Alignment of anterior teeth before minimally invasive veneers to treat microdontic laterals

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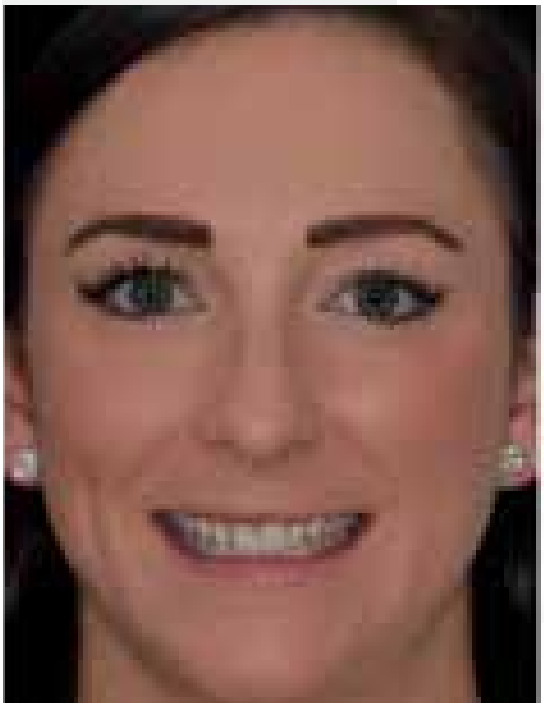

Figure 1: Full face - pre-operative.

Case Report

The patient was a 30-year-old female in good health who presented to the practice requesting smile enhancement.

It was decided to improve the alignment of her teeth with cosmetically-focused fixed upper and lower orthodontics followed by feldspathic veneers on her upper lateral teeth. Orthodontic planning of the final position of her lateral teeth allowed for a truly minimally invasive approach.

Presenting complaint

Her main complaints were that of uneven upper and lower teeth with gaps present. After full discussion and time spent looking at pictures of her smile, she decided that it was the imbrication of her teeth that she did not like the appearance of, in addition to being displeased by her smaller and spaced upper lateral teeth.

Diagnosis

A full clinical examination was completed, including all normal periodontal examinations and radiographs. There was nothing abnormal to report. Oral hygiene was considered poor at initial consult and hygiene therapy was recommended. There were no concerning social factors.

The upper left central tooth (UL1) had a small fracture of the mesioincisal edge. She was Angle class 1 on the left and class 3 in the right (Angle, 1899). She had microdontic upper lateral teeth. Her lower anterior teeth had minor crowding and her upper teeth had

Figure 2: Frontal smile view.

Figure 3: Right lateral smile view

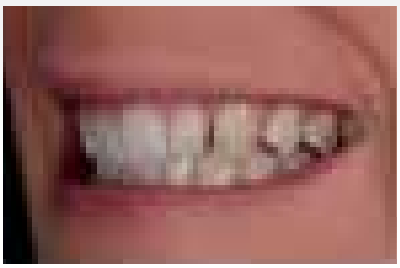

Figure 4: Left lateral smile view

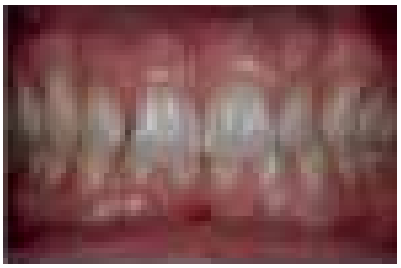

Figure 5: Frontal retracted view, teeth in occlusion

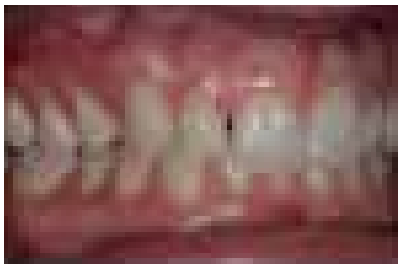

Figure 6: Right lateral retracted

Figure 7: Left lateral retracted

Figure 8: Right lateral retracted view, teeth slightly parted

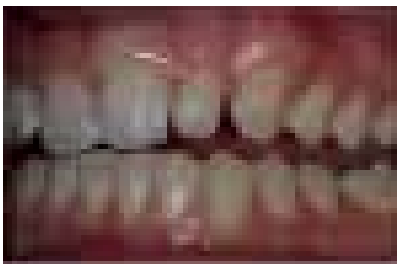

Figure 9: Left lateral retracted view, teeth slightly parted

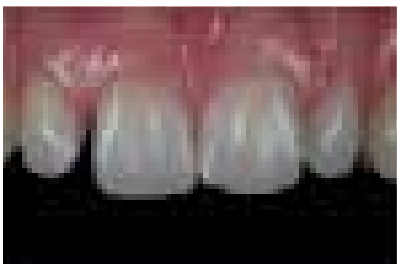

Figure 10: Anterior close-up view 1:1.5

minor rotations and protrusive/retrusive positioning from the ideal arch shape.

