



Perspectives in Prosthodontics: 1970-2010

*In Celebration of the 40th Anniversary of the
American College of Prosthodontists*

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Chapter 8 *Computer Based Technology in the Prosthodontic Practice*

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Introduction

The continued improvement of computer based clinical hardware and software applications has enabled the computer-based prosthodontic practice model. Today prosthodontic graduates are using electronic records, having never utilized a physical chart or film based radiographs^{1,2}. Newer capabilities like 3D digital diagnostic imaging, implant planning software and computer generated surgical guides empower prosthodontists to establish themselves as effective leaders providing optimal treatment solutions for both simple and complex restorative protocols. The purpose of this paper is to provide an update on the clinical application of computer technology currently available for the diagnostic management of prosthodontic patient.

Although the benefits are recognized, many clinicians avoid incorporating computer technology into their practices^{3,4}. Some transition cautiously into the digital realm in order to benefit from the advantages that newer technology promises. An entire range of practice profiles has been described by Farman⁵. They are characterized by the degree of digital integration into the patient care setting ranging from no computer integration to completely paperless/chartless.

This change is not easy for most dentists and staff because it involves a cultural shift.

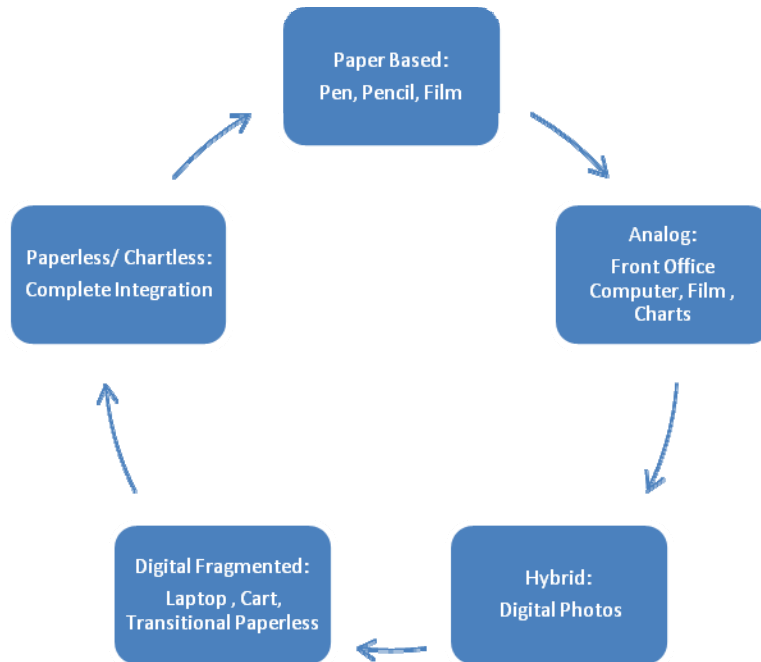


Diagram 1: The Increasing Levels of Digital Integration

Identification, Evaluation, and Infrastructure

In order to introduce new technology to a practice, it is necessary that a thorough evaluation and testing of the proposed new application takes place prior to being introduced into the practice⁶. The application must be installed and tested and key members of the staff must be trained and accountable for the training of other staff members. Additionally, once the decision is made to introduce the digital process, occasionally hardware upgrades will be required.

It is necessary to install a robust and secure network infrastructure. This includes a fileserver, hard drive backups, an uninterruptable power source, and a stable hardwired network based upon a high-speed gigabyte switch. Clinical workstations monitors must be large enough to provide effective visual access to two programs simultaneously. A 22' inch wide flat panel LED monitor on a movable arm is now considered a minimum recommended configuration. In order to achieve an ergonomic viewing position of the screen, it must be adjustable and movable for visual access to the patient, dentist and staff member when seated or standing during consultation or examination. Once the digital

infrastructure is in place, one is in a position to incorporate the clinical software application that best fits your practice's needs. It is best to make the decisions in manageable steps that allow for an effective roll out of the new software or process.

The Critical Start-up Application

When transitioning to a digital based practice, the doctor should identify a software application that would provide a valued benefit. One might call this "The Critical Start-up Application". Trends suggest that for most offices the first clinical application introduced is digital photography or digital radiography⁷.

Initially the software application and data usually reside on a laptop or cart that is moved from room to room. Typically this is kept separate from the practice management database and its data is stored locally and may not be integrated with the main system data storage, backup and security protection. This approach is cost-effective but it carries risk and inefficiency. The local data stored could be lost in the event of a hard drive failure. Regular backups must be scheduled. The lack of an integrated database results in duplicates in data entry, as patient names and identifiers are required causing redundancy by adding a separate data set. Non-linked data sets typically result in bottlenecks and are limited in scale to very small practice environments. Staff members cannot access the photographs and radiographs while communicating with a patient, if they reside on a laptop or a cart. In time, a second or a third application may be identified which will serve as an incentive to build out the clinical hardware network to boost efficiency and security. Once the back office network is built, new applications can be added very effectively without additional hardware expenses.

