

Direct restoration in the aesthetic zone - a case study

Neil Gerrard¹

The patient, a 27-year-old female in good health, presented to the practice requesting improvement of her smile.

She requested alignment of her anterior teeth and improvement to the general colour of her smile – in particular the shade of existing composite restorations that had been carried out on teeth UR1 and UL1. Both teeth had previously been treated with direct composite in order to mask enamel hypoplastic white spots as a teenager.

Diagnosis

On examination it was noted that her general dental health was good, with no existing restorations (other than those at UR1/UL1), no carious lesions and no loss of clinical attachment of periodontal tissues (though general gingivitis was diagnosed).

Closer examination of the teeth confirmed widespread hypoplastic white enamel spots on both anterior and posterior teeth. Some minor brown spot lesions were also noted on teeth UR2 and UL2, as was pitting of the enamel on teeth UL3/UL4. On questioning, no obvious cause – such as ingestion of fluoride toothpaste as a child, for example – of the white spots could be established, only that the incisal third of each central incisor were the teeth most obviously affected and subsequently treated.

The presenting appearance of this case suggested that fluoride ingestion was the most likely cause, leading to a diagnosis of mild fluorosis being made.

Treatment plan

The patient presented with a number of concerns relating to her smile, including alignment of the anterior teeth as well as general shade, and the shade of existing restorations. The patient's aim was to achieve a straighter, whiter smile with an even colour to teeth UR1 and UL1.

A number of treatment options were therefore presented to the patient, including:

1. Pre-restorative alignment of the teeth with either fixed or removable (clear aligner) orthodontic appliance therapy. Following this, general tooth whitening followed by replacement of existing composite at UR1/UL1 with direct composite better representing the new shade of the natural dentition for seamless integration into the smile
2. An alternative to pre-restorative alignment of the smile was to complete general whitening of the smile, followed by placement of direct composite (partial and full coverage veneers) in order to correct shade as well as form and alignment (with or without minimal preparation as required)
3. As per option two, but utilising indirect minimal prep ceramic veneers.
Option one was deemed the most conservative approach, option three the most aggressive.

¹ Dr Neil Gerrard BDS RDT MSc
Private Practice, Bristol, UK

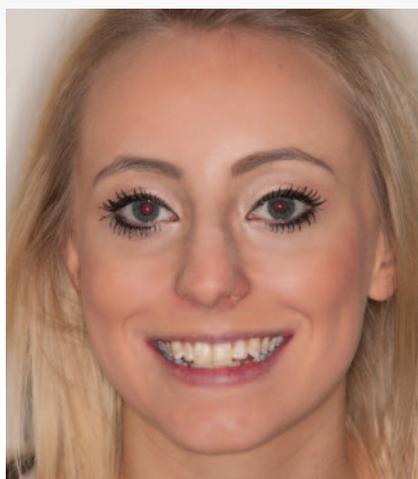


Figure 1: Full face view



Figure 2: Smile view (1:2, anterior)



Figure 2: Smile view (1:2, anterior)



Figure 4: Smile view (1:2, left)



Figure 5: Retracted view (1:2, anterior)



Figure 6: Retracted view (1:1, anterior)



Figure 7: Retracted view (1:1, right)



Figure 8: Retracted view (1:1, left)



Figure 9: Upper occlusal view



Figure 10: Lower occlusal view

After considering all options, the patient chose to proceed with pre-restorative alignment utilising a labial fixed appliance, followed by whitening and subsequent replacement of the existing composite.

Treatment sequence and description

Prior to any restorative treatment, the patient was referred to a colleague for aesthetic orthodontic alignment of both upper and lower dental arches.

A non-extraction approach was taken, using a

combination of interproximal reduction (IPR) and rounding out of the arch forms to achieve alignment (while trying to minimise dumping of the anterior teeth forward).

Following successful alignment, the patient was referred back to the author for post-alignment whitening and restorative care. Alignment of both arches had been successfully achieved, with little evidence of any significant proclination of the maxillary teeth.

However, some residual space, of approximately 1mm, was noted distal to tooth UR2. It had been noted that without



Figures 11 and 12: Preparation

further aggressive IPR and retraction to the lower incisor teeth, this space could not be closed. Following discussion with the patient prior to debonding of the fixed labial appliance, the patient agreed to a compromise – that of direct composite bonding to the distal surface of the UR2 – to both minimise excessive enamel removal to the interproximal surfaces of the lower incisors, and to speed up completion of treatment.

Tooth whitening

The patient undertook a course of home tooth whitening using custom made trays and 16% carbamide peroxide.

The patient was instructed to use the trays for approximately four weeks each night to brighten the teeth, then stop for two weeks prior to the restorative phase in order to account for rebound (Kugel et al, 2009).

The patient had also been preoperatively advised that due to the nature of hypoplastic spots, that these would likely appear worse in the short-term until the full whitening effect had been achieved. The patient had also been advised that the appearance of the white spots would not fade, only that the contrast between the 'normal' enamel and hypoplastic enamel would reduce as the enamel became brighter.

Review of the patient at two weeks post-whitening confirmed a much improved result, of which the patient was very happy despite the appearance of multiple white spot lesions still being evident. Assessment with a bleaching shade guide (Ivoclar Vivadent) confirmed a new shade approximating that of BL3 (compared to the original body shade of A2), suggesting that a very acceptable result had been achieved. A two-week cessation of whitening prior to direct composite placement will also minimise any potential effects on resin bond strengths which may lead to premature bond failure (Li, Greenwall, 2013).

