Restoring **Discoloured incisors** – a case report

Before (left) and after.

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This case study describes the treatment provided to a young patient with two badly discoloured upper incisor teeth.

Presenting complaint and expectations

Patient TM, a sixteen year old male patient, who was referred from an specialist endodontist for restorative management of his upper central incisor teeth (11 and 21) which had been subjected to major trauma when he accidentally slipped off a cliff at seven years of age.

The patient desired central incisors that were longer, symmetrical and of a uniform tooth colour. TM had limited financial resources.

Medical and dental history

TM had no significant medical issues and was not taking any medications.

Teeth 12 and 21 had been subjected to multiple past root canal treatment attempts with functional failure attributed to coronal leakage and recontamination and aesthetic failure associated with dark dental staining secondary to hemosiderin retention and bacterial mass ingress. Both central incisors had recently re-root filled by a specialist endodontist using Gutta Percha and Roths sealer.

Examination

A comprehensive examination was competed. Only the findings relevant to the management of teeth 11 and 21 are presented.

Periodontal probing depths around 11 and 12 were 3mm with an isolated 4mm pocket on the disto-buccal of tooth 21. Bleeding on probing was present at all six sites.

Teeth 11 and 21 were restored with composite restorations which were discoloured, uneven and aesthetically unacceptable which caused the patient anxiety. The composite restoration on the distal aspect of teeth 21 was undercontoured, leaving a sub-gingival shelf or under-hang and a deficient emergence profile. The root of tooth 21 had a subgingival perforation (and repair) in the mid-buccal region resulting in periodontal pocketing and gingival irregularity.

Figure 1

Figure 2

The clinical crown of tooth 21 was shorter of that of 11. Tooth 21 was also proclined compared to 11, (see image 1). The distal aspect of tooth 21 was where the "underhang" existed, and as such, there was a hard tissue deficiency present subgingivally affecting the emergence profile from distobuccal to distolingual aspects. Teeth 13 to 23 were not tender to percussion or palpation, and exhibited no significant clinical mobility. *(Figures 1, 2 - pre-operative views)*

Radiographic examination involved a single periapical radiograph of the region. Large obturation spaces were noted within the root canal space. No endodontic post was present.

Treatment plan

A range of treatment options were presented to TM (and his mother), and after discussion he elected to follow my recommendation of the placement of direct, layered complex composite veneer restorations on teeth 11 and 21. A gingivectomy in the distal aspect of tooth 21 was included in this plan. Composite bonding was selected as it would require removing a minimum of tooth structure, allowed reparability and was financially accessible to the patient.

Treatment

Colour mapping was performed. It is noted that any given time, colour assessment is a snapshot of the varying optical properties of the tooth in flux. This assessment is influenced by dehydration, time/aging, and is depending on 6 variables: value, hue, chroma, translucency, fluorescence and opalescence. Ahmad (2013) describes the colour match at any given time is more ephemeral rather than eternal.[1] The teeth were isolated using a split rubber dam technique. This case utilized the achromatic enamel technique according to Fahl (2010).[2] The following photographs provide detailed information on the delivery of the veneers. *(Figure 3)*

A diode laser gingivectomy (Ezelase 940nm, Biolase, 1.5W continuous) was completed to remove overgrown tissue on the distoaxial surface of tooth 21. The use of the laser facilitated simultaneous tissue removal and

Figure 3

Figure 4

Figure 5

Figure 6

hemostasis, producing ideal conditions for bonding. The subgingival perforation and repair can be visualised in this photograph, along with the translucent composite used by the dentist in the previous core. It was decided that complete removal of existing composite would result in possibly more damage to residual tooth structure so the preparation was stopped at this point. Caries detector dye (Caries Detector, Kuraray) was utilized at this point to visualize and remove residual bacterial mass, ensuring a hard, clean dentin base. *(Figure 4)*

Following dry #0 (Ultrapak, Ultradent) retraction cord placement via the continuous buccal sulcus packing technique, micro air abrasion was completed using micro air abrasion using 50 micron aluminum oxide for increased micromechanical retention. *(Figure 5)*

Etching with 33% orthophosphoric acid was completed, followed by application of a 4th generation, 3-step total etch adhesive system (Optibond FL, Kerr). The initial composite layer (approximately 0.3mm thick) was the lingual shelf, created using a Mylar matrix strip. This layer would have been more easily created using a putty matrix fabricated from a diagnostic wax-up, however the patient chose to omit this step due to financial limitations. This layer re-establishes the desired length and proportions of the tooth, and was fabricated from a milky-white translucent enamel shade (Voco Amaris TN -translucent neutral). *(Figure 6)*

