

# The aesthetic dentist and the worn dentition

## Accreditation Case Type 1

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### Introduction

The patient was a 35-year-old male who has been a regular attender at the practice for almost 15 years. He had previously undergone tooth bleaching, and had had veneers fitted to the lower right canine and lateral incisor teeth some five or six years previously in order to align them for cosmetic reasons.

Apart from the two veneers, the patient has a restoration free mouth, with all 32 teeth present. Both courses of treatment had been instigated at the patient's request, rather than the dentist having suggested the options to him proactively. It may be fair to say that many healthy patients, such as this man, may well become subject to rather cursory examination processes by their regular dentist with any treatment other than caries or gum disease being ignored, unless the patient raises the subject.

Much traditional dental care has been provided in response to an acute problem, and with little follow-

up care or long-term planning. This approach has left many patients with deteriorating issues both functional and aesthetic which the complacent dental practitioner eventually has to address. Many dentists are acutely aware of the reputation the profession has for over-treatment and are perhaps reluctant to proactively offer the treatment of which they feel the patient has no understanding.

This case report outlines such a situation whereby a well motivated patient who attended every six months, actually brought to the attention of the dentist the fact that his front teeth appeared to be getting shorter. This was due to an ongoing occlusal issue, which the practitioner had failed to address, preferring to watch and wait. The patient sought help for cosmetic reasons rather than functional reasons but the result was still the same.

### Main complaint

The patient suggested his upper front teeth were 'disappearing' from

his smile in recent years and wished them to be lengthened in order for them to be displayed when he smiled, as in the past. He was happy with the colour of his teeth, having undergone bleaching in the past, and the two veneers placed on the lower right canine and lateral incisor had survived well for over five years, prompting him to suggest veneers would be the ideal treatment to restore the length of his worn upper incisors.

### Examination

As a patient of record, the practice had all the historical notes and radiographs to allow for a thorough examination. The medical history was unremarkable, and due to his regular attendance with the hygienist, the patient's periodontal health was ideal. His intra-oral tissues generally appeared disease-free, but there was significant, gingival recession, perhaps, 2mm. beyond the cement-enamel junction and although the gingival tissue appeared pink, firm and stippled, there were characteristic 'V' shaped notches mid-labially, which exposed



Figure 1: a-b – Full face. : Before (left) and after (right) images of the case

significant areas of the root surface. The patient suggested that he had always wanted, very white teeth and throughout his life had been a very aggressive brusher, and that this was probably the cause. This gum damage was visible generally, but specifically on the upper jaw from canine to canine; however, the central incisors still measured 11.5mm (just beyond the classical 11mm) from incisal edge to the gingival crest. As the average length for a healthy upper central incisor is 10-11mm, why was the patient concerned about short teeth if they had already measured almost 11mm long?

In order to establish why the patient's teeth appeared short it was necessary to check the position of the incisal edge, as it appeared in his smile. A selection of photographs was taken with his lips in repose, in a normal smile position and with the most extreme smile he could muster. The results of the photographs suggested his upper incisors were perhaps 2.5mm short when viewed in his smile rather than the bald statistic of measuring the length of the teeth, and this was followed with a direct mock-up of the proposed new incisal edge position using composite resin there and then at the chairside.

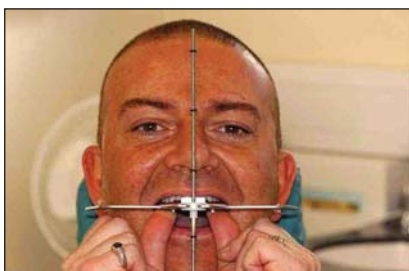


Figure 2: Kois Dentofacial Analyser

### Composite resin mock-up

The issue of just how long to make his central incisors was addressed by way of a free-hand composite resin mock-up. The resin was added to the surface of the upper six anterior teeth and sculpted into shape before curing in order to give the patient some idea of what could be achieved and to help establish the exact position for the incisal edge in relation to his smile. This method is preferred to computer imaging as it gives a better indication of what is possible and allows a more realistic assessment of what is actually possible in the mouth.

