

“The kind of dentistry I do....”

Accreditation Case Type 2

(Two indirect porcelain units with natural teeth beside)

Ken Harris BDS, MFGDP(UK)

We often hear the lament that while complete smile makeover procedures are very much the headline procedure when it comes to cosmetic dentistry, it's not the kind of dentistry most dentists do, even those who do have a special interest in cosmetic dentistry. *Accreditation Case Type 2* which involves blending indirect restorations into the natural dentition, is probably the more common and certainly more challenging scenario faced by most. Dr Ken Harris describes his approach to just such a case – including the need to adapt his treatment plan as the clinical situation unfolded.

Treatment provided

- 22 Dentine-Bonded Porcelain Crown
- 12 Dentine-Bonded Porcelain Veneer

Introduction

The task of trying to mimic natural tooth tissue with an aesthetic synthetic alternative has always been difficult and becomes more so when fabricating indirect restorations. Working with a laboratory technician, who may never actually meet the patient in the flesh is a major challenge and

communication between the clinician and the laboratory is of utmost importance. The most popular method to determine shade is still the subjective eye of the clinician even though the clinician's interpretation of traditional shade tabs is notoriously unreliable; not forgetting that the effects of different light sources upon the perception of colour can also be significant. The skill of the clinician in imparting the information required to the lab technician is therefore a key factor.

Furthermore, the skill of the technician in carrying out the instructions provided by the clinician is equally important. There

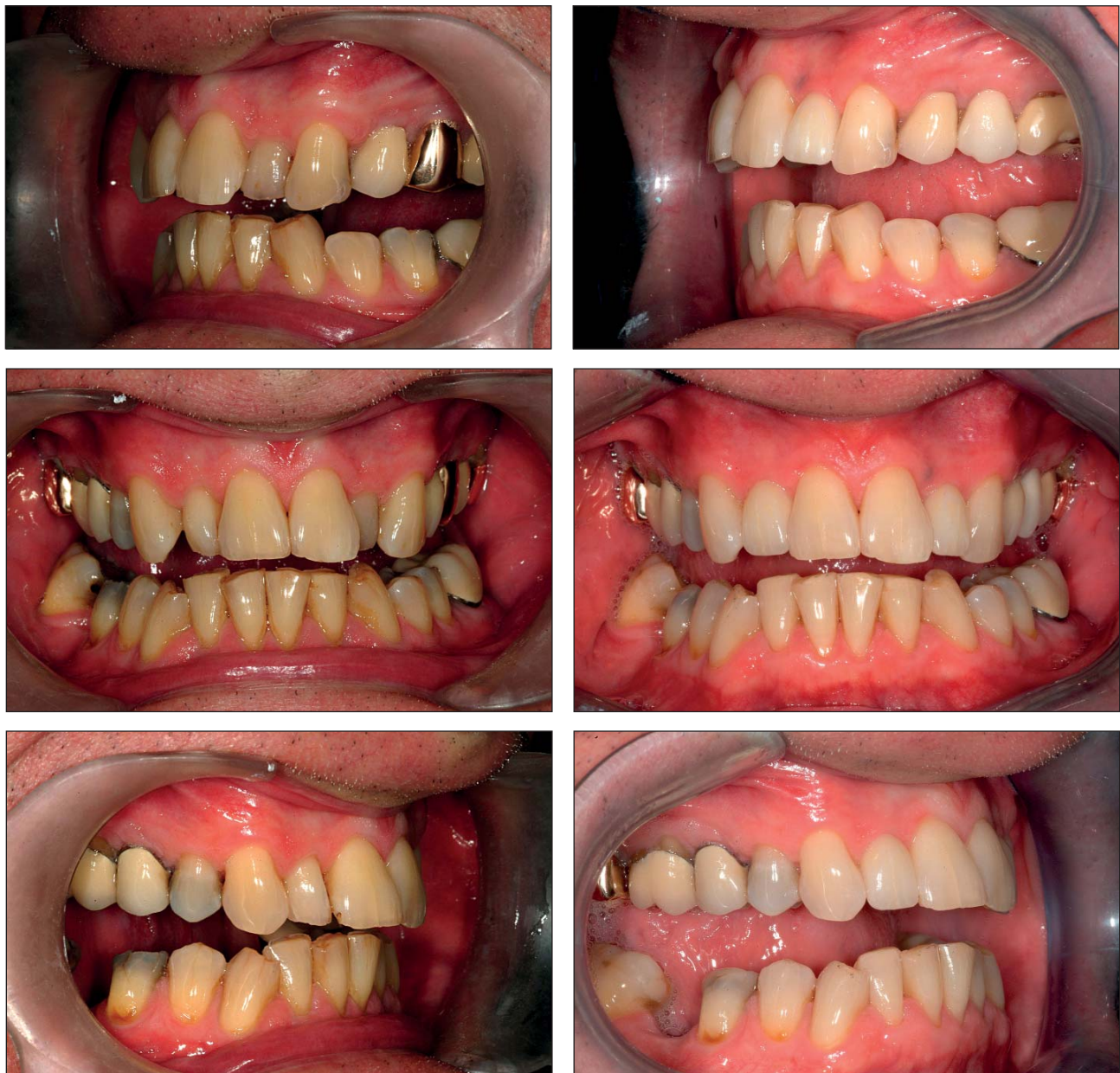
have been many attempts made to simplify this process from increasingly sophisticated lab tickets to actually attempting to draw in great detail, the maverick colours and characteristics of a particular tooth even to the use of sophisticated computerised colour scanners, yet the problem still persists.

