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Review Article

Digital Dentistry- New Era in Dentistry

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ABSTRACT:

Various digital technologies continue to aid the dentist's efforts in order to ensure that the patients receive the best possible treatment under most comfortable circumstances. The day when the dental technology is fully understood and also properly implemented then the dentists can provide a better care for patients as well as can improve their clinical practice. The digital dental technologies enable the consultations with the patients and also collaborations with the other dental specialists in order to be conducted quicker as well as with more detailed and immediate information than in the past years. The quality of care improves through enhanced diagnosis and such advancements in the dental technology enable the patients in order to receive the modern solutions for the traditional dental problems.

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INTRODUCTION:

Digital revolution is changing the whole world, and dentistry is no exception. Digital dentistry can be defined in a broad term as any dental technology or device that incorporates the digital or computer-controlled components in contrast to that of the electrical or mechanical alone. ¹This broad definition can range from the most commonly thought area of digital dentistry to the most prime areas of digital dentistry, which includes CAD/CAM (computer aided

design/computer aided manufacturing) and also to those that may have not even be recognized, like computer-controlled delivery of the nitrous oxide. The following represents the majority of the areas of digital dentistry and are assumed to be comprised of some type of digital components: CAD/CAM and intraoral imaging -both laboratory- and clinician-controlled; Caries diagnosis; Computer-aided implant dentistry - including design and fabrication of surgical guides; Digital radiography - intraoral and extraoral, including

cone beam computed tomography (CBCT); Electric and surgical/implant handpieces; Lasers; Occlusion and TMJ analysis and diagnosis; Photography - extraoral and intraoral; Practice and patient record management - including digital patient education as well as Shade matching.² There are several other areas of the digital dentistry available as well as many more are being researched. It is an exciting phase to be in dental profession as more technologies are being introduced which make the dentistry faster, easier, better and most importantly enjoyable.

MAJOR AREAS OF DIGITAL DENTISTRY:

Following are the briefly described major areas of digital dentistry. In order to determine the adoption as well as integration of some of the digital dentistry technologies into daily practice, following areas can be considered:

Practice, patient education and records management -

The first and foremost frequent acquisition in the digital dentistry is the implementation of computers into each operatory as well as throughout the practice.³ In most of the developed countries, this has reached the “early majority” stage while the dentists who have not yet acquired this prerequisite for digital dentistry should do so now. The advances and the improved software adapted from other industries allow this technology to be affordable and attain the fastest adoption rate as well as offer a high return on investment. The current highly effective systems include Dentrix, Practice Works, Eaglesoft and Web-based software like Curve Dental. The digital patient education is growing very rapidly.^{2,3} The future in this field will reveal the technologies as well as methods of communication which are already available in the other industries like touch-screen computer and/or voice-activated software instruction, rapid recall of photos and educational components, live video and 3-D video presentation with and without the tablets or monitors as well as off-site live consultation and education. However, there are many effective options for the digital patient education, such as CAESY, Guru, DDS GP for iPad, Consult-PRO Chairside, etc. A recent CR Foundation (clinicians report) has done a survey of more than 1,000 dentists which revealed that 80% would consider purchasing a tablet or an iPad or tablet for patients’ education. Clearly, the drawing sketches on the paper or using our hands to demonstrate the teeth are a thing of the past times.

Digital radiography-

Other logical investment into the digital dentistry after full implementation of computers into your practice; is switching to the digital radiography. Many researchers

have reported the advantages of both the extraoral and intraoral digital radiography. The main advantages include significant time reduction; lower radiation by following the ALARA principle; ease of storage as well as organization; and also image enhancements for improved and quick viewing.⁴ Although there is no significant reduction in the cost during the past five to eight years, the advantages far outweigh the limitations. The existing as well as new developments include caries diagnosis (Logicon by Carestream Dental), wireless sensors (CCD, CMOS and PSP), Intelligent Positioning System for easy and quick digital alignment of tube head to the sensor (Carestream Dental), and also the integration with voice activation and tablets.⁴ The future improvements will use the algorithms based upon thousands of the patient radiographs that accurately diagnose the caries and also make the suggestions for dentist. Complete conversion to the extraoral imaging is the potential possibility for the future. Currently, there are many excellent intraoral digital radiography systems such as Kodak, Schick, Dexis, ScanX, Gendex etc.

