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DIGITAL DENTISTRY - THE FUTURE

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ABSTRACT

Digital Dentistry is an emerging technology in dental field, which will enhance patient's treatment modality in future. It provides digital equipment available to cosmetic dentists and implant dentists. Digital dentistry is not a wave of future, its occurring now. Whether a dentist embraces a new technology will define his/her practice and possibly future. The purpose of this article is to examine the concept of digital dentistry, its advantages and limitations and make statements and observations in specific areas of digital dentistry based on research. The success of incorporating a new technology in dental office is dependent on the knowledgebase of not only the dentist but the entire dental team.

KEYWORDS

Digital dentistry, CAD/CAM, Cone beam computed tomography and Caries diagnosis.

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INTRODUCTION

It's quite amazing to think about the dentistry performed today as compared to 30 years ago or even 10 years ago. The advances in dentistry state clearly that the dental profession has experienced an exciting amount of technological growth. Yet in comparison to medicine, bio-medical engineering, automotive or aeronautics, electronics and others, dentistry appears to be more than a decade behind in adopting or integrating new technologies on a wide spread basis[1]. A comparison of the technologies used in other advanced industries on a routine basis

clearly demonstrates this chasm. The success of incorporating a new technology in the office is dependent on the knowledgebase of not only the dentist but the entire dental team. The knowledge of the digital workflow of the different technologies enhances the confidence and the use of these technologies. Basically immense amount of data can be easily preserved or transported, which makes data transmission quicker[2].

In the dental world, it means using any digital technology or device involves computer versus mechanical or electrical stand-alone technology or service. This transformed how people communicate, learn or work. The array of digital equipment available to cosmetic dentist, general dentist and implant dentist etc has increased significantly. Such advancements in dental technology enabled patients to receive modern solutions to traditional dental problem[3].

The following list represents the majority of areas, which incorporate some type of digital components[4].

1. Shade Matching
2. Caries diagnosis
3. Occlusion and TMJ analysis and diagnosis
4. Computer-aided implant dentistry- including design and fabrication of surgical guides.
5. Digital radiography-Intraoral and Extra oral including cone beam computed tomography (CBCT).
6. Electrical and surgical implant hand pieces.
7. Photography - Extra oral and Intraoral.
8. Practice and patient record management - Including digital patient education.
9. Lasers.
10. CAD/CAM and intraoral imaging - both laboratory and clinician controlled.

Dentists are eager to incorporate proven digital technology into their practice to provide leading edge dental treatment that can be performed in a more efficient, effective and comfortable manner.

CAD/CAM

Computer aided design (computer assisted manufacturer) technology enables dental restorations such as crowns, dentures, inlays and onlays to be fabricated using computerized milling technologies. It is faster, more economical, predictable, consistent and relatively accurate. Merging of procedures such as, Implant placement and immediate provisionalization through strategic company alliances and shared technologies allows dentists to do more in less time. Future advances in CAD/CAM will better align dentistry with what other industries use CAD/CAM for computer predictability of outcomes considering all extraneous variables. This would include automatic restoration design with no further modifications based on all patient factors such as skeletal and arch classifications wear age, and tooth conditions, excessive movements, TMJ condition, exact inputs of condylar movements in relation to tooth positions, and design based on esthetics and desired looks. This would help dentist to complete tooth restorations on the same day that would otherwise require two or more visits to complete[5].

CONE BEAM COMPUTED TOMOGRAPHY

This form of computerized Tomography provides dentists with a quick 3D image of a patient's oral or maxillofacial anatomy. It gives a complete image, which can be viewed in 360^0 accurate to $1/10^{th}$ of minimum. We can zoom through tissues to explore the gums, teeth and vital areas like sinuses. The clarity of the image allows us to measure the thickness of the bone and orientation of the nerves. It act as an implant surgical guides for oral surgeons and periodontists when placing dental implants, which in turn makes the treatment accurate than before. Thus it enables to place implants with greater precession and also to diagnose TMJ problems[6].

CARIES DIAGNOSIS

Diagnodent is designed to aid in early detection of caries by measuring the increased light induced fluorescence. Visual examination and dental explorers help us to find decay on the surfaces of teeth and x-rays show us advanced decay and decay between the teeth. However, these methods don't find decay that's located inside the tooth. So these digital technologies help us to diagnose the hidden decay were the light probe scans the teeth with laser light. When laser reaches decay under the surface of

the tooth, the decay emits the fluorescent light that bounces back to the sensors and it is translated into the digital read out and also as audible signal. Higher the value greater is the amount of decay in the tooth. The advanced technology uses sound, pulse and laser to detect caries earlier than the traditional methods. This in turn allows the dentist to commence the treatment immediately. With this advanced technology, we can more accurately and reliably find the decay in its earlier stages before it causes more damage and helps to preserve the healthy tooth structure[7].