It is all too easy for us as clinicians to blame the laboratory technician when there is a mismatch in colour, yet often the problem is due to a breakdown in communication. Ultimately it is the responsibility of the clinician to provide what is required because it is the clinician



Figure 1: a-b – text to be added

Figure 2: a-f – Retracted: Before (left) and after (right) images of the case



who has to actually fit the restoration and also deal with any embarrassing errors that may only manifest themselves for the first time at chairside. There are many ways to communicate with our labs, and it is not unusual these days, to use a combination of tools to get our message across. Obviously,

photography can be a key tool, especially when coupled with sophisticated image management software such as Photoshop. There are also more sophisticated shade tab systems, which are attempting to deal with the problem by dealing with hue, chroma and value as separate entities.

Chief complaint

A 62-year-old, recently retired gentleman in excellent health, and possessing significant dental awareness attended the practice to enquire about the possibility of cosmetic improvement to his teeth. Initially, he felt that a complete

smile makeover was what he required, but when he realised the financial implications he decided that perhaps compromise would be the way forward.

He left the practice promising to think things over and it was almost a year before he contacted us again. In the meantime, his regular dentist had replaced a gold crown upper left premolar with a porcelain crown but had not felt competent enough to deal with the challenges of more anteriorly placed porcelain work given the dramatic colouration of his natural teeth. For this reason, the patient had returned; believing we could deliver a successful outcome and match the shades.

