

# Treating tooth wear: a step-by-step explanation

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## Case report

The patient in this case, aged 39, presented with discoloured teeth that were showing signs of wearing down. He was concerned about the long-term implication of not correcting the problems. He was also interested in improving the appearance of his smile. The photographs in Figure 1 show the preoperative condition.

## Baseline clinical records

The patient completed a detailed questionnaire. We then performed a comprehensive initial assessment that included the following diagnostic records:

- A dental panoramic radiograph and full mouth series of periapical radiographs
- Full series of digital photographs
- Upper and lower silicone impressions (using Honigum by DMG) (Figure 2)
- Centric relation (CR) record (using Luxabite and also O-Bite; after the muscles were deprogrammed using a custom-made NTI appliance)
- Facebow record (Denar system)
- Stick bite record (using O-Bite)
- Diagnostic mock-up in the mouth (using Luxaflow)
- A silicone impression of the mock-up
- Extraoral assessment (muscles and temporomandibular joint [TMJ])
- Joint vibration analysis (JVA) to assess the TMJ
- T-Scan (computerised occlusion assessment)
- Full intraoral assessment, including tooth by tooth review, occlusion review, periodontal assessment (including six-point pocket charting)
- Smile analysis.

**Table 1**

	UR1	UR2
Width (mm)	8	8
Height (mm)	7	8

**Table 2**

UR4	UR3	UR2	UR1	UL1	UL2	UL3	UL4
8.11mm	9.45mm	9.77mm	10.95mm	11.39mm	9.69mm	10.53mm	9.44mm

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Figure 1: Preoperative photographs



The following information is a summary of the clinical findings at assessment.

### Extraoral

There was some tenderness around the sternocleidomastoid and masseter muscles on the left side (score of two out of 10 regarding discomfort on palpation).

There was also slight retrodiscal pain on the left side of the TMJ (score of four out of 10). It was difficult to get the patient to go into CR (by the bilateral manipulation technique).

The maximum opening (inter-incisal measurement) was 47mm, and the maximum right and left movement of mandible was about 9mm. The overjet was 3.5mm, and the overbite was 1.5mm.

In the right lateral excursion, there were contacts on the palatal surfaces of UR2 and UR3 as well as a non-working side contact on UL7 (mesiopalatal cusp).

In the left lateral excursion, there were contacts on the UL3 and UL4 as well as a non-working side contact on UR7 (mesiopalatal cusp).

The patient can be considered as a 'destroyer' (wear evident on incisors, canines and first premolars), as opposed to an 'avoider' (whereby a patient has posterior occlusal interferences and causes wear on only the anterior teeth).

There was evidence of abfraction on UR4, UR5, UL3, UL4, LL3, LL4, LR5; this indicates heavy occlusal forces. There were also some teeth with broken fillings and decay. There were minimum periodontal problems (pockets 2-3mm, mostly with good oral hygiene). Good root fillings were present within UR4 and UL6, and LL5 had an apical area (ie, root canal treatment was required).

### Cosmetic assessment

The patient had the following concerns:

- Different coloured crowns
- Teeth thinning down
- Wanted whiter teeth
- Unhappy with lower teeth (tiny, uneven sizes, poor colour)
- LL5 darker, possibly mobile.

He had never tried whitening in the past and had never had any orthodontic work. Teeth were not sensitive. The lips were classed as having a normal fullness on the upper one and a fuller lower lip and not being symmetrical on smiling fully. The patient also showed 10 upper teeth on smiling fully. Improved fullness was required for UR3, UR4, UR5, UL3, UL4, and UL5.

The amount of upper incisor showing at rest was -1mm. Because the patient was aged 39, it was decided to



Figure 2: Preoperative silicone impression

increase the incisal edge length of the central incisors by about 2.5-3mm. The lower incisors being worn down also needed to be increased by about 1.75mm.

The CEJ to CEJ measurement was 10mm and the distance of the upper vestibule to the upper incisal edge was 22mm. Table 1 indicates the dimensions of the upper central incisors.

