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The Nuances of Digital Dental Implantology

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Abstract

The digitalisation in the field of dentistry particularly talking in terms of Dental Implantology is running swiftly. The contribution from the various sources of digital dentistry i.e., the digital devices namely the 3D CBCT (Cone Beam Computed Tomography), Digital Scanners including the Intraoral scanners & Extra oral (Lab) scanners with recent introduction of Facial scanners along with 3D Photogrammetric approaches have paved the way for the dental surgeon to cater the patients virtually. A commonly used term i.e., Digital Workflow, also helped the clinician to treat the patients in a proper stepwise manner. The workflow approach has helped the clinicians to deal with the patients, right from the diagnosis, and scanning, designing and final fabrication of the prosthesis. Digital workflow in implant dentistry has always ensured better treatment planning with increased accuracy and predictability of the final treatment thereby helping the dental surgeons to foresee the exact surgical procedure giving due respect to the anatomy and the associated landmarks and thereby treating the patient with minimal discomfort. This review article highlights about the incorporation of digital dentistry and digitization as nuances in the field of dental implantology with more accuracy and reduced error and further possible complications to improve the final planning and prosthetic rehabilitation of the patient.

Keywords: Dental; Dentistry; Digital; CBCT; Scanners; Design; Milling; Machining; CAD; CAM; RP; Dental implants; Implantology; Nuances

Introduction

The incorporation of digital techniques and innovations is not a very new chapter in the field of dentistry. Since the inception of digitization in dentistry particularly dental implantology, there have been significant updates and contributions [1]. This has led to the attraction of dental surgeons, academicians as well as dental students to plunge into the practice of digital implant dentistry. The use of CAD CAM in dentistry dates to the 1980s when Dr. Francois Duret, did extensive research in the field of optical impressions. This was followed by Preston in 1990s, Mörmann *et al.* in 1989; and Andersson *et al.*, in 1996 who did extreme research in the field of digital dentistry as pioneers [2].

Earlier, the dental applications pertaining to the digital technology was limited only to inlays and onlays. Subsequently, with the inclusion of more novel and recent innovations, the digitization came out truly to be a promising innovation in implantology. The

incorporation of digital techniques into implantology helped the dental surgeons to implement a novel approach in the field of dentistry. Out of this, dental implant placement i.e., both the surgical and the prosthetic protocols fascinated the clinicians to a greater extent [3].

Previously, the conventional 2D approaches had been used to acquire the diagnostic data of the patient. The practitioners had been using free hand drilling as a blind procedure to rehabilitate the patients with dental implants. Subsequently, with the inclusion of digital approaches, the angulation and placement of the dental implants along with proper planning has been achievable. Proper implant placement is important for the overall health of the oral tissues. The combination of modern digital approaches including CBCT, digital scanners, 3D designs as well as the printed techniques have helped the clinicians as well as the laboratory personnel to successful rehabilitate the implant patient with predictable outcomes [4].

Discussion

Tooth loss is one of the most common causes for patient handicap. This can occur due to caries and periodontal disease commonly with other factors involved less commonly. The prosthetic rehabilitation of such patients can help to revive them from this handicap. Talking in these terms, the 3rd dentition i.e. dental implants have always been the top most preference for dental clinicians for prosthetic rehabilitation. Moreover, it is also the 1st choice of treatment as far as the patients are concerned, keeping in view the increased awareness, better treatment protocols and increased life expectancy. This has led to the emerging discipline of dental implantology outshining the other treatment protocols i.e. removable and fixed prosthodontics. The incorporation of dental implants has totally change the OHrQol (Overall Health related Quality of life) [5].

The concept of digital dentistry had always led to the revolution in the field of dentistry. The inclusion of digital dentistry admixed with the field of dental implantology has given birth to the concept of digital implant dentistry or digital implantology [6]. Digital dental implantology revolves around 3 major components namely scanning, designing, and milling. A stepwise approach commonly used in the field of dental implantology is termed as digital workflow. This can be elaborated as a workflow in which every phase of the diagnosis, planning & treatment is conducted by a digital resource (Figure 1).

