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Dental Implantology has evolved from being an area of super-speciality to an area of specialty within the reach of a general dentist. Evolution is the essence of modernization. How will the technologies in dentistry evolve over the next decade? What shall be the redefined roles of the specialists & lab technologists? Will technology and advances in material sciences bring out a paradigm shift in our understanding of bone microanatomy & physiology? These questions are already implanted in the minds of researchers in the field of dental implants. Just as our previous generations are in awe of the technological advancements like bonding, lasers, CAD-CAM, tomorrow we will be amazed by the outputs of today’s research. The general conclusion that can be drawn is that the coming years will be lot more complex and uncertain. The next decade will bring information and computing power that is even more accessible and affordable straight into our hand held tablets. Dental Clinics, dental labs, dental schools & dental industry will become increasingly interconnected. The new age may bring about custom made implants, milled in our offices! Innovative stem cell based cellular scaffolding for tissue regeneration! The distance the future has to travel is that from our mind to our hands.

“I never worry about the future” said Albert Einstein, when he was asked about predicting the future, “it comes soon enough”.

A journal is the evidence of our research endeavors, dear friends, we at AOI are in a constant momentum towards improving our standards. An earnest request is placed before our contributors to send more of original research and clinical studies. A special acknowledgement is due to my predecessor Ashish Kakar for steering the Journal.

Till we meet in our next issue, Adiós!

Prof. Saranjit Singh Bhasin
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**CASE REPORT**

A 62 year old female presented at a recall appointment with full maxillary and mandibular dentures with a chief complaint of insufficient retention on the lower arch without a denture adhesive. The patient’s dentures had been fabricated within the prior six months. The patient desired eliminating the use of a denture adhesive and inquired about dental implants. A panoramic radiograph was taken (Figure 1) along with a clinical examination it was determined that adequate osseous height and width were present to accommodate implant placement (Figure 2). Finances were limited and use of standard implants was not within the patient’s financial means.

Kromopan alginate (Kromopan, Chicago, IL) was mixed and placed into one half of a Lang Denture Duplicator (Lang Dental, Wheeling, IL) and the patient’s lower denture was placed tooth side down into the alginate and allowed to set. A second batch of Kromopan alginate was mixed, placed into the tissue

---

**Introduction:** Mini implants have become a common treatment option for improving retention of lower dentures.1-3 They can provide improvement in the patient’s quality of life when traditional implant treatment is not within the patients financial means.

Patients are now living longer and expect a higher quality of life as they age. As masticatory ability is tied to nutrition, patients with poorly retained mandibular dentures may suffer from nutritional deficiencies due to their inability to masticate food. With a decrease in nutrition, the patient’s general health is affected and their quality of life suffers. 4-6 This can be corrected with improved denture retention allowing the patient to improve their diet.

The immediate load nature of the mini implants gives patients an immediate satisfaction without delays in treatment to accommodate conventional healing permitting full osseointegration.

**Figure 1:** Preliminary panoramic radiograph with markers within a stent to aid in location of the mental foramen.

**Figure 2:** Lower arch showing shallow buccal vestibule.
side of the denture sitting in the lower half of the Lang Denture Duplicator. The upper half was filled with alginate and the duplicator was closed allowing the material to set. The duplicator was then opened and the denture was removed from the alginate. Clear orthodontic acrylic (Lang Dental, Chicago, IL) was mixed to a thin consistency and poured into the mold formed in the duplicator, then closed and immersed in hot water. Immersion in hot water accelerates the set of the acrylic and provides a transparent denture replica when completed. After setting of the acrylic, it was removed from the duplicator and flanges were adjusted to remove any flash of material. Vertical grooves were made on the buccal/facial surface at the ideal sites for implant placement, and then short pieces of wire were fixated in the grooves to act as radiographic markers. A panoramic radiograph was obtained and the location of the mental foramina was identified in relation to the locations of the intended implants. Any modification of the implant locations relative to anatomic structures could be made at this time.

Placement of the implants in a fully edentulous arch without a stent to guide the process has the potential to position the implants too far buccal or lingual and hamper the esthetics of the prosthesis. The use of a duplicate of the patient’s denture allows the practitioner to know the outlines of the denture and permit placement of the implants within its confines eliminating the prosthetic complications such as the retentive heads being shown through or the bulging of the male retentive head in the denture.

Once the final implant locations were determined, the tooth at each implant site on the clear duplicate denture stent was ground to provide a flat horizontal area. Every implant site was adjusted on the stent where a height of approximately 3mm of acrylic between the crest of the ridge and the superior aspect of the horizontal area. A 3/32 inch twist drill was used to place the a pilot hole through the clear stent into the underlying stone model. A pin was placed into this site (DéPlaque, Victor, NY) and the adjacent site was prepared using the twist drill to parallel the pin placed into the first site. A pin was then placed into the second site and the process was repeated until all five sites had a pilot hole placed. (Figure 3)

The surgical stent was then tried intraorally and the occlusion opposing the maxillary arch was verified. (Figure 4) Local anesthetic was administered via infiltration into the buccal vestibule from the distal of the far right implant position through the distal to the far left implant position.