On saying 'F' and 'V' sounds, the edges of the upper central incisors fell onto the vermillion border of the lower lip. On saying the 'E' sound, less than half of the upper incisor was showing.

On saying the 'J' sound, a few millimetres of space were evident between the mesiobuccal cusp of the first molar and the opposing tooth

(this is an important observation – space in the molar region [eg, 2-3mm+] on saying 'J' indicates to the clinician that the vertical dimension can be opened up successfully).

The midline was mid facial and slightly canted to the left side. The labial inclination of the incisor teeth was 90° to the respective occlusal plane. The preoperative shade of the teeth (using the Vita 3D Master shade guide) was 5M1 (upper

incisors) and 5M2 (upper canines). The patient desired a shade of 1M1.

### Analysis of function, and occlusion and treatment planning

To obtain an accurate pre-tooth contact CR record, it is important to first deprogramme the facial muscles by wearing a night-time custom made deprogramming device (eg, NTL appliance). This will relax the muscles and allow easy manipulation of the mandible. The CR record was then recorded using a 'composite ball technique', and Luxabite and O-Bite materials.

Upon analysis of the articulated study casts and the clinical photographs, it was decided that a reorganised approach would be the most satisfactory way of treating this case (ie, the need to alter the vertical the case using CR rather than centric occlusion [CO]). This was indicated because we needed to lengthen the upper teeth by 2.5mm for aesthetic reasons (ie, -1mm showed at rest before treatment and the aim was to show 1.5mm in the final restored case).

The lower anterior teeth also had signs of moderate wear, and many teeth had older, failing restorations. Therefore, the patient would benefit by having almost the entire mouth treated. The lower left first premolar required root canal treatment.

### Aims and sequence of treatment

- Periodontal treatment (with the hygienist)
- Diagnostic records and a mock-up (use of Luxaflow to simulate the incisal edges of the front four teeth, ensure

Figure 3: Mock-ups



Anterior, retracted



Anterior



Face



At rest



Left-hand side, retracted



Right-hand side, retracted



UR1 measurement



Figure 4: Wax-ups and prep guides



Prep guide, lower



Prep index, upper



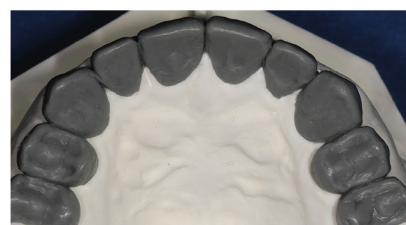
Lower wax-ups, occlusal



Lower wax-ups



Upper wax-ups, anterior



Upper wax-ups

the dental centre line is correct and add material to get the correct amount of buccal fullness for the premolar teeth (Figure 3)

- Creation of laboratory made diagnostic wax-ups for treating 19 teeth (upper 10 anterior teeth, and lower nine anterior teeth) simultaneously
- Use of a hard tissue laser to improve gingival outlines (ie, soft tissue recontouring and removal of bone to create the correct biologic width). Teeth treated in this manner were the front upper and lower incisors. Approximately three weeks' time was allowed for healing to occur
- Preparation of 19 teeth, treatment records and the creation of the upper and lower anterior trial smiles with Luxatemp (shade B1)
- Review of temporary restorations for aesthetic, occlusal and phonetic reasons. A second review appointment was required to ensure modifications made to the temporaries regarding the aesthetics were acceptable

- Fitting of 19 restorations
- Review of fitted restorations, occlusal equilibration, final polishing and finishing. New silicone records and bite registration for wax-ups of posterior teeth
- Preparation, review and fitting of posterior restorations (seven molars and the lower left second premolar that required root canal treatment and a post/core)
- Review of posterior restorations and occlusal equilibration/finishing. New impressions, facebow and CR bite for fabrication of a hard acrylic lower splint for night-time wear. Final photographs were also taken
- Hygiene appointment after the restorative treatment
- Annual dental examinations and four monthly hygiene maintenance visits recommended thereafter.

