CAD/CAM technology provides an efficient and reliable method to create full-contour restorations from high-quality zirconia for complex restorative needs in the posterior region.

**Cleanic: Clinical use of a recognised prophy paste with Perlite**

By Dr. Fabio Cosimi D.D.S., Dr. Sussanna Giovanni D.L., I-Ostia Lido, Rome

Cleanic® prophy paste by Kerr has a creamy and smooth consistency. It also has a pleasant fresh taste that is not too strong and is well accepted by the patient.

This creaminess and the clever use of binding agents have made the paste easy to use. Available in a tube, used with both cups and brushes, the paste stays more constant on the tooth surface, thereby avoiding the unpleasant sensation caused by coarse particles left in the patient’s mouth. Within a few seconds after application (during the cleaning cy-cle), Cleanic® paste removes extrinsic discoloration caused by chlorhexidine or stains caused by cigarette smoke.

(If either of these are present in a patient at a recall of 6 months, the application should be repeated)

About 8 seconds after application, the paste automatically starts its polishing action thanks to Perlite technology making the tooth appear smooth and shiny.

After our usual professional oral hygiene procedures (debridement, scaling and root-planing), Cleanic® paste, compared with others on the market, seems to be less apparent in the gingival sulcus.

Pro-Brush™ new generation brushes are very suitable for patients with dental overcrowding or malposi-tioned teeth. Plastic replaces the traditional metal part and allows the brush to rotate more efficiently. This helps to prevent damage to adjacent teeth. Pro-Cup® cups have been de-signed and developed to avoid pastes being splattered as with tradi-tional cups.

**An ideal combination for optimized esthetic success**

By Marko Jakovac, DMD, MSc, PhD, Croatia, and Michele Temperani, CDT, Italy

Modern dentistry is not only concerned with oral hygiene or caries prevalence – wear from attrition, abrasion or erosion is increasingly becoming a subject of concern. These destructive oral processes are in large measure attributable to stress. Stress can trigger parafunc-tional habits and lead to gastric reflux and low pH values in saliva.

Additional factors such as bulimia and excessive consumption of soft drinks also come into play.

**Case presentation**

A 30-year-old female patient presented at our practice with pain in the posterior region. She was also dissatisfied with the esthetic appearance of her anterior teeth (Fig. 1). Considerable erosive loss of tooth structure on the palatal and cervical surfaces was observed at the prelimi-nary examination (Fig. 3). An initial interview revealed that the patient was concerned with oral hygiene or caries prevalence – wear from attrition, abrasion or erosion is increasingly becoming a subject of concern. Following initial examination, an impression and bite record were taken. Portray imaging and eBSI technology (Digi-mate Designs) have proven to be highly useful in situations where the dental technician cannot gain an impression of the patient’s oral situation in person.

Mock-up and initial temporaries

As provided for in the treatment plan, the dental technician fabri-cated a diagnostic wax-up to visualize the ideal oral situation. Wax-ups are convenient to assess the feasibil-ity of such complex prosthetic treat-ments. Duplicate casts were made from the contoured wax-up and silic-on cores matrices were created (Fig. 3). In the first step, the matrices assisted in the construction of the mock-up and, further on, in the fabrication of the baseline temporaries in the patient’s oral cavity. The mock-up was completed on the basis of the wax-up. It was then used to simul-ate the final outcome on the patient and visualize the inclination of the occlusal plane (Fig. 4). The patient agreed to the treatment plan and we proceeded to implement the necessary surgical measures – i.e. tooth extraction and crown lengthening. It is important to consider the form identified in the wax-up when per-forming surgical crown lengthening (Fig. 5). Subsequently, the patient un-derwent periodontal treatment and root canal therapy. Additionally, all existing restorations were replaced.

Preparation and temporization

The teeth were prepared in two ses-sions. At the first session, we pre-pared the teeth along the gingival margin. Impressions were taken and temporaries fabricated. Generally, temporo-pation is essential to achieve an optimum healing result after sur-gical crown lengthening and tooth extraction. Since the tempora ries should follow the parameters estab-lished in the wax-up, we decided to employ CAD/CAM technology for this step.