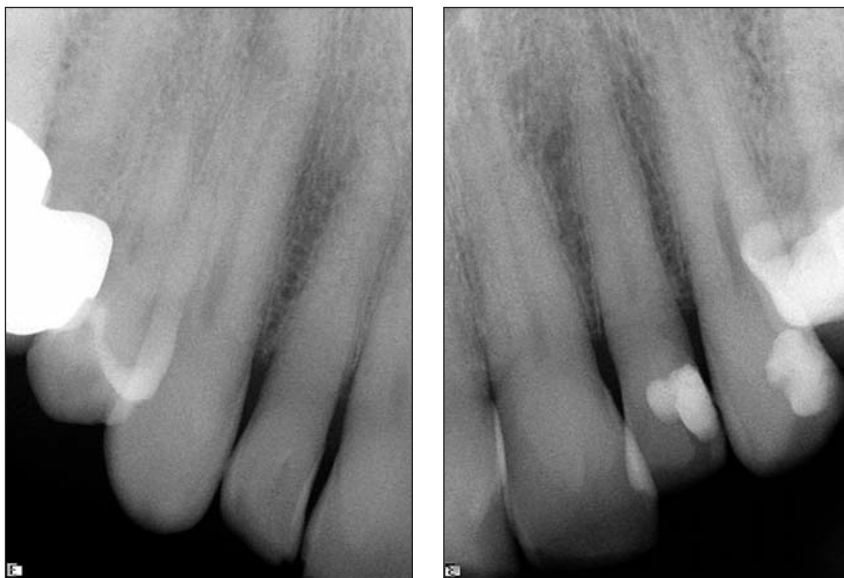
Examination

He was a regular patient at another practice and stated he intended to return there for his regular treatment, and so we addressed only his cosmetic interests.

A routine examination revealed nothing of note, and upon examining his occlusion felt we could work within his current occlusal pattern and decided upon a 'conformative' occlusal approach despite the posterior wear, as we were only working with two teeth.

The teeth themselves were vital despite large restorations in place, and radiographs revealed no areas of concern apically. Medically he was taking anti hypertensives, but nothing else.

Figure 3: a-b – Pre-operative radiographs, note condition of 22.



Discussion and treatment plan

It is relatively easy to shade match when providing porcelain work for an entire upper arch, which was what I expected the patient to request after his visit last year, however, he had actually decided his cosmetic goals could be achieved by working with just two teeth. The teeth in question were the in-standing upper lateral incisors, which he wanted bringing forward into the arch, and of course he wanted them to match his other teeth perfectly. His natural teeth, were exactly as we might expect for a gentleman in his 60s with chips, cracks and staining producing what might charitably be called a 'lived-in look'. I explained a great deal of laboratory communication would be necessary to satisfy his needs, especially given his heightened dental awareness, and he agreed to proceed with treatment.

We tested the idea of bringing the laterals forward by adding composite resin freehand to their labial surfaces and the resulting appearance was acceptable.

At this stage I suggested we could produce the result he required with direct composite resin, however, he felt a more long term solution was what he required and so we agreed to fit all ceramic porcelain restorations to both upper lateral incisors.

Armamentarium

- Fuji S2 pro Digital camera with macro capability
- Retractors and mirrors (Photomed Industries)
- Adobe Photoshop CS2 (Adobe)
- Schick CDR Digital radiography system (Schick Industries)
- Dental loupes x4.5 magnification (Zeiss; Nu-View)
- Dental headlight