The digital workflows are commonly categorized as analogy, partial digital and complete digital workflow (Figure 2). As stated, the digital workflows incorporated in the field of implant dentistry has improved the predictability as well as the treatment outcomes [7]. The stepwise approach of digital workflows is a tabulated format that should be followed during prosthetic rehabilitation of the patient (Figure 3).

The inclusion of digital diagnostic modalities i.e., 3D CBCT (Cone Beam Computed Tomography) has been a benchmark in the field of dental implantology. Previously, CT (Computed Tomography) had been into medical practice, but with the radiation exposures associated, its use in dentistry was discouraged. Conversely, CBCT gave a better accuracy of the parameters of bone and associated vital structures with reduced radiation dosages [8]. CBCT is now being commonly used as the 1st choice of diagnostic modality while rehabilitating patients with dental implants. CBCT as juxtaposed with MRI (Magnetic Resonance Imaging) is quite commonly discussed in the literature. MRI is a road beyond CBCT in terms of soft tissue imaging. Metal artefacts have been a common limitation of CBCTs. CBCT with its broad horizon, has been into picture for scanning the dental impressions as well as the models. However, unfortunately, the surface texture details associated is still questionable [9].

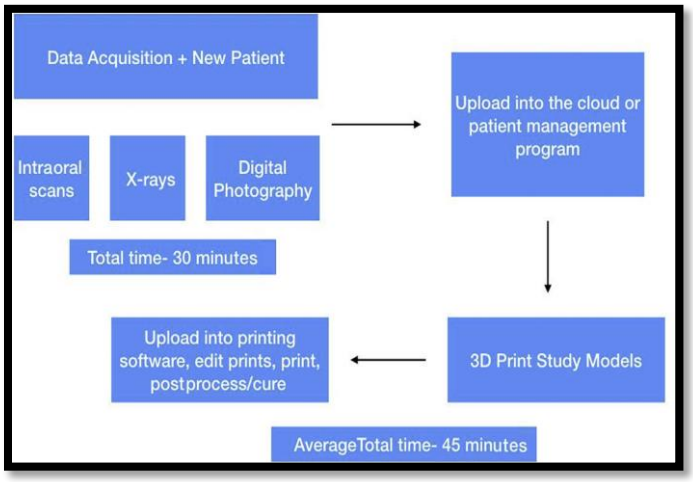

Figure 1: *Digital workflow in dental implantology.*

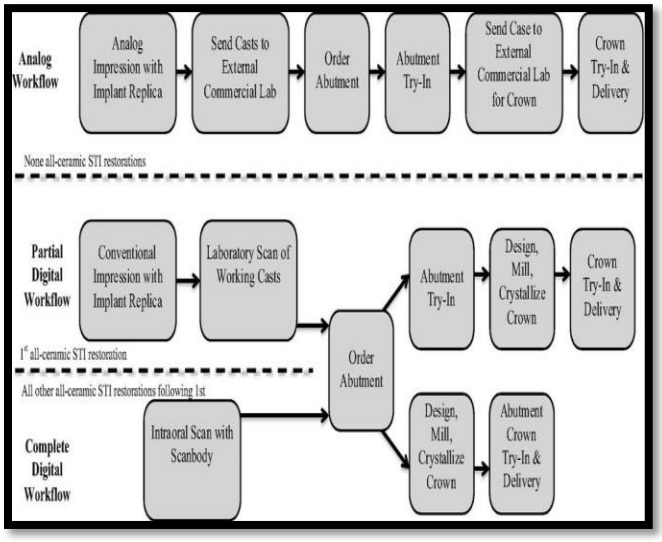

Figure 2: *Types of digital workflow.*

Scanners have revolutionized the digital implantology which can be credited to the incorporation of intraoral scanner (optical scanner) along with extraoral scanner (lab scanner). Recently, with the inclusion of facial scanner, the field of digital dentistry has done wonders. The accuracy and effectivity of the implant treatment has been significantly improved with the use of scanners. Scanners help to capture the oral cavity which further helps planning for the implant patient [10].

