Predictable steps to Biomimetic Class IV restorations

By Dr. Anand R. Narvekar, India

Introduction
Composite Artistry has become an important element of direct restorative treatment in dental practice today enabling clinicians to create lifelike restorations with individualized characterizations 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 Minimal invasive Cosmetic Dentistry (MiCD) concept, introduced by Dr. Sushil Koralia 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 Intraoral 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.

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 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 premolar, Rubber dam in place.
- Infinite bevelling of margins to eliminate contamination with sulcular fluid. (Fig 4)
- Freehand build-up of composite for both teeth to evaluate the final outcome.

Shade Selection
Vita Shade guide was used for shade selection while tooth was hydrated. Black and white photo is recommended for assessing value. Shade A2 was selected. (Fig 2)

Tooth Preparation
- Rubber dam isolation from premolar to premolar, Rubber dam inverted and floss tied around teeth.
- Adhesive system (FL Bond II)

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

Technique
Step by Step Restorative Technique

Fig. 1: Fractured maxillary anterior incisal edge of tooth #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 INC 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-antenna 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 for further retraction of gingiva to eliminate contamination with sulcular fluid (Fig 4).

Fig. 12: After contouring, finishing done with dura white stone

Before and after

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The use of a proper protocol for finishing and polishing helped achieve a glazed-like composite surface similar to ceramic or natural teeth as seen in the extreme close up clinical photographs.

**Conclusion**

The before and after clinical photos of this patient case highlights that predictable life-like restorations can be created to mimic natural teeth using a conservative approach with minimal tooth preparation, selection of the right type and shades of composites followed by a comprehensive finishing and polishing protocol.

**Acknowledgment**

Author wish to thank Shofu Dental Asia Pacific Pte. Ltd. and Garrisons USA for their Support.

Fig. 13: Polishing with Super Snap X-Treme green disk followed by pink disc clearly showing the reflection on the tooth

Fig. 14: Intra oral image showing final restoration

Fig. 15: Before and after image digitally overlapped to showcase extent of actual build-up of the composite restoration

Fig. 16: Frontal view of maxillary anterior teeth showing the monolithic aesthetics of composite rein with a close match to natural tooth translucency and effects in the incisal area

Fig. 17: Artistic side view of both dental arches in anterior guidance 1 week post treatment showcasing complete rehabilitation of teeth and natural life-like aesthetics

**Rehabilitation of a dentition damaged by bruxism**

**Prosthetic treatment using monolithic all-ceramic crowns and composite bridges**

By Dr Meni Chatzinikolaou, Dr George Pagavoussios, Dr Alexandros Gonidis & Maria Spanopoulou, Greece

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 treat-ment. The press technique and the CAD-CAM technology 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 or worn down teeth. 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 compo-site resin. 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, ad- vances 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 pro-thetic treatment of a severely worn dentition in a buccal. A consistent treatment plan is critical to a suc-cesful rehabilitative treatment as it is a correct diagnosis and the implementation of pre-prosthetic treatment mea-sures. 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 severe bruxism, on account of 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 peo-ple, 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. To 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. Implants together with a diag-nostic and therapeutic stage are just as essential as the pathway to a full-throated rehabilitation. The treatment plan for this patient was based on a diagnostic splint and performing regular check-ups. Before restoring the worn denture, a decision as to which materials to use has to be taken. On the one hand, the risks of a preparation trauma should be minimized. On the other hand, ade-quate strength should be provided to rule out chipping of the material or damage being caused to the tem-ponsuivreinlayer. In addition, the aesthetic expectations of the pa-tient should be considered. If veneer- ing 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 bruxis-m**

First, we have to decide which of the two aspects should be given pre-dominance: aesthetics or adequate strength under high masticatory stress. Strength is decisive for the long-term stability of a restora-tion, particularly in patients with bruxism. The higher the crystalline content, the stronger the ceramic material is. This is particularly true for oxide ceramics (zirconium ox-ide, strength > 1000 MPa) which is a material that has a dense micro-structure and is consequently highly opaque. It may therefore not always meet the aesthetic requirements of a restoration. While more recent zirco-nium oxide variants offer increased translucency, their strength is consid-erably lower than the strength of their predecessors. Conventional di-li-cate ceramics are based on a lesstee-reinforced glassy phase, which has a beneficial effect on aesthetics. With a
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strength of 80 to 200 MPa, however, their strength is weakly low. Hav- ing initial clinical strength compar- ing from 500 to 400 MPa, lithium-di- silicate glass-ceramic materials (IPS e.max Press and CAD) are located be- tween the strength values of zirconi- um oxide and conventional silicate ceramics. Lithium disilicate is natu- rally translucent and is indicated for monolithic single-tooth restorations, three-unit bridges (precordial region), hybrid abutments and hybrid abut- ment crowns. Monolithic restora- tions significantly reduce the risk of chipping compared with veneered restorations and are therefore par- ticularly advantageous for patients with bruxism. A possible route to employ this material also for pos- terior bridges is to use the CAD-on technique (IPS e.max CAD/Veneer- ing Solutions) to produce composite bridges. If this technique is used, the framework is created from high- strength zirconium oxide and then a monolithic veneering structure made from comparatively “elastic” and above all aesthetic lithium di- silicate is sintered to it. This special combination of materials and the homogeneous ceramic bond cre- ated between them results in strong restorations that can withstand se- vere masticatory forces and prevent fractures from occurring. Even if, ac- cording to the manufacturer, these indications are contraindicated for patients with bruxism, from a prag- matic point of view, two material concepts emerge as possible routes to an all-ceramic full-mouth reha- bilitation: monolithic restoration using high-strength lithium di- silicate glass-ceramics and the CAD-on / Veneering Solution technique for posterior bridges.

