Predictable steps to Biomimetic Class IV restorations

By Dr Anand R. Navekar, India

Introduction
Composite Artistry has become an important element of direct restorative treatment in dental practice today enabling clinicians to create life-like restorations with individualized characteristics to match the patient’s natural teeth.

Anterior restorations in the aesthetic zone tend to constantly challenge the clinician’s skill, therefore it is important to plan carefully by combining art and science. Adopting the Minimally invasive Cosmetic Dentistry (MiCD) concept, introduced by Dr Sushil Kotala in my treatment protocol with emphasis on preservation of natural tooth structure “Do No Harm Dentistry” has helped create predictable aesthetic restorations that exceed patient expectations.

Fractured upper central incisors are one of the most common cases of dentoalveolar trauma in the permanent dentition. The following clinical case highlights a simple technique to achieve predictable aesthetics with natural optical characteristics in a class IV restoration using a sculptable bio-mimetic direct restorative “Beautifil II LS”.

Patient Case
A 35 years old male patient visited our dental office with a complaint of chipped upper front teeth (tooth # 11,21) resulting from a childhood injury with no pain or sensitivity. The patient requested to enhance his smile with minimally invasive treatment.

Treatment Plan
After Introral examination, photographs were taken (Fig.1) and a treatment strategy was formulated keeping in mind the patient high expectations for aesthetic restorations with less invasive treatment.

A direct composite restorative material with low shrinkage, predictable aesthetics, sculptable handling and easy polishability- “Beautifil II LS” was selected.

High value translucent enamel shade was identified to create optical effects of youthful teeth.

Materials

Tooth preparation – Diamond Bur FG, Super-Snap Coarse Disk (Black)
Restoration – Beautifil II LS – shade A2O, A2, Beautifil Injectable - shade INC, Beautifil II
Enamel – shade HVT (High-Value Translucent enamel shade)
Bonding system – Etchant and 2 step Adhesive system (FL-Bond II)

Adhesive system – Fine Diamond Bur (Red Band on shank)

Step by Step Restorative Technique

Shade Selection
Vita Shade guide was used for shade selection while teeth was hydrated.

Black and white photo is recommended for assessing value. Shade A1 was selected.

Mock Up
An impression is taken and model poured using die-stone material.

Freehand build up of composite for both teeth to evaluate the final outcome. Both teeth were carefully ana- lysed and identified that each tooth required a different recipe for layering the composite material. (Fig.3)

• Silicon putty index made from the plaster model to create an enamel shell to guide the build-up of the palatal enamel layer.

Tooth Preparation
• Rubber dam isolation from premolar to molar to premolar, Rubber dam in- verted and floss tied around teeth for further retraction of gingiva to eliminate contamination with saliva.

• Infinite bevelling of margins to blend the composite material on both sides, labial and palatal with a round ended tapered Diamond bur.

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Fig. 1: Fractured maxillary anterior incisal edge of teeth #11 and 21
Fig. 2: Black and white photo taken with classic Vita shade guide for value assessment. Shade A2 matches with natural dentition compared to A1.
Fig. 3: Buccal view of the composite build-up on the tooth model, showing differences of a fractured incisal edges
Fig. 4: Rubber dam isolation with floss ties
Fig. 5: Labial bevelling of fractured area
Fig. 6: Smoothing incisal edge with the Super Snap Black disk
Fig. 7: Putty index checked intra orally after placing rubber dam
Fig. 8: Palatal shell made using Shofu Injectable 10K enamel shade
Fig. 9: Build-up of deep dentin with Shofu Beautifil II LS A20, note the different amount placed in each tooth
Fig. 10: Thin layer of Beautifil II LS shade A2 placed after placement of Composi-antiresein matrix band with silicon wedge between both central incisors for better contact and contour of the tooth
Fig. 11: Final enamel layer build-up with Beautifil II Enamel shade HVT of high-value translucent enamel shade
Fig. 12: After contouring, finishing done with dura white stone

Before and after

**Page 22**
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The present report describes the reconstruction of a severely worn dentition with the use of fixed restorations and with maximum preservation of the existing tooth structure. Implants were employed for the restoration of the partially edentulous lower jaw. Rehabilitation of the general, worn teeth was attained with all-ceramic materials. Temporization was preceded by splint therapy and comprehensive pre-prosthetic treatment. The press technique and the CAD/CAM technique were utilized in the transfer from the temporary to the final all-ceramic reconstruction. This report describes the individual treatment stages and discusses the approaches taken in these stages.