Installation and Integration

The transition to a completely electronic record is highlighted with decisions about where information belongs^{8,9}. Doctors and staff members must be able to answer fundamental questions. "What information is needed and where does that information reside? Where is the patient's medical history and list of medications? Is the restoration on the broken tooth the one that we provided? When was the patient last seen in our office?"

When attempting to retrieve information from a physical chart, one simply accesses the information by opening the chart, turning the pages and reading. In an electronic record, information is accessed using mouse clicks which open digital pages. In a digital record the same information is available that is in a

physical chart, but it is accessible from multiple locations within the record. Additionally the information can be mined, sorted or searched. Information can be viewed by category, tooth number, date, or other variables like completed treatment or planned treatment. Therefore, questions about a patient's condition are usually simple to answer when using the electronic record. All this is possible from any computer in the office, without ever having to retrieve a physical record ¹⁰.

The Integrated Imaging Suite

It is very important to have a practice management software that is paired with good digital radiography software. The integration of the business management package with the radiography package creates an imaging foundation. That means any photographs that are included in the patient's radiographic record are tagged to the patient's digital record. For greatest efficiency an integrated imaging suite offers a practice the most stable and serviceable platform. A fully integrated system also allows you to seamlessly attach images directly to insurance claims without any third party interface.

Today most practice management software packages have partnered with digital radiographic imaging companies to create an integrated radiographic/photographic imaging suite. PracticeWorks and SoftDent have a partnership with Kodak. EagleSoft has a partnership with Schick. Dentrax has partnered with Dexis. Therefore, depending on your favorite practice management package, one might get the best support with an established partner brand. The benefit is that you will have a supported and proven system.

Additionally, as with digital radiography, digital photography can be delegated to trained staff providing the practitioner with efficient and enhanced diagnostic information. One advantage of starting with digital radiography is that the linked imaging software can serve as a foundation for the photographic images at a no additional cost.

The Key Benefits:

Efficiency and Workflow

In order to best benefit from digital technology and the efficiencies it offers, an organized workflow must be established for standard procedures such as the new patient exam. The following is a description of a new patient workflow that has proven effective in a prosthodontic group practice. It involves a standardized series of events that are managed and a new patient examination template/digital form is completed in the clinical setting. An organized workflow including

education videos, and examination templates are all utilized to manage the new patient experience while building the digital record.

Prior to seeing a new patient in the office, a treatment coordinator will extensively interview the patient and indicate the reason for the visit in the digital phone record/journal. An appointment is made in the online appointment book. Once the patient presents to the office, a receptionist scans the patient medical history and demographic information documents into the digital document center. A registered dental assistant has received the authorization to take the patient's digital panoramic radiograph and digital extraoral and intraoral photographs. Once digital imaging has been completed the patient is given a walking tour of the practice and then seated. While uploading the photographic images to the digital record the patient watches a six-minute online Florida Probe Periodontal educational video. Then the patient's photographs and radiographs are opened up onto the 22" inch LCD while and the patient interview begins. An examination template is launched from the digital chart which prompts the RDA through a series of questions about the patient. The patient sees their photographs on the monitor while the dental assistant discusses the patient's chief concerns and reviews the patient's digitally scanned medical history. The dentist is then introduced to the patient while the dental assistant repeats the patient's entire pertinent profile, in the presence of the patient while the dentist is reviewing the photographs and radiographs. Within moments the dentist has been introduced to high quality digital information about that patient with a minimum of time invested. The universal application of an electronic health record is a primary focus of the federal government to be established by 2015 and therefore a digital platform will ultimately be necessary.

Patient Education and Treatment Planning

The doctor reviews the radiographs and photographs while making treatment planning notes. The Dexis alert functions are used to annotate areas of concern on the intraoral radiographs(FMX). While the periodontal exam is being performed, The Florida Probe software gives audible warnings that inform the patient. Then the restorative charting is completed while correlating the diagnostic input with the patient's condition in order to develop an appropriate treatment plan that directly addresses the patient's concerns. Launching 3d software assists in clarifying the steps, benefits, alternatives and possible limitations of the treatment. Pulling up photographs of other patients treated with similar needs is a powerful prognostic tool. Then the patient is transitioned to the treatment coordinator who is prepared to discuss the benefits of a comprehensive approach, staging options, and costs. He/she can access all the

patient's digital information and a library of completed treatments, using a tablet PC or Laptop to reinforce treatment acceptance. If the dentist does not have a library of their completed work, patient educational software packages can be accessed, such as Consult-PRO, Implant Docs, BiteFX™, Casey, Dentrix Presenter or Guru.