As the photographs suggested that 2.5mm of extra length would be the correct addition this was carried out, which then created central incisors 14mm long; more than 3mm longer than the classical length for a central incisor. However, the patient liked the results so much that he requested we place porcelain veneers to lengthen his teeth in this way as soon as possible. His success with his previous veneers further fuelled his enthusiasm.

### Gingival considerations

His significant gingival recession, however, suggested that the



Figure 3: Composite Mock-up

cosmetic result could benefit by a connective tissue graft. He had significant root exposure as previously described, and so lengthening the teeth with porcelain, as proposed, would make them appear far too long cosmetically, especially as his upper lip measured the conventional 24mm revealing his upper gingival margins when he smiled. Connective tissue grafting was discussed and he decided to consider the option seriously.

### Occlusal considerations

Although the patient was very pleased with the composite mock-up, when he closed his teeth together the extra composite resin applied to lengthen his upper incisors immediately fractured off. It was therefore immediately apparent to the patient that his problem could not be solved by arbitrarily placing porcelain veneers at the length he desired and that further issues concerning his occlusion would have to be addressed before the cosmetic issues could be dealt with. His upper anteriors were significantly worn and while there was also some wear on the lower incisors, this was negligible on any teeth distal to the canines. The cause of this wear pattern indicated the need for a detailed occlusal examination, which was conducted following the teachings of Dr John Kois.

The patient gave no history of trauma to his jaw, nor had he ever experienced a locking jaw joint. He reported no problem chewing, either hard or chewy foods and he was quite able to chew gum for hours at

Figure 4: Kois Deprogrammer &amp; first contact



a time without discomfort. He was unaware of any grinding habits (confirmed by his partner), and he slept well generally. However, he did point out that that his teeth were wearing down at the front, and that the situation was deteriorating over the years.

Extra-orally his mandible seemed slightly forward, and his masseter muscles a little too well defined, however, muscle palpation revealed nothing of note. There were no jaw sounds on opening and closing nor any mandibular deviation and he could comfortably accommodate three fingers when fully opened. Load testing produced no responses in the TMJ, so the joints were diagnosed as healthy. All 32 teeth were present and aligned evenly with the buccal segments following a classical Class 1 arrangement.

Basic bi-manual manipulation suggested a premature contact in the premolar region on the right side with an anterior slide into maximum intercuspation.

The provisional diagnosis was of occlusal dysfunction, possibly brought on by the premolar contact and a more thorough occlusal investigation following a period of deprogramming was indicated. Occlusal equilibration was

Figure 5: Equilibration complete, Upper



suggested as a probable necessity prior to definitive restorative treatment.

## Treatment planning

A comprehensive treatment plan, including occlusal therapy followed by placement of porcelain restorations with connective tissue grafting as the final phase was proposed. Following the intra-oral mock-up, it was agreed that the patient would like six upper anterior units restored with porcelain. He was happy with the wear on his lower incisors, and it was agreed that it would not be necessary to treat them if he underwent his occlusal therapy as the first stage of treatment. It was also agreed that the upper anterior gum recession would need attention after the placement of the porcelain veneers with the graft being taken from his palate.

Most importantly, the patient appreciated that underlying the entire process was the need to establish a stable and functional occlusal pattern, and this would need to be completed before any definitive porcelain work could be fitted or gingival surgery carried out.