Cone beam computed tomography (CBCT) -

It is an exciting technology that has seen rapid growth due to decreased costs and many options to choose from, decreased radiation compared to the conventional CT scans, increased number of general dentists placing the dental implants and also rapid adoption by the specialists. However, some provinces, states and countries are struggling with the way to regulate this fast-growing area of digital dentistry, but its accuracy and effectiveness are unparalleled. The dentists are encouraged to obtain the further advanced education on this disruptive technology because of the moderate learning curve to understand the anatomy, software and also the diagnostic capacity. As compared to any other area of digital dentistry, the return on investment for many clinicians is far superior when implemented properly.^{4,5} The cone beam CT is being quickly acquired by most of the specialties and thus becoming the proposed standard for many of the surgical procedures, including third-molar removal, implant placement and endodontics. Future changes and advances will continued to decrease in the cost, improved software diagnostic capabilities to automatically take the measurements and to propose the implant positions as well as the algorithms that automatically look for asymmetries and pathology to alert radiologist for further examination and also rapid treatment planning for the surgeries.⁵

CAD/CAM and intraoral imaging-

CAD/CAM for the dental manufacturing and also the dental laboratory profession is already in early majority and will soon approach the late majority.^{5,6} It

is more economical, faster, consistent, predictable and relatively accurate. Return on the investment can be incredible if a team approach is implemented. CEREC has been available nearly 30 years, and also recent advances with both CEREC as well as E4D clearly demonstrate that the chairside CAD/CAM is uniquely positioned in order to lead our profession in the field of digital dentistry. The merging of procedures like implant placement and immediate provisionalization, through the strategic company alliances and also by shared technology allows the dentists to do more in less time. ⁶The future advances in CAD/CAM will better align the dentistry with that most of the other industries are using CAD/CAM for complete predictability of outcomes considering all the extraneous variables. This would include automatic restoration design with no further modifications based upon all the patient factors like wear, age, skeletal and arch classifications and tooth conditions and also excursive movements; moreover, TMJ condition; exact input of the condylar movements in relation to the tooth positions; and design based upon the desired look and esthetics. In order to make advances in these future advances, it the manufacturers will need to further integrate and adopt the technologies from other industries and also to create pathways for increasing the investment. In order to fabricate an indirect crown chairside or in the dental office, digital intraoral imaging and impression making is growing rapidly and also should draw the attention of every dentist. ^{6,7} The teeth scanning and the preparations are becoming increasingly faster and easier. Now days, there are more than eight companies that offer the intraoral imaging which are being the most used and are recognized. Various studies have researched all of these scanning systems and have proven all to be as accurate as the conventional methods i.e., stone die systems. Most of them are faster, more accurate and easier.

Lasers-

The diode lasers are one of lowest costing areas of the digital dentistry to adopt, and also one of the easiest. In the past few years only, the cost of diode lasers decreased to a level where “early majority” adoption is taking place. ⁷ The advantages of the universal use around all restorations, excellent hemostasis, simplified surgical procedures, and also an expanding use in a plethora of the dental procedures make this area of digital dentistry highly desirable. The current trend is portable, cordless, small; low-cost diode lasers remain effective and popular. The advances in the lasers include expanded use in almost every field of the dentistry. Further research is needed in order to validate many of the claims, although many users of not only diode lasers but the other categories such as

CO₂, Nd:YAG, erbium, etc. have integrated the lasers very effectively into their practices, and also their observations seem to correlate with claims. Use in the field of periodontics, surgery, endodontics, prosthodontics and also in the general practice has drawn the growing attention of the specialists. ^{7, 8} Future advances will see the integration into the dental operatory equipment, similar to the LED curing lights and also the intraoral cameras, and other software hands-free control advances similar to that in the other areas of digital dentistry. ⁸

ADVANTAGES:

In comparison to the conventional device or technique, each area of the digital dentistry has many advantages. However, some of the advantages may be diminished by the increased technique sensitivity or cost. In order to be considered a clear advantage, the field of digital dentistry should include the following three features i.e., improved efficiency both time and cost, improved accuracy in comparison to the previous methods and also a high level of predictability of the outcomes. Certain areas of the digital dentistry lack one or more of these characteristics and could easily be improved by integrating or adopting the technology from other industries or eliminating the attempts to improve the older and outdated technology while implementing the newer and disruptive technology.

LIMITATIONS:

The major limitation of most areas of the digital dentistry is cost. In order to adopt new technology often requires a higher capital investment, especially at the early stage. Despite this factor, if new technology meets the above criteria to be considered an advantage, then return on investment can be high if it is implemented properly. The lack of desire on the part of clinician and the team to be adequately trained is one of the common pitfalls in the adoption of this new dental technology. Some of the clinicians will purchase a new technology, but never read the owner’s manual or seek advanced training on how to operate the technology efficiently which often leads to abandonment and a high failure rate. Due to the misunderstanding, this new technology tends to have a slower adoption rates. However, this scenario can be easily avoided by greater attendance of basic as well as advanced hands-on courses in these areas of technology.

CONCLUSION:

With the advent of digital dentistry and as it continues to adapt and become more common, the approach to incorporate the topic of digital dentistry in the learning outcomes during the dental training must also change. As we enter this digital age of dental education, the

future practitioners need to be exposed to new digital procedures in their curriculum and teaching.

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