

Injectable composites in modern practice

The injection moulding technique allows dentists to plan a predictable aesthetic outcome.

Background

Adults are retaining their teeth for longer and tooth wear is therefore on the rise.¹ This is not just an ageing challenge as evidenced from a pan-European study, which found that moderate tooth wear was present in 29% of 18-35 year olds.² The management of tooth wear has been aided by the gradual improvement in adhesive products. Once stabilisation has been achieved, an adhesive and minimally invasive approach should be the first line of treatment, as recommended by the European Consensus Statement on the Management of Tooth Wear.³ The improvement in composite resin products has allowed us to manage cases in a highly conservative and aesthetic way. Historically, optimal strength, aesthetics and viscosity were difficult to achieve in a single product. In particular, producing a flowable composite that offered excellent aesthetics and flexural strength was complicated. With the evolution of composites and the development of nanotechnology, however, these issues have been overcome, and there is now a range of highly filled flowable composites on the market. Some products (e.g., Filtek Supreme Flowable by 3M) achieve a high filler percentage by arranging their particles in nanoclusters, which wear at the same rate as the matrix, thus allowing for more durable aesthetics. Other products (e.g., G-aenial Universal Injectable by GC) use nanotechnology to universally disperse filler particles so finely that it allows for a very high filler percentage.

The availability of high-strength flowable composites has enabled the use of the injection moulding technique in dentistry. This essentially involves injecting a flowable composite through a clear silicone stent under pressure. The stent is fabricated on the diagnostic model, and the aesthetic and occlusal elements of the wax-up can therefore be replicated predictably. The case report below describes a composite rehabilitation using this technique.

Case report

A 34-year-old female was referred for the management of severe tooth wear. There was a clinical history of bulimia, which had stabilised. The primary complaint was 'shortening of the teeth, which were unevenly worn on one side'. Extra-oral examination revealed masseteric hypertrophy and intra-oral examination revealed generalised tooth wear with UL3 to UR5 most severely affected (**Figures 1a and 1b**). A diagnosis of severe erosive tooth wear complicated by attrition was made.

It was decided to treat the UL3 to UR5 with composite resin at an increased occlusal vertical dimension (OVD). The posterior teeth would be allowed to 'Dahl' or 'compensate' into occlusion. The aims of treatment were as follows:

- restore the worn tooth surfaces of the most severely affected teeth;
- restore the right-side occlusal plane to match the left side;
- improve dental aesthetics; and,
- allow the untreated teeth to 'Dahl' into occlusion.

A digital workflow was followed in this case. An intra-oral scan was taken of both arches, with a pre-contact record in retruded axis position (RAP) at the proposed OVD. Clinical records and photos were used when prescribing the digital wax-up. A putty index was made on the printed model and this allowed the wax-up to be tested intra-orally by carrying out an intra-oral mock-up using Protemp (3M) (**Figure 2**). The patient tested the aesthetic and occlusal outcome in advance.



FIGURES 1a and 1b: Pre-operative photographs.



FIGURE 2: Mock-up.



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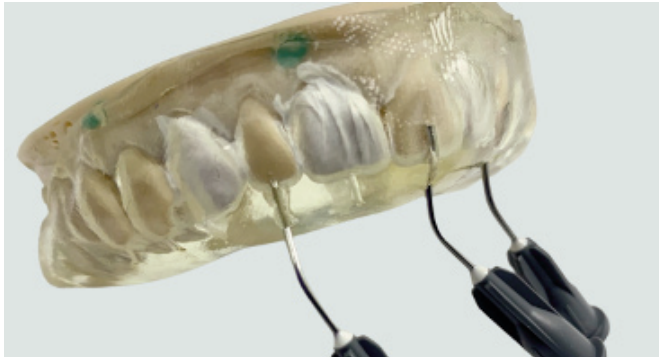


FIGURE 3: Clear stent (Exaclear) fabricated on digital wax-up model.



FIGURES 4a and 4b: Postoperative photos.

The patient attended on a separate day for treatment and the following steps were carried out:

1. A clear matrix was fabricated chair side using Exaclear (GC). This silicone material was injected into a clear impression tray, into which the printed model was seated. This was allowed to set in a hydro-flask (TOPDENT; PolyPot) for ten minutes. Access holes were then prepared through the stent (Figure 3).
2. Teeth were isolated and pumiced clean, followed by air abrasion.
3. Every alternate tooth was separated using PTFE tape.
4. The teeth were acid etched and bonded using G-Premio BOND (GC).
5. The Exaclear stent was seated and every alternate tooth was injected in two stages – the palatal wall first, followed by the buccal layer.
6. Excess material was trimmed with a size 12 scalpel before polishing was carried out – even contacts were achieved on UL3 to UR5.

Full arch contacts were achieved by the ten-week review appointment, at which point a hard acrylic splint was fabricated. The patient attended for six- and 12-month reviews, during which time no chipping and minimal staining had occurred



FIGURES 5a and 5b: Pre-operative and postoperative view of incisal plane. (Figures 4 and 5).

Conclusions

The improvement in bonding protocols has allowed composite to be a viable alternative to indirect restorations in the management of tooth wear. Although highly conservative of tooth structure, the literature would describe composites as a 'medium-term' treatment option, with high patient satisfaction. Their survival has been quoted at five years when used in the treatment of tooth wear at an increased OVD.⁴ The evidence relates to paste composites, which were not nano-filled. It is clear that there is plenty of scope for research on nano-filled injectable composites in tooth wear cases. They offer a truly conservative treatment option and allow for a highly predictable aesthetic and occlusal outcome through the injection moulding technique.

References

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2. Bartlett DW, Lussi A, West NX, Bouchard P, Sanz M, Bourgeois D. Prevalence of tooth wear on buccal and lingual surfaces and possible risk factors in young European adults. *J Dent*. 2013;41(11):1007-1013.
3. Loomans B, Opdam N, Attin T, Bartlett D, Edelhoff D, Frankenberger R, et al. Severe tooth wear: European Consensus Statement on Management Guidelines. *J Adhes Dent*. 2017;19(2):111-119.
4. Gulamali AB, Hemmings KW, Tredwin CJ, Petrie A. Survival analysis of composite Dahl restorations provided to manage localised anterior tooth wear (ten year follow-up). *Br Dent J*. 2011;211(4):E9.

Quiz answers

Questions on page 192.

1. From the photograph, an enamel-dentine-pulp fracture of the maxillary left central incisors can be diagnosed. It is important to get the patient to attend the dental surgery as soon as reasonably possible for further assessment of the injury, including percussion tests, mobility test, sensibility test and radiographic test. This is to ensure that no other dental injuries, such as luxation or root fracture, have occurred to the tooth, or to the adjacent or opposing teeth.
2. For this trauma, with no mobility, root fracture or luxation injury identified, a partial pulpotomy is recommended. Apply local anaesthesia, isolate with rubber dam if possible, disinfect with sodium hypochlorite, and perform

pulpotomy to a depth of 2mm using a round diamond bur and water/saline spray. Place a cotton pellet moistened in sodium hypochlorite over the pulp until bleeding has ceased, apply pulp capping material, seal with glass ionomer cement and restore the tooth with composite. If the tooth fragment is available, this can be bonded back onto the tooth after the exposed pulp is treated. Guidelines for treatment of dental trauma found in the Dental Trauma Guide at <https://dentaltraumaguide.org/>.

3. Clinical and radiographic follow-up is recommended at three, six and 12 months. It is recommended to look for signs of loss of vitality, root resorption and infection long term.