Treatment planning

Aims of the treatment were to improve the alignment of the anterior upper and lower teeth and address the microdontic lateral teeth. In addition, options for the small fractured edge of UL1 were considered.

The options for the alignment were:

1. Referral to a specialist orthodontist for comprehensive orthodontic therapy to correct the posterior malalignment and return the patient to a class 1 position with normalised overjet and overbite
2. Accept the position of the posterior teeth and align only the teeth in the aesthetic zone
   a) Fixed labial
   b) Fixed lingual
   c) Removable clear aligners.

The options to address the microdontic lateral teeth and the fractured UL1:

1. Composite bonding
2. Ceramic veneer.

Figure 11: Right lateral close-up view 1:1.5

Figure 12: Left lateral close-up view 1:1.5

Figure 13: Upper occlusal view

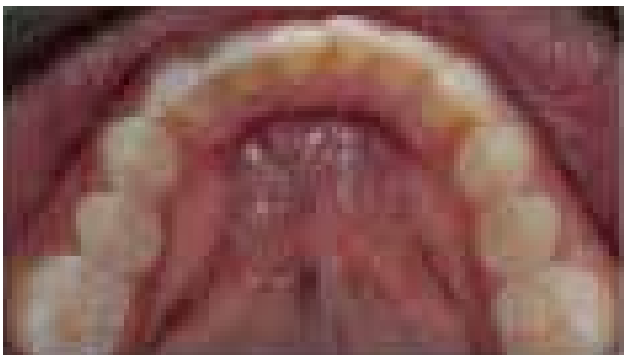

Figure 14: Lower occlusal view

Treatment planning considerations

In all treatment planning, the treatment choice is dependent on the diagnosis and there is often a hierarchy of treatment options that 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 (Joiner, 2006). With that in mind, it was decided to complete 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.

On 31 October 2012, the EU Council Directive (2011) came into force in the UK. 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% hydrogen peroxide present or released from other compounds or mixtures in these products is safe for use when prescribed by a registered dental professional.

The patient completed a three-week course of home tooth whitening using 16% carbamide peroxide.

When she returned, composite material was placed on her lateral teeth and shaped. The patient was then allowed time to assess the changes to her smile before deciding how to proceed with her treatment planning.

The patient decided that she indeed still wanted to continue with alignment of her upper and lower teeth.

After considering all the options, longevity of materials, treatment costs (now and in the future), advantages, disadvantages, risks and alternatives; she decided upon alignment of her upper teeth with fixed orthodontics, alignment of her lower teeth with removable clear aligners, followed by ceramic veneers on her upper lateral teeth and a composite repair to her fractured incisal edge UL1.