For some years now, monolithic all-ceramic restorations have been a frequently used treatment option for the reconstruction of destroyed tooth structure. Their benefits include the ability to eliminate the use of metal, to implement a cost-efficient manufacturing procedure and to eliminate the risk of chipping associated with porcelain. With the increase in the use of all-ceramic materials, the failure rate of these materials at high loads (bruxism and other parafunctions) has been discussed. However, advances in materials engineering and adhesive technology have led to the introduction of ceramic systems (e.g., lithium disilicate) that can be used for high load bearing restorations.

Introduction

This report focuses on the prosthetic treatment of a severely worn dentition in a bruxist. A consistent treatment plan is critical to a successful rehabilitation as it is a crucial diagnosis and the implementation of pre-prosthetic treatment measures. Material selection also becomes a crucial criterion of success or failure. We are of the opinion that it is possible to use all-ceramic materials in patients with bruxism - even if according to the classifications of their predecessors, - as long as the materials are selected appropriately to accommodate the requirements of the given indication and then applied correctly. Yet, there is no such thing as a universal ceramic. Rather, the treatment team must take a decision concerning the specific circumstances of the indication at hand. Monolithic restorations made of lithium disilicate (IPS e.max Press, Ivoclar Vivadent) using the press technique are possible for the treatment of single teeth. When fabricating long-span restorations (impacted supported bridges) a combination of lithium disilicate and zirconium oxide may present a viable alternative to purely monolithic zirconium oxide or metal-ceramic restorations.

Rehabilitation of a dentition damaged by bruxism

The term 'bruxism' refers to various parafunctional activities of the stomatognathic system. Bruxism is assumed to have multiple possible causes. Causal treatment of bruxism should depend on whether the disorder is caused by medical or psychosocial factors. The oral and physical consequences of bruxism vary in the severity of the parafunctions. In many cases, bruxism correlates with at least some degree of dental attrition or wear. Particularly in patients with an inadequately restored, interrupted dentition, for instance in older people, the residual teeth which still have contact to the antagonists may be affected by a severe loss of tooth structure. Generally, rehabilitation of a patient with a worn dentition presents a considerable challenge to the treatment team. In this context, extensive pre-prosthetic planning and consistent implementation of the treatment plan are essential prerequisites for the success of the treatment. Primary objective of the rehabilitation is to establish a stable occlusion and an adequate vertical dimension. Implementing a diagnostic and therapeutic stage are just essential as to be on the pathway to a fullmouth rehabilitation where space is minimised. Protective splint is worn during dental check-ups. Before restoring the worn dentition, a decision as to whether the to use has to be taken. On the one hand, the risk of a preparation trauma should be minimized. On the other hand, adequate strength should be provided to rule out chipping of the material or damage being caused to the tissue or another material. In addition, the aesthetic expectations of the patient should be considered. If veneering ceramics are used, chipping in the areas of high masticatory stress is another risk that should be taken into account.

Strength of all-ceramic materials in dentition of patients with bruxism

First, we have to decide which of the two aspects should be given preference: aesthetics or adequate strength under high masticatory stress. Strength is decisive for the long-term stability of a restoration. Particularly in patients with bruxism. The higher the crystalline content, the stronger the ceramic material is. This is particularly true for oxide ceramics (zirconium oxide, strength > 1000 MPa), which is a material that has a dense microstructure and is consequently highly opaque. It may therefore not always meet the aesthetic requirements of a restoration. While more recent zirconium oxide versions offer increased translucency, their strength is considerably lower than the strength of their predecessors. Conventional di- lute ceramics are based on a lessie-reinforced glassy phase, which has a beneficial effect on aesthetics. With a...
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A 67-year-old male patient presented with a functionally and aesthetically severely compromised dentition. His pressing need at the initial assessment was to have his dental situation improved. He wanted his teeth to be restored to their ‘old’ functional and aesthetic shape. His general medical history did not reveal anything unusual. He did not complain about TMJ problems or jaw tension.

The gaps in his upper posterior region had been prosthetically filled with restorations that were now deteriorating. In the mandibular posterior region the patient was edentate in the posterior region on both sides. The teeth that were still in situ showed signs of generalized dental wear. A detailed clinical and radiological assessment revealed an extensive loss in vertical dimension, severe abrasion and attrition, pronounced bruxism and a high lip line (Fig. 1). The occlusal and incisal surfaces showed flat, sharply confined wear facets that corresponded to the opposing teeth. The cervical areas of the teeth were characterized by wedge-shaped non-catastrophic defects (abstractions) typically observed in bruxism. Anterior esthetics was negatively affected by several factors. For instance, the incisal edge line jarred with the lower lip curvature. This mismatch was caused by the loss of tooth structure, change in the length-to-width ratio of the anterior teeth and interruptions in the anterior row caused by the loss of proximal contacts.

