

Smile transformation using minimally invasive techniques

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Introduction

The patient was a 35-year-old female in good health who presented to the practice requesting a smile makeover. Her main complaints were that of crowded lower teeth and a dark front right central incisor tooth 11 (*Figures 1 and 2*).

Diagnosis

A full clinical examination was completed including all normal periodontal examinations and radiographs and there was nothing abnormal to report. Oral hygiene was good and there were no concerning social factors.

The tooth 11 had a root canal treatment completed at the time of

trauma when she was younger. The obturation was well-condensed, following a tapering preparation and to within 2mm of the radiographic apex. There was lamina dura around the apex and no obvious periapical pathology. The root canal treatment was deemed successful according to the European Society of Endodontology treatment outcomes.¹ The tooth 11 had suffered intrinsic tooth discolouration, likely from pulpal haemorrhagic products as a result of the trauma.²

Historic orthodontics had compensated a class II malocclusion by bilateral extraction of the upper first premolars and retraction of the pre-maxillary segment. This retraction had caused entrapment of the lower teeth and accelerated the lower crowding over the following years (*Figures 3 and 4*).

Treatment plan

Aims of the treatment were to address the discoloured tooth 11 and improve the anterior alignment of the upper and lower teeth.

The options for the discoloured tooth 11 were:

1. Internal and external tooth whitening
2. Direct or indirect veneer.

The options to address the anterior crowding were:

1. Comprehensive orthodontic treatment
2. Extraction of the retroclined tooth 32 and anterior space closure
3. Interproximal reduction (IPR) to create space to align tooth 32 into the arch.



Figure 1



Figure 2

Figure 3



Figure 4



Treatment planning considerations

With regards to tooth discolouration, the treatment choice is dependent on the diagnosis and there is often a hierarchy of treatment options which should be pursued in a logical order starting with the least invasive until a satisfactory outcome is achieved.

Research has shown that this treatment cascade is an appropriate approach as often patients are pleased with the outcome and decide against further restorative treatment.³

With that in mind, it was decided to complete internal and external tooth whitening before orthodontic treatment began. The aim was to assess the improvement of the tooth colour and then to re-evaluate the patient's expectations before tooth alignment was completed and before proceeding to alternative and more invasive options for tooth 11.

On 31 October 2012, the EU Council Directive 2011/84/EU came into force in the UK.⁴ It sets out who can use what strength of product when performing tooth whitening. This directive states that the use of tooth whitening or bleaching products containing more than 0.1% and up to 6% of hydrogen peroxide present or released from other compounds or mixtures in these products is safe for use when prescribed by a registered dental professional.

It has been conclusively proven that internal, or non-vital, bleaching can induce cervical root resorption in certain conditions,⁵ but the exact mechanisms and understanding behind this still has researchers' opinion divided. Cervical root resorption is a painless, inflammatory mediated external resorption of the root. The underlying mechanism for this effect is unclear, but it has been suggested that the bleaching agent reaches the

periodontal tissue through the dentinal tubules and initiates an inflammatory reaction.⁶ It has also been speculated that the peroxide, by diffusing through the dentinal tubules, denatures the dentine which then becomes an immunologically different tissue and is attacked as a foreign body.⁷

It is recommended that after access into the tooth, the prepared cavity space for the bleaching agent which extends down into the coronal root canal is sealed at the CEJ level with a dental restorative which bonds to dentine, such as GIC. This will seal the dentinal tubules that lead from the pulp chamber apical to the epithelial attachment so that the internal bleaching agent stays within the access cavity, preventing penetration of the peroxide at the level of the periodontal ligament attachment. Care must also be taken when placing the rubber dam clamp so as not to damage the cervical root



Figure 5



Figure 6

Figure 7



Figure 8



cementum of the tooth, as it is broadly accepted that damage to or deficiency of this protective cementum layer below the epithelial attachment exposes the root surface to osteoclasts, which then resorb the dentine.⁸

Treatment sequence and description

Treatment began with internal whitening of tooth 11 with all the risks explained to the patient. The tooth was isolated with a rubber dam and the palatal access restoration and GP removed to 2mm below the CEJ. A 2mm GIC restoration was then placed to the level of the CEJ followed by a cotton pledget soaked in 6% H₂PO₄ gel. The access was sealed with Cavit™ (3M) followed by GIC. The patient was reviewed after three days and the gel was removed and replenished. This process was repeated three times. In

addition to the internal whitening the patient completed a three-week period of night-time home-whitening using 10% CH₆N₂O₃ in custom-made trays. The result was fairly dramatic and the patient was happy at this stage. After considering all the options the patient chose to align her teeth using a clear tooth alignment system and to reassess tooth 11 after this process was completed before deciding on further treatment.

Smile TRU was used to assess the arches and calculated the space required for alignment of the teeth and the necessary lower tooth slenderisation. This was within the tolerances of acceptable IPR.⁹ Twelve lower and six upper transparent sequential positioners were fabricated and composite attachments were placed bilaterally on the lower first molars to assist retention. IPR was completed to the requested specifications with

interproximal finishing strips and using wooden wedges to protect the gingiva. Fluoride varnish was then applied. Each aligner was worn for two weeks meaning a treatment period of 6-months for the lower teeth and 3-months for the upper teeth. After tooth alignment (Figures 5 and 6), indirect fixed-wire retainers were constructed and cemented to the lingual surface of the anterior teeth using flowable composite and normal etch and bond protocol (Figure 7 and 8).

