

Recent Trends in Dental Implants-Few Prospectives for Better Patient Care : Review Article

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Abstract

Prosthodontics has come a long way from just replacing missing teeth to replacing lost alveolus supporting facial structures, recreating esthetics, reestablishing phonetics and many other major developments. Since the concept of Osseointegration was first applied to human patients, there have been many advances in the understanding and application of Implant dentistry as a method for the replacement of missing teeth. The evolution and change seen in basic science and the surgical understanding of dental implant therapy have perhaps been more far reaching than parallel advances in knowledge of the restorative aspect of dental implants. As the 21st century draws to a close, it is appropriate to review the significant advances and changes in implant Prosthodontics that have occurred over the past 2 decades and more importantly, describe future directions of investigations that are paramount to the advancements of dental implant therapy as a beneficial treatment modality. Although implants have improved the life of millions of patients, the fundamental information relating to implant characteristic and clinical performance is often lacking. So to provide superior treatment, researchers are more focusing on modern Implantology.

Keywords: Implant, Prosthesis, Tissue Engineering.

Introduction

Advancements in technology have resulted in improved materials and innovations in all fields of Dentistry and Implants is no exception which has provided significant improvements in abilities of dental practitioners to treat patients with both simple and complex dental problems. The field of Dentistry has adopted many new techniques and technologies to improve its ability to restore the oral health of patients to a level of precision and predictability that could not be previously achieved. Additionally, there is improvement in materials, with wear resistant esthetic materials that have allowed dental practitioners to replace the missing teeth with very natural, biologically friendly, beautiful replacements. Since the first Dental Implant was used in 1965 till today, now there is a continuous advancement in implants as per today implant supported various prosthesis are offering even more predictable treatment outcome. In this article let us see few of them in the field of implant design, surgical procedure etc.

Recent Advances in Implants

Implant Design

Geometry

- Short Length Implants
- Mini Implants
- Angled Abutment Implants
- Siliastic Implants
- Tapered Implants
- Groovy Implants

Surface Topography

- HA Splutter Coated Implant
- Tissue Engineering
- Hydrophilic Implant Surface Treatment

Surgical Procedures

- Guided Tissue Implant Surgery
- Tissue Punch Surgery
- All on 4 Concept
- Peizosurgery

Implants in Maxillofacial Prosthesis

- Bio-Eye Implant
- BAHA
- Cochlear Implants

Implant Design

A prosthetic device of alloplastic biologically compatible material(s) implanted into the oral tissues beneath the mucosal and/or periosteal layer, and on/or within the bone to provide retention and support for fixed or removable prosthesis. (GPT8).

Implant is like a root analogue & maximal primary stability¹ is achieved when it fits exactly in the extracted socket so extensive work is on designs of implant. In this implant design we will consider Geometry & Surface Topography of Implant.

Geometry

Short Length Implants : Short implants are considered as a viable alternative in patients with reduced alveolar height to avoid more invasive surgical procedures. They simplify the implant treatment, reduce patient morbidity, shorten the duration of treatment and make it less expensive. Increase in implant length will increase the total surface area of implant and improves primary stability. But the area that transfers the compressive and tensile loads to bone i.e. functional surface area is confined to crestal 5-7mm. increasing in length will not change this where as short implant with wider diameter provides both, improved primary stability and increased functional surface area.

Mini Implants : Prosthetic options: Add retention to long term fixed bridge prosthesis by pinning them through their pontics to the underlying bone, or used to support transitional prosthesis. They add long term Buttress to superstructures

Angled Abutment Implants : Its conical seal design enables to create a tight and firm connection. The indexing feature allows easy

parallel placement of the abutments, promising the correct positioning during prosthetic procedures.

Siliastic Implants : A brand name for any group of substances containing polymers silicones having the properties of rubber but more capable of withstanding extremely high & low temperature and other causes of deterioration. Siliastic Implants² have a soft pliable consistency that allows them to be readily modeled to body contour for augmentation. Uses are chin augmentation, cranioplasty, malar hypoplasia facial asymmetry & nasal augmentation.