The patient attended to review the treatment plan and ask final

Figure 6: Equilibration complete, Lower



questions, sign paperwork and consent forms and agree an appointment schedule. As already stated, there were no intra-coronal restorations present in any of his 32 teeth, so no pre-restorative treatment was deemed necessary

## Tooth whitening

The patient's teeth had been bleached over many years using a 10% carbamide peroxide gel (Opalescence, Ultradent) in a bleaching tray, hence the colour of his lower teeth was deemed to be acceptable as a reference for the colour of his new upper porcelain veneers

## Occlusal equilibration

Upper and lower impressions were taken and the lab instructed to fabricate a Kois Occlusal deprogrammer for the patient, which is a modified removable Hawley orthodontic appliance with a small, level platform of acrylic resin added just behind the upper incisors in the position of the incisive foramen to act like a Lucia jig.<sup>1</sup>

The patient was instructed to wear it at least 20 hours a day; removing it only for meals. After one week of home wear he was reviewed, deemed to be deprogrammed and a diagnosis of occlusal dysfunction caused by posterior tooth contact

interference was noted in the right side first premolar area.

It was therefore decided that further treatment would be scheduled to equilibrate the occlusion to allow the condyles to achieve Centric Relation (CR), again utilising the Kois de-programmer to aid in the process as well as both red and black articulation foil (Accufilm, Parkell) and shimstock foil.

#### Trial equilibration

An initial trial equilibration was carried out on study models which had been mounted using the centric relation record obtained with the aid of the de-programmer which showed that equilibration was indeed a viable option for this patient. The process was initially carried out on the mounted study models, and was then repeated upon the patient.

#### Live equilibration

Once stable centric holding contacts (without disturbing CR) were created

using the red and black articulation foil, it was necessary to adjust the functional part of his occlusion and give consideration to his guidance pattern. The protocol outlined by Kois involves asking the patient to open and close their teeth together on to thick (200 micron) blue, horseshoe shaped articulating paper (Bausch), which is designed to indicate the areas where the envelope of function is constricted.

The process is completed when the patient can move their jaw from open to closed into maximum intercuspation without any interfering tooth contacts taking place within the envelope of function, which would produce deviation on the way to full closure. The process can be confirmed as compliant with Dawson's principles by using the classical red streak approach for canine guidance and posterior disclusion if the practitioner prefers the Dawson approach to anterior guidance.

Upon review one week later, just slight adjustment was needed for equilibration to be deemed a success.