A 1.6mm pilot drill was placed into a surgical headpiece, then introduced through the surgical stent at each site, piercing the soft tissue and entering the crestal bone 3-4mm with sterile water irrigation (Figure 5).

The surgical stent was removed, the perforation through the gingival tissue at the implant site in the anterior was identified and the stationary pilot drill was used to explore the osteotomy at this location. The pilot hole was deepened to a depth of 13mm corresponding with the selected implant to be placed at this site (Figure 6).

A paralleling pin was placed at this osteotomy site, then the adjacent site was explored with the stationary pilot drill and the process was repeated for this site (figure 7). This was repeated for each site using the paralleling pins to align each of the pilot five holes.
Next, a 3mm disposable tissue punch was pressed over each perforation to the osseous crest and a gingival tissue plug was removed (Figure 8). Paralleling pins were replaced into the anterior implant sites, a 1.6 mm drill was introduced into the far right site and then prepared to the intended depth, paralleling the drill with the parallel pins placed adjacently (Figure 9). The process repeated at the next site continuing until all sites had been prepared with the 1.6 mm drill to desired depth and paralleling the other osteotomy sites. Due to the width of ridge available in this patient, 3.25mm diameter fixtures were selected. In narrower ridges, a 2.2mm diameter fixture may be selected.

Next, the countersink bur for the 3.25mm mini ERA implant was utilized at each site. Due to higher bone density at the anterior three sites it was necessary to use the 3.25mm bone tap run at 45 Ncm and 20 rpm to allow placement of the anterior implants to the desired depth.

An implant carrier was placed onto the implant handpiece and torque was set at 45Ncm and a speed of 20 rpm. A mini ERA implant package was opened and the sterile titanium cylinder containing the ERA mini implant was removed. The implant carrier was snapped onto the ERA attachment end of the mini implant (gold nitrite coated portion) and was removed from the titanium sleeve (Figure 10 and 11).

The implant was carried to the osteotomy site and under irrigation the implant was rotated apically either until the surgical unit stopped at the present 45Ncm or correct depth was achieved (Figure 12).

When depth was not achieved with the handpiece, a mini torque wrench was placed fully on the ERA attachment of the mini implant and a clockwise rotation was applied until the implant reached correct depth (Figure 13). Use of the mini wrench verses a standard torque wrench decreases the forces placed on the mini implant due to the shorter level arm of the wrench and eliminates any deformation of the ERA attachment that may occur.

Placement of the ERA mini implants continued until all fixtures were placed (Figure 14).

From the patient’s cast, a vacuform stent was fabricated. This was taken intraorally and marks were made over each fixture location with a Sharpie® marker. A hole was made at each mark the width of the implant and taken back to the mouth to verify positioning. This stent was then inverted into the tissue side of the denture and a black mark made at each
implant location to assist in relief of the denture acrylic in order to accommodate the ERA Micro OV metal housing. ERA Micro OV males in the metal housing were placed onto each fixture (Figure 15) and the denture was tried in to verify clearance. Fit at this stage should be passive with no contact with the attachment housing. Pieces of non-latex dental dam with a central hole were placed over each mini implant fixture and the ERA housing snapped down over the attachment (Figure 16). The dam will act as a block-out preventing any acrylic from getting between the implant and soft tissue during pickup in the denture.

The denture was dried and SternVantage Varnish LC primer was brushed onto each receptor site in the denture and light cured for one minute. To aid in cleanup of excess material it is advised to avoid placement of the primer in areas other than the receptor sites. ERA PickUp resin was expressed from an automix syringe into the receptor sites carefully not to overfill each site (Figure 17). The denture was inserted intraorally. Since the anesthetized patient will lack proprioception at this stage, it is suggested that when waiting for the acrylic to set a finger from a staff member is placed under their chin to help them remain closed. Upon setting the denture is removed along with the pieces of dam placed earlier. Since primer was not applied outside the receptor sites removal of excess material requires use of an acrylic bur to expose the rim of the metal housing and the extra material can be flaked off with an instrument. A Micro core cutter bur was used to remove the black processor male in each housing and a white ERA male was snapped into each location using a Micro seating tool (Figure 18). The denture was then returned to the mouth and the retention was evaluated. Prior to dismissing the patient, a post-op panoramic radiograph was taken to evaluate the implant positions (Figure 19).

