Restoration of upper central incisors

Paul Gerrard presents a detailed case study

Paul Gerrard started his career at his father’s dental laboratory in London in 1991 and, while carrying out his initial study at Lambeth College, he spent the next several years learning the fundamentals of dental technology, gaining a broad range of experience.

In 2002 Paul attended the Las Vegas Institute to study anterior aesthetics and smile design, where his eyes were opened to the possibilities of full mouth cosmetic restoration, and from where his passion for dental ceramics grew.

By 2005 Paul’s brother Dr Neil Gerrard, who ran his own practice in Bristol, had decided to begin the BACD accreditation process, and this led Paul to move to Bristol in 2008 and start a laboratory onsite at the practice. This allowed him to begin the process for technical accreditation and offer the highest levels of dental care.

Paul continues to develop his skills by attending courses and meetings throughout the UK, Europe and America, while working with illuminated clients who have an interest and passion in cosmetic and implant-based restorative dentistry.

The BACD is a dynamic community of illuminated professionals, all sharing a passion for excellence and a dedication to UK dentistry. Registration for the 2012 BACD Annual Conference, on the 22-24 November at the Manchester Central Convention Complex, is now open. For more information visit www.bacd.com or email info@bacd.com.

Introduction and patient’s chief complaint

The patient presented to the practice wishing to enhance the appearance of her smile after her upper central incisors had been traumatized two years ago, leaving them fractured and discoloured.

Summary of clinical information: medical and dental history, diagnosis, treatment plan and treatment carried out

Trauma of the patient’s central incisors had resulted in de-vitalisation and severe discolouring of the 21 and an incisal fracture of the 11, which was vital but had approximately 40% of the coronal tooth tissue missing. The 21 had also been palatally displaced by about 1.5 to 2mm. 21 had already been root treated and further radiographic examination indicated a potential periapical lesion, although the tooth was asymptomatic. Remaining dentition was healthy.

The aim of treatment was to restore correct form to the 11 and bring 21 labially in line with the existing 11 and 22, whilst restoring a more natural colour. It was decided that a full all-ceramic crown would replace 11 due to the extent of the fracture with a veneer on 21, which would allow correction of any form, position and shade issues and satisfy the patient’s wish for a more aesthetically pleasing smile. The patient was also instructed that 21 would need further root treatment for long-term health and stability, but as the patient only had a two-week window to complete treatment, we were unable to carry it out at that point.

Description of prep design

Design follows the manufacturer’s recommendation for all ceramic restorations, with an additional consideration for the cad/cam system used for frame production.

An incisal reduction of 1.5-2mm, including smooth round edges to avoid stress points and aid internal milling and fit, with a bevelled margin for ceramic support and optimum frame thickness in this area. As 21 had been palatally displaced, only minimum reduction was required. The stumps of the 11 veneer was quite dark so a labial reduction of 1mm was made in the incisal region with an increased reduction of 2mm made in the upper cervical half, which would accommodate greater material thickness in the restoration for colour masking.

Preparation design of 21 also took into account access for re-treatment of endodontic orthograde root filling at a later date. A copy of the lab prescription, including shading diagram, can be seen in Figures 1-2.
Discussion of material chosen and reason for choosing it

Ivoclar IPS e.max CAD was the material of choice for this case, which has a wide range of indications including crowns, bridges and veneers. e.max has a range of opacity levels and the ability to work to very thin sections (0.3mm) thanks to its strength of 360-400 MPa. In my opinion, this makes e.max the most flexible, durable and aesthetically pleasing product currently available for anterior restoration. As the patient's shade on tooth 21 was quite dark, a medium opacity block (MO1) was chosen. This would be sufficient to mask the underlying colour and achieve a final shade in the region of A1. The same block was also used for 11 to help
maintain a uniform colour between the two restorations.

