (Figure 6).

## Discussion

With the increasing use of resin composites in cosmetic and restorative dentistry there is value in having techniques that will replicate an already approved aesthetic outcome and occlusal scheme.

The IMT aims at providing this copy/paste approach by using modern injectable resins. Alternative techniques include the index technique as described by Ammannato and colleagues (2015) and the partial and full moulding techniques as described by Dietschi and Saratti (2020).

Each technique has its limitations and the IMT has the



Figure 5: Isolation and etching on the alternate tooth technique



Figure 6: The final result exhibited good surface texture and lustre while anterior guidance was maintained tooth technique

limitations of working best on mono-shade restorations and having a greater treatment time and cost than freehand composites.

The IMT does require some finishing but significantly less than freehand restorations. Its main benefit after all is the replicated anatomy of a diagnostic wax-up. There is some excess material cervically and proximally but there should not be a need to alter the shape facially/incisally with discs and burs.

It can be used for both purely additive or in subtractive/additive techniques. However, it is mainly intended for fully additive direct restorations where a mock-up can be done to assess the proposed aesthetics and occlusion. Similarly, it is indicated for monochromatic restorations although layering is possible through cutback, a palatal silicone key or different stents made at different levels.

This novel technique aims at copying the anatomy of the

diagnostic wax-up. It is more consistent and predictable than freehand techniques while avoiding unpleasant surprises for the patient. Furthermore, it does not require complex clinical skills and it is easy to teach

## References

- Ammannato R, Ferraris F, Marchesi G (2015) The 'index technique' in worn dentition: a new and conservative approach. *Int J Esthet Dent* 10(1): 68-99
- Dietschi D, Saratti CM (2020) Interceptive treatment of tooth wear: a revised protocol for the full molding technique. *Int J Esthet Dent* 15(3): 264-286

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