Resin infiltration of the enamel surface using a system such as Icon by DMG has been shown to treat the appearance of hypoplastic spots effectively. This was offered to the patient prior to replacement of the direct composite on UR1/UL1 with the view to completely masking the white spots, or significantly reducing their visual impact.

The patient declined such treatment, stating that she was very happy with the aesthetic appearance of all teeth other than that of UR1/UL1.

Treatment therefore proceeded as planned with replacement composite to UR1/UL1 and direct diastema closure distal to UR2. Importantly, the patient agreed that in order for any new restoration to blend seamlessly with the natural dentition, it would need to include and replicate hypoplastic regions.

Preparation phase

In preparation of the restorative phase, a diagnostic wax-up on stone casts was completed, and the laboratory instructed to mimic the general form of the UR1/UL1 regarding the incisal silhouette and incisal width.

This would enable the use of a putty stent for accurate replication of anatomical forms of both teeth, in which composite could be layered into and thus create a thin palatal shell/silhouette from which to aid an additive technique (requiring minimal contouring and adjustment post placement) (Devoto et al, 2010).

In order to compensate for a change in value as a result of desiccation of the teeth during treatment, a diagnostic composite mock-up (physical colour map) was completed at the very beginning of the treatment session on the labial surface of the UL1 in order to confirm shade and value accurately. Once confirmed, this prescription would be



Figure 13: Full face view



Figure 14: Smile view (1:2, anterior)



Figure 15: Smile view (1:2, right)



Figure 16: Smile view (1:2, left)



Figure 17: Retracted view (1:2, anterior)



Figure 18: Retracted view (1:1, anterior)



Figure 19: Retracted view (1:1, right)



Figure 20: Retracted view (1:1, left)



Figure 21: Upper occlusal view



Figure 22: Lower occlusal view

followed regardless of the appearance of the adjacent teeth, which would likely increase in value, and with an even greater number of white spot regions developing as treatment progressed (a result of dehydration).

In order to counter this, a pre-restorative photo would also be referred to as the pattern and distribution of the existing white lesions on adjacent teeth.

The existing composite was removed with multi-fluted carbide burs, under magnification and without water in order to visualise the existing composite interface with the underlying tooth substrate. Approximately one third of the

width of labial surface appeared to have been removed when the original composite restorations were placed, exposing some minor regions of dentine.

Direct composite bonding

The composite resin of choice in this case was HFO. The colour map indicated a basic chromacity of UD1 and UDO.5, with an enamel layer of medium high value GE3. Opalescent white incisal (OW) was also found to mimic the existing enamel, while IW (opaque white intensive effect) was chosen to represent areas of hypocalcification.

A mildly textured surface was noted on all incisors with a view to mimicking this as closely as possible in order to integrate the restorations.

Preparation of the tooth surface prior to bonding included the placement of bevelled margins (where possible) to the buccal and lingual surfaces with a finishing diamond bur (to aid integration of the restoration reducing appearance of marginal edges), followed by air-abrasion utilising 27µm alumina oxide to maximise bond strengths.

A partial etch technique using 37% phosphoric acid was employed to prepare the enamel for a maximum of 30 seconds. Following this, a self-etching bonding resin was used to complete bonding to the etched enamel surface, but also create a bond to the dentine surface for improved dentine bond durability over time as a result of MMP reduction compared to a total etch technique (Mazzoni et al, 2013; Reis et al, 2013).

With the putty matrix in position, HFO composite resin was incrementally layered to the correct anatomical form. GE3 enamel was layered first into the matrix, then cured against the tooth. This was then followed by body composites UD1 and UD0.5 until the basic dentinal form was achieved (including mammelon forms).

Even though the optical properties of enamel had been modified with preoperative whitening, these layers still exist and thus require mimicking if an accurate shade match is to be achieved. Prior to layering of the labial enamel increment, IW intensive white was placed in a form to mimic the natural hypoplastic regions of adjacent teeth. As with all intensive effects, this was placed sparingly, as the subsequent addition of the enamel layer magnifies such effects. The final enamel layer consisted of GE3 and a thin layer of OW to help replicate the shade, while blending the composite with the body of the tooth.

The same process was used to directly bond composite to the distal surface of the UR2, though care not to etch the mesial surface of the UR3 was taken. By avoiding etching of the canine, composite could be directly layered to the mesial surface forming an intimate contact point. This can then be separated by spreading the teeth between the contacts, followed by the use of flexi-discs in order to achieve the desired final form.

The utilisation of the putty matrix normally means that little finishing is required following placement of the composite resin. The minor finishing required for this case was achieved with abrasive discs, rubber polishing points and fine diamond burs.

To complete the restoration some minor secondary and

tertiary anatomical features were created. Polishing was completed with 3µm and 1µm diamond pastes, followed by aluminum oxide to achieve a natural high lustre to the restoration.

Convex surface anatomy was created with flexi-discs to produce a smooth natural finish to the restoration and enamel-composite junction.

Functional occlusion was checked and adjusted with 100µm paper while seating the patient at a 45° angle and asking them to chew. But as the new restorations essentially followed the natural incisal silhouette, little adjustment was required.

Finally, the patient was provided with a new removable orthodontic retainer and whitening tray to fit the modified tooth forms.

Conclusion

On immediate completion of the procedure, such significant desiccation of the enamel had occurred that the true shade could no longer be determined with white regions significantly exaggerated. The patient was therefore invited back for a review a few days later in order to confirm accurate shade replication following rehydration of the enamel surfaces. In this instance, the restorations proved to be a successful match and the patient was delighted with the results.

The above case study was a winner of an Aesthetic Dentistry Today 2016 (UK) award.

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