- (Altair; High Q Dental)
- Surface anaesthetic gel (Optident)
- Local anaesthetic (Lignocaine 2% with adrenaline)
- Air rotor handpiece (Kavo 640 Lux; Kavo)
- Speed increasing handpiece 1:5; red band (Kavo)
- Contra angle handpiece 1:1; blue band (Kavo)
- Straight handpiece 1:1; blue band (Kavo)
- Electric Micromotor (Micromega)
- Sonicflex Sonic Scaler (Kavo)
- Rosenthal Group Veneer Preparation Kit (Brasseler Komet)
- 018 and 024 Round diamond burs (Brasseler Komet)
- Conventional hybrid composite resin (XRV Herculite; Kerr)
- Front surface reflecting dental mirror (Claudius Ash)
- Silicone impression material (Express; 3M)
- Silicone bite-registration material (Futar)
- Rimlok metal impression trays (Prestige Dental)
- Gingival retraction cord (Ultradent)
- Bis-acryl provisional crown material (Integrity; Dentsply)
- Unfilled resin (Biscover; Bisco)
- Vitapan 3D shade guide (Vita Zahnfabrik)
- Rubber dam (Hygienic non-latex; Coltene Whaledent)
- Rubber dam clamps (Hygienic; Coltene Whaledent)
- Rubber dam clamp pliers (Lustra; Claudius Ash)
- Rubber dam punch (Hygienic; Coltene Whaledent)
- HF Porcelain etching acid (Ultradent)
- Ultrasonic water bath
- Silane coupling agent (Monobond S; Ivoclar)
- Hairdryer
- Light-safe box (Ivoclar)
- Benda brushes (Centrix)
- Disposable plastic dappen dishes
- Ronvig sandblaster (Optident)
- Consepis scrub (Ultradent)
- 35% phosphoric acid etch gel (Ultradent)
- Desensitiser (Aquaseal; Aquamed)
- Optibond FL dentine adhesive system (Kerr)
- Optibond FL1 primer (Kerr)
- Optibond F2 adhesive (Kerr)
- Flowable composite resin (Filtek Flow; 3M)
- Appeal light cured resin cement (Ivoclar) Low value shade 2
- Halogen curing light (Optilux 501; Kerr)
- 11mm diameter curved curing light tip (Kerr)
- 2mm diameter curved curing light tip (Kerr)
- Optilux radiometer light meter (Kerr)
- Swan Morton scalpel (No 12)
- Soflex ET contouring and polishing discs (3M Espe)
- Ultrafine rotary diamond burs (Brasseler Komet)
- Aluminium oxide impregnated rubber polishers
- Flexipoints and flexicups, blue and pink: Cosmident)
- Diamond polishing cups for contra angle handpiece
- Serrated saw (Brasseler Komet)
- Diamond polishing strips (Visionflex; Brasseler Komet)
- Epitex finishing strips (GC Industries)
- Dental floss
- Accu film II articulating foil, black and red (Parkell)
- Miller's forceps
- Skimstock foil



Figure 4: a-b – Occlusional views: Before (left) and after (right) images of the case

Photography and shade-mapping

He returned for a shade mapping appointment where photographs were taken and shade comparisons noted. The light in my treatment room is from fluorescent tubes, which are not ideal for shade-matching and the process was therefore carried out in the waiting room, which has full length windows facing north, as a source of natural light, and with all the lights turned off. Optimum light quality to distinguish subtle colour differences is Cloud-Diffused North Noon Daylight because it provides a uniform spectral power distribution and a colour temperature of 5000 K.¹ Photographs of the anterior teeth were taken from directly in front but also from oblique angles and above and below, in an attempt to gather as much information as possible; a procedure known as 'Vectoring'.

Teeth were also photographed both wet and dry to show surface texture variations. Extra close-up photography was utilised in an attempt to see all the subtle details within the enamel of the adjacent teeth. Shade selection was narrowed down to a small selection of possible shades by using the Vita pan 3D shade matching system.

Final shade selection (Hue) was aided by using a selection of photographs, taken each with a different shade tab held next to the teeth for comparison. Using Photoshop, all the photographs were then 'improved' by adjusting the histogram to provide for full chromatic range, and sharpened to

Figure 5: a-c – After images



varying degrees to highlight individual nuances of detail. We were able to once again use Photoshop to take out the colour altogether, creating black and white photographs. Consulting a selection of black and white photographs of the teeth with differing shade tabs adjacent to the tooth in each picture is an ideal way to check the 'value' without the complications of hue to distract us.

Eventually, I was able to draw a detailed plan for the shade, including the cracks and surface texture required for the lab to make a realistic attempt at colour matching. All the photographs were then e-mailed to the lab and an appointment scheduled to talk to the technician before any work was begun. It is important that the lab actually see the digital photographs on their screen in the same way as you see them on yours so it is best to ensure that both screens have the same resolution and are calibrated to the same colour range.²

Laboratory discussion

Following discussions with the lab, we decided to use Authentic pressed porcelain (Jensen Industries) to fabricate the restorations as the lab felt they had more than enough space labially to achieve a good shade. However, the laboratory still felt further shade investigation was necessary before building the final restorations so they fabricated a few trial 'Tabs' of porcelain across a range of shades and sent them to the practice, and the patient then returned for shade comparisons with

these trial 'Tabs' to be made. A similar shade likeness was chosen from the 'Tabs' and a further range of colour corrected and black and white photographs with the selected 'Tab' in place were taken for the laboratory. The patient was then scheduled for his preparation appointment.