The wax-up and master models were digitized using a lab scanner (Telio® Dental) and the resulting data sets were imported into the dental design software (iShape). This method allowed us to transfer the shape of the wax-up to the model that contained the tooth preparations. The virtual project is automatically converted into a STL data format and sent electronically to the pro-ducer. From this, the STL data were imported into the milling program of a X4 Pro CinCAD/CAM unit (Wieland Dental) to manufacture temporaries from Telio®CAD/PMMa material (Fig. 6). Occlusal and func-tional adjustments were repeatedly performed over the three-month healing period (Fig. 7). After success-ful healing, the second stage of the preparation process was implement-ed. When carrying out this step, vis-ual aids (loupes, dental microscope) are recommended to achieve accu-rate results. After completion of the preparation procedure, the impres-sion of the oral situation was taken (Fig. 8).

Jaw relations were established with the help of a bite record.

The jaw position was “test driv-er” during the healing phase when the patient was wearing the tem-poraries. A special procedure (cross-mounting) enables the clinician to communicate the jaw relations to the technician without loss of information.
that they were faithful to the parameters involved in this case, we preferred to mill the components from wax to be able to assess the quality of the virtual construction in a conventional fashion. With this inexpensive method, we were able to assess the shape and function of the structures in "real life.

In the present case, we noticed that a few areas had not been properly contoured in the wax. These areas were corrected accordingly.

The corrected STL data were processed in the CAM module and the data required for the milling process imported into the program of the Zentron mini milling unit. The restoration was then milled from a pre-shaded Zenostar zirconia disc (shade T4) (Fig. 11). It is an advantage of this material that it is supplied in discs that are pre- shaded. Normally, framework shading requires a separate working step to apply metal oxide based colouring liquids either by an immersion or brush-on technique prior to sintering. In pre- shaded discs, the shades are added to the zirconia powder and homogenised during the industrial production process. The result is a material that demonstrates a highly homogeneous shade. As the need for manual shading is eliminated, time savings can be gained in the fabrication of restorations, providing an additional advantage. Colour consistency is another advantage that should not be underestimated. A consistent colour is achieved, irrespective of the skills and experience of the technician.

To ensure an optimum integration of the posterior restorations made of zirconia and the anterior restorations made of lithium disilicate, the vestibular areas of the premolars were layered over with a veneering ceramic (IPS e.max Ceram) (Fig. 12). We used a conventional press technique in conjunction with IPS e.max Press ingots (shade LT A1) to fabricate the anterior lithium disilicate restorations and then completed the pressed crowns individually using the cut-back technique (Fig. 13).

The master models and the models of the most recently modified temporary crowns and bridges were permanently cemented using the dual-curing luting composite Variolink® Esthetic DC. In the mandible, the veneers were luted using the light-curing variant of the same luting composite (Variolink® Esthetic LC) in a neutral colour. This luting composite is easy to apply and excess material can be effortlessly removed during the cementation process.

Two weeks after the restorations had been placed, the patient came for another visit to our practice. Pink and white esthetics were harmoniously balanced (Figs 14 to 17). This outcome was possible due to the careful adaptation of the treatment to the needs of the patient and the smooth communication between practice and lab.

Conclusion
Successful treatment of young patients with complex treatment needs requires a high degree of accuracy and minimally invasive preparation methods. Full-contour zirconia restorations milled using CAD/CAM strategies provide a straightforward method to achieve accurate restorations, particularly for the posterior region. The success of anterior restorations continues to depend largely on the skills of the technician and on the use of materials with optimum properties, such as the IPS e.max lithium disilicate glass ceramics.

Creating the final restorations
We used the Zerotech CAD/CAM system and Zenostar® zirconia materials (iWeld Dental) to fabricate full-contour crowns and bridges for the premolar and molar region. The plan was to customize the premolar restorations with IPS e.max® Press Ceram veneering ceramic using the layering technique. The anterior restorations were manufactured using the press technique with IPS e.max Press lithium disilicate glass-ceramics. These restorations were also customized using IPS e.max® Ceram. On the one hand, the final restorations had to be manufactured in such a way that they were faithful to the parameters established in the simulation models. On the other hand, the final restorations should reproduce the shape and occlusal dimension of the temporaries, which had been consistently optimized during the long-term temporization stage. To achieve an ideal outcome, the laboratory was provided with a range of useful data to allow the technician to mount the models on the articulator and to interchange them with one another.

