The CAD/CAM Technology Restorative Evolution

Embracing with Excitement and Frequent Assessment—Part I

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CAD/CAM technology has the immense potential to continue to facilitate restorative patient care in terms of oral health along with the function, longevity and aesthetics of the restorations. From a restorative perspective, one major feature of CAD/CAM technology is that it enables clinicians and dental technicians to use materials, such as zirconia and titanium, which otherwise could not be applied in dentistry. In addition, using traditional materials with CAD/CAM technology creates an opportunity to process industrially manufactured homogenous materials at a high level of quality that could not be otherwise achieved. Regardless of the CAD/CAM system used, both the dental technician and the clinician must bear in mind that CAD/CAM technology is only a contemporary means for providing patients with restorations that could otherwise be fabricated using traditional materials and traditional laboratory procedures. Moreover, from a clinical perspective, CAD/CAM technology is less forgiving than traditional techniques. The requirements for preparation design are more rigid and, if not met, may negate the CAD/CAM system's ability to fabricate the desired restorations. In addition, the design software and fabrication processes of such systems are still evolving and have their limitations. For the dental technician, while CAD/CAM technology facilitates efficiency and is cost effective in the dental laboratory, it requires an additional set of skills to ensure no compromise is made in the quality of the restorations.

Table I: Materials Used With CAD/CAM Technology

Ceramics Silica-Based, Leucite-Reinforced Glass, Lithium-Disilicate Glass, Glass-Infiltrated, Densely-Sintered High-Purity Alumina and Yttrium Tetragonal Zirconia Polycrystals
High-Density Polymers Composite-Resins, Acrylic-Resins
Hybrids Ceramic-Composite-Resins
Titanium
Metal Alloys

Table II: Restorations Generated With CAD/CAM Technology

Veneers
Inlays
Onlays
Crowns
Fixed Dental Prostheses
Resin Bonded Fixed Dental Prostheses
Implant Abutments for Cement-Retained Implant-Supported Restorations
Implant Infrastructures (such as Bars and Superstructures for Implant Overdentures)
Screw-Retained Implant-Supported Restorations (Single-Unit to Complete Arch)
Removable Implant-Supported Prostheses
Complete Dentures
Provisional Restorations of All Types

Materials

Many CAD/CAM systems support the use of a wide array of restorative materials including high-density polymers (composite-resins, fiber-reinforced composite-resins and acrylic-resins), which can be used for both provisional and definitive restorations depending on the desired treatment modality; metals (commercially pure titanium, titanium-alloys, high-noble-, noble- and base-metal alloys); ceramic materials (silica-based ceramics, leucite-reinforced glass, lithium-disilicate glass, glass-infiltrated ceramics, densely-sintered high-purity alumina and yttrium tetragonal zirconia polycrystals); and hybrid ceramic-composite resin materials (Table I).

Treatment Modalities

CAD/CAM technology can offer multiple restorative treatment modalities to the patient

Table III: Progression of the CAD/CAM Restorative Evolution
Process materials for both provisional and definitive restorations such as titanium, zirconia and others (silica-based ceramics, leucite reinforced glass-ceramics, lithium-disilicate, high-density polymers, etc.).
Quality control with consistent homogenous materials with no inherent defects.
Custom design and processing for copings, frameworks, complete-contour, partial coverage, implant abutments, implant screw-retained prostheses and bars.
Treatment versatility (for simple and complex patient care).
Digital libraries of natural teeth and delivered restorations (for initial design and managing clinical complications).
Open platform for complete digital workflow (CBCT, surgical guides, digital impressions, restoration design and fabrication).
Intraoral scan or in the lab for all types of preparations and finish line designs.
Consistent excellent fit and marginal integrity with automatic finish line detection and adjustment as needed.
Efficient with minimal wear of hardware.
Financially feasible, efficient (time savings) and cost effective.
Available at the lab and chair side.

for both provisional and definitive implant-supported, tooth-borne restorations and tissue-supported restorations. Fixed tooth-borne restorations including veneers, inlays, onlays, crowns, fixed dental prostheses (FDPs) and resin-bonded FDPs can all be fabricated with either monolithic, bilayered or hybrid design. For implant-supported restorations, CAD/CAM technology facilitates the fabrication of custom implant abutments for cement-retained restorations and implant infrastructures (such as bars and superstructures for implant overdentures) as well as single and multiple-unit splinted screw-retained implant-supported restorations (fixed hybrid, metal-ceramic and all-ceramic). More recently, the use of CAD/CAM technology has become available for the fabrication of complete dentures and precision attachments for extensive fixed and removable rehabilitations (Table II).

Conclusion

Ultimately, from a clinical perspective, CAD/CAM technology must be able to support a wide array of restorations and materials with high quality while also creating the opportunity to assist in patients' long-term restorative management—especially with implant-supported restorations. The formation and storage of digital libraries of natural teeth and restorations designed and delivered with CAD/CAM systems provide treating teams with easy access to data that can facilitate initial designs for new restorations. Moreover, access to previously designed restorations will facilitate management of clinical complications. As the CAD/CAM restorative evolution continues, such restorations are expected to perform in a superior manner to the ones fabricated with traditional laboratory procedures in terms of design, fit, marginal integrity, durability, longevity, and aesthetics while demonstrating better efficiency and cost effectiveness (Table III).

With the next issue of The Seattle Study Club Journal, I will address design options for different types of restorative modalities to facilitate the restorations' durability and aesthetic outcomes.

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