CONCLUSION

Patients who present with lower full arch dentures with poor retention may not be candidates for conventional implant treatment due to financial issues. Utilization of 4-6 ERA mini implants can secure the denture and improve the patient’s quality of life while fitting within their financial budget.
REFERENCES


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Dr. Kurtzman is in private general practice in Silver Spring, Maryland and a former Assistant Clinical Professor at University of Maryland. He has lectured internationally on the topics of Restorative dentistry, Endodontics and Implant surgery and prosthetics, removable and fixed prosthetics, Periodontics and has over 320 published articles. He has earned Fellowship in the AGD, AAIP, ACD, ICOI, Pierre Fauchard, ADI, Mastership in the AGD and ICOI and Diplomat status in the ICOI and American Dental Implant Association (ADIA). Dr. Kurtzman has been honored to be included in the “Top Leaders in Continuing Education” by Dentistry Today annually since 2006 and was featured on their June 2012 cover. He can be reached at dr_kurtzman@maryland-implants.com

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Direct Sinus Augmentation Along With Immediate Implant Placement, Using Balloning Technique To Protect The Sinus Membrane

ABSTRACT
The Ballooning technique in Direct sinus augmentation for reflecting the sinus membrane was first described by Dr.R.Summers. It is a simple and easy technique which prevents the most common complication of sinus elevation which is a tear in the sinus membrane. This technique not only prevents the sinus tear but also helps us to estimate the amount of graft material that may be required during the procedure. This article presents a case with 4-year follow-up of sinus augmentation using ballooning technique with grafting done on a patient.

KEYWORDS
SINUS MEMBRANE, BALLOONING TECHNIQUE, SINUS AUGMENTATION, DENTAL IMPLANTS, EDENTULISM, SUBANTRAL AUGMENTATION.

INTRODUCTION
Denture prosthesis, which are often used to treat edentulous patients, may not completely restore their function because of poor fit related to alveolar ridge atrophy. Dental implants provide an alternative to the standard removable complete or partial dentures and improve function almost completely. To be a candidate for the dental implant procedure, a patient must have sufficient bone in maxillary and mandibular alveoli to support these fixtures. Unfortunately, due to a prolonged period of being edentulous, the alveolar ridge that once supported the teeth becomes atrophic and sufficient bone may not be present for implant fixture placement. To increase amount of bone in the maxilla, the sinus lift procedure or subantral augmentation, has been developed. This procedure involves placing of bone graft material in the maxillary sinus to increase the height and width of the alveolus. A sinus lift procedure is a surgical procedure, performed by an appropriately trained dental surgeon or dental specialist, to augment bone mass in the maxilla which increases the likelihood of successful placement of dental implants. Bone from another side of the body such as iliac crest, or artificial bone grafting material is grafted into the bone(endosseous) in the floor of the maxillary sinus. In the maxilla the amount of bone is reduced by the presence of the sinus.

WHY SHOULD THE MEMBRANE BE LIFTED?
Advantage of membrane elevation is that if there is laceration of the sinus membrane, the freeing up of the mucosa will allow membrane to collapse over the lacerated portion of soft tissue and facilitates healing. If not elevated, membrane tends to be taut, and laceration or opening will tend to persist because of tightness of the membrane.
A 35-year old male patient walked into our dental office complaining of inability to chew. Clinically, missing tooth was seen in relation to 25. Radiographic evaluation showed dipping of sinus membrane in relation to 25 region with 4-5mm of bone remaining between the crest and the floor of sinus. Slight mesial migration of 26 also was noted. Simultaneous sinus augmentation along with implant placement was planned.

Quantity of 1.5mm of synthetic graft containing a 1:1 mixture of beta tricalcium phosphate and hydroxyl apatite mixed with patient’s own blood was used. A 4.2mmX11.5mm length root form with a SLA surface coated implant was used. Good primary stability of 30Ncm torque was achieved at the time of placement of implant. Second stage surgery was performed after 16 weeks and the final prosthesis was delivered.

The Balloning Technique

BALLOON SINUS LIFT – CASE REPORT

CASE HISTORY

A lateral sinus window of 6*6 mm diameter, done using 2mm diameter round bur taking care not to perforate the sinus. An out fracture of the bony window was done, and sinus membrane was released slightly from the sides of the window using the stoma sinus lift instruments. Integrity of sinus membrane was confirmed by valsalva maneuver. Inflatable balloon (Hager and Meisinger) is anchored and balloon slowly inflated with syringe filled with 0.9% saline, one desired elevation (more than 10 mm) is achieved. The balloon is deflated and removed. Root-form implant of 4.2mm diameter and 11.5mm length is placed in the site. The elevated sinus area is filled with mineralized bovine bone graft (BIO-OSs). The bony window is placed back in the opening and sutured to obtain primary closure.

INDICATIONS

1. Loss of alveolar bone height as a result of periodontal disease prior to tooth loss.
2. Pneumatization
3. Poor bone density (bone mineral density and contact between implants and bone surface)
4. Strong occlusal forces.