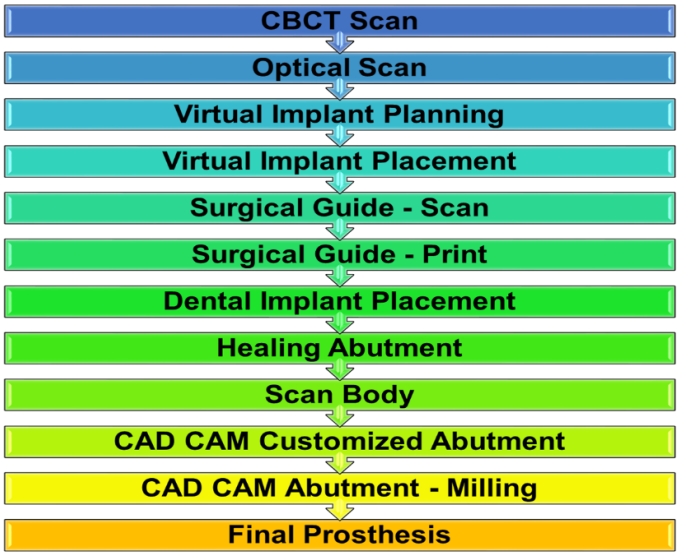

Figure 3: *Digital workflow in implant dentistry – a stepwise approach.*

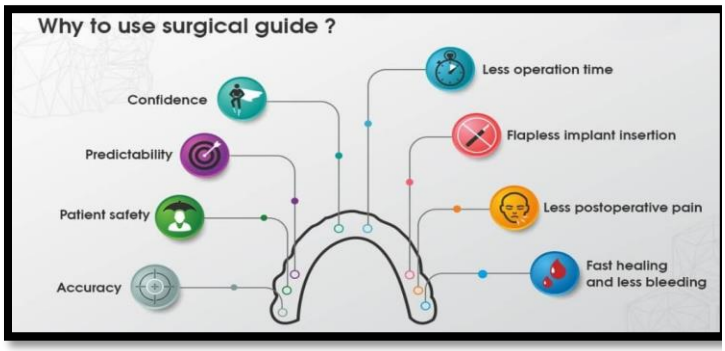

Figure 4: *Surgical Guides (Templates) – Applications.*

Virtual implant planning or 3D planning gives an idea about the digital simulation of the planned restoration for achieving the treatment outcome more precisely. This is followed by the placement of dental implants under the effect of digital implantology with more precision and safety [11]. Precise dental implant placement can be made possible with the use of Surgical Guides or templates which are designed and machined/milled/printed ultimately. A commonly used term in the field of dental implantology is "Go Guided" which showcases the effectivity of surgical guides for further improving the accuracy and placement of the dental implants (Figure 4). The surgical guides have been quite effective as far as the placement of basal and zygoma implants is concerned. Surgical guides can be static or dynamic. The dynamic ones have shown better treatment outcomes in contrast to the static surgical guide. This has led to better placement of the dental implant further improving the treatment outcome [12].