The layer was intended to 'mask-out' the translucent background using opaque dentin shades. The material is positioned in a way to conceal the 'join-lines'. Failure to do this would lead to a less-attractive final outcome. The limitation in this case was the thickness and translucency of the existing residual core. *(Figure 7)*

Voco Amaris O3 (Opaque #3) was used in the distoaxial region in the deeper layers to visualize whether this shade was adequate to match the stump shade of the tooth. After curing, it was decided that a slightly lighter opaque shade (Opaque #2) would be utilized in the superficial layers to best match the target value of the tooth. This layer is also important because dentin creates the basic hue of the tooth and complements the fluorescence and chromatic interpretation of the final restoration.[3] *(Figure 8)*

The superficial dentin layer was sculpted and burnished cervically in the marginal areas to occlude the buccal subgingival perforation region. The incisal half was created from a second increment of Voco Amaris O2 and

Figure 7

Figure 8

burnished incisally. This layer is characterized by irregular fingers of dentin which will form the basis of the incisal effects seen in the final restoration. Lobe formation of the dentin layer is also built into this superficial dentinal layer before final curing. The next layer involves a highly-translucent shade used in the incisal fingerling and dentinal lobe areas as a space filler. The use of a clear translucent shade increases the light penetration, transmission, reflection and refraction of this area in the finished result. *(Figure 9)*

The shade is now assessed with the dehydrated shade of the adjacent teeth. It is an imperative that the colour map is followed as planned. The temptation to modify the colour map plan during treatment must be resisted as the lighter appearance of the teeth during restoration (due to treatment dehydration) may result in a less than optimal aesthetic result. *(Figure 10)*

Two balls of cured Voco Amaris composite placed on tooth 11 act as an intraoperative shade guide: the more incisally-placed ball is TN (translucent neutral), and the more cervical ball is TL (translucent light). TL applied by itself in a thick layer would increase the value of the tooth beyond our target shade, so it is important to always judge the thickness and morphology of your dentin layers from the incisal aspect.[1] In this case, a very thin layer of final enamel-shaded composite was all that was required to build the tooth emergence profile and line angles to full profile, and thus it was decided to use TL to slightly lift the value of the dentin layer. *(Figure 11)*

Following final curing, contacts were opened using light interdental separating force (The "Mopper Pop") and finished using moderate and fine abrasive metal strips (GC) as well as Epitex abrasive polymer strips (GC). Pencil

Figure 9

Figure 10

Figure 11

Figure 12

markings were placed on the labial surface guiding preservation of line angles and emergence profile. Primary and secondary anatomy finishing was completed using coarse abrasive discs (Soflex, 3M ESPE) and fine needle-shaped diamond grit burs (Mani Dia-Burs). Polishing was completed using the Double Diamond two-step (Clinician's Choice) System at 5000 rpm to high shine, followed by final buffing using an aluminum oxide paste (Enamelize, Cosmedent) on a felt disc (Flexibuff, Cosmedent). *(Figures 12-14)*

Material selection

There are a large number of composite systems available for the aesthetic restoration of anterior teeth. For patient TM, I elected to use Voco Amaris as I believe this system has excellent physical properties, an advanced shading system and a highly 'polishable' surface. The system allows the creation of a restoration with outstanding optical properties. This composite system also allows mathematical modifiability as core shade changes during the clinical stages which simplifies the clinical delivery of the restorations and optimizes the aesthetic outcomes (demonstrated during selection of O2 as a secondary opaque layer after O3 was judged to be too low in value).

Tooth preparation

The tooth reduction required in this case was minimal, perhaps 15-20% of the total tooth and existing restoration volume. It was decided to retain the existing core as there was no evidence of caries and because of the high risk of further reducing the amount of residual dentine. The preservation of residual intact dentine volume was key in the decision to leave the bulk of core structure intact. Note, that because the preparation was conservative in nature retaining a maximal amount of residual tooth structure there was no need for an endodontic post. The treating endodontist was in agreement with this decision.

Magne & Belser (2003) advocate bonded porcelain restorations in cases where greater than 60% of the original tooth volume has been lost.[4] This figure represents the critical threshold of minimal crown stiffness needed for long-term performance where increased loss will require a material with heightened physical properties. A composite material is more flexible than porcelain and when used to regain stiffness in a critically-weakened tooth renders it still highly susceptible to fracture.[4] Tooth 21 in this case exhibited less than 40% residual tooth structure, and would have been a good candidate for a bonded porcelain restoration, however, financial constraints precluded this. Aesthetic symmetry would have been most predictable by also placing a bonded porcelain restoration on tooth 11, but again was not possible in this case.

Figure 13

Figure 14

References

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