### Preparation of the teeth

During stage one, the 19 teeth were prepared using conventional techniques for porcelain restorations. Old



Figures 5A and 5B: Preparations

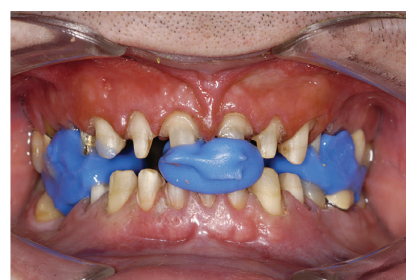


Figure 6: CR bite (Luxabite)

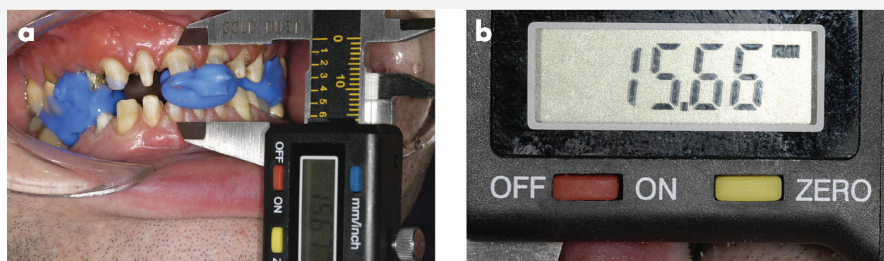


Figure 7A and 7B: CEJ to CEJ measurement

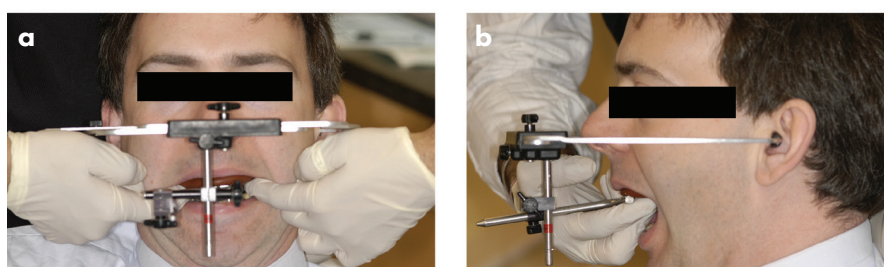


Figure 8A and 8B: Facebow (anterior and lateral)



Figure 9: Stick bite



Figure 10: Stump shade

fillings and any decay were removed. The teeth were restored, if necessary, using Luxacore as a composite core material.

The amount of tooth preparation was controlled using depth cuts and putty indices made from the diagnostic wax-ups (Figure 4).

A speed increasing handpiece was used to ensure smooth preparations and well-defined margins cervically (Figure 5).

The molar control bites (at the correct CR position) and the preoperative O-Bite sectional bites were used to verify the bite position and therefore appropriate interocclusal clearance.

### Records at the preparation visit

- Upper and lower Honigum master impressions (using rigid trays and a two-stage technique)
- CR records at the correct vertical dimension (verified by the CEJ-CEJ measurement) using Luxabite and O-Bite (Figures 6 and 7)

- Facebow record (Denar) (Figure 8)
- Stick bite (O-Bite and a Benda brush placed horizontally parallel to the interpupillary line) and a photograph (Figure 9). Note the patient is standing with a horizontal reference plane (ie, the door behind the patient's head). The following records were taken after the teeth were prepared:
- Preparation shade (shade of prepared teeth using Ivoclar's shade guide) recorded with digital photographs (Figure 10). Temporary restorations (the trial smile) were then made using Luxatemp (shade B1) (Figure 11).

NB: Preop CEJ-CEJ (UR1 and LR1) = 15.3mm (with lower control bite in situ). This was coincident with the wax-ups. Final bites in CR on the day of the preparation showed the CEJ-CEJ measurement to be 15.66mm.

### Impression technique

My preferred impression technique, which works very predictably, is as follows.