POST OPERATIVE CARE

Maintaining oral hygiene and using mouth wash is must. Prescribed antibiotics must be taken as directed to help prevent infection. Patient is not supposed to blow the nose for the next four weeks, not to sneeze holding the nose. Not to drink with straws and not to spit. Scuba diving and flying in pressurized aircraft should be avoided. Avoid “bearing down” as when lifting heavy objects, blowing up balloon, playing musical instruments that require blowing action or any other activity that increases nasal or oral pressure. Smoking must be stopped. Not to rinse or spit on the day of surgery.
Not to brush the teeth in the area of surgery for 48 hours. Partial dentures, flippers or full dentures should not be used immediately after surgery.

COMPLICATIONS
- Sinus membrane perforations
- Infection
- Bleeding
- Infra orbital nerve lacerations

• Post operative discomfort like bleeding, discoloration, disability, hematoma and pain.
• Loss of incorporation of graft material

POST OPERATIVE FOLLOW UP
The post-operative follow up of the patient has been satisfactory and the implant is well stabilized and satisfactory in function.

SUMMARY AND CONCLUSION
Advantages in sinus bone grafting have been interesting and exciting for prosthodontic reasons. There is scope for research opportunity in the future for the development of improved methods of treating patients requiring implant therapy with sufficient maxillary deficiencies in need of osseous reconstruction as part of overall root form implant supported prosthodontic rehabilitation; where technologic innovation of sinus bone grafting will lead in future as the era of tissue engineering. As rightly said by Aristotle, “all future inquiry must be based on critical observation and experimental validation”. Sinus lift procedures are thus rightly proved to be a boon to patients who would otherwise never have dreamt of having implant placed because of the inherent deficiencies in bone quality and enlarged sinuses or would have to compromise retention.

ABOUT THE AUTHOR
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Grafts in Osseointegrated Supported Prosthesis

KRISHNA PRASAD D., ANUPAMA PRASAD D., DIVYA MEHRA

ABSTRACT
Rehabilitation of the partially incomplete dentition by means of osseointegrated supported prosthesis is a highly predictable and widespread therapy as of today. Oral implant treatment when compared to conventional non-surgical prosthetic rehabilitation allows avoidance of removable prosthesis and tooth structure conservation of the remaining dentition. However, implant placement necessitates sufficient bone quantity as well as bone quality that may be compromised following tooth loss or trauma. The existing three-dimensional bone morphology may not permit favourable implant fixture positioning.

This article gives an overview about the various grafts and the techniques for hard and soft tissue grafting around osseointegrated supported prosthesis to achieve the best possible treatment outcome even in compromised clinical situations.

KEY WORDS
GRAFTS, RIDGE AUGMENTATION, IMPLANT PROSTHESIS

INTRODUCTION
In the present scenario of prosthetic rehabilitation with osseointegrated supported prosthesis, grafting procedures may be indicated not exclusively due to lack of bone volume, but to ensure favourable biomechanics and long-term esthetic outcome. Various Techniques and materials have been developed over the years to facilitate a high degree of clinical success. Bone augmentation procedures in cases with inadequate bone height and width are either performed prior to, at the time of, or after the implant surgery.

The techniques that had been described for ridge augmentation include guided bone regeneration, block graft, particulate graft, ridge expansion technique and distraction osteogenesis. Common soft tissue grafting procedures include Roll technique, Pouch procedure, Interpositional graft, Onlay graft, Combination grafts. Various materials are available at our disposal for the execution of these hard and soft tissue modifications.

Soft tissue modification prior to implant placement in order to provide proper tissue contour and support can increase the predictability of the treatment outcome; however additional surgical procedure is necessary to achieve the goal. Alveolar ridge defects resulting from tooth extraction, trauma or periodontal disease are recommended to have surgical corrections prior to their comprehensive prosthodontic reconstruction. Lack of proper treatment planning can result in prosthesis with compromised function and esthetics.

Graft materials classification of grafts
Several types of bone grafts have been studied over the years, and dental specialists continue to search for ideal materials. Bone substitutes have also been developed. These are useful as fillers in repairing bone defects however prompt regeneration of bone is still to be achieved.

Bone grafts are classified as:
The two most commonly used in oral implantology today are autogenous and allogeneic grafts.

AUTOGRaFTS
Autografts are derived from the patient himself, from a suitable site and grafted at the surgical site. They mainly augment bone through osteogenesis and osteoinduction. They are obtained intraorally from edentulous areas, tuberosity, mandibular symphysis and mandibular ramus. Extraorally, they may be obtained from rib, tibia, calvarium or the iliac crest. Depending on the size of the defect, autogenous bone from the donor site may be obtained as particulates or as a block. As it the patient’s own bone, autogenous bone grafts have many advantages to its use. Chances of an immune reaction are negligible resulting in high success rates. They also contain live osteoblasts and osteoprogenitor cells, which aids in rapid proliferation of the bone thereby filling the defect between the graft and recipient bone. However,
morbidity of a second surgical site is an unavoidable disadvantage.