Clinical case
Preoperative situation, diagnosis and treatment planning
A 67-year-old male patient present- ed with a functionally and aestheti- cally severely compromised denti- tion. 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 re- veal anything unusual. He did not complain about TMJ problems or jaw tension.

The gaps in his upper posterior re- gion had been prosthodontically filled with restorations that were now defective. In the mandibular pa- tient it was evident in the posterior region on both sides. The teeth that were still in situ showed signs of general dental wear. A detailed clinical and radiological assessment revealed an extensive loss in verti- cal dimension, severe abrasion and attrition, pronounced bruxism and a high bite line (Fig. 8). The occlusal and initial 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- canuous defects (abstractions) typi- cally observed in bruxism. Anterior esthetics was negatively affected by several factors. For instance, the in- cisor 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 interrup- tions in the anterior row caused by the loss of proximal contacts.

Diagnosis: Generalized abrasion with a severely reduced vertical jaw base relationship, prosthodontically in- adequately 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 prognosis.

Treatment plan: Functional resto- ration of the vertical dimension of occlusion (VDO), surgical crown lengthening, restorative reconstruc- tion, long-term temporization, inser- tion of three implants in the lower jaw, final prosthetic reconstruction with all-ceramic restorations.

The treatment was implemented in two phases: 1. Initial [pre-prosthetic] phase 2. Restorative [prosthesis] phase

Functionational reconstruction and crown lengthening
An impression of the oral situation was taken and the situation was recorded using a facebow. By deter- mining the interocclusal space at rest (freeway space), we were able to evaluate the loss of height in the vertical relation (Fig. 2). In the laboratory, the models were mounted on a semi- adjustable articulator. The pre-pros- thetic phase was begun by having the patient wear a splint to stabilize the bite. For this purpose, an occlus- ally 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 ad- justing to the new VDO. When the diagnostic wax up was created, the functional requirements and aesthetic expectations of the patient were taken into considera- tion (Fig. 3). Removal of the existing restorations was followed by surgic- al crown lengthening of the upper and lower teeth in the anterior and premolar region. A vacuum-formed tray was created from the diagno- tic wax-up and used as a template, or guide to attain the planned tooth length (Fig. 4). Excess tissue was care- fully removed, the gingival tissue around the teeth incised and tem- porarily folded back and the bone reduced by the necessary height. The surgical site was closed with loose su- tures (Fig. 5).

Upon completion of the healing phase preparation of the teeth for the restorative treatment began. The amalgam fillings and secondary caries were meticulously removed. Some of the teeth required prepara- tion for the placement of the crowns.

Teeth 11, 12, 13 and 12 received endo- dentic treatment with glass fibre reinforced endodontic posts (IRC Poster Plus, Ivoclar Vivadent, see Figs 6 and 7) and a core build-up made of self-curing composite (Multiflow, Ivoclar Vivadent). The endo- dentic posts consisting of a specially developed composite matrix offer 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. Perfora- tions were applied to the occlusal surface of the template at the im- plant exit points that were deemed most suitable for achieving an ideal prosthetic restoration and filled with radiopaque material (Fig. 9). Prepara- tion of a CT scan with the template in place was followed by virtual im- plant position planning in region 36, 45 and 46 (Fig. 10). We recorded the X-ray template into a guiding/deliv- ery template for the insertion of the implants. The surgical intervention was uneventful. Subsequently, the three implants (Astra Tech, Dentply Implants) were inserted into the lo- cal 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 dimen- sion and to validate the aesthetic ob- jectives. A high-performance FMMAA (TeledxCAD, Ivoclar Vivadent) was used for the fabrication of the tem- poraries. Wax-up and CAD/CAM em- brailed 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 com- fortable with the restorations and did not report any functional com- plaints. 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 resto- ration. Once the temporaries were removed, an impression of the pre- pared teeth was taken using a self-polyacrylate precision impression material (Virtual, Ivoclar Vivadent). The propitious hydrophilic proper- ties of the impression material allow for a detailed and accurate record- ing of the oral hard and soft tissues [8, K. Něvling, University of Texas , 2001], providing the ideal condi- tions for obtaining high-precision working models. The validated oc- clusal position was transferred to the articulator using a sequential split mouth method (Fig. 14). 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 monolith- ic single-tooth crowns using lithium disilicate. Polychromatic press in- gots were used for the press tech- nique (IPS e.max Press Multi, Ivoclar Vivadent) to achieve the planned...
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The implants were fitted with custom-designed 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 extraorally bonded to a titanium base using a special luting composite (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 flexural strength of the lithium disilicate, compared with zirconium oxide, has a favorable 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 tactility, we assume that lithium disilicate provides a suitable abutment material for restorations in patients with bruxism.

Seating the restorations

The IPS e.max Press restorations were seated using a dual-curing luting composite (Variolink Esthetic Universal, Ivoclar Vivadent) according to the manufacturer’s instructions. The tooth preparations were conditioned with an adhesive (Adhese Universal, Ivoclar Vivadent) and a glass-ceramic veneering structure (IPS e.max CAD) was fused to the pre-fabricated interface (e.g., for the Sirona Ti base) and ensured a high accuracy of fit. In our opinion, the reduced flexural strength of the IPS e.max Press restorations compared with zirconium oxide has a favorable 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 tactility, we assume that lithium disilicate provides a suitable abutment material for restorations in patients with bruxism.

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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, 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 prosthetic restoration, 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.

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