

Recent Advances in Dental Implants

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ABSTRACT

With technological advancement, dental treatments involving dental implants have gained increased acceptance by patients. Improved reliability of implant along with greater acceptance of minimal invasive restorative treatment, have made implant treatment the first choice of treatment offered to patients. More of clinical trials conducted on different commercially available implants, its effect on bone and oral tissues as well as the development of implant designs, have increased the success rate of implants to over 95% and specially in anterior mandible where the success rate is over 99%. This paper reviews the latest technological advances in Dental Implantology.

KEYWORDS: Dental Implant, Implantology, Computed Tomography, Distraction Osteogenesis

INTRODUCTION

Success of Dental Implant placement relies on proper imaging. Among the latest technology in dental imaging is Cone Beam Computed Tomography (CBCT) which uses 3D images from different planes like axial, coronal, and sagittal views. It provides a stream of data which helps a dental surgeon to reconstruct images when needed, while exposing patients to less amount of radiation.^{1,2}

Recent Technological Advances in Computed Tomography are:

- Cone beam Computed Tomography: This technology uses a conical beam of radiations. It reconstructs the image using special software. All information of a Computed Tomography are obtained with 1/8th of radiation exposure and at minimal cost.
- Microtomograph: This device helps in obtaining serial sections of bone implant interface.
- Multislice helical CT: This device has the feature of providing high quality images when compared to Computed Tomography. It is referred as Dentascan Imaging.
- Interactive Computed Tomography: This device develops image files that can be transferred from Radiologist to dentist's computer, who can work upon the case with precision and ease. Both the dentist and the radiologist work together and perform "Electronic Surgery" (ES) by selecting and placing arbitrary size cylinders, thus simulating root formimplants in the images.
- Magnetic resonance imaging: MRI which is a three-dimensional imaging technique, involves an electronic image acquisition process and production of digital image.

Indications of Dental Implant Therapy have expanded with change in implant shapes, sizes, materials, coatings and technological advances, like guided tissue regenera-

tion, immediate loading concepts. Research aiming at improving the design of implant's surface treatment like increasing bone to implant contact ratio with plasma sprayed surface, Ion-sputtering coating, Anodized surface, Sand-blasted and acid-etched, Hydroxyapatite coating and biochemical surface, aids in controlling the tissue implant interface with molecules delivered directly to the interface.^{3,4}

The form and configuration of implants aids in achieving better stability, which plays a critical role in the process of osseointegration. Refinement of drilling machines has led to better control over drill speed and torque, thus reducing the overheating of bone that surrounds the implants.⁵ Better control of water irrigation and the presence of internal implant irrigation systems minimises the rise in bone temperature. Custom-made surgical splint helps in defining the implant location and angulation based on CT data.⁶

Dental professionals and specifically prosthodontists are more concerned of the occlusal loading on the dental implant prosthesis. Patients most commonly demand for dental implant fixed bridges that require good precision in dental implant alignment and implants to be linked up in triangular configuration in enhancing the stability of the implant support bridges to resist from the lateral displacement forces, which can be delivered.⁷

ADVANCES IN IMPLANTOLOGY

Peri implant surgery

Usually tooth loss results in a concomitant resorption of the alveolar bone leading to insufficient bone width or height for the placement of implants and this is well known that adequate implant width and length are important for the longevity of dental implants. Bone volume can be enhanced by various bone augmentation methods like simple onlay bone graft for small

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depression, inlay bone graft for sandwich osteotomy or the maxillary sinus floor augmentation. One of the latest procedures for augmenting areas of bone is Distraction Osteogenesis. Now a days, Osteo-inductive and osteo-conductive substances are also available to assist in accelerating healing. Vestibuloplasty and palatal graft transplant are gaining wider acceptance where there is a lack of soft tissue due to ablative surgery or tissue atrophy. Using free gingival graft transplant was found to be technically easier and produced less morbidity to the patients. Combination of various peri-implant surgeries may treat the problems related to either the soft tissue or bone deficiency around the implant placement and for implant maintenance.^{8,9}

Image Guided Implantology

In the last few years, Image guided implant placement has undergone revolutionary development. There are two main types of image guided implant surgery which involve the implant planning on dedicated software to define the angulation and position of the implants to be placed, the avoidance of the intrusion into the maxillary sinus, and the avoidance of contacting the inferior alveolar nerve. The difference in both is, one is a real time navigational implant surgery and the second one is the insertion of implants using a stereolithographic surgical splint.¹⁰

Both these systems have drawbacks and benefits. The benefits of the real time navigation is that the implant placement is being guided via computer onscreen guidance and if the implant position in bone is found to deviate from the computer planned position, an intra-operative adjustment can be made. The drawback is that the productivity is not very economical due to the expensive machine and long calibration time. The system can be used as a good training tool for teaching rather than being used in busy clinics.

Whereas, the computer designed surgical splints enhance the speed of implant placement tremendously. The drawback is that if there is any error in the computerised planning or splint fabrication, any intra-operative adjustment cannot be done unless the surgeons abandon the use of the splint at all and the implants will ultimately be wrongly placed.

Other developments

In addition very long implants of 40-55 mm are available to insert through the palatal bone to the zygoma have been developed. These zygomatic implants have advantage of avoiding any sinus grafting and bone graft so are extremely reliable. For supported facial or ear prostheses these implants can be placed extra-orally. Moreover, the navigational surgery enhances the accuracy of implant placement.^{9,10}

To raise the speed of implant osseointegration and to enhance the longevity of the implants, improvements such as the coating of the implants with bone growth factors are being actively researched. The Growth Factors are natural proteins present in our bodies which stimulate

growth of certain tissues.¹⁰

In many animal and recently human clinical studies, genetic engineers have been able to isolate and clone some Bone Morphogenic Proteins (BMPs), which induce tremendous bone growth. BMPs may very well become a potential substitute for autogenous graft material for certain applications in the future. Research in substituting the titanium material with ceramic is being pursued in order to reduce the exposure of the metallic implant body above the gingival level. This is to a certain extent being improved by the recently developed opaquely white and extremely hard zirconium material, which is a suitable material for the abutment construction. Further search for a biological compatible material simulating the tooth colour for dental implants is still on.

CONCLUSION

Developments in the field of Implant Dentistry have been noticed and are widely accepted in clinics. Research works to improve the biocompatibility, peri-implant tissue have increased the success rate of implants. Latest advances in Dental Implant imaging has led to precision implant delivery and better prognosis.

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