- Impressions for master models
- Impressions of the temporaries after functional and occlusal adjustments
- Occlusal record
- Facebow

The anterior restorations were also customized using Zerotech CAD/CAM technology to fabricate the posterior crowns and bridges from monolithic zirconia. The occlusal conditions established in the long-term temporaries were accurately taken into account. Prior to seating the final restorations, we checked their accuracy of fit and shape match intraorally using glycerine-based try-in pastes (Variolink® Esthetic Try-In). The crowns and bridges were permanently cemented using the dual-curing luting}

Fig. 6: Long-term temporaries were instrumental in stabilizing the vertical dimension of occlusion.

Fig. 8: Anterior teeth prepared for the final restoration.

Fig. 9: The master models were digitized to create the final restorations.

Fig. 10: Virtual construction based on the situation created by the long-term temporaries.

Fig. 11: Restorations after having been milled from pre-shaded Zenostar® zirconia material (iWeld Dental)

Fig. 12: Molars were created in full-contour and the vestibular aspects of the premolars were layered over.

Fig. 13: Frontal view of the completed restorations on the model.

Fig. 14: Two weeks after the restorations had been seated: optimal situation with successful pink and white esthetics.

Fig. 15 to 17: All-ceramic restorations: integrated harmoniously and unobtrusively into the dentition and facial appearance of the patient.
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Advanced Restorative Techniques and the Full / Partial Mouth Reconstruction - Part 2 Occlusal Concepts

In the second part of the series on advanced restorative techniques, Prof. Paul Tipton focuses on occlusal concepts.

By Prof. Paul Tipton, UK

Most advanced restoration dentistry techniques have changed little over the last 20-30 years, including that of the full mouth reconstruction. However, the impact of new dental materials, such as titanium and zirconia, has had a major influence on aesthetic dentistry and implantology during this time period. As a result, the profession must have an ever-relevant new materials rather than tried and tested techniques. Some fundamental techniques are just as relevant today as they were when I started my Master’s degree in conservative dentistry at the Eastman Dental Hospital in 1987.

During the course of this series of articles on advanced restorative techniques, some old techniques will be revisited in light of today’s aesthetic and restorative requirements and some newer concepts will be discussed in greater detail whilst dealing with the overall topic of full mouth reconstruction. This article discusses the topic of occlusion and occlusal concepts.

Gnathology

Stallard first coined the term gnathology defining it as the science that relates to the anatomy, histology, physiology and pathology of the masticatory system. McCollum formed the Gnathological Society in 1924, and is credited with the discovery of the principles of mandibular movements recorded using complex instrumentation to the occlusion in fixed prosthodontics. This has evolved into the five dimensions of occlusion, embrace today.

1. RCP – RCP around RAP
2. Mutually protected occlusion
3. Anterior guidance
4. No non-working side interferences
5. Position stability

The early gnathologists studied the recorded tracings made during mandibular movements. When the mandible travels forward along the sagittal plane it is considered a protrusive excursion or protrusion. Therefore, protrusion is the movement toward the posterior, and it is the most retruded physiologic relation of the mandible to the maxilla to and from which the individual can make lateral movements that initially defined axis position (RAP) or centric relation (CR) to the gnathologist. Further investigations led the gnathologists to believe that mandibular movements are governed by the three axes of rotation.

The concept of retruded axis position evolved into a three-dimensional position, resulting in its description as the rearmost, uppermost, and midmost (RUM) position of the condylar fossae. The mandible travels forward along the sagittal plane it is considered a protrusive excursion or protrusion. In contrast, it is considered an intercuspation ( IC ) to a more anterior position and having immediate and definite differentiation between intercuspation ( IC ) and centric relation ( CR ) instead of inter-cuspal position ( IC ).

Pankey Mann Schuyler

Pankey Mann Schuyler as gnathology was evolving, several competing occlusal concepts and permutations were theorized, such as the Pankey Mann Schuyler (PMS) theory of occlusion. The Pankey Mann Schuyler concepts evolved out of an initial study group headed by LD Pankey on the east coast of America. Nomenclature was different and included centric relation (CR) instead of retruded axis position (RAP), centre related occlusion (CRO) instead of retruded contact position (CRP) and centric occlusion (CO) instead of inter-cuspal position (ICP).

Shuyler further suggested that initial guidance without freedom of movement from a centric related occlusion (CRO) to a more anterior tooth intercuspation (CC) will lock in the ‘posterior occlusion (long centric)’.

