AMERICAN COLLEGE OF PROSTHODONTISTS
Your smile. Our specialty.®

The Impact of Digital Technology in Prosthodontics—Executive Summary

Innovation and improvement in oral health and the techniques used to diagnose, prevent, and intervene in providing optimal oral health is a continuous process. Dentistry's earliest innovations were highlighted in diagnostics (e.g. radiography) and followed by prevention (e.g., understanding of biofilm-mediated disease and the discovery of fluoride's role in caries prevention). Recent decades have seen the innovation in therapeutic technologies that dramatically changed the treatment of damaged or missing teeth using the acid etch technique and the osseointegrated dental implant. True innovations have a demonstrable impact. Today, therapeutic interventions involve digital diagnostic, treatment planning, and prosthesis design/manufacturing techniques that are revolutionizing patient care.

The early 1990's brought digital radiography and first generation intraoral scanning with Computer-Assisted Design/Computer-Assisted Manufacturing (CAD/CAM) crowns to the dental operatory. Early adopters recognized the value of novelty and the potential for new work flows. The next decade brought Cone Beam Computed Tomography (CBCT) imaging that offered lower radiation doses and lower instrumentation costs access to three-dimensional diagnostic information. The feature of in-office technologies previously available only through dental laboratories and radiology centers provided incentive to many clinicians. Dentistry has widely recognized the benefits of digital technology only in this decade of truly advanced scanning, data management, and manufacturing improvements.

These benefits include four broad aspects of improved dental therapy leading to improved oral health and wellness. One is improved communication. Digital platforms (the patient record, radiographs, 3-D models) enable improved clarity, error free, and real-time communications that enhance both the efficiency and accuracy of dental care. Improved quality is the second benefit. Digital technologies today provide micron accuracy to enhance diagnoses, guide surgeries, and fabricate better prostheses. Using subtractive (milling) and additive (printing/sintering) techniques, the accurate 3-D virtual models are transformed into useful tools, guides and prostheses. Prototyping technology has become personalized dentistry technology at its very best; one scan, one design, one prosthesis with iterative opportunities available to improve care at each step. Third among key benefits digital technology provides to dentistry is the ability to archive and retrieve at will individual patient data.

Associated with this is the growing awareness that the transformation of currently distinct forms of data acquired for a single patient into connected, converged data sets will guide the future. Comprehensive patient records containing large data sets (DICOM, STL, Text, clinical chemistry reports, photographs) resulting in a 3-D virtual patient are envisioned.

"Despite the list of benefits and the associated features technology has, digital technology has crept rather slowly into dental practices."

The benefit of a single comprehensive patient data set will enable year-to-year comparison, enhanced communications, and expedited design and manufacture. Notably, digital manufacturing techniques embrace new materials that promote therapeutic innovation. These general benefits of digital technology in dentistry provide many practical and economic advantages for the entire therapeutic team and the patient. This is a time of individualized, personal medicine and the use of digital technologies may allow the dental profession to transform patient care and develop well-defined patient outcome measures. The fourth benefit of digital technology in Prosthodontics is its impact on the patient experience. Patients who experience digital technology recognize its value, appreciate its precision and enjoy the relative comfort these advances offer in the dental operatory. Today, dentistry leverages digital technology to improve virtually every aspect of the profession including, record keeping and reporting, patient education, planning and therapeutics, prosthesis/device design and manufacture, as well as interprofessional communication. These same documentation, design and communication platforms also enhance dental education.

Despite the list of benefits and the associated features technology has, digital technology has crept rather slowly into dental practices. Both digital radiography, and now, cone beam technologies are widely represented in the community. CAD/CAM chair side restorations and surgical guides for dental implants have been less rapidly adopted. While there are many reasons for reticent adoption of technology, clinicians are weary of change and especially of change they do not inherently understand. Replacing an impression with another device – a scanner – may not offer benefit to an accomplished clinician. It can't be argued intensively. Yet, the scanner offers other benefits beyond the impression that must be appreciated and understood. In the evolving digital dental practice, the scanner is a tool for diagnosis, patient education, record keeping, impressions and linking to prosthesis design/manufacture. When integrated into a digital clinical practice, this example of evolving technology becomes arguably, indispensable. In 2017, more interest among clinicians and wide use of digital technologies by dental laboratory technicians to produce crowns, dentures, partial dentures, implant abutments and prostheses from diverse materials is evident. As dental practices become more fully integrated with one another, with health care systems, and become required to communicate more completely with patients, digital technologies will offer further incentives to adoption.

Digital technologies face adoption barriers of cost, research support, regulatory concerns, technical and expert support, regulatory challenges regarding security and privacy, existing workflow disruption, and time. Honest concerns regarding initial costs, potential financial risks, and suspicion regarding the integrity of the digital solution are common barriers among different professionals' adoption of technologies. However, the main barriers to dentists' adoption of new technology are awareness and emotion.

Prosthodontics has much to gain from its strong embrace of digital technology over the past decade. As leaders in education and a specialty that has provided many early adopters and innovators in this field, cautious optimism has served dentistry well. Continuous efforts are directed at improving work flows and increasing accuracy of digital scanning, design and manufacture. The industry that supports these efforts appear relentless to outdo one another with regard to speed, accuracy, ease of use and comfort.

All of this benefits patients. Despite the growing benefits, it is acknowledged that significant barriers to adopting digital technologies exist. The American College of Prosthodontics Education Foundation's support of a comprehensive, national "Digital Dentistry Curriculum" initiative is addressing awareness and emotion at the grass roots level of educating the next generation of dentists and Prosthodontists. Sponsored by an unrestricted gift to the ACPEF from Henry Schein, efforts have focused on informing the educators and their next generation of dentists about all aspects of digital dental technologies.

True innovations have a demonstrable impact. The impact of digital technology in Prosthodontics is palpable. There is excitement about improvements in the provision of care. There is interest in the innate technologies supporting better dentistry. There is a growing investment in digital infrastructure among dental schools and dental practice. New technologies continue to emerge at an ever-increasing rate. A new framework for educating dentists by embracing these digital technologies has been established. In doing so, it has been demonstrated that digital technology in Prosthodontics positively influences the expectations of industry, patients, technicians, clinicians, and educators faster and, perhaps further than imagined.