At this stage we then reassessed the patient's expectations and she still felt that further improvements were needed on the tooth 11 (Figure 9). I also felt that I could improve the symmetry of her smile with a slight addition in length and width of her upper right lateral tooth 12. All options were again discussed. I felt that I would be able to achieve a superior aesthetic and better tailor the colour-blend to the natural tooth



Figure 9



Figure 10

Figure 11



Figure 12



if I were to use a direct composite approach rather than placing an indirect ceramic veneer on teeth 11 and 12. We discussed the differences in these materials and the increased maintenance of the composite restorations.

Whenever we are treating front teeth we should always take our shade-matching photos at the very beginning of the appointment. Tooth dehydration will quickly change the appearance of a tooth and affect the colour-match detrimentally. Using custom composite shade tabs and a cross-polarised lens for your photos will help with the shade determination (Figure 10). Once the shades are chosen, you must form a mind-map of your plan to use these colours within the restoration and stick to this rigidly. It is very easy to begin placing composite material and decide mid-treatment that you need to add a lighter or darker shade. This is usually a misnomer

and an illusion created by the dehydration of the tooth or the light refractions from the colour of your rubber dam etc. It is essential to decide the shade-mapping at the beginning of treatment and maintain this plan throughout.

The teeth 11 and 12 were isolated with retraction cord only as all the preparation was to be supra-gingival and there was no anxiety regarding moisture control. A window-veneer design preparation was chosen for tooth 11 and a round diamond bur used to remove 0.5mm of the facial-surface enamel leaving a circumferential chamfered edge (Figure 11). The neighbouring teeth were protected with a metal matrix strip and microabrasion with 50µ aluminium oxide powder was performed to increase retention. Selective enamel-etch protocol was followed and the dentine primed with a self-etching primer (Optibond XTR) (Figures 12 and 13). This

product uses a primer containing special acidic monomers to simultaneously etch and prime the tooth surface. The short-acting pH 1.6 acidity of Optibond XTR primer is a potential advantage for dentine bonding because it may result in less post-operative sensitivity. Priming was followed by Optibond XTR filled adhesive that has increased hydrophobic characteristics to maximise bond to both dentine and enamel.¹⁰

An opaquer was placed (Cosmodent White Opaque) to mask the underlying dark yellow dentine (Figure 14) and then the internal anatomy of the tooth was built in layers; dentine first using chromatic shades (Kulzer Venus Pearl OLC middle and incisal third, and OMC gingival third) (Figure 15) then the mesial and distal walls and the space between the dentine mamelons in an opalescent translucent enamel shade (Kulzer



Figure 13



Figure 14

Figure 15



Figure 16



Figure 17

Figure 18

Venus Pearl CO) (Figure 16), and finally the tooth was finished with a facial layer of enamel composite (GC Essentia LE).

These shades were all chosen at the beginning of treatment using the direct shade tab technique. The same layering process was repeated for tooth 12; however, this tooth was

a direct veneer placement with no preparation with a dental bur. After composite layering was completed a pencil was used to define the transition line angles of the tooth utilising the neighbouring central tooth as a guide (Figure 17). Vertical and horizontal macro-anatomy was replicated followed by horizontal micro-anatomy using a narrow-tip fine diamond bur (Figure 18). The restorations were finished using the

Kulzer Astropol polishing system. Photos were taken at this stage and the tooth assessed on a large screen for any flaws in the polish and shape.

The close-up photos showed errors in blending of both composite to tooth as well as the definition of the anatomy (Figure 19). The reflections from the camera flashes are assessed to ensure that the shaping



Figure 19

Figure 20

Figure 21



of the tooth is correct and symmetrical to the neighbouring teeth. Additional shaping and polishing was then completed to eliminate these errors and the tooth was finished using EVE DiaComp Twist diamond-impregnated polishing wheels followed by a felt wheel with water only. This finishing, reviewing, refining, and final polishing sequence give consistent results with an incredible lustre and high shine to the composite.

Reflections

Both the patient and I are very happy with the final result. The smile is symmetrical and all crowding eliminated (*Figure 20*). The direct

composite veneers on both tooth 11 and 12 blend seamlessly with the natural teeth and are almost undetectable (*Figure 21*). Regular polish and 6-monthly top-up tooth whitening will ensure the colour-blend and lustre of these teeth is maintained (*Figure 22*).

Conclusion

Following a cascade of procedural invasiveness during treatment planning can often realise patients' required cosmetic expectations earlier than intended, saving the patient from more costly and often more destructive procedures.

Cosmetic orthodontic solutions are an invaluable tool in our armamentarium to align patients' front teeth in a predictable and minimally invasive manner which can achieve drastic smile transformations with very little risk to the health of the patients' teeth. When combining this treatment with tooth whitening and composite-bonding techniques one can achieve incredibly beautiful and natural aesthetics which are far superior to a ceramic smile makeover.

By approaching anterior composite restorations in the same methodical and planned approach every time, you can achieve consistently excellent aesthetic results. The choice of your composite material is a critical component to this methodology. It is very important to stay with one or two brands as to understand implicitly the texture, hue and chroma and metameric effects of your composite material so that you can begin to restore teeth with accuracy and consistency. Only by investing good clinical time into your chosen brands and really practising and developing your techniques can this become an easy everyday treatment outcome (*Figure 23*).

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Figure 22

Figure 23



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