Diagnosis. Generalized abrasion with a severely reduced vertical jaw base relationship, prosthetically inadequately restored dentition with missing teeth and free-end gaps. Each tooth was individually assessed for its risk of failure and all of them - except for teeth 27 and 28 - were given a good prognosis.

Treatment plan. Functional restoration of the vertical dimension of occlusion (VDO), surgical crown lengthening, restorative reconstructions, long-term temporization, insertion of three implants in the lower jaw, final prosthetic reconstruction with all-ceramic restorations.

The treatment was implemented in two phases:

1. Pre-prosthetic phase
2. Restorative [prothetic] phase

Functional reconstruction and crown lengthening

An impression of the oral situation was taken and the situation was recorded using a facebow. By determining the interocclusal space at rest (freeeway space), we were able to evaluate the loss of height in the vertical relation (Fig. 2). In the lab, the models were mounted on a semi-adjustable articulator. The pre-prosthetic phase was begun by having the patient wear a splint to stabilize the bite. For this purpose, an occlusally adjusted splint was prepared to attain the envisaged vertical height in a centric condylar position. The patient wore this appliance for three months. He had no problems in adjusting to the new VDO.

When the diagnostic wax-up was created, the functional requirements and aesthetic expectations of the patient were taken into consideration (Fig. 3). Removal of the existing restorations was followed by surgical crown lengthening of the upper and lower teeth in the anterior and premolar region. A vacuum-formed tray was created from the diagnostic wax-up and used as a template, or guide to attain the planned tooth length (Fig. 4). Excess tissue was carefully removed, the gingival tissue around the teeth incised and temporarily folded back and the bone resected by the necessary height. The surgical site was closed with loose sutures (Fig. 5).

Upon completion of the healing phase, a new impression of the teeth for the restorative treatment began. The amalgam fillings and secondary caries were meticulously removed. Some of the teeth required preparation for the placement of the crowns. Teeth 12, 11, and 22 received endodontic treatment with glass fibre reinforced endodontic posts (RC Poste Plus, Ivoclar Vivadent, see Figs 6 and 7) and a core build-up made of self-curing composite (MultilayFlow, Ivoclar Vivadent). The endodontic posts consisting of a specially developed composite matrix offered a natural translucency and dentin-like elasticity (flexural strength). The composite used for the core build-up is available in several shades and provides favourable mechanical and aesthetic properties. Teeth 22, 23 and 24 received cast gold posts (Fig. 8) and the other teeth were built up with composite to enable them to be used as abutments.

Implant insertion

An X-ray template was created on the basis of the wax-up and then used for planning the position of the implants in the lower jaw. Perforations were applied to the occlusal surface of the template at the implant exit points that were deemed most suitable for achieving an ideal prosthetic restoration and filled with radiopaque material (Fig. 9). Preparation of a CT scan with the template in place was followed by virtual implant position planning in region 36, 45 and 46 (Fig. 10). We recorded the X-ray templates into a guiding/drill-template for the insertion of the implants. The surgical intervention was uneventful. Subsequently, the three implants (Astra Tech, Dentaly Implants) were inserted into the buccal bone (Fig. 11). Healing abutments were screwed onto the implants and the implant sites were closed with sutures.

Long-term temporization

The patient received a long-term temporary restoration to stabilize the planned vertical occlusal dimension and to validate the aesthetic obtective. A high-performance PMMA (TeloCAD, Ivoclar Vivadent) was used for the fabrication of the temporaries. Wax-up and CAD/CAM enabled a swift implementation of this stage (Fig. 12). Although a monolithic design was used, the translucent properties of the polymer lent a life-like appearance to the temporaries (Fig. 13). The patient was very comfortable with the restorations and did not report any functional complaints. The aesthetic appearance was considerably improved, which was reflected in both the patient’s speech and facial expression.