Tapered Implants : These are Ti unite surface treated due to this they have faster and stronger osteomigration quality in immediately extracted socket. Large cervical diameter better buccal support and helps in preserving the buccal bone from resorption (esthetic zone). Also improve implant- bone interface. Dehiscence and fenestration reduced. Clinical benefits of noble active implants- Indicated in all type of bone but especial in poor bone quality and quantity due to its self drilling, self condensing, self cutting ability.

Groovy Implants : These implants are offered in one body geometry, parallel walled with a diminishing thread depth toward the apical of the implant and secondary groove underneath each thread to enhance the initial stability. Cutting flutes incorporated at the apex of the implant give this implant design self tapping capability.

One Piece Implants with Aggressive Threading : The presence of little steps on the lower side of the thread on the implant body. These feature a very deep coil depth designed to provide increased primary stability even in soft bone. Blood gathers into these threads, promoting the precocious formation of bone tissue and thus faster osseointegration.



Surface Topography

HA-Splutter Coated Implants : The incorporation of nanotechnology into implant dentistry has been a major breakthrough in implant surface technology. This technique makes use of an ion beam modification of the titanium alloy surfaces⁷. The titanium alloy is modified using an Ion-Beam Assisted Deposition with a thin (less than 1 micrometer) amorphous calcium phosphate compound with HA-like chemistry for enhancement of bone integration.

The advantages are formation of a nano-thin calcium phosphate compound on the titanium implant, surface thickness of less than 500 nanometers and maintenance of the rough micro topography of the implant surface.

Tissue Engineering Strategies : Aimed at growing a thin layer of Ca-P on the implant surface from a physiologically related supersaturated calcifying solution at ambient temperatures by mimicking the natural bone or tooth mineralization process.⁴ Osteo-inductive substances used as biomimetic coatings on the surface of dental implants and optimize the cascade of biological events that result in the bone formation appropriate for securing a dental implant. This development has made it possible to incorporate therapeutic agents directly into the Ca-P coating like BMP and rhBMP, BISPHTHONATES, IGF 1 & 2 and PDGF. Most popular method is to load therapeutics and bioactive agents into the Ca-P coating. Coating with **BMPs**-accelerate initial healing times, reduce overall treatment time- improve implant success rate. Experimental investigations with a BMP known as recombinant human BMP-2 (rhBMP-2) in animal models have shown that it promotes initial integration of dental implants and “rescues” implants affected by experimentally induced peri-implant bone loss.

Advantages are these coatings on the load-bearing dental implants are the superior mechanical properties of the substrates, the excellent biocompatibility of Ca-P materials, Conformal coating-on implants with a complex shape or porous structure, can be applied on temperature-sensitive substrates, more controllable than plasma spraying & Biomimetic apatite coating are more closer to the minerals in bone and have a higher bone-bonding ability than the PSHA coating.

Hydrophilic Implant Surface Treatment : These exhibit a fundamentally improved surface chemistry. These implants are initially Sandblasted with Large grit, Acid etched & Conditioned then Immediately preserved in an isotonic saline solution, (helps maintain a high surface activity, which would otherwise be lost due to reaction with the atmosphere). Due to this ideal conditioning, the implant surface quickly attracts blood and proteins, potentially promoting the process of bone formation and thus increased early stability.

Surgical Procedures

Guided Implant Surgery : It uses patient's CBCT (Cone Beam Computed Tomography) images to plan implant surgery through computer software⁵. CBCT- In this patient is seated, as compared with lying down in a medical CT unit. Open design of the cone beam CT units virtually eliminates claustrophobia. Radiation dose is considerably less than a medical CT. Very easy to operate and to maintain; little technician training is required⁶.

