



DIGITAL DENTISTRY AND IMPACT ON ORAL SURGERY – REVIEW

Dr. Senthil Kumar K (MDS)¹, Dr. Satish Kumar (MDS)², B. Vasanthi³, Shyaame⁴

Professor, Department of Oral and Maxillofacial Surgery¹

Reader, Department of Oral and Maxillofacial Surgery²

Junior Resident^{3,4}

Thai Moogambigai Dental College and hospital, Chennai^{1,2,3,4}

ABSTRACT :

Digital dentistry involves use of computer controlled devices for both diagnostic and restorative purposes rather than the mechanical or electrical support. CAD/CAM called as Computer Aided Design/ Computer Aided Manufacturing was introduced to dentistry in the 1980s. There has been a lot of development in dental materials and computer software technology. CAD/CAM dental procedures are now available as chair side and lab side. Computer Aided Design (CAD) involves use of computers for creating projects with high accuracy. Computer aided manufacturing (CAM) process has been developed to materialize virtual objects using CAD. Virtual files can be converted into real objects using Computer Aided Manufacturing (CA) which operates by a machine connected to a computer. Apart from guided implant placement, the computer Aided approach has been introduced to certain other procedures such as bone regenerative procedures, like sinus floor elevation with lateral window, guided bone regeneration, with titanium mesh or bone block grafts, ridge split/expansion techniques and distraction osteogenesis.

KEYWORDS : Computer Aided approach, Digital dentistry, Bone regenerative, Block graft.

INTRODUCTION :

The technology Aided growth in dentistry is quite amazing over the last few decades. Yet in comparison to machine, biomedical engineering, automobile or aeronautics, electronics and others. Dentistry appears to be more than a decade behind in adopting or integrating new technologies on a wide spread basis¹. Thus digital dentistry refers to use of newly developed techniques in both dental practices and laboratories to aid in better accuracy, efficiency and to provide an improved quality of treatment. Digital dentistry involves the use of artificial intelligence (AI), virtual reality (VR), Augmented reality (AR), 3D printing, Digital smile designing and tele dentistry². Where Artificial intelligence (AI), Virtual reality (VR) are used to develop 3D models which help the patient to visualize the treatment plan and witnessing the treatment success³. Tele dentistry helps the oral surgeon to monitor the patient post their treatment.

Digital dentistry plays a vital role in dentistry in the following⁴

- Dental caries detection.
- Aesthetic shade matching.
- Occlusion and TMJ analysis.
- Computer aided implant dentistry.
- Intra oral and extra oral digital radiography.
- Electrical and surgical implant hand piece
- Practice and patient record management
- Lasers

Dentists are more eager to incorporate all the available digital technology into their practice to prove and provide their practice as unique, effective, efficient, accurate and comfortable for both the dentist and the patient.

CAD/CAM

- Computer Aided Design/ Computer Aided Manufacturing (CAD/CAM) now has a serious growth in the field of dentistry
- They help in designing the dental restorations such as crowns, dentures, inlay and onlays
- They work on the principle of computer milling technologies
- They have a serious growth because they are accurate, faster and more economical
- They are more predictable and consistent

- It is believed that CAD/CAM would reach a serious growth in the future with the efficiency to detect the problem in occlusion and TMJ movements based on tooth positions
- They end up with single visit repair and restore which would otherwise take multiple visits.

CARIES DAIGNOSIS

- In this technique caries is detected by high light induced fluorescence
- Using visual examination and dental explorer further prevention and management are carried out.
- This plays a major role on high caries indexed individual
- They help in detecting at the early stage.⁵

CONE BEAM COMPUTER TOMOGRAPHY

- This provides an exact visual of the patients anatomy
- They include both the soft and hard tissue
- They give a clear picture of nerves original and their layout
- This helps the oral surgeon to measure the bone thickness, available support and the tissue coverage to plan and program the dental implant procedures ⁶

DIGITAL RECORDING

- Helps to store the pre operative and the present records safely
- Can be viewed many years later
- Amount of storage space is less
- Helps in future reference
- Easy way of evidence collection

PATIENT EDUCATION

- Due to recent advances it is easy to educate the patient on the available advanced treatment plan in more efficient way
- It helps the patient to see the future results ,which gives confidence to them to being the treatment
- It helps the dentist to show how far the treatment is done, what's the progress in the treatment to the patient ⁷

THE WAND

- In this technique painless delivery of anaesthesia is carried out
- It is a computer guided delivery system
- The rate , amount of LA to be injected and predetermined and automatically computerized
- The work of the dentist is to hold the Pen like device and deliver it to the site
- In this case less panic attack since no sign of sharp injection is visualised ⁸