Radiographs

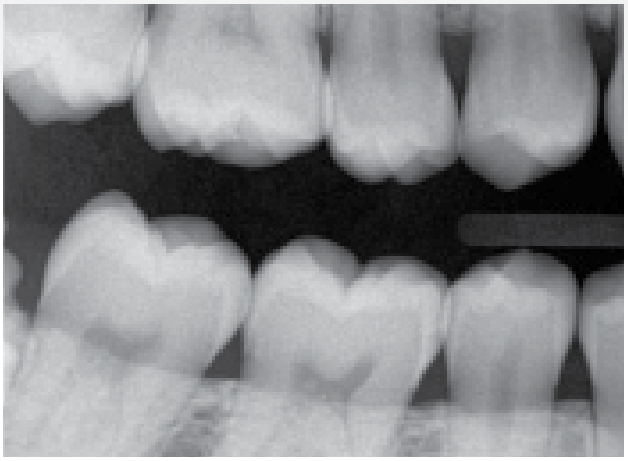

Figure 15: Right intraoral bitewing radiograph

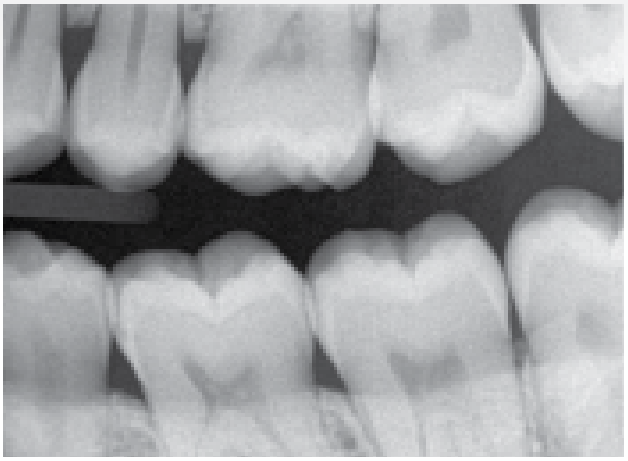

Figure 16: Left intraoral bitewing radiograph

Figure 17: Upper right central intraoral periapical radiograph

Figure 18: Upper left central intraoral periapical radiograph

Figure 19: Lower central intraoral periapical radiograph

Treatment process

Fixed labial brackets were placed on the patient's upper teeth and a 0.014 nickel titanium wire was secured with elastics. The movement of the teeth was monitored and after only eight weeks they had been positioned correctly with symmetrical spacing around the lateral teeth.

By blocking the bracket slot on the lateral teeth and jumping the orthodontic wire over the bracket, I was also able to retrocline the upper lateral teeth as far as the occlusion would allow. This placed them in a more retrusive position to provide more space facially for the planned final ceramics.

An alignment company fabricated four lower transparent sequential positioners to properly align the lower anterior teeth. Interproximal reduction was completed to the requested specifications with interproximal finishing strips, using wooden wedges to protect the gingiva (Rossouw and Tortorella, 2003).

Fluoride varnish was then applied. Each aligner was worn for two weeks, meaning a treatment period of eight weeks for both the upper and lower teeth.

After tooth alignment (Figures 20 and 21), an indirect fixed-wire retainer was constructed and cemented to the lingual surface of the lower anterior teeth using flowable composite and normal etch and bond protocol. A temporary removable upper retainer was made to retain the upper teeth.