Tooth preparation

Both lateral incisors were in-standing and as the aim was to bring them forward into the arch we anticipated very little labial reduction would be necessary during our preparation, yet still be able to leave space for adequate thickness of porcelain for the technician to create a lifelike restoration. One tooth also had a significantly sized composite resin filling with the other way out of line we had to concede that perhaps simple veneers would not suffice. Both teeth were mocked-up with composite once again to bring them into the required position in the arch, and using depth cutters³ the labial surfaces were prepared. It turned out that only margin preparation was required labially and that almost all the labial enamel was left intact. Upon removal of the old composite restorations, however it was decided that the upper left lateral incisor would best be served by placing a full coverage crown. Equally, significant porcelain wrap-around was indicated for the upper right lateral incisor Veneer, so our ideal of minimal preparation was somewhat compromised.

The restoration margins were then refined with a Kavo sonic-flex

handpiece⁴ respectful of biologic width, and all sharp angles within the preps rounded off with sofex discs (3M). The exposed dentine was 'Hybridised' to seal the tubules, and following gingival retraction, major impressions and opposing arch impressions were taken with silicone (Express; 3M), as well as interocclusal record (Futar). Having already examined the patient's occlusion, it was not deemed necessary to use an articulator (other than the basic average value model) and so no face-bow recording was taken. Provisional restorations were fabricated and shaped freehand to an acceptable contour using multi-fluted carbide burs and sofex discs. Provisional restorations were fabricated freehand with reference to contact point placement⁵ and again, considering biologic width.⁶

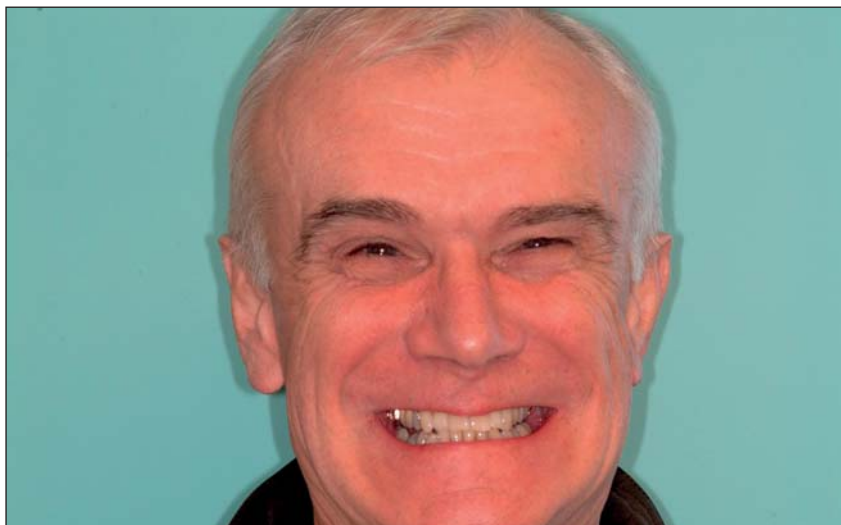
Stump shades

When using all ceramic restorations it is important for the lab to be aware of the underlying colour of the preparation stumps to deal with any modifying influence they may have upon the final shade, so the shade of the stumps were recorded and again extensively photographed before the Provisionals were fitted.

Review of provisionals

The patient attended two days later without the numb lip, for further refining of the shape of the provisionals, and then silicone impressions were taken of the final acceptable provisionals. Further

Figure 6: a-c – After images of the case



photographs were also taken and everything was sent to the lab.

Further detailed discussions took place with the lab, and it was decided that two different-shaded sets of restorations should be fabricated rather than just the one as we felt unsure which of two final shade designs would be best. The decision which set to use would be made at chairside.

