Stratified layering of composite restorations after the use of orthodontic aligners

Linda Greenwall and Robert Katz present a multidisciplinary approach to a minimally invasive smile makeover

There is a trend towards minimally-invasive aesthetic dentistry and ensuring that no healthy enamel is cut in the preparation of an enhanced smile. This case illustrates the use of orthodontic aligners, whitening treatment in the aligners, and composite bonding using a stratified layering technique and the placement of glass ionomer restorations on the cervical enamel areas.

The use of aligners in orthodontics

The use of removable aligners has increased greatly over the last 18 years. In 1999, Align Technology addressed the demand for an aesthetic alternative to braces by developing an ‘invisible’ method of orthodontic treatment (Invisalign) that uses a series of computer-generated, clear, removable aligners to move the dentition (Kunicio et al, 2007).

Since then over 4 million Invisalign cases have been undertaken worldwide, according to Align Technology.

Dr Linda Greenwall is a specialist in aesthetic and restorative dentistry and principal of the award-winning Heath Dental Care in the heart of London’s Hampstead. An international authority on tooth whitening, she is the founder and current chair of the British Dental Bleaching Society, and the driving force behind the international charity, the Dental Wellness Trust. Dr Greenwall is editor-in-chief of Aesthetic Dentistry Today, and has written several textbooks, including The use of orthodontic aligners. She is a member of the British Orthodontic Society, British Dental Association, American Association of Orthodontists, and the Alpha Omega International Dental Fraternity.

Dr Robert Katz, BDS, MSc Dent (Rand), MS Orth (Ohio State) qualified in South Africa in 1985. In 1986, Robert went to the Ohio State University in the US, and in 1990 graduated with a Master’s degree in orthodontics. Robert is a member of the British Orthodontic Society, British Dental Association, American Association of Orthodontists, and the Alpha Omega International Dental Fraternity.

Aligner popularity has increased in adult patients who do not want to wear braces, as they find them more difficult to tolerate, due to their effect and impact on daily life (Bernabe et al, 2006). The simple idea that a clear aligner can be used to align and reposition teeth is appealing to adult patients. Patients can remove the aligners for eating, brushing, flossing, and important meetings, but can wear the aligners for most of the day (Joffe, 2003). The aligners are normally comfortable and offer ease of use. They are made of polyurethane and are normally 0.75mm thick. Patients are asked to wear the aligners for two weeks and then change to the next number in the sequence of aligners.

Educational aims and objectives

This article aims to demonstrate the benefits of a multidisciplinary approach to minimally invasive aesthetic dentistry.

Clear expected outcomes

Correctly answering the questions on page 74, worth one hour of verifiable CPD, will demonstrate that the reader understands the Invisalign treatment workflow in conjunction with whitening and stratified layered composite restorations.

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<Figure 3: Patient commenced upper and lower Invisalign treatment with Dr Katz, orthodontist, to improve the positioning of the teeth>

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<Figure 4: While wearing the Invisalign aligners the patient bleached with 10% carbamide peroxide to improve the shade of her teeth. This photo illustrates the whitening gel has started to work and starts on the incisal edges first and moved up to the neck of the tooth>

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<Figure 5: Study models made to make the retainer after Invisalign treatment was completed. The aligner had to be fitted immediately after commencement of treatment and before undertaking the restorative bonding to lengthen the upper right canine. The technician made a dent to let us know how much length we need to add>

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<Figure 6: SDI Aura is applied onto the teeth to check the shade of the composite against the tooth after whitening. A test composite is placed onto the teeth at the very beginning of the bonding procedure prior to isolation so that the correct shade of composite is selected before the tooth dehydrates to a lighter shade. The translucent enamel shades are tested first. Here we are testing Aura E1 and E2 onto the transluscent incisal tip>

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<Figure 7: SDI Aura is built up in layers to look like natural enamel starting with the placement of the enamel layer on the incisal and palatal edge. Layers are created to give the effect of the mamelons and the translucency at the tip. The lobes also help to determine the secondary anatomy and correct form and shape. The composite is always over built and the restorative reshaped and polished afterwards>

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Patient assessment

The orthodontist will normally undertake a full assessment of a new patient. Treatment options are enumerated and discussed. Whilst fixed orthodontic braces may move the teeth more predictably and quicker, patients do not want to wear braces. They want the effects of the treatment without having fixed braces.

It is often the preference of orthodontists to undertake fixed appliance therapy because it can be more predictable and in some cases the teeth can move quicker. However, patients are given all the treatment options to align their teeth and many choose to have clear aligners. There are now several aligner brands on the market that the orthodontist can choose. A recent systematic review of Invisalign research by Lagravere and Flores-Mir (2005) found that no strong conclusions could be made regarding the treatment effects of Invisalign appliances. It is the personal selection of the orthodontist and their patient.

