NANOCERAMICS AND NANOCOMPOSITES

IN IMPLANT-RETAINED FIXED HYBRIDS

New materials save the day for this restorative approach

By Conrad J Rensburg, ND, NHD; and Jack Marrano, CDT

OVER THE LAST FEW DECADES, the dental industry has experienced a staggering evolution in technology. This evolution has caused a need for better materials and ultimately has led to the development of new and exciting products. These products have opened the door for the creation of extremely innovative new treatment protocols.[1] Arguably, one of the biggest advancements during this period has been the ability to treat the edentulous patient with a fixed hybrid solution.

In earlier use, fixed hybrid prosthetic options were limited and brought with them multiple issues, the biggest concern being longevity. Initially, a wrapped acrylic hybrid supported by a milled titanium substructure was seen in the industry as the gold standard. Although the milled titanium bar proved to offer an extremely solid foundation to support the dental implants by cross-arch stabilizing the individual units, the lack of chemical bonding between the different materials caused long-term stability issues in the prosthesis. The general consensus among multiple restorative clinicians who were interviewed about this is that many patients experienced some type of failure in either the hybrid teeth or acrylic support structure 36 to 48 months post-delivery.

On the up side, these failures prompted advancements in denture tooth materials specifically designed to cope with the additional forces exhibited by the bone-on-bone occlusion seen in implant-retained fixed hybrids.[2] Nano-hybrid-composite teeth are commonly used for hybrid applications. Even when used in combination with a high-impact injectable acrylic, the acrylic titanium structure simply does not stay stable under medium- to long-term function.

Nano-ceramics like Crystal Ultra® (Digital Dental; crystalultra.com) and other materials like Grandio® disc (VOCO; voco.dental) have created a bridge between the soft occlusion of acrylics and the strength that monolithic zirconia offers. These materials address the harsh occlusion of zirconia while stabilizing the inherent weakness of acrylic hybrids with a true one-piece, monolithically milled tooth structure. Combining a nano-ceramic overlay with a millable support structure like TriLor® (Preat; preat.com) or TRINIA® (Shofu; shofu.com) produces a truly revolutionary hybrid option.

Nano-ceramics are changing the way progressive dental laboratories are processing hybrids. They allow laboratories to offer an extremely unique hybrid that can be processed with great efficiency over a substructure of millable fiber-reinforced resin. This hybrid material truly allows the modern-day technician the ability to bridge a product gap that has existed for many years.

The combination of nano-ceramics on a substructure of millable fiber-reinforced resin material offers:

- a significantly lighter weight than a zirconia final restoration;
- a higher compressive strength than acrylic;
- a full monolithic occlusal table and tooth structure;
- a modulus of elasticity comparable to natural teeth, resulting in very low wear of opposin dentition; and
- chairside repairability with light-curing composite.

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The traditional titanium support structure is replaced by a fiber-reinforced resin substructure that is milled in-house. Proprietary or non-proprietary titanium implant interfaces are cemented to the substructure.

Case Study

The patient presented with severely worn dentition (Figure 1). After stabilizing the patient's oral health, implants were placed, and in the surgical stage, the case was converted to implant-retained transitional hybrids (Figure 2 and Figure 3).

At the first clinical appointment, an abutment-level impression was taken, then the laboratory poured a soft tissue model and created a verification jig and bite rim. However, if a latched, guided surgical conversion process is followed, the transitional hybrid can be used for mounting and a prototype diagnostic starting point.

At the second clinical appointment, the dentist registered the bite and verified the accuracy of the model. Then the laboratory created an implant-retained or tissue-borne tooth set-up in wax (Figure 4). (In a variation of this treatment, the second and third clinical appointments may be skipped.)

The dentist examined the tooth try-in and smile pictures for diagnostic changes during the third clinical appointment. The laboratory dual-scanned the approved tooth try-in (Figure 5), made the diagnostic changes as requested, and created a PMMA prototype. This prototype was printed from PMMA as a "try-in only" non-functional prototype (Figure 6). To create the functional prototype, the case was milled using double cross-linked PMMA Temp Esthetic PMMA (Harvest Dental; harvestdental.com) (Figure 7). This prototype hybrid can also function as a long-term emergency denture in the case of final prosthesis failure.

The prototype try-in was done at the fourth appointment. Required adjustments were made to the prototype while in the mouth, and final diagnostic notes and smile pictures were taken.

Once the final adjustments were made to the design, the adjusted prototype was placed on the model and digitally dual-scanned. The TriLor substructure was designed within the parameters set by the approved prototype (Figure 8). The bar was milled and hand-finished, and titanium interfaces were cemented, using the model as a reference.