Fit appointment

Three weeks later the patient attended for fitting. The porcelain restorations were first shown to the patient, and his approval was sought, and agreement was reached to fit the restorations before any LA was administered or any Provisionals removed.

Try-in paste

LA was then administered, the Provisionals were removed, and the preps gently sandblasted and cleaned with Chlorhexidine (Consepsis scrub; Ultradent), and the porcelain restorations were tried on to check fit. They were then both tried on with water in lieu of a transparent cement to see what effect the stump shades would have on the final shade. As is often the case in older patients who have reduced thickness of enamel, their natural teeth have a relatively lower 'value' than a younger person's teeth. So, perhaps as might be expected in this case, it was felt after try in with water that the value of the restorations would be too high if we used a transparent cement. So after experimenting with try-in

pastures of different shades, we were able to select a coloured try in paste which would help us achieve a good match. Once tried in with the correct try-in paste, the porcelain restorations were again shown to the patient, and his approval was sought, and agreement was reached to actually fit the restorations.

Porcelain treated

The fit surface of the porcelain was then etched at chairside with HF acid (ultradent), and then each placed in a separate test tube of distilled water and then into an ultrasonic bath for cleaning. They were then removed and dried with suction; can we trust our air supply to be oil free? Multiple coats of Silane coupling agent (Monobond-S; Ivoclar) were then applied and sequentially evaporated with warm air for 5 minutes using a hairdryer.

Adhesive and cement

Rubber dam (split dam technique) was then placed and the preps were cleaned again with Chlorhexidine, and using 35% phosphoric acid, the total-etch system⁸ was used and care was particularly taken to avoid over-etching.⁹ The etched preps were rinsed thoroughly and kept hydrated with an aqueous based desensitising agent (Aquaseal; Aquamed Industries). A 4th generation bonding system (Optibond FL; Kerr) was applied to the preps as directed by the manufacturer, with separate primer and adhesive components used. Light cured resin cement (Appeal; Ivoclar) with a 'Low value' shade (shade -2) was applied to the porcelain and to the preps and the restorations were fitted. The

restorations were spot cured using the 2.0 mm curing tip to tack them down, and excess resin cement removed before thorough, final curing with the wide diameter 11.0 mm light tip.

Clean-up

If the restorations fit correctly there is no need to use rotary instruments to refine the gingival margins, and a curved scalpel (Swann Morton no 12) was all that was needed to clear excess resin. Contact points were also cleared and the areas polished with diamond strips (Visonflex; Brassler Komet) and checked for smoothness with dental floss. Finally, occlusion was checked and found to be fine, so there was no need to adjust the porcelain, and consequently no need to polish the porcelain either. Photographs were taken and the patient was dismissed to return the following week for final review.

Review appointment

The patient rang to cancel his review appointment the day he was due to return for final checks and to offer feedback. He reported that he was delighted with the results and so were his family and friends. He felt his time would be wasted (he travels 120 mile round trip) if he attended as he was completely satisfied. Consequently we were unable check final results or take final radiographs or indeed any other photos. The patient thanked us profusely and confirmed he would be attending his regular practice for his long-term continuing care, so a report was sent to his dentist outlining which

treatment had been carried out, however, he did suggest he may consider further cosmetic work with us in the future if the need should arise.

Summary

Complete 'smile makeover' procedures, whereupon all the teeth visible within smile are treated is very much the headline procedure carried out within cosmetic dentistry today; if the media is to be believed. However, probably more common is the single tooth case. These cases require much greater skill to achieve harmony and integration within the smile when considering the shape and colour of the natural (often more variable) neighbouring teeth. The challenge is greater when attempting to match to older teeth, and as the population retains their teeth for much longer than the previous generation did, it is often not possible to select an 'off the shelf' colour from a traditional shade guide for these types of patient. In such cases, communication between clinical and laboratory colleagues must be nothing short of excellent. Thankfully there are newer technologies arriving all the time, which will hopefully aid in this difficult process.

Acknowledgement

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