Permanent prosthetic restoration

The patient was wearing the long-term temporaries for an adequate length of time to get used to the new VDO, which was then to be transferred to the permanent restoration. Once the temporaries were removed, an impression of the prepared teeth was taken using a vinyl polysiloxane precision impression material (Virtual, Ivoclar Vivadent). The propitious hydrophilic properties of the impression material allow for a detailed and accurate recording of the oral hard and soft tissues [8].

The validated occlusal position was transferred to the articulator using a sequential split mouth method (Fig. 16). A facebow registration was performed for the skull-related repositioning of the upper jaw model.

All-ceramic single-tooth crowns

In line with the treatment plan, the dental technician created monolithic single-tooth crowns using lithium disilicate. Polychromatic press ingots were used for the press technique (IPS e.max Press Multi, Ivoclar Vivadent) to achieve the planned
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All-ceramic implant abutments

The implants were fitted with customized hybrid abutment crowns made of lithium disilicate (IPS e.max CAD). The hybrid crowns were designed using CAD software, ground from specially developed lithium disilicate blocks and extraneously bonded to a titanium base using a special luting composite (Multilink Hybrid Abutment, Ivoclar Vivadent, see Figs 19 and 20). Subsequently, the monolithic hybrid abutment crowns were screwed into place in the oral cavity. The IPS e.max CAD blocks for the manufacture of hybrid abutments or hybrid abutment crowns feature a pre-fabricated interface (e.g. for the Sirona Ti base) and ensure a high accuracy of fit. In our opinion, the reduced fissural strength of the lithium disilicate, compared with zirconium oxide, has a favourable effect on the patient’s chewing comfort and the implants. In view of the fact that implants have no inherent mobility and therefore have only reduced tackiness, we assume that lithium disilicate provides a suitable abutment material for restorations in patients with bruxism.

All-ceramic bridges

To somewhat cushion the high masticatory forces that are to be expected in a bruxer to be occurring in the posterior region, we opted for lithium disilicate, here too. However, here the focus was on reliability and strength. For this reason, we decided to design what is termed as a composite bridge (IPS e.max CAD Veneering Solutions). This unique combination of lithium disilicate (LSi) and zirconium oxide (ZrO2) allows the fabrication of tooth- and implant-supported bridge constructions that offer an exceptional overall strength and aesthetically pleasing properties. Two structures are required to create the restoration: a high-strength zirconium oxide framework (IPS e.max ZirCAD) and a glass-ceramic veneering structure (IPS e.max CAD, see Fig. 21). After both structures were manufactured using a CAD/CAM procedure (inLab MC-XL, Sirona), the framework was tried in and fine tuned down to the last fine details before finalization (Fig 22).

The short processing times required to complete the structures increase the rate of efficiency and productivity. After the try-in, the two structures, which had been milled off ground separately, were fused together to achieve a homogeneous ceramic bond using a fusion glass-ceramic (IPS e.max CAD Crystal/Connect, Ivoclar Vivadent, see Fig. 23). The fusion process takes place at the same time as the crystallization process of the lithium disilicate.

Seating the restorations

The IPS e.max Press restorations were seated using a dual-curing luting composite (Varioink Esthetic DC, Ivoclar Vivadent) that features optimum aesthetic properties. The glass-ceramic components were pre-treated using a single-component primer (Monobond Etch & Prime, Ivoclar Vivadent) according to the manufacturer’s instructions. The tooth preparations were conditioned with an adhesive (Adhese Universal, Ivoclar Vivadent, see Figs 24 and 25). Once an appropriate shade of luting composite was selected, the glass-ceramic restorations were permanently seated using an adhesive luting technique (Fig. 26). The IPS e.max CAD hybrid crowns were screwed into place (Fig. 27) and the screw channels sealed using an aesthetic composite filling material.
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Conclusion
In the clinical case described in this report, the treatment goal was achieved and the functional and aesthetic expectations of the patients were fully met. All-ceramic restorations were employed, for the rehabilitation of the dentition that had been severely damaged by bruxism. If we take a retrospective view, the importance of thorough diagnostics, careful treatment planning and a step-by-step, pre-prosthetic treatment phase becomes evident. Consistent adherence to the treatment plan is equally important. Only after the planned vertical dimension is achieved with the help of long-term temporaries should the permanent prosthetic restoration phase be begun. When selecting the materials for the prosthesis, the high functional loads to which the dentition of a bruxer is exposed should be considered and, ideally, monolithic structures should be preferred. If these points are taken into consideration, long-term stability of the bite and, if appropriate materials are used, high aesthetics can be achieved.

AD

scans in vivo preparation mark margin lines scan impression view merged data