The computerisedClincheck

With Invisalign treatment, the number of aligners needed is assessed with a computer scan called Clincheck (Align Technology). Each aligner is programmed to produce a precise movement on a tooth of about 0.15-0.25mm (Vlaskalic et al, 2001). The stereolithographic technology is used to fabricate custom aligners from an impression or an intraoral digital image scanned in the dental office. Patient compliance is mandatory to achieve good results with Invisalign. It is important for patients to wear their aligners 22 hours a day or more (Malik et al, 2013).

Once the Clincheck is undertaken, the number of aligners needed is calculated and the position and location of the attachments determined. The attachments are fabricated from clear composite resin and are transferred onto the teeth with an attachment template. The attachments are removed at the end of treatment. Where proximal enamel reduction (PER) is necessary, this is calculated in the Clincheck.

Studies have been undertaken to assess the accuracy of the computerised Clincheck assessment. In a study by Hroula et al (2017), the mean accuracy of posterior expansion discrepancy between predicted and actual achieved movements with Invisalign (Krieger et al, 2012). In a prospective clinical study by Kravitz et al (2009), the mean accuracy of occlusal movements with Invisalign was 72.8% and 87.7% in the mandible.

There are limited data on the amount of discrepancy between predicted and actual achieved movements with Invisalign (Krieger et al, 2012). In a prospective clinical study by Kravitz et al (2009), the mean accuracy of tooth movement in the anterior region was found to be 41% with Invisalign. An internal study from Align Technology found that one should expect about 80% of tooth movement seen on Clincheck (Tuncay and Orhan, 2006).

A multidisciplinary case – which treatment first?

This case involved multidisciplinary treatment including orthodontic treatment, restorative treatment and aesthetic home whitening treatment (Figures 1 and 2). Invisalign treatment was commenced first (Figure 3).
After the teeth had moved significantly, when the central incisors had straightened and towards the end of treatment, tooth whitening was undertaken in the upper and lower aligners (Figure 4).

Once whitening was satisfactorily completed, new retainers were made from new study casts (Figure 5). Composite bonding was undertaken (Figures 6-8) to repair the worn and shorter incisal edges of the upper central incisors. This was followed by glass ionomer treatment placed in the lower cervical areas to reduce sensitivity.

Normally, class V glass ionomer restorations are placed first prior to commencing any treatment as this helps to reduce sensitivity during whitening and also reduce sensitivity of the orthodontic tray rubbing against the cervical area of the tooth. However, it was decided that the erosion of the cervical areas was not an area of concern and so Invisalign treatment was started first.

Whitening treatment was next followed by composite bonding and class V restorations. The cervical areas of the lower premolars became extremely sensitive during whitening and so after whitening and waiting for the bond strength to improve, the areas were restored with a light cured glass ionomer restoration.

**Orthodontic treatment**

In this case, the patient’s main concern where the uneven smile and the shortened upper central incisor teeth. The characteristics of the malocclusion were as follows:

- class I molar and canine occlusion
- 5mm overjet
- proclination of the upper and lower incisor teeth
- mild lower anterior crowding
- upper incisor irregularity.

**Patients should wear their Invisalign retainers as prescribed by the orthodontist to ensure stability of the occlusion and correct alignment of the teeth**

After a new patient consultation and a treatment planning discussion where all the options were discussed with the patient, she elected to have an orthodontic assessment to explore the options to move and align the teeth. She was presented with two options, that of fixed braces or aligning treatment. She requested that aligning treatment was undertaken.

PVS impressions were sent to Align Technology for conversion into 3D study models using their software. The Clincheck Pro software was used to modify the initial setup (Figures 9 and 10). When finalised, 20 upper and lower aligners were prescribed, giving a treatment...
duration of about 10 months (Figures 11 and 12). IPR, totalling 1.2mm in the lower arch, was necessary to make space to correct the crowding the decrease the incisor protrusion. As the teeth have been bleached, the...of the missing incisal edge. A beautiful natural restoration can be achieved by the dentist visualisation of the final outcome. The prediction of transverse changes achieved by the different treatment procedures, and what is involved in each treatment so that an ideal outcome can be achieved. The patient also needs to be fully aware of the retention phase needed to maintain the teeth in the same position, and to maintain a beautiful smile and when further whitening, may be needed. In addition, any repairs to composite need to be detailed and occlusal checks need to be made regularly to maintain a beautiful smile. From time to time during recall appointments the patient is provided with a little kit to use so that the incisal edges can be checked from the front of the patient.

References