At this stage, we reassessed the patient's expectations

Preparation

Figure 20: Eight-week tooth alignment frontal view

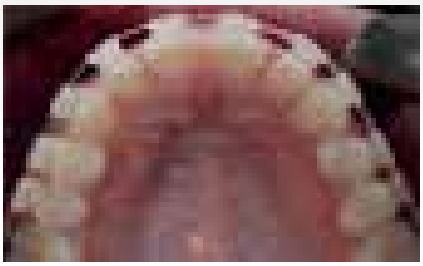

Figure 21: Eight-week tooth alignment occlusal view

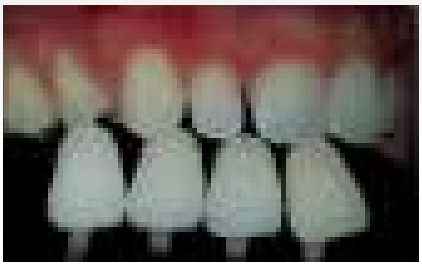

Figure 22: Cross-polarised shade photo

Figure 23: Wax-up

Figure 24: Gürel technique reduction grooves

Figure 25: Preparation upper left lateral tooth

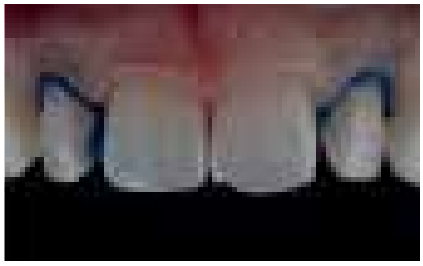

Figure 26: Retraction cord pre-impression

Figure 27: Veneers on model

Figure 28: Isolation for sandblasting

Figure 29: Isolation for acid etching

Figure 30: Dry-try of veneer upper right lateral tooth

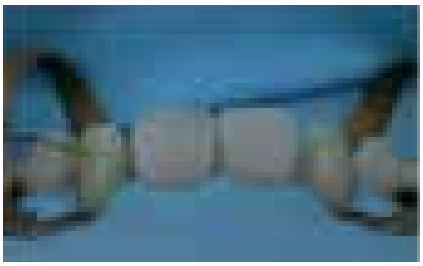

Figure 31: Adhesive protocol

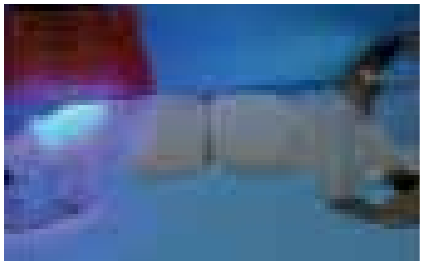

Figure 32: Light activation of cement

Figure 33: Finishing of margins with scalpel

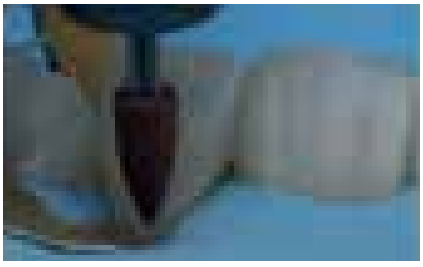

Figure 34: Finishing of margins with brownie point

Figure 35: Finishing of interproximal areas with finishing strip

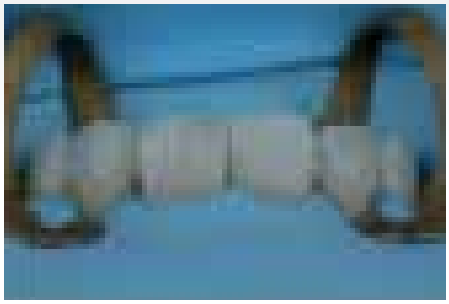

Figure 36: Margins visualised before rubber dam removal

and she still felt that further improvements were needed. All options were again discussed.

We were of the opinion that to achieve an excellent aesthetic and tailor the colour-blend to the natural tooth, a direct composite approach should be used, or alternatively we could continue as planned using an in-direct ceramic veneer on her upper lateral teeth.

We discussed the differences in these materials, the increased maintenance of the composite restorations versus the increase preparation for the ceramic veneers, and the patient confirmed that she still wanted to proceed with the ceramic option.

Before the day of treatment, a wax-up for the planned final shape of the upper lateral teeth was completed in office using an additive technique (Figure 23). Custom silicone stents and guides were made to help direct the preparation following a minimally invasive protocol. Shade-matching photos were taken at the very beginning of the appointment as tooth dehydration will quickly change the appearance of a tooth and affect the colour-match detrimentally. Photography with cross-polarised filters while using custom composite shade tabs and a Vita shade guide helps with the shade determination and communication with the ceramist (Figure 22).

The Gürel (2003) reduction technique was used to ensure that only necessary tooth removal was completed to allow for the adequate thickness of veneer ceramic. Acrylic was placed over the lateral teeth using a stent taken from the wax-up. A depth-gauged diamond bur was used to remove 0.5mm of the facial-surface of the planned veneer position.

Pencil was used to mark the depths of these grooves before the acrylic was removed (Figure 24). Reduction only to the pencil marks was completed, ensuring the entire preparation was contained within enamel (Figure 25). The double retraction cord technique was used and an impression taken (Figure 26).

To maximise the beauty of the underlying colour of the natural tooth and create a new enamel skin to simply reshape the facial of these lateral teeth, it was decided to use a feldspathic ceramic for its excellent colour properties and external texture that the ceramist can place (Figure 27).

On the day of cementation, the temporary veneers were removed and the feldspathic veneers checked. The ceramic work was exceptional and a perfect fit.

The teeth were first isolated with an inverted rubber dam to prevent sulcular fluid contamination and the teeth individually clamped to retract the dam and expose the restorative margins.

The neighbouring teeth were protected by placement of a metal matrix strip and then sandblasted to remove any biofilm to increase micromechanical retention, followed by a short total etch of only 10 seconds (Figures 28 and 29).

The veneers were again tried-in to ensure that the rubber dam and the clamp placement did not interfere with the passive seating of these delicate feldspathic veneers (Figure 30).

After try-in, the veneers were conditioned with a 9.6% hydrofluoric acid etch for 60 seconds as per the material preparation guidelines followed by a cleaning product to remove any salts and phosphate molecule contamination. The fitting surface was then silanated and pre-loaded with a light-cure resin-cement (Variolink Esthetic, Ivoclar Vivadent).