Figure 11: Temporaries

- After tray selection (rigid trays are ideal, eg Heatwave from Optident), Honigum adhesive is applied to the trays. The dental nurse will get ready two cartridges of Honigum Light material (regular set), one of the large tips will have the small, curved tip attached at the end for syringing around the teeth preparations.

- The dental nurse will begin by mixing a scoop each of the Honigum Rigid base and catalyst, and place this in the tray. A piece of clingfilm is placed on top. The dentist then seats this in the mouth fully and waits till it sets.

- A Coltene putty knife is used to cut excess material away (eg, posteriorly in the palate area), or to remove undercuts. OO Ultrapak retraction cords (from Ultradent, Optident) dipped in Racestryptine solution can then be placed around the crown margins, leaving the cords there for four to five minutes.

- After removal of the cords, the teeth are dried and Honigum wash material is syringed around the margins, the prepared teeth and onto the occlusal surfaces of the other posterior teeth. In the meantime, the nurse will have introduced the Honigum wash from the second delivery gun into the putty. The tray is then seated fully and left in the mouth for about five and a half minutes.

I have found this technique to give superior, predictable margins. I also take digital 3D scans and a bite scan using the 3shape Trios scanner. I occasionally use Expasyl (Kerr) and the soft tissue diode laser (Biolase Epic) for retraction

techniques to achieve an accurate impression. Figure 14 shows the quality of the trimmed master models.

### Creating the trial smile

The requirements to create well-fitting temporary restorations are:

- Accurate, articulated, aesthetic and functional wax-ups
- Relined rigid putty and wash impressions of wax-ups (laboratory made using Honigum putty and Honigum light body material)
- Acid etch
- Gluma desensitiser (Kulzer)
- Optibond FL2 (partially filled bonding resin. Note: Luxaflow can also be used for this step.
- Luxatemp Fluorescence (B1 or other colour)
- Luxaflow (B1 or matched colour)
- Luxaglaze
- Light-curing machine
- Articulating paper
- Burs.

The steps involved using the above are:

- Isolate and dry the teeth
- Spot etch the centre of each prepared tooth with the acid gel for 10 seconds. Wash and dry lightly
- Apply a thin layer of Gluma desensitiser for about 15 seconds. Gently dry with moisture free air
- Apply a thin layer of Optibond FL2 and gently blow air.



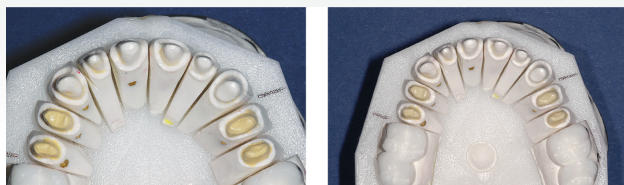


Figure 12: Laboratory models of anterior preps

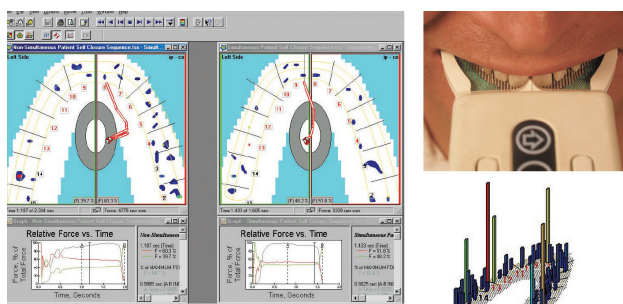


Figure 13: T-Scan

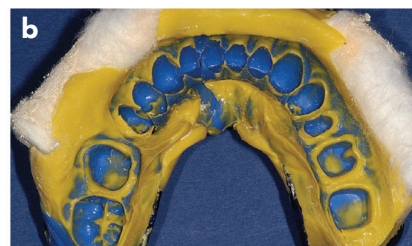
- Light-cure each tooth for 10 seconds
- Load the putty index with Luxatemp
- Place accurately in the mouth and hold in place for 2.5 minutes (from the start of mixing)
- Remove the putty index
- Remove excess Luxatemp material cervically (both buccally and palatally) using a Mitchell's trimmer, a sickle scaler and fine diamond burs
- Add Luxaflow to any voids (such as small air blows) and to any areas that require changes (eg, making teeth longer, making embrasures smaller etc)
- Check and adjust the occlusion
- Smooth the temporaries with fine grades of Sof-Lex