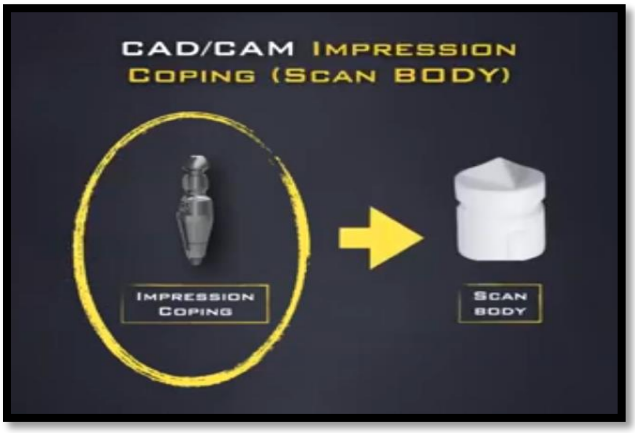

Figure 5: *Dental implant scan body.*

Figure 6: *Conventional impressions - shortcomings/disadvantages.*

After placement of the healing abutment to mimic the shape of a natural tooth, impressions of the associated area are taken with the help of scanners. This is commonly known as an optical (digital) impression. The impressions for a single implant generally pose no problem. However, for multiple implants and full mouth rehabilitations, a combination of open mouth

impression technique using scannable elatomers along with lab/extraoral scanners, will help to achieve the best possible results [13].

A very important component of impression i.e., implant scan body i.e. a true representation of the position and orientation of the respective dental implant, analogy or abutment in CAD CAM scanning procedures, is generally used during these impression procedures. It is commonly known as CAD CAM implant impression coping (Figure 5). The digital impressions in implant dentistry have successfully overcome the shortcomings associated with the conventional impressions [14] (Figure 6). This is followed by the designing of the abutments & final prosthesis with the help of CAD (Computer Aided Design) [15] commonly known as the customized abutment for optimal form and tissue support. The abutment & the final prosthesis if finally machined or milled with the help of subtractive milling i.e., CAM (Computer Assisted Milling) [16] or additive manufacturing i.e., RP (Rapid Prototyping) or Rapid Additive Manufacturing. This is followed by the final placement of the implant supported fixed restorations. Henceforth, the incorporation of the complete digital workflow has totally changed the landscape of the dental implantology.

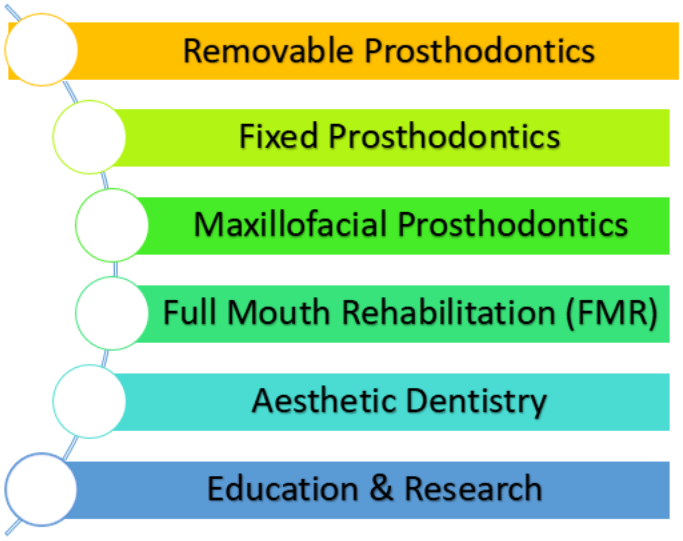

Figure 7: *Digital Dental Implantology – Broad horizon of applications.*

The concept of implant protective occlusion has also been digitized with the subsequent incorporation of Tek Scan (T Scan) into implantology. T scans can differentiate between the high pressure and low-pressure areas. This has furthermore improved the success rate of the dental implant prosthesis [17]. Keeping in view the multivariate applications of digitization in the field of implantology, [18] it is used in various associated fields of dental implantology is attributed to an expanding horizon (Figure 7).

Conclusion

Dental implants had been and will always remain as the 1st choice treatment modality for the clinicians, a preference for getting treated by the patients, a subject to research for the faculties and researchers in various universities as well as a new and an innovative way of learning by the dental students and young budding dental surgeons. There has been a paradigm shift from the conventional dental implantology to the digital dental implantology in due course of time. The ubiquitous tool of digitization into dental implantology has been a magic rather a dream come true to rehabilitate the patients in the best and the most natural way. Although, the learning curve is steep but still the dental surgeons can learn with good knowledge and updates to become more proficient in their own skills to treat the implant patients. The nuances of digital dental implantology are significant not only in research but also in day-to-day clinical practices to improve the accuracy, predictability, and outcome of the dental implant treatment.