DIGITAL PATIENT EDUCATION - PRACTICE AND PATIENT RECORD MANAGEMENT

Long gone are the days when appointments were recorded in scheduling books manually. Currently, computer specific software for the dental offices has evolved not only to make appointments, but everything that permits to the patient's dental well-being can be recorded as well. With a variety of appointment scheduling program available dentists today are making it easier for patients to make and keep their oral hygiene and treatment appointments via the internet. However, some offices have not converted. Additionally, communication programs make it easy for the dentist to clearly share the information about a patient's case with their laboratories and specialists to ensure proper care and eliminate unnecessary patient office visits. Real time computer consultations are also possible while patients are in the chair. So any esthetic or functional issue can be discussed and resolved[8].

DIGITAL IMAGING/DIGITAL RADIOGRAPHY

A cornerstone of diagnosis and treatment planning is the use of radiographs. Traditional radiographs consisted of radiographic films that are manually processed involving several steps. Today, dental offices have access to digital radiography. The advantages of using a sensor to capture data are immediate viewing, exposure time reduction and storage. The image can be transferred to other rooms such as Dentist Private Office for viewing or even emailed to specialists for consultation using a HIPAA-compliant email service. Images can be enlarged and enhanced to provide a comprehensive diagnosis and evaluation. Digital imaging uses up to 256 shades of grey compared with conventional film. There is 60% reduction in radiation exposure when using digital imaging. Dentists appreciate the fact that less radiation is used since the sensors are more sensitive and provide a more quality image**.** It also helps to reduce environmental impact bar film packets, which contains lead and processing solution is no longer used. These images can be stored and compared with previous or future images to estimate the dental health of the patient[9].

IMPLANT TREATMENT PLANNING SOFTWARE

Implants have grown remarkable as a viable option for missing tooth replacement. There are many brands of implant systems to choose from today. The success of the implant is dependent on correct placement as well as several other factors such as Osseo-integration. Presurgical treatment planning software is designed to increase this efficiency of placing implants. Surgical templates assist in proper placement for esthetics restorative and functional purposes making implant placement faster, easier, and safer and more precise. Thus, treatment planning, diagnosis, and placement of implant is easy and more accurate. Treatment planning software incorporates a digital scan either from an intraoral digital scanner or from a 3D image from a CBCT scan[10].

Some implant companies have their own systems[11].

- 3M True Definition
- (3m.com/3M/en_US/Dental/)
- Carestream CS 3500 (carestreamdental.com)
- iTero by Align Technology (itero.com)
- The DWIO system from Dental Wings (dentalwings.com)
- PlanScan from Planmeca (planmecacadcam.com)
- Trios from 3Shape (www.3shape.com)
- CEREC (sirona.com)
- Lythos by Ormco (ormco.com)

OPTICAL SCANNERS: (SHADE MATCHING)

Optical scanner helps to create a digital image of the teeth and also enables the dentist to create digital impression of the tooth's anatomy. Digital color map helps to ensure accurate color analysis for determining the shade of the teeth. Newer digital impression techniques is more comfortable for the patient's when compared with traditional methods of using bulky trays with unpleasant tasting impression materials, which can lead to possible gagging[12].

THE WAND

The wand is a computerized tool that can deliver anesthesia in a slow and methodic manner. This slow and gentle delivery associated with the WAND often makes injection painless. It is a computer controlled device, which determines how much flow goes in and the pressure in which anesthetic solution is given to the patient. So it takes away lots of sensitivity that patient encounter when they have anesthetic injection. It helps the dentist to numb up one single tooth, which they are working on, so that patients don't have to walk out with fat lips and tongue, which is very unpleasant. The wand looks more like a pen and dentists holds it like a pen and it definitely does not induce the anxiety because it doesn't look like an injection. The delivery holder is small and easy for the dentist use[13].

DIODE LASER

Lasers are defined as monochromatic electromagnetic energy of one wavelength. Diode lasers are most commonly used soft tissue lasers by dentists. It is used for a variety of procedures such as soft-tissue gingivectomy, biopsy, impression toughing, frenectomy, adjunct periodontal procedures, implantlogy, in endodontic, and for tooth whitening. The infrared wavelengths of the laser have the ability to precisely and efficiently cut, coagulate, ablate, or vaporize the target tissue. Manufacturers have made the units small, portable, cordless, and low in cost, which make them desirable and easy to add the investment into the practice.

Examples of dental laser companies include:

- Discus/Philips
- Ivoclar Vivadent
- Biolase
- AMD Lasers

ADVANTAGES OF DIGITAL DENTISTRY

- Improved efficiency-Both cost and time.
- Improved accuracy in comparison to previous methods.
- High level of predictability of outcome.
- Technology will make practice management more efficient.
- Educational software and intelligent assistants will increasingly support the needs for decision making in clinical practice[14].

LIMITATIONS OF DIGITAL DENTISTRY

- The major limitation of most areas of digital dentistry is cost. To adopt new technology often requires a higher capital investment, especially at the "innovator" or "early adopter" stage.
- The other main limitation for the clinician to explore these new advancing dental technology is lack of training, knowledge and desire.
- Misunderstanding the new technology tends to foster slower adoption rates[15].

CONCLUSION

Going completely digital is the right decision. There is no doubt in mind that this is the future of dentistry and future of dental education, the future of oral care. When properly implemented and fully educated, return on investment can be excellent, increased joy in practicing dentistry can be experienced, and better care for patients can be delivered. It definitely not a fade, it's a WAY where WE ALL GOING TO GO.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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