Figure 14: Occlusion check



Figure 15 a - e: Posterior preps, impressions and master model



discs (3M)

- Apply a thin layer of Luxaglaze with the supplied brush for 30 seconds and light-cure each tooth for 20-30 seconds
- Apply some Vaseline on the patient's lips; let them have a rinse and wow them with their new smile by letting them have a first look in a large mirror.

### The review appointment

A review appointment is normally carried out a few days later. On this visit, it is important to review the appearance and to get the patient's feedback. Minor aesthetic changes can be carried out by adding Luxaflow or making teeth shorter using Sof-Lex discs.

The occlusion is again verified, and the speech is evaluated. The following records were taken:

- Honigum impressions or digital scans of the approved temporaries
- Occlusal verification (T-Scan and articulating paper)
- An interocclusal O-Bite record (temporaries to temporaries in CR)
- Full series of digital photographs
- An accurate shade record (or alternatively can be done by the ceramist at the laboratory)
- Accurate heights of the front six anterior teeth (up to 0.01 mm accuracy using a digital calliper)
- A laboratory prescription of additional comments, changes etc.

The patient also signed a form to give consent to the shade selected at this stage. Approved heights of the temporaries (after two review appointments) were as per Table 2.

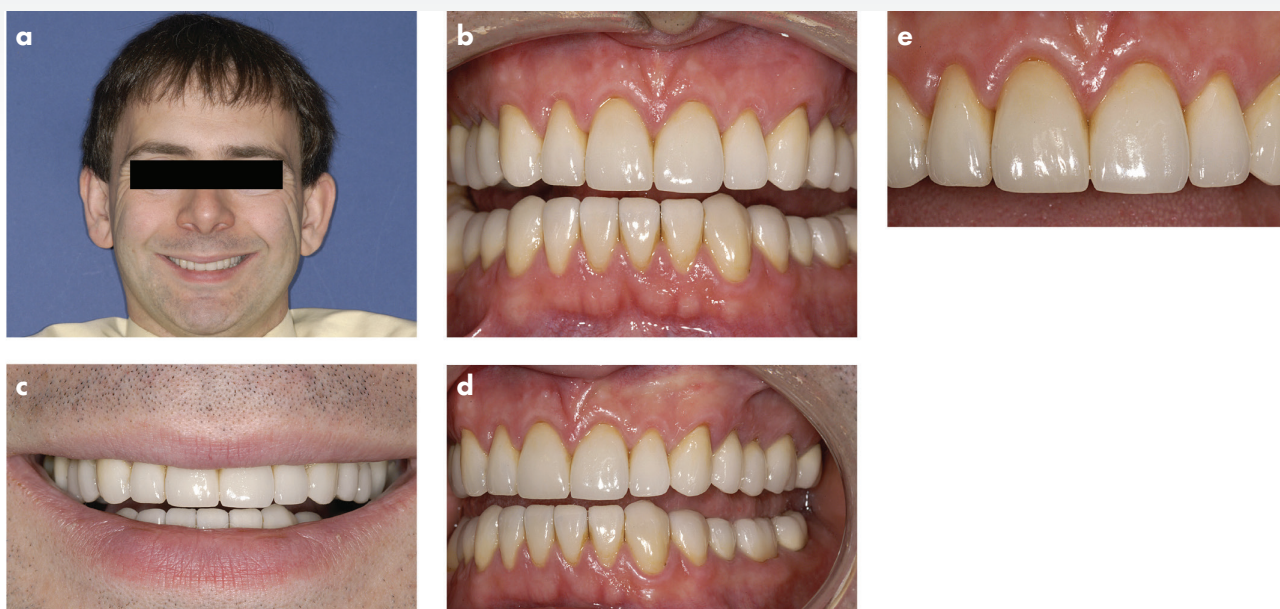


Figure 16: Final full face shot, anterior retracted, full smile, lateral view, close up