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Conflict of Interest

None

Presentation in a conference/meeting

This article was presented as a keynote lecture (webinar) by the corresponding author

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References

1. Al-Abdullah K, Zandparsa R, Finkelman M. An in vitro comparison of the accuracy of implant impressions with coded healing abutments and different implant angulations. J Prosthetic Dentistry. 2013; 110: 90-100.
2. Burgner J, Simpson A, Fitzpatrick JM. A study on the theoretical and practical accuracy of conoscopic holography-based surface measurements: toward image registration in minimally invasive surgery. Int J Medical Robotics Computer Assisted Surg. 2013; 9: 190-203.
3. Eliasson A, Ortorp A. The accuracy of an implant impression technique using digitally coded healing abutments. Clinical Implant Dentistry Related Res. 2012; 14: 30-e38.
4. Garg AK. The Atlantis Components Abutment: simplifying the tooth implant procedure. Dental Implantology Update. 2002; 13: 65-70.

5. Gigandet M, Bigolin G, Faoro F. Implants with Original and Non-Original Abutment Connections. Clinical Implant Dentistry Related Res. 2014; 16: 303-311.
6. Hamilton A, Judge RB, Palamara JE. Evaluation of the fit of CAD/CAM abutments. Int J Prosthodontics. 2013; 26: 370-380.
7. Holst S, Persson A, Wichmann M. Digitizing implant position locators on master casts: comparison of a noncontact scanner and a contact-probe scanner. Int J Oral Maxillofacial Implants. 2012; 27: 29-35.
8. Howell KJ, McGlumphy EA, Drago C. Comparison of the accuracy of Biomet 3i Encode Robocast Technology and conventional implant impression techniques. Int J Oral Maxillofacial Implants. 2013; 28: 228-240.
9. Kapos T, Evans C. CAD/CAM technology for implant abutments, crowns, and superstructures. Int J Oral Maxillofacial Implants. 2014; 29: 117-136.
10. Kerstein RB, Radke J. Acomparison of fabrication precision and mechanical reliability of 2 zirconia implant abutments. Int J Oral Maxillofacial Implants. 2008; 23: 1029-1036.
11. Lewis S, Beumer J, Hornburg W. The “UCLA” abutment. Int J Oral Maxillofacial Implants. 1988; 3: 183-189.
12. Lewis S, Avera S, Engleman M. The restoration of improperly inclined osseointegrated implants. Int J Oral Maxillofacial Implants. 1989; 4: 147-152.
13. Ma T, Nicholls JI, Rubenstein JE. Tolerance measurements of various implant components. Int J Oral Maxillofacial Implants. 1997; 12: 371-375.
14. Mahn DH, Prestipino T. CAD/CAM implant abutments using coded healing abutments: a detailed description of the restorative process. The Compendium of Continuing Education in Dentistry. 2013; 34: 612-615.
15. Malaguti G, Denti L, Bassoli E. Dimensional tolerances and assembly accuracy of dental implants and machined versus cast-on abutments. Clin Implant Dentistry Related Res. 2013; 13: 134-140.
16. Persson AS, Andersson M, Oden A. Computer aided analysis of digitized dental stone replicas by dental CAD/CAM technology. Dental Materials. 2018; 24: 1123-1130.
17. Persson AS, Oden A, Andersson M. Digitization of simulated clinical dental impressions: virtual three-dimensional analysis of exactness. Dental Materials. 2009; 25: 929-936.
18. Priest G. Virtual-designed and computer-milled implant abutments. J Oral Maxillofacial Surgery. 2005; 63: 22-32.