Veis et al. concluded in their study that the most successful site of autogenous graft was the mandibular symphysis region. The next best donor site would be the ramus and the maxillary tuberosity. Another potential site to obtain an autograft is the Mandibular torus. Tori are unnecessary bony extensions that offer no structural or esthetic benefit to the patient. They contain both cortical and cancellous bone, with a thickened outer cortical plate of haversian bone. Hence, they serve as an excellent donor site for onlay grafting procedures.

The various types of autogenous bone grafts that have been used clinically are osseous coagulum, intraoral and extraoral cancellous bone and marrow, cortical bone chips and bone blend.

**OSSEOUS COAGULUM AND BONE BLEND**

Intra-oral bone, when procured with high- or low-speed round burs and mixed with blood, becomes a coagulum. Bone blend is obtained with the help of trephine or rongeurs. It is a slushy osseous mass of triturated cortical or cancellous bone done in an amalgam capsule. It has a particle size in the range of 210 x 105.6.

The bone blend technique was designed to overcome some of the disadvantages of osseous coagulum, including inability to aspirate during the collection process, unknown quantity and quality of collected bone fragments, and fluidity of the material.

Froum et al. reported the osseous coagulum-bone-blend type of grafts provided 2.98 mm coronal growth of alveolar bone, compared with 0.66 mm obtained when open flap debridement alone was used.

**LIMITATIONS**

- Extensive defects may require more material that cannot be procured with this technique.
- Relatively low induction potential for Osteogenesis. Therefore, perforation of the cortex is indicated to gain some trabecular bone and marrow elements to enhance osteogenic potential.

**BONE SWAGING**

Bone swaging was described by Even in 1965. This technique consists of bending and breaking the thin bony walls that forms one and two walls of hemisepta or craters, into the defect in an effort to reduce the periodontal defect. This technique requires an edentulous area adjacent to the bone defect so that the bone can be pushed into contact to the root surface without fracturing the bone at its base. This technique theoretically maintains a continuous blood supply and thus a viable graft.

**LIMITATIONS**

- Bone swaging is complicated with varying degree of elasticity of the bone.
- It is technically difficult and clinically limited to the cancellous composition of bone.

**INTRAORAL /EXTRAORAL CANCELLOUS BONE AND MARROW**

Healing bony wounds, healing extraction sockets, edentulous ridges, mandibular retromolar areas, and the maxillary tuberosity have all been used as sources of intraoral cancellous bone and marrow. Iliac cancellous marrow bone (fresh or preserved) may serve as an extraoral site of cancellous bone and marrow. However, the use of technique is no longer preferred due to the several problems associated with its use. These include sequestration, post operative infections; root resorption, exfoliation, varying rates of healing etc.

**ALLOGRAFTS**

They are procured from individuals of the same species. They may also be derived from human-cadaver bone that has been tested to be free of transmitted diseases such as HIV. Allografts include fresh frozen bone allografts, Freeze Dried Bone Allograft (FDBA) and Demineralized Freeze Dried Bone Allograft (DFDBA).

The disadvantages of fresh frozen allografts like possibility of disease transfer, immunogenicity and the...
need for cross matching made. FDBA and DFDBA are procured from commercial tissue banks for bone grafting procedures.

The most common allograft used is Demineralized Freeze-Dried Bone Allograft (DFDBA). It comprises of most of the organic component of bone. Besides, allograft contains BMPs, which stimulate osteoinduction – formation of new bone. Fugazzatto demonstrated that, a combination of osseous coagulum collected during preparation and freeze-dried bone allograft placed at immediate implant insertion and loading resulted in a clinically immobile and healthy soft tissue surrounding.

FREEZE DRIED BONE ALLOGRAFT

Undemineralized FDBA was introduced to periodontal therapy in 1976. Freeze drying removes approximately 95% of the water from bone by a process of sublimation in a vacuum. Although freeze drying kills all cells, the morphology, solubility, and chemical integrity of the original specimen are maintained relatively intact. Freeze drying also markedly reduces the antigenicity of a periodontal bone allograft.

DEMATERIALIZED FREEZE-DRIED BONE ALLOGRAFT (DFDBA)

It was introduced, for augmentation in periodontal defects. Here, a cortical bone graft is demineralized with hydrochloric acid thereby exposing the bone inductive proteins located in the bone matrix. These proteins are called as the bone morphogenetic protein (BMP). Exposure of these proteins greatly enhances the osteogenic potential stimulating the formation of new bone by osteoinduction.

That is, the demineralized graft induces host cells to differentiate into osteoblasts whereas an undemineralized allograft functions by osteoconduction by providing a scaffold for new bone formation. It is mainly osteoconductive and slightly osteoinductive in nature and its use has proven to be effective in periodontal regeneration. Subsequently, its use was extended to socket preservation implant therapy where augmentation procedures were indicated. The use of DFDBA in combination with autogenous bone grafts and resorbable and Nonresorbable membranes is also a viable option.