Changes to 'approved temps' (ie, comments to the ceramist technician) were:

- Make UR1 vertical, slanting mesially
- Make UL5 longer
- Remove some buccal fullness UL4
- Make UR3 slightly shorter (and less bulky looking)
- Make UR2 look wider (and more symmetrical to UL2) to make upper incisors look more balanced
- LR3 seems bulkier at the incisal edge
- UR3 looks too straight labially (buccal contour needed).

### Fitting of the porcelain restorations

The laboratory constructed Emax (Ivoclar) all ceramic restorations. The trial smiles were carefully removed, and the teeth were cleaned with pumice and Hibiscrub. The restorations were tried for assessment of fit and aesthetics.

Teeth were isolated with rubber dam, and the upper 10 restorations were fitted with Vitique base and catalyst (low viscosity) transparent shade. This was repeated for the lower nine restorations under rubber dam isolation.

The restoration margins were finished and all the excess deposits of cement were removed and the teeth checked interproximally with floss.

The occlusion was checked to ensure multiple, even contacts in maximum intercuspation; canine guidance; and multiple, even contacts anteriorly in protrusive guidance. Note that there would have been spaces interocclusally in

the molar areas at this time.

After the anterior restorations were fitted, CEJ-CEJ was measured at 15.66mm, identical to the preparation day, indicating a great result by the dental technician.

### Review appointment and equilibration

A review appointment a few days later gave the opportunity to review the newly fitted porcelain restorations.

The occlusion was further equilibrated using T-Scan, which is computerised occlusion evaluation software (Figure 13). This equipment – in conjunction with certain fine quality articulating papers (Bausch) (Figure 14) – is the most sophisticated and accurate way of making occlusal changes. First, 100-micron blue articulating paper (with transculase bonding agent) is used, followed by eight-micron red foil (ink being an additional five microns).

There will be a blue halo, with a red 'bullseye' – this is the precise spot to adjust. Any adjusted areas were polished with porcelain polishing burs (Shofu friction grip burs). Diamond polishing paste was used to create the final lustre. New silicone impressions, and an interocclusal bite registration was taken to create laboratory made wax-ups for the posterior teeth.

### The posterior teeth

It is now relatively straightforward to treat the posterior teeth (eight teeth) in CR. The old, faulty restorations and



decay were removed as before. Treatment records were taken for the construction of laboratory made all porcelain restorations. Figure 15 shows the posterior preparations, impression and master model. These were then fitted with Vitique base and catalyst (low viscosity) A2.5 shade (for a more natural end result). New Honigum impressions, CR bite registration record using Luxabite and a Denar facebow record were taken to create a lab-made, lower, hard acrylic appliance for night-time wear.

## Final review appointment

The final review appointment was to check all the restorations, interproximal areas, further occlusal refinements using T-Scan and articulating papers.

The final postoperative digital photographs were taken, as well as the hard acrylic appliance fitted (equilibrated so that there were multiple, even contacts in maximum intercuspation; canine guidance; multiple, balanced contacts on the incisors in protrusive guidance; and no non-working side contacts in excursions).

We then issued the patient with a referral pack and a card with the before and after pictures of the smile. This is an important moment in the patient's life and the entire team celebrates the patient's new smile! The final postoperative photographs were also taken (Figure 16).

## Summary

Our goal was to create a beautiful and healthy smile. This occurs when there is excellence in assessment, diagnosis, treatment planning and actually doing the dentistry.

I am indebted to Mr Rob Storrar of Amdecc Dental Laboratory in Basildon, Essex who skilfully and artistically created these beautiful ceramic restorations, and to the patient in this case who was excellent throughout all the treatment stages.

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