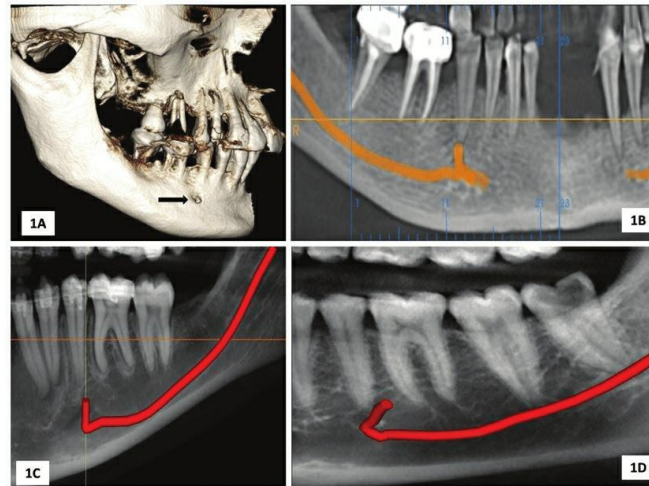
DIGITAL DENTISTRY AND ORAL SURGERY

Dealing with modern surgical pathology has roots from late 19th century but has a greatest leap over the last three decades. The search of accuracy, cause and better treatment has boomed along with the growth of digital dentistry ⁹

CLINICAL APPLICATIONS

DENTOALVEOLAR SURGERY

Among the various digital dentistry technology, cone beam computer tomography plays a important role before planning a dentoalveolar surgery nowadays. The importance of CBCT ranges from extraction to implant placement. This is because CBCT provides a quantitative and qualitative evaluation of bone along with the surrounding vital structures such as sinus, tissue, nerves and inferior alveolar canal. When compared to panoramic radiography CBCT has less role in third molar impaction, but in case of canine impaction and supernumerary it helps to have better treatment plan by avoiding multiple radiography which follows SLOB techniques. CBCT also gives an idea about surrounding bone and the rate of resorption in the surrounding structures which help in proper diagnosis and better treatment planning and accurate treatment delivery to the patient.



MAXILLOFACIAL PATHOLOGY AND RECONSTRUCTION

Three dimensional assessment help diagnosis and to further evaluate the rate and extent of the lesion. Digital dentistry help in ruling out the problems based intra- lessional changes such as loculation ,calcification roots proximity with the nerve. They help in monitoring the patient even after the treatment in case of recurrent and persistent lesion. By this way they help in early diagnosis and better treatment.

ADVANTAGES

- Avoids the risk of injury to important structures
- Can avoid complex bone grafting or regeneration
- Most cost effective
- Involves multidisciplinary approach
- Reduced surgical chair time
- High chance of predicted out come
- Educational software and intelligent assistance help in better decision making during the treatment plan
- Allows minimal surgical intervention (flap surgery)
- Improves dentist patient communication

LIMITATIONS

- High cost of investment
- Guide or training needed
- Steep learning curve initially
- Increased preoperative planning
- Challenge to be faced are more
- Clinical challenges such as decreased mouth opening and difficult to be managed along with digital dentistry

CONCLUSION :

Digital dentistry adds on great comfort to the dentist in their daily dental practice. They help in providing dental treatment at high accuracy, efficiency. It adds a great advantage to the daily practice. But they are high cost of investment and needs technical supporter or technical knowledge in handling out the challenges.

REFERENCE :

1. Paul L. Child J R, Jr, DMD, CDT, CEO. Digital dentistry: Is this the future of dentistry?, CR Foundation,
2. Mangano FG, Hauschild U, Admakin O, Fullin G, Ciocca L. Current trends in digital dentistry researchand development. Dent Clin North Am. 2021;65(1):1–18. Doi:10.1016/j.cden.2020.08.002.
3. Al-Saleh MA, Al-Mutairi MA, Alsadoon AA. Applications of virtual and augmented reality in dentistry: areview. Dental Press J Orthod. 2019;24(6):71.e1–71.e9. doi:10.1590/2177-6709.24.6.071.e1-9.onl
4. Burgess J, Digital DICOM in Dentistry, Open Dent J, 9(suppl 2, M12), 2015, 330-6.

5. Gaalaas L, Tyndall D, Mol A, Everett ET, Bangdiwala A. Ex vivo evaluation of new 2D and 3D dental radiographic technology for detecting caries, *Dentomaxillofac Radiol*, 45(3),2015,1-10.
6. Baumgarten HS, Wunsche A. CAD/CAM Fabrication of Definitive Implant Prosthesis: A Digital Workflow Planning to Implant Placement To Final Restoration, *Compend Contin Educ Dent*, 36(10), 2015, 746-55.
7. Mensudar R et al. Digital dentistry – the future, *International Journal of Medicine and Health Profession Research*, 4(2), 2017, 49 - 53.
8. Haralur SB. Digital Occlusion Parameters and their Association with Temporomandibular Disorders, *J Clin Diagn Res*, 7(8), 2013, 1772-5 Res, 7(8), 2013, 1772-5.
9. Ashish Patel, DDS, MD et al Digital Technologies in Mandibular Pathology and Reconstruction Published:January 16, 2012 DOI:<https://doi.org/10.1016/j.cxom.2011.12.003>