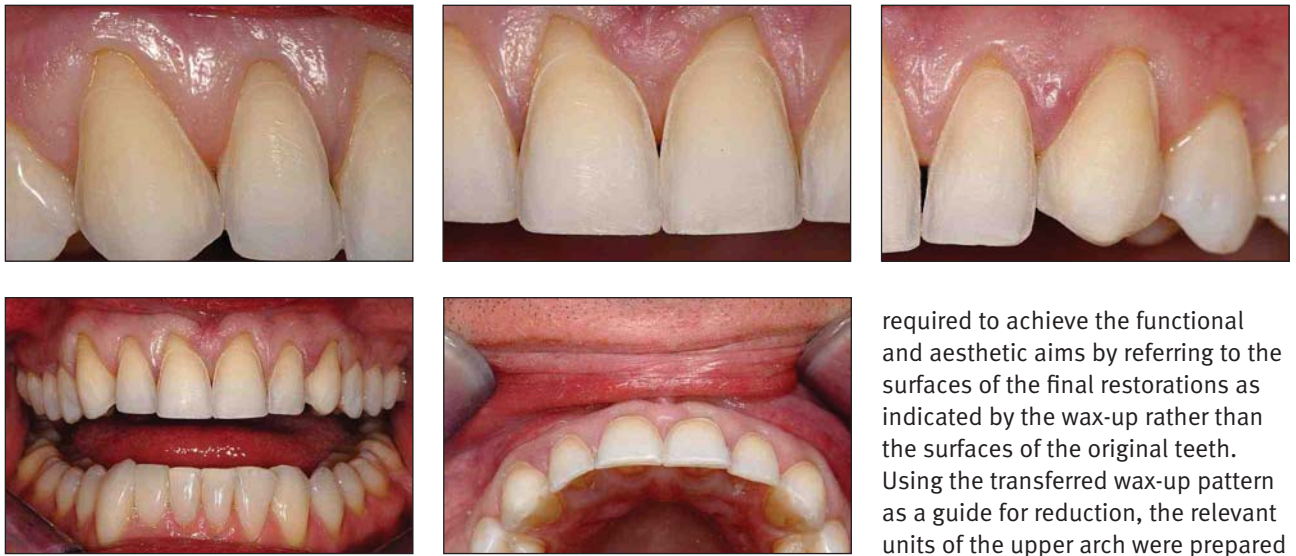
#### Laboratory instruction

Records were taken of the six upper units for the lab to create a functional wax-up with reference to the Golden Proportion with the study models mounted in CR. The lab was informed that equilibration had taken place, and that they should mount the equilibrated study models in maximum intercuspation. Upper and lower silicone impressions and a face bow record were taken using a Kois dentofacial analyser face bow (Optident, Bradford). The aesthetic occlusal plane is also recorded with this piece of equipment, as long as a full face photograph is included. The photos of the original composite mock-up were consulted and a smile design agreed with the patient, and the lab informed of the desired outcome. All the photos



Figure 7: a-f – Anterior: Before (above) and after (below) images of the case

Figure 8: a-e – Images of preps



were sent to the lab and detailed communication was also carried out by email.

It was agreed that minimal labial preparation would be required for the veneers, and because the teeth were to be lengthened by 2.5mm, there would be no need for incisal reduction. The wax-up was shown to the patient for approval, and to answer any further questions, before the definitive work began.

### Definitive clinical procedure

Following equilibration, the plan was at the next session to prepare the six upper anterior teeth for indirect porcelain veneers and place provisional restorations.

Although significant gingival recession was evident, it was decided to finish the cervical margin of the veneers still on the enamel for better bonding, and not take the gingival shoulder preparation margin

on to the root surface. This allowed the definitive bond of the ceramic onto enamel rather than on to the cementum of the root surface. Equally, this prevented the creation of an over long porcelain restoration (14mm) and the plan was to eventually cover the root surfaces with a connective tissue graft anyway.

With this approach there were no issues with biologic width infringement to contend with, and happily, there were no gingival embrasures, so alleviating the need to seriously consider 'black triangle' formation<sup>2</sup> before the definitive preparation appointment was scheduled.

### Major preparation

The functional wax-up shape was transferred on to the patient's teeth with provisional resin material (Integrity, Dentsply) using a stent of the wax-up before any actual tooth preparation was started. The aim was to remove only the actual tooth tissue

required to achieve the functional and aesthetic aims by referring to the surfaces of the final restorations as indicated by the wax-up rather than the surfaces of the original teeth. Using the transferred wax-up pattern as a guide for reduction, the relevant units of the upper arch were prepared with the minimal tooth reduction technique as described by Magne<sup>3</sup> using depth cutting burs.

Conventional 3-plane labial surface reduction was completed and refined and once again the stent was used to transfer the wax-up to the prepared teeth to confirm adequate tooth reduction had been achieved by checking for show-through. With the help of x4.5 magnification loupes, gingival margins were refined with a Kavo sonic-flex hand piece, and all sharp angles within the preps rounded off with soflex discs (3M). The small amount of exposed dentine in the cervical region was hybridised to seal the tubules, and silicone impressions were then taken. A CR interocclusal record of the prepped teeth and a separate stick bite registration were recorded along with prep stump shades, and lots more photographs.

Working provisionals were then fabricated in self-curing, bis-acryl composite acrylic resin (Integrity, Dentsply) once again using the wax-

up stent, and fitted carefully to prevent full bonding to the recently hybridised dentine surfaces of the preps. The provisional margins were then finely polished to facilitate gingival health during the porcelain construction phase, and occlusal adjustment of the provisionals carried out.