XENOGRAFTS

Xenografts are graft materials derived from the inorganic portion of animal bones; the most common source is bovine. They are processed to remove the organic component in order to remove their antigenicity, while the remaining inorganic components provide a natural matrix as well as an excellent source of calcium. Examples of Xenografts are Calf bone (Boplant), Kiel bone (calf or ox bone) – It is treated with 20% hydrogen peroxide, acetone, and sterilized with ethylene oxide. Anorganic bone (ox bone) – Treated with ethylenediamine to extract the organic content and then sterilized by autoclaving. The disadvantage of xenografts is that they are only osteoconductive and the resorption rate of bovine cortical bone is slow.

In addition, patients may have anxiety to mad cow disease or bovine spongiform encephalitis. Bio-Oss (OsTEOHEALTH)

Currently, the most commonly used xenograft material is Bio-Oss. It is an osteoconductive, porous bone mineral matrix from bovine cancellous or cortical bone. The organic components of the bone are removed, but the trabecular architecture and porosity are retained. It has been successfully used for periodontal defects and implant surgeries. Cornelini et al. conducted a study on Bio-Oss used as an adjunct to a biodegradable barrier membrane (Bio-Gide) following the immediate placement of transmucosal implants into extraction sockets and concluded that the use of Bio-Oss as a membrane support at immediately placed transmucosal implants may provide good soft tissue support in areas with high esthetic demands.

ALLOPLASTS

Alloplastic bone grafts are synthetic materials that have developed to replace human bone to avoid transmitted diseases such as HIV, bovine spongiform encephalitis (BSE), or hepatitis. They are biocompatible and osteoconductive materials. Commonly used alloplastic graft materials include calcium phosphates, bioactive glasses and biocompatible composite polymers. The main disadvantage of alloplasts is that they are unpredictable in allowing bone formation.

HYDROXYAPATITE OF TRICALCIUM DERIVATIVES

It is one of the more recent alloplastic graft materials. It is used in combination with other autogenous or non-autogenous graft materials as the material by itself does not have any bone-forming capabilities. Hydroxyapatite B-Tricalcium Derivatives are similar to the inorganic components of the natural bone. Hence, it has greater biocompatibility and shows elevated bioactive characteristics in
physiological conditions. Synthetic bio-resorbable material scaffolds may be potentially used in lateral ridge augmentation procedures.

**HARD TISSUE REPLACEMENT POLYMER (HTR)**

HTR synthetic bone (Bioplant, Norwalk, CT) is a biocompatible microporous composite of polymethylmethacrylate, polyhydroxyethylmethacrylate and calcium hydroxide. HTR acts as a scaffold allowing the patient’s own bone to grow through the HTR polymer structure, thereby re-forming the original bone ridge. Paulino Castellon et al.,16 demonstrated that immediate implant placement in sockets augmented with HTR synthetic bone is a predictable procedure and provides a good bone for successful prosthetic reconstruction.

**BIOACTIVE GLASS**

There are two forms of bioactive glass currently available. Perioglas (bioglass synthetic bone graft particulate) and biogran (resorbable synthetic bone graft). Bioactive glasses are composed of silicon dioxide (46 mole %), sodium oxide (24.4 mole %), calcium oxide (26.9 mole %), and phosphorous pentoxide (2.6 mole %). Perioglas (Block Drug Co, Jersey City, NJ) has a particle size ranging from 90 to 710 μm, which facilitates manageability and packing into osseous defects. Biogran (Orthovita, Malverne, PA) has a narrower range of particle sizes of the purportedly critical 300 to 355 μm, size, range, which has been reported to be advantageous for guiding osteogenesis.

A study performed by Stanley et al.17 using bioglass cones as endosseous ridge maintenance implants to prevent ridge resorption suggest that favourable clinical results can be obtained with this materials.

**TECHNIQUES FOR HARD AND SOFT TISSUE GRAFTING**

Once the need for a hard or soft tissue grafting has been confirmed by the implantologist, the next step is to decide the grafting technique which is the most appropriate for the existing clinical condition.

**DISCUSSION**

Replacement of extensive local bone loss is a significant clinical challenge with Osseointegrated supported prosthesis. There are a variety of techniques available to the dental specialists to manage this problem, each with their own advantages and disadvantages. It is a known fact that autogenous bone grafting procedure brings along complications such as limited available bone quantity and the morbidity associated with the donor site.

Allografts, on the other hand, have a significantly high trend of postoperative infection, fracture as well as the risk of disease transmission. Efforts have been made over the past few years to develop synthetic bone graft materials which help minimizing the above mentioned complications.

Also, sterile synthetic grafts are easily available in the required quantity, hence reducing the donor site morbidity.

The main purpose of this paper was to examine bone graft materials and bone substitutes which are in use today and a brief mention about the soft and hard tissue augmentation procedures that are available at our disposal. For decades, researchers have applied different methods and materials for the restoration of the hard and soft tissues. Presently, predictable and satisfactory bone growth occurs from the application of affordable bone graft materials that initiate and enhance the biologic process to achieve true bone regeneration to its full potential. On the other hand, new techniques and modifications for soft tissue augmentations help in achieving the desired esthetics around the implants. Thereby, restoring both function and esthetics and providing the patient with a more life-like rehabilitation of the lost tissues.