The restorations were left in a covered restoration tray until ready for use.

An adhesive bonding system (Adhese Universal, Ivolcar Vivadent) was then applied to the teeth. The mild self-etching adhesive creates a more stable and durable bonding interface, as there is only partial demineralisation of any exposed dentine and consequent bonding to the hydroxyapatite crystal that remains (Walter et al, 2011) (Figure 31). The restorations were then individually placed and agitated into position and lightcured for one second. The quick-cure allows easy clean-up of the margins before being fully cured under an oxygen inhibiting gel (Figure 32).

This gentle technique allows very easy clean-up and is much kinder to the gums as you don't get the cement stuck in-between the teeth etc. The margins were refined with a scalpel before being polished with a brownie and greenie before and after rubber dam removal (Figures 33 and 34). Composite interproximal finishing strips were used to clean the margins at the mesial and distal (Figure 35).

Due to the excellent soft tissue retraction of the rubber dam, the margins were easily visible and were able to be assessed with magnification to ensure a smooth transition from ceramic to tooth (Figure 36).

A fixed-wire retainer was then placed on the palatal surfaces of the upper teeth using flowable composite and normal etch and bond protocol.

After rubber dam removal, all occlusal and excursive movement were recreated and the restorations assessed for any interferences.

Figure 37: Full face

Discussion

Both the patient and clinician were very satisfied with the final result. The crowding has been eliminated and th indirect feldspathic veneers on both lateral teeth blend seamlessly with the natural teeth and are almost undetectable.

Regular review and six-monthly top-up tooth whitening will ensure the colour-blend and lustre of these teeth is maintained.

On such a young patient a minimally invasive approach is always followed where possible and we ensure that full consent is gained with absolute understanding of the proposed treatment options.

By following a protocol of aligning first and then home tooth whitening, we can sometimes reach the patient expectations without further intervention. This is the best scenario as we have achieved the patient desired goals without having to touch a tooth with a drill.

When the patient desires further intervention, it is advantageous to be able to show them the step-by-step photographic process of each of the type of treatments, be it composite veneers or minimal preparation ceramic veneers. Taking the time to properly document and catalogue these cases can be very consuming, but ultimately is a fantastic tool to help educate the better understanding of our patients.

One can feel very confident that patients can fully understand the treatment they are having and there are no surprises along the way by approaching the planning of every case in this manner.

During treatment planning, it is important to manage patients' cosmetic expectations. By doing this sooner than later, it can save the patient from more costs 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 that can achieve drastic smile transformations with very little risk to the health of the patient's teeth.

When combining this treatment with tooth whitening and composite bonding or minimally invasive ceramic techniques, one can achieve incredibly beautiful and natural smile aesthetics.

Figure 38: Frontal smile view

Figure 39: Right lateral smile view

Figure 40: Left lateral smile view

Figure 41: Frontal retracted view, teeth in occlusion

Figure 42: Right lateral retracted view

Figure 43: Left lateral retracted view

Figure 44: Frontal retracted view, teeth slightly parted

Figure 45: Right lateral retracted view

Figure 46: Left lateral retracted view

Figure 47: Anterior close-up view 1:1.5

Figure 48: Right lateral close-up view 1:1.5

Figure 49: Left lateral close-up view 1:1.5

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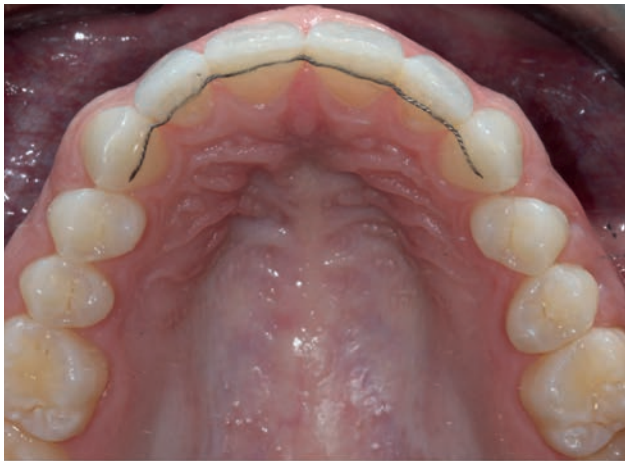

Figure 50: Upper Occlusal view

Figure 51: Lower Occlusal view