### Provisionals assessed

Three days later the patient returned for a detailed review of the provisionals without the numb lip! Occlusion, speech and aesthetics were again checked and refined before the provisionals were finally accepted. Silicone impressions and incisal edge position records were then taken of the acceptable provisionals to help the lab fabricate the definitive restorations. The length of the provisional central incisors was measured (14mm) and photos taken. The final shade was agreed with the patient and everything was sent overnight delivery to the lab in the USA.

### Fit appointment

The porcelain restorations were shown to the patient, and agreement was reached to fit the restorations before any local anaesthetic was administered or any provisionals removed. The preps were gently sandblasted (prepstart) and then cleaned with chlorhexidine (Consepsis scrub, Ultradent). Each restoration was then tried in individually, and then all were tried in together; initially dry to check fit, and then with water to test that the final shade was acceptable to the patient. Try-in pastes were available but not required. Once again the patient's approval was obtained before the definitive fit stage

The fit surface of the veneers were then etched at chairside with HF acid (Ultradent), and then placed in an ultrasonic bath for cleaning. They were then dried with suction as the air supply has to be oil free. Multiple coats of Silane coupling agent (3M) were then applied and sequentially evaporated with warm air for 5 minutes using a warm air dryer. Meanwhile at the chairside, utilising a team of two nurses, rubber dam (split dam technique) was placed and the preps were cleaned again with chlorhexidine, and using 35% phosphoric acid, the total etch system was used to allow all six units to be fitted at the same time.

The preps were etched in groups of three so as to avoid over-etching, and kept hydrated with desensitiser (Aquaseal, Aquamed Industries). A 4th generation bonding system (Optibond FL, Kerr) was applied as directed by the manufacturer, with separate primer and adhesive components used.

Light cured resin cement (Vitique, DMG) in transparent shade was applied to the veneers and to the preps and the veneers were seated. The veneers were spot cured using the 2.0mm diameter curing tip to initially tack them down, and the excess resin cement removed before thorough, final curing with the wide diameter light tip.

If veneers 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 away. Resin in the

contact point areas was also removed and the areas polished with diamond strips (Visonflex; Brassler Komet) and checked for smoothness with dental floss. Finally, occlusal adjustment was addressed and basic porcelain polishing carried out. The patient was then dismissed to return later for further review.

### Review appointments

The patient returned seven days later for final occlusal checks and aesthetic refinement at a more relaxed pace and without the numb lip. Final radiographs were taken to confirm no excess resin cement was left subgingivally and the adjusted porcelain occlusal surfaces were fully polished with graded silicone points (Ceramiste Kit, Shofu) and diamond paste (Luminescence, Premier). The aim was to reduce wear on opposing teeth and also remove any surface marks and crazes which can act as a focus for crack propagation and future porcelain breakage. Equally important, it is also smoother to the patient's tongue. Photos were then taken, and the patient instructed in the future care of the restorations.

### Gingival surgery

The patient expressed himself to be so delighted with the results that he decided he did not wish to undergo the connective tissue graft procedure, which was part of the initial treatment plan. He felt that to undergo surgery for what he considered to be little improvement was a daunting prospect and so declined. However, he did say that if the issue became a problem he would consider the procedure for the

Figure 9: a-f – Smile: Before (above) and after (below) images of the case



future. He pointed out that the photographs showed no cosmetic issues except when his lips were pulled back with the retractors.

### Long-term maintenance

As a long-term patient of the practice, he will return regularly for hygienist therapy as he has done for the past 15 years and the occlusal position will be checked on a 12 monthly basis with adjustment as necessary. The patient was advised about extreme eating habits in order to protect the incisal edges of his new porcelain although in this case the patient was not offered a hard acrylic splint as he had no signs of bruxism, and had been successfully equilibrated earlier.

It would have been a more complete treatment with the connective tissue graft to improve the gingival appearance but the patient was happy with the result without the surgery.<sup>4</sup> The resultant smile does not fully comply with classical smile design principles, and some

practitioners may feel that the veneers should have finished at the crest of the gingival tissue, but it was preferred to have all the margins finishing on enamel where possible rather than on the dentine and cementum of exposed root surfaces.