The incisal guidance, along with ‘long centric’, is determined by the distance from transverse horizontal axis-centric relation and the normal freedom of movement in the envelope of function. This method requires that the incisal guidance be established and the mandibular posterior buccal cusps be placed to a height measured along the occlusal plane as dictated by the curve of Occlusion. The maxillary posterior teeth are developed after the completion of the mandibular restorations as dictated by a wax functionally generated path record. The definitive restorations are equilibrated into a centric relation position with mandibular buccal cusps onto...
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a flattened fossae-marginal ridge contact with 'freedom in centric' anterior guidance and group function in laterotrusive (working) excursion.

Deflective contacts

Though 90% of natural dentitions have a deflective occlusal contact or an occlusal 'prematurity' between centric related occlusion (CRO) and centric occlusion (CO), it is usually in the form of a slide that has both a vertical and horizontal component occurring in all three planes. According to Ash and Ramfjord, the horizontal 'long centric', from centric related occlusion to centric occlusion, should be incorporated into a restorative means of a post restorative occlusal adjustment.

Dawson illustrates the 'freedom in centric' concept within the lingual concavity of the maxillary anterior teeth. He redelineates long centric as 'freedom to close the mandible either into centric relation or slightly anterior to it without varying the vertical dimension at the anterior teeth'. Additionally, long centric accommodated changes in head position and postural closure (Moil position).

Gnathology versus PMS

Gnathologists believe that once the condyles are positioned in retruded axis position (centric relation), any movement out of this position should disclude the posterior segment, thus nullifying any horizontal cuspal-fossa area contact.

This belief, combined with the immediate anterior disclusion, forms the basis of a mutually protected occlusion and limits tooth wear. The PMS occlusal scheme, however, encourages multiple occlusal contacts during lateral movements (group function or wide centre) and during protrusive movements (long centric). This may have the effect of increasing tooth wear. It is, therefore, logical that the PMS occlusal scheme recommends that occlusal wear is physiological, not pathological as suggested by gnathologists. The task of adjusting maximum intercuspal contacts in two different positions on an articulator may result in a lack of precision in both positions. However, the maxillomandibular system has the ability to adapt to various influences and though, in the author’s opinion, the concept of gnathology will produce stable long-term results, some patients may require more freedom in their occlusion and the PMS concepts are not to be dismissed in these patients. Indeed, some PMS concepts such as waxing up the curve of Spee and Monson prior to occlusal rehabilitation are incorporated into every day occlusal practice.

Case study

Patient A was referred to me for a full mouth reconstruction and aesthetic improvements to her smile (Figures 1-3). Initial impressions, facebow and jaw registration were taken for mounted study models (Figure 4). The study models showed the degree of over-eruption of her anterior segments and disturbances to the occlusal plane (Figures 5-8).

Initial diagnostic waxing (Figures 6-9). Prototypes (Figures 13 and 14) and prep guides (Figures 15 and 16) were completed using a lower curve of Spee of 4° radius (anatomical average as recommended by the PWS techniques). Initial prototypes were placed with large palatal ramps on the upper anterior teeth to allow anterior tooth contacts and thus an immediate disclusion style of occlusal scheme as recommended in the gnathological approach.

During the course of the initial preparation and prototypes and after a period of stabilization, the patient was struggling to come to terms with the palatal ramps from a speech and comfort point of view. The decision was made to change the occlusal scheme to a PMS 'freedom in centric' style approach where initial guidance in both left and right lateral excursions came from posterior teeth until such time as the canines contacted and then took over as canine guidance. In protrusion, a similar long centric was established on posterior teeth so that in protrusive movements the initial guidance was from the posterior teeth until such time as the incisors touched and then took over the further smooth protrusive movements.

This was achieved by using a fully adjustable articulator to complete the restorations (Figures 17 and 18).

Conclusions

The definitive anterior crowns were made of Procera all ceramic (Nobel Biocare) (Figures 19-21). The posterior crowns were constructed of traditional porcelain fused to metal with large flat areas on the palatal cusps for the establishment of both long and wide centre. (Figures 22-24) as in the new intercuspal position there were no anterior contacts (Figure 25) due to loss of the palatal ramps. The final aesthetic result can be seen in Figures 26 to 29.

Occlusion and the various occlusal concepts have caused – and continue to cause – debate. Whilst the author has been trained throughout his career in the concepts of gnathology, there is the recognition that other occlusal concepts, such as PMS and bilateral balance, may have a part to play in treatment of some patients.

During the rest of this series, the principles of gnathology will be used in the treatment of the partial or full mouth reconstruction.

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