Implant planning software (simplant) reads these DICOM files and reconstructs them in two-dimensional or three-dimensional images. Stereo Lithographic Templates⁷ formed. Guided implant surgery requires the following tools like Medical or Cone-beam CT, Implant planning software, Guided implant surgery drill kit, Custom surgical template, Cone-beam CT⁸ produces images in DICOM format & Implant planning software (simplant) reads these DICOM files and reconstructs them in two-dimensional or three-dimensional images. These softwares provide various tools for implant planning, therefore, the user can refer to the anatomic structure of the patient and plan a safe surgery⁹. Then Stereo lithographic templates were formed on the surgical template, small metal sleeves are inserted in place, which guides the drilling and implant direction.

Tissue Punch-Flapless Approach : Flapless surgery involves using a tissue punch device to gain access to the alveolar ridge for implant placement or abutment connection. Use of Flapless surgery for implant placement has been gaining popularity among implant surgeons. Flapless surgery involves using a tissue punch device to gain access to the alveolar ridge for implant placement or abutment connection. It can be hand held and rotatory tissue punch. Available in different diameter corresponding to implant diameter. Advantages are preservation of circulation, soft tissue architecture, and hard tissue volume at the site, decreased surgical time. Improved patient's comfort.

All On 4 Concept : Implants placed- 2 Axial implants in anterior and 2 distal tilting implant in posterior region supporting a provisional fixed and immediately loaded prosthesis on same day of surgery. All four titanium implants are placed so that the bone will grow around & secure them in place. With only four implants, there is much less invasive and lengthy surgery.¹⁰ Once the implants are in place, the oral Surgeon attaches abutments to which the new replacement teeth can be secured. The Prosthodontist fits the replacement teeth on the abutments and adjusts the bite for comfort and a beautiful smile. It Increase Interimplant space, reduces cantilever length in jaws as implant support moves posteriorly and reduces the need for bone augmentation.^{7,11}

Peizosurgery : In 2000, Velcelotti

published a case report on his new piezoelectric jaw bone- splitting technique, new performed with due efficiency and safety during bone preparation with the Peizosurgery device¹². Precise cutting, selective cutting, greater control of the surgical surgical device, a large selection of headpieces, bleeding free surgery site & faster bone healing were some of its advantages that make it so popular.

Implants In Maxillofacial Prosthesis

Bio-Eye Implant : A wide range of artificial eye movements as well as fine darting eye movements (commonly seen during close conversational speech) are seen¹³. Because the surface of the hydroxyapatite implants is rough and rigid, they should be covered with fascia for the attachment of the extraocular muscles.

Bone Anchored Hearing Aids (BAHA) : BAHA uses the principle of osseointegration. In this the sound conduction is through the bone directly to the internal ear. It is used in Chronic otitis media with conductive & mixed hearing loss where the use of air conduction device is contraindicated, Congenital malformation of external or middle ear, Chronically draining ears, Chronic external otitis.

Cochlear Implants : Cochlear implants have had a great impact on the procedures that are used to treat profound hearing loss in children and adults. Today, most profoundly deaf individuals who use a cochlear implant are able to detect speech sounds within a normal range of hearing.¹⁴ Each cochlear implant system has two primary components: (a) a surgically implanted electrode array and receiver and (b) an externally worn speech processor. The internal and external components work together to provide the implant user with sound.¹⁵

Conclusion

While dental implants have been around for decades, recent advances in technology and treatment protocols have made treatment more convenient, more effective, and more affordable; making implants a treatment of choice for missing teeth. The introduction of newer advances has bought about a new revolution in the field of implants. Over the past decade, dental implant manufacturers have made major advances in the design and effectiveness of dental implants. New and advanced coating technologies help implants better integrate with the surrounding bone for greater stability and long-term endurance. New shape and designs of implants help them to be more easily inserted, and become more stable upon placement and new component designs allow greater flexibility in implant placement to maximize use of existing bone. This article has discussed some of the current trends in implants in newer techniques, advances in surgery, clinical efficiency & skills.

References

References are available on request at editor@healtalkht.com