The new occlusal design has been trouble-free for two years now, but an annual occlusion review appointment is scheduled in order to specifically monitor any future occlusal changes. Currently, the appearance of the lower incisors is acceptable to the patient despite there being previous wear issues, and it is hoped that following the occlusal therapy he has undergone, this wear situation will not develop further. However, as already stated, the occlusal review protocol will allow diagnosis of any changes as soon as they happen.

### Summary

This patient had been a regular return at the practice for many years,

but the slow process of incisal wear over this period had not been noticed and it was left to the patient to point out the issues.

However, proactively suggested equilibration prophylactically as treatment before the patient perceived his problem on a cosmetic level, may have met with some resistance. Overall, the functional issues have been present for a long time and only recently did they finally manifest themselves in a cosmetic issue for the patient which led to him seeking treatment.

What seemed an initially easy treatment plan of lengthening his upper incisors by 3mm was in fact more complex due to the occlusal issues present. The importance of preoperative assessment of both aesthetics and occlusal function, followed by any preparatory treatment these assessments may flag up cannot be over emphasised in a case such as this.

The initial mock-up was carried out at the chairside and helped raise the patient's enthusiasm and expectation levels so that he hoped everything could be completed within a few weeks. However, once the full treatment plan was explained and he understood the complexities he readily accepted a long-term view which took over three months to complete, rather than opting for a quick fix.

## Armamentarium

- Nikon D200 Digital camera with macro capability.
- Retractors and Mirrors (Photomed Industries)
- Schick CDR Digital radiography system (Schick Industries)
- Dental loupes x4.5 magnification (Zeiss; Nu-View)
- Dental Headlight (Altair; High Q dental)
- Electrosurgery Unit (Ellman)
- Kois dentofacial analyser Slidematic Facebow (Panadent; USA)
- Panadent Semi-adjustable Articulator (Panadent; USA)
- John Kois Occlusal de-programmer. (Frontier Dental Lab)
- Silicone Bite-registration Material (Futar)
- 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)
- Front-surface reflecting dental mirror (Claudius Ash)
- Silicone Impression Material (Express; 3M)
- Rimlok Metal Impression Trays (Prestige Dental)
- Bis-acryl Provisional Crown Material (Integrity; Dentsply)
- Unfilled Resin (Biscover; Bisco)
- 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. (3M)
- Warm air dryer (Adec; Oregon, USA)
- Light-safe Box (Ivoclar)
- Benda Brushes (Centrix)
- Disposable Plastic Dappens Dishes
- Prepstart Sandblaster
- Consepsis Scrub (Ultradent)
- 35% phosphoric acid etch gel (Ultradent)
- Desensitiser. (Aquaseal; Aquamed)
- Optibond FL Dentine adhesive system (Kerr)
  - Optibond FL1 primer (Kerr)
  - Optibond FL2 adhesive (Kerr)
- Flowable Composite Resin (Filtek Flow; 3M)
- Vitique Light Cured Resin Cement (DMG; Hamburg)
  - Transparent Shade
- Halogen Curing light (Optilux 501; Kerr)
  - 11 mm diameter curved curing light tip (Kerr)
  - 2 mm 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)
- Silicone Porcelain Polishing Kit (Ceramide; Shofu)
- Aluminium Oxide Impregnated rubber polishers (Flexipoints and Flexicups, Blue and Pink; Cosmudent)
- Diamond Polishing Paste (Luminescence; Premier)
- Rubber polishing cups for contra angle handpiece.
- Serrated Saw (Brasseler Komet)
- Diamond polishing strips (Visonflex; Brasseler Komet)
- Epitex finishing strips (GC Industries)
- Dental floss
- Accu film II articulating foil, black and Red (Parkell)
- Miller's forceps
- Shimstock foil
- 200 micron Horseshoe Articulating Paper (Bausch)



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