**CONCLUSION**

Alveolar resorption following trauma, extraction, or infection resulting in ridge form with deficient width and/or height is one of the most common clinical situations that a dental specialist comes across today. This can be well taken care of, with tissue...
preservation or augmentation procedures, using the various graft materials available in the present time. This article gives an overview of the commonly used graft materials which offer considerable results to the clinicians. However it is important that the implantologist carefully evaluates the present clinical condition of each case and also thoroughly consider the probable consequences of any surgical interventions that may be undertaken.

REFERENCES


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Guidelines For Implant Abutment Selection

AMAN ARORA, AMAN POPLI, ASHIMA CHOUDHARY

ABSTRACT
Since past few years, there has been significant enhancement in the dental implants and their restorative components for treatment of partially edentulous patients. Apart from this being advantageous for the patients, it provides wider area of workability for the clinician and dental technician in meeting the needs of patients. However, selection of appropriate abutment becomes difficult in today’s time as multitude of implant is available in the market. So, the correct selection of abutment is call for successful implant treatment. This article highlights guidelines for satisfactory selection of abutment to meet with recently increasing demand of esthetics and function in the implant restorative treatment.

KEYWORDS
DENTAL IMPLANT, ABUTMENTS, ESTHETICS.

INTRODUCTION
The introduction of osseointegration in the 1970s has changed the picture of dental implant treatments. One of the most popular dental practices in today’s era is dental implant treatment. These days’ patients are very intelligent, knowledgeable and put forth high demands when it comes to esthetics and function. It is the ethical responsibility of the practitioner to advice the patient with the most current procedures as elective treatment options.

During the past 10 to 15 years, implant manufacturers have introduced prefabricated, machined, and custom abutments designed for use with cement-retained and screw retained crowns in partially edentulous patients. Selecting the appropriate abutment can be both complex and confusing with the ever-increasing number of implant choices and transepithelial abutments available. Many dentists resort to choose costly custom abutments over the more desirable prefabricated abutments in order to avoid the selection process.

This article presents clinical/ laboratory protocol for optimal abutment selection in implant dentistry for implant surgeons, restorative dentists and dental laboratory technicians for a good prognosis.

CRITERIA’S FOR ABUTMENT SELECTION
Definitive abutment selection may be accomplished by implant surgeons, restorative dentists and dental laboratory technicians; it may be accomplished clinically or in the dental laboratory if an implant level impression has been made. Abutment selection can be accomplished for any implant system by using the following eight guidelines: type of implant abutment connection, implant restorative platform, emergence profile of healing / interim abutment, implant position, angulation of implant, interocclusal distance, depth of the peri-implant soft tissues and implant material.

1. IMPLANT ABUTMENT CONNECTION
Implant abutment connections may be described as internal or external connections. The Branemark original implant abutment connection was a 0.7mm external hexagon. The external hexagon served the purpose as a coupling and as a torque transfer device. According to the branemark protocol, a fully edentulous arch was restored by connecting the externally hexed implants together with a metal bar followed by giving fixed prosthesis. There were many shortcomings seen with this external hexagon connection like loosening of the abutment screw, fracture and micromotion at the implant abutment interface1. This was rectified by modifying the geometry of the screw, the accuracy of the fit over the hex, and the torque required to secure the screws.

To overcome the complications with the external implant-abutment connection, the internal implant-abutment connection was developed (figure 1). Its goal was to improve connection...
stability throughout function and placement as well as simplify the armamentarium necessary for the clinician to complete the restoration. One of the first internally hexed implants was designed with 1.7mm deep hex below a 0.5mm wide, 45° bevel. This design provides deep distributed intraoral forces within the implant thereby improving the implant abutment stability.

2. IMPLANT RESTORATIVE PLATFORMS

Implant restorative platforms are the interfaces for the implant abutment connections. The implant restorative platforms are selected depending on the size of the teeth that are being replaced. Their diameter can be of same size, wider or narrower than implant. This difference in the diameter of implant abutment platforms has demonstrated an impact on the biological width, overall bone height and restorative stability.

Platform switching has been defined as an abutment or a suprastructure with a diameter at the implant-platform level that is smaller than the implant diameter (figure 2). This configuration results in a circular horizontal step, which enables a horizontal extension of the biological width. Compared with the conventional restorative procedure using an identical size implant and suprastructure diameter, platform switching is suggested to prevent or reduce crestal bone loss.

3. EMERGENCE PROFILE OF HEALING/INTERIM ABUTMENT

Healing abutment can be placed either at the end of the surgical appointment in a single stage surgical protocol or after implants have been uncovered in a two stage surgical protocol. Healing abutment should be selected consistent with the size of the teeth being replaced.