The final processed substructure support bar was returned to the model and digitally dual-scanned as a new file (Figure 9). The file was then prepared and ready for the final overlay tooth

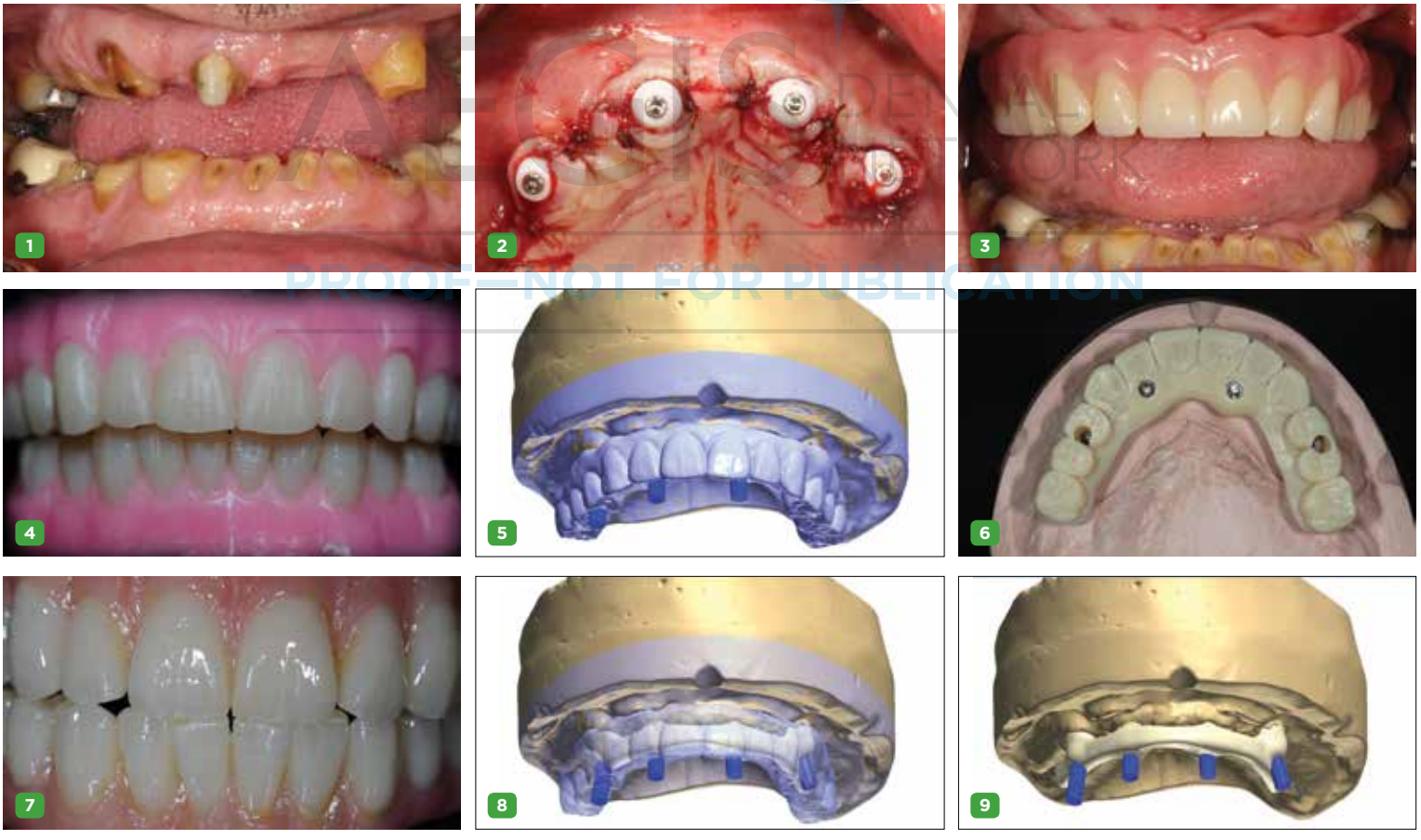

Fig 1. The patient presents with severely worn dentition, as shown prior the start of treatment. Fig 2 and Fig 3. The implants are placed and the process of creating the implant-retained transitional hybrids begins. Fig 4. An implant-retained wax try-in is created after the second clinical appointment. Fig 5. The approved tooth wax-up is scanned digitally prior to the laboratory making any changes requested by the dentist. Fig 6. The printed PMMA non-functional prototype is to be used exclusively as a try-in. Fig 7. The long-term transitional/functional prototype is milled from Temp Esthetic PMMA. Fig 8. The Trilor bar design is based on the prototype scan. Fig 9. The bar design is ready for milling.