Education modules are linked to the patient's chart and stored as a permanent part of the digital record. Annotations are also stored on the image and are have a digitally sealed, time-stamped image of the video vignette and the notes from that day. These entries serve as very powerful testament to the patient's digitally signed comprehensive informed consent. Other steps like digitally signed oral sedation consent and pharmaceutical prescriptions are recorded and printed directly from the treatment planning and pharmaceutical modules and are permanently stored as a part of the electronic record. Physical printouts of the plan and corresponding consents and prescriptions are given to the patient who is then appointed in the online appointment book according to the proposed treatment sequence in the digital journal.

If the treatment plan involves a number of implants, both the 2d and the 3d CBCT visualization software add-ons have a digital library of major manufacturers' implants to clarify appropriate sizes and shapes. The radiograph is calibrated according to the magnification factor for the given image and is then used as a guideline for treatment possibilities. Implants from the library set into the panoramic or cone beam radiograph can serve as a reminder of the intended plan and serve as a record of the conversation with the patient. Collaborative implant treatment planning software also allows the colleagues as well as the patient to visualize the position of the mandibular nerve, the sinuses, the available bone, the various sizes and shapes of implants that are most appropriate for the given situation.

Improved Clinical Results

Once the digital infrastructure is in place, applications can be added to the practice very cost-effectively. For example, if in one's community a radiographic laboratory purchases a cone beam scanner, one can purchase 3D implant imaging software to complement the cone beam data in order to view and edit those files. Some 3D software, such as Facilitate View can be downloaded free from the Materialise/Astra Facilitate Web site.

Virtual access of the digital radiography and cone beam technology facilitates implant treatment decisions. Interdisciplinary team members may collaborate on

CBCT data prior to performing procedures. The position, the depth, inclination and orientation that a very highly skilled surgeon may be able to do only after a great deal of training, the younger surgeon may be able to accomplish with a flatter learning curve and with a minimum elevation of flaps. Using web-based password protected file transfer services, like yousendit.com, transferbigfiles.com or sendbigfiles.com, CBCT labs may transfer patient data bypassing physical mail and physical CD data storage.

Remote access software, like GoToMyPC.com or Logmein.com, is an unexpected advantage of applications serving the digital office. Via communication over the Internet, one can access the schedule and patient clinical data from anywhere. One can be at home and in moments log in to look at the patient schedule, review radiographs/treatment plans, prescriptions, laboratory or implant ordering needs.

An online Electronic Health record that is password protected, HIPPA compliant, and secure also enables interdisciplinary team collaboration. TeamLinx.com or USHealthRecord.com an application service provider offers interdisciplinary team members and study group members access to an interdisciplinary Electronic Health Record for complex treatment sequencing and treatment coordination. Diagnostic coding with ICD9 and ADA Codes may also allow for data mining of the electronic records. This might be used to revealing information about patient risk or treatment prognosis from similarly treated patients. The electronic record will be the way of the future so any investment in digital technology now will likely serve as a platform for the future.

Overcoming Challenges

The more one transfers their practice processes into digital realm, the more dependent one becomes upon maintaining and troubleshooting their digital infrastructure. It is of critical importance to have access to a well disciplined daily backup procedure and to use industry standard processes. Practice management software companies have access to many service technicians who apply industry standard processes to insure that your system is functional and secure.

Identifying technologically savvy staff members is key to performing data backups and troubleshooting when problems arise. If a clinical workstation goes down, a wireless laptop can be used effectively to keep the team running. A free software service included with Microsoft Windows called Remote Desktop

allows the laptop to access another functional computer in the office until a solution to the original problem can be applied. Remote Desktop can be installed quickly.

Brand name vendors include online assistance where many problems can be addressed efficiently with an expert technician via the web. In the technology world there is a constant leapfrogging of hardware performance and memory hungry features that software developers offer. New software upgrades may make older computers slow to a crawl necessitating upgrades. Realizing that these possible slowdowns occur often necessitates updating older hardware workstations. Two approaches to hardware are commonly used. One is to purchase all the computers in the system at the same time and limit the upgrades. An alternative approach is to have high priority computers workstations and use the newest computers there, with a trickle down of the older computers for non-patient purposes.

Conclusion

The digital dental practice requires staff training, infrastructure and clinical software. Customized clinical software can improve communication within the office team, increase patient acceptance of treatment plans, make staff more productive, allow access to patient records from anywhere and enable better and faster delivery of care. Patients expect today's dental office team to function with the latest technology. They want access to online information about your practice and to be able to download patient forms, such as those for their health history, financial information and appointment dates. All of this is possible with today's technological advances in clinical software and a secure computer hardware infrastructure.



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process

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