**Description of production of model**

The impression was first sprayed with a wetting agent to aid the flow of die stone and help reduce bubble formation. The type 4 die stone Fujifilm EIP CaptXcetar was chosen for its low expansion, strength and scanning properties which aid accuracy during the CAD/CAM fabrication of the framework. The die stone was mixed under 3.3 bar vacuums for 40 seconds, then poured into the impression to a sufficient thickness to allow removal of the cast without breakage. This was allowed to set for one hour. The cast was then removed and trimmed on a dry trimmer to avoid any additional wetting and expansion of the stone. To construct the sectional model, holes were drilled with an airpin. A small amount of glue was applied to the pins from the crosspin system, which were then placed into the holes and sprayed with an activator to set the glue. The base was then sprayed with a separating agent and plastic sleeves were placed over the pins. The plastic base from the crosspin system was then filled with the stone and a small amount of die stone was placed around each sleeve to stop air pockets forming around them, before setting the model into the base. This was then allowed to set for a further hour before removal. The two parts were then separated and the cast impression was sectioned with a pin. The model was then allowed to set for a further hour before use.

**Description of design and production of framework**

The model die was first trimmed and dried under x6 magnification to ensure integrity of the margin and allow easy identification of the margins by the Cercon Intalabs CAD software to be used. Sectional casts in the model were filled with scanning putty to avoid any anomalies in the proceeding scan. The model was mounted on the Siemens iLeo scanning platform and sufficient images...
were taken to ensure an accurate 3D model. A wax was then taken of the provisional model, which could be superimposed over the preparation model and aid in design of the frame. Margins were defined in the software and frames were designed to approximately 80% of the size of the provisional restoration. These were then milled from an Emax MOY block via the MCXL milling unit. After 10 minutes the completed frames were removed from the milling chamber and the fit was checked on dies with blue marker under magnification. It was then necessary to sinter the frames which transform them from their blue lithium metasilicate phase into the final lithium disilicate state, achieving their final shape and strength. The frames were filled with object fit putty which supports them during the sintering processes and placed onto the sintering tray. A 45-minute sintering cycle was then conducted at 850 degrees before allowing the frames to cool to room temperature. The fit was checked again on the dies and the margins were then thinned out to create a smooth emergence profile.

Description of layering of ceramic

A base shade of A1 was chosen with a slight A2 neck. This was slightly brighter than the laterals to create the illusion of dominance in the central region and all the three-dimensional appearance of the arch. A pasty incisal index was fabricated against the provisional model which the working model could be seated into. This would then provide a template for the incisal area of the build up. The frames were first mastered with glass liquid and dusted with a fine layer of A1 deep dentine and A1 Dentin was applied to the buccal region to increase chroma slightly and help mask the underlying spray colour. A1 dentine was used to cover the rest of the frames. Translucent Incisal was placed in the mesial and distal sides of each unit and also along the incisal edge, approximately 1 mm longer than the incisal index to allow for shrinkage. Some small wedges were removed from the incisal edge, which were filled with Emax Dental White (EW), and some margins were created with MM Light, which would break up the monochromatic appearance of the incisal edge. The restorations were then fired. On the second build, EW was used to highlight the mesial and distal lines angles and OHE which is a blue-opalescent enameled, was used on the incisal corners. The whole surface was then covered in a thin layer of T1. Metal and distal edges were built out slightly to allow precise modifications of contours. A second firing cycle was then carried out with a slight temperature reduction to limit any further shrinkage of the previous layer. This two-stage build up technique allows greater control of shrinkage and modification of any internal effects before the final enamel layer is applied, thus avoiding a complete rotator of the ceramics should the internal effects need intensifying or reducing.

Once the veneers were re-lit to the solid model and any shape modifications made using the incisal index for reference, the surface was smoothed with a fine wet diamon and primary anatomy was created. A rubber wheel was then used to smooth the surface further and some fine secondary anatomy was added. Some white/cream stain was then applied to create some small occlusalization areas and this was fixed with a low firing cycle, followed by application of glass liquid and firing cycle to seal the surface of the ceramic. The restorations were then lightly buffed on a lave with a fine synthetic powder to reduce plaque amelosis and achieve the final desired surface texture.

References