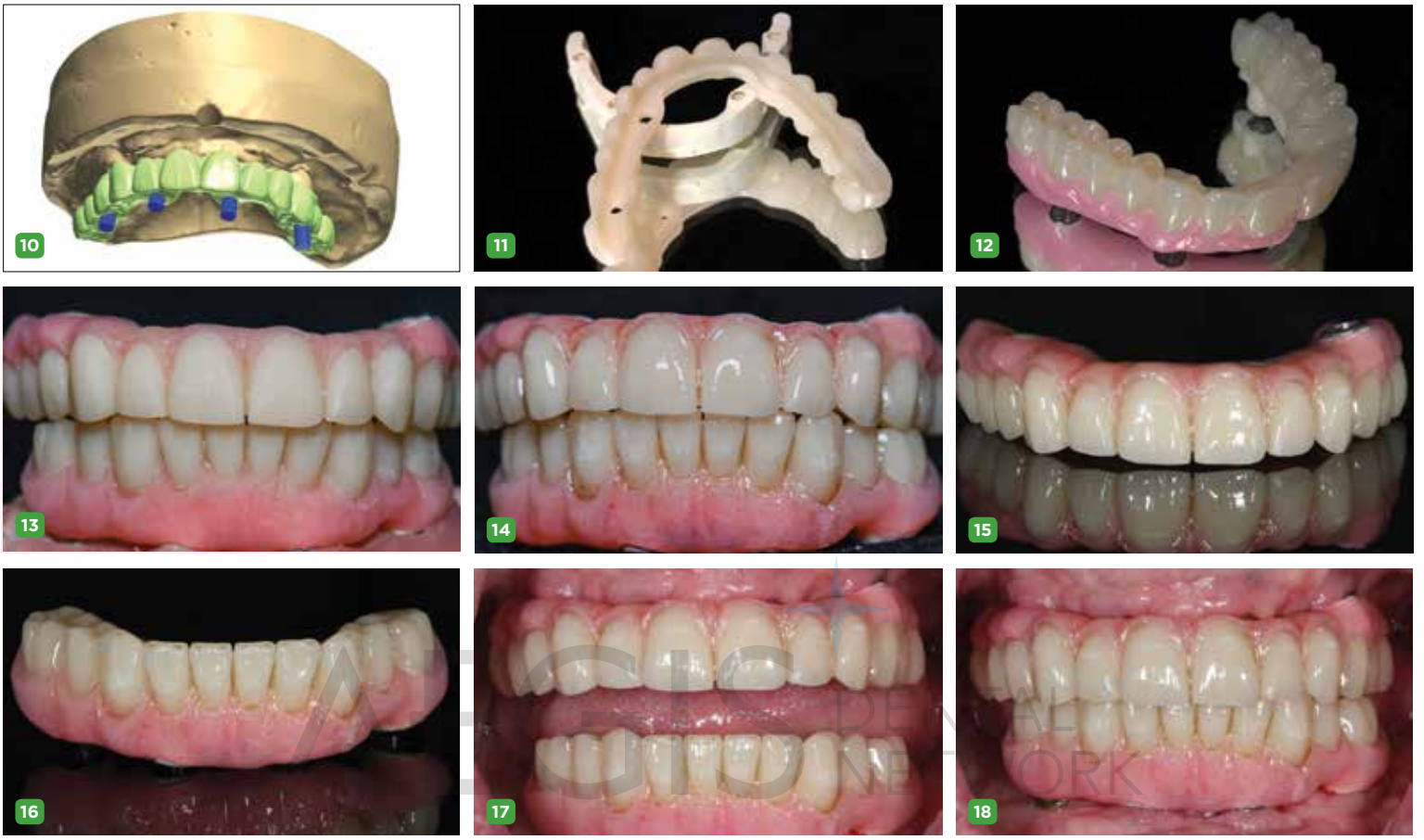

Fig 10. The final tooth overlay is designed to fit the substructure perfectly. Fig 11. The case is ready to be assembled. Fig 12. Pink tissue is waxed and processed. Fig 13. The unfinished acrylic is ready for glazing. Fig 14. The hybrid is customized using GC OPTIGLAZE. Fig 15 through Fig 18. The finished case is ready for final delivery.

structure design.

The final monolithic overlay tooth structure was made using Crystal Ultra nano-ceramics. The intaglio surface of the tooth structure was designed to fit snugly over the TriLor supporting structure (Figure 10).

After all the components were milled, the case was ready for assembly (Figure 11). Before cementing and further processing, it was placed back on the articulator for a post-milling bite-verification check. The required adjustments were made, then the case was cemented using a luting composite cement, here Multilink Hybrid Abutment (Ivoclar Vivadent; ivoclarvivadent.com).

The case was then finished by hand-waxing the desired soft tissue contour and injecting it with high-impact acrylic (Figure 12). After acrylic clean-up, the case was customized using OPTIGLAZE color (GC America; gcamerica.com) (Figure 13 and Figure 14) and returned for final delivery (Figure 15 through Figure 18).

New materials address the harsh occlusion of zirconia while stabilizing the inherent weakness of acrylic hybrids with a true one-piece, monolithically milled tooth structure.

After more than a decade, the original all-on-4 concept has proven to be a very predictable treatment option in full arch application. The author believes that modern day materials and processes have finally evolved to a point where they can effectively support this highly utilized restorative protocol.

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REFERENCES ONLINE

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