In situations without esthetic concerns, such as maxillary and mandibular molars, 6mm or 7.5mm diameter healing abutments may be selected (figure 3). Similarly for smaller sized abutment 4-5mm healing abutments may be used (figure 4). In areas where optimal esthetics is required, such as anterior maxillae, the interim or provisional abutments may be used to contour the peri implant soft tissues (figure 5) and to develop optimal, anatomic emergence profiles and soft tissues contour consistent with contour of natural teeth.

4. IMPLANT POSITION

Another criterion is the implant position, which is evaluated as the implant relates to the final prosthesis and the adjacent teeth. If the implant lies outside the mesiodistal and buccolingual boundaries (figure 6) of the planned restoration, then the implant may not be restorable. Although some of these implants can be restored, positional discrepancies may result in a compromised prosthesis with one or more of the following problems: incorrect biologic contours, incorrect location of the access opening, and most significantly non axial loading of the implant.
5. ANGULATION OF IMPLANT

The success of dental implants has changed treatment planning for patients with edentulous areas dramatically. A critical determinant for placement of an implant is the height and width of bone available in the edentate sites. Ideally, implants should be placed parallel to each other and to adjacent teeth and be aligned vertically with axial forces. However, due to some deficiencies of bone, it may be malpositioned in the vertical plane. Malpositioned implants are the most common reason for using custom designed abutments. However, if implants are placed consistent with the planned location of the teeth, premachined straight or preangled abutments may be used with predictable results.

Eger et al (1997) compared the survival of straight and angled abutments and noted that after one year, they found no statistically significant differences with respect to probing depths, gingival inflammation or attachment levels around straight or angled abutments. Lin et al (2008) performed finite element analysis on two different implant systems with straight and 20 degrees angled abutments. They reported that better strain /stress distribution is possible when abutments are placed along the long axis of implant loading with multiple areas of cortical contact. The literature is replete with the reports regarding abutment angulations and stresses to screws and peri implant bone; however, no papers were identified regarding clinical failure rates associated with angled abutments.

6. INTEROCCLUSAL DISTANCE

Pre-machined abutments generally can be used if the distance from the implant restorative platform to the occlusal surfaces of the opposing dentition is between 5 mm and 9 mm (figure 8).

If the interocclusal distance is less than 6 mm, the abutment axial walls may be no longer than 4 mm. However, 4-mm axial walls may not provide adequate retention and resistance form for predictable cementation of cement-retained implant crowns because axial wall removal of implant abutments has been shown to affect the retention of cement-retained abutments negatively. If the interocclusal distance is greater than 10 mm, even without occlusal reduction, a pre-machined metal abutment may not be tall enough to provide optimal retention and resistance form for predictable cementation of an implant crown. In this case, a custom-designed abutment would be the treatment of choice because the custom abutment could be designed with near-parallel axial walls and the requisite 2-mm interocclusal reduction.

7. DEPTH OF PERI IMPLANT SOFT TISSUES

To perform abutment selection in the laboratory, implant level impressions are required to fabricate master casts with implant analogs. Implant-level impressions are predictable and relatively straightforward when the peri-implant tissues are less than 4 mm (figure 9). Well-designed and well-fitting anatomically shaped healing abutments and/or custom provisional restorations expand the peri-implant soft tissues and...
provide access to the entire implant restorative platforms. However, if the peri-implant soft-tissue depth is greater than 4 mm, implant-level impressions may be difficult to obtain because the soft tissues may collapse and obscure the implant restorative platforms (figure 10). In areas without esthetic concerns, it may be beneficial to place abutments onto the implant restorative platforms and, in effect, raise the level of the restorative platforms.

8. IMPLANT MATERIAL

Titanium, base materials, stainless steel, gold are available for implant abutment prosthesis. They can be used in the posterior but esthetics is a problem with these abutments. So, focus of interest in implant dentistry is the application of ceramic materials for the fabrication of implant abutments. The ceramic materials of choice are currently alumina and zirconia (figure 11). In 1994 alumina was the first esthetic abutment of dense aluminium oxide (Al₂O₃). But this abutment presented a problem with its radio clarity at the time of radiologic investigation, weak resistance to fracture and static fatigue. Zireal abutment is an esthetic abutment composed primarily of high strength zirconia ceramic (zirconium oxide ZrO₂) which offered many improvements that was not possible with the metal abutments such as improved esthetics, fit, translucency, ease of fabrication, adaptability, biocompatibility and high bending strength.

CONCLUSION

Abutment selection is one of the most important steps in the process of successful clinical treatment with implant restoration. Proper superstructure design is desired to achieve osseointegration and satisfy diverse expectation of patient and dentist. This article presented a eight step protocol, for abutment selection in partially edentulous patients. As technology and biomedical science improve and modify implant components and protocols, the points developed in this article should provide clinicians and dental laboratory technicians with the ability to choose implant abutments in virtually any clinical situation.

REFERENCES


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Surface Interactions on Nanostructured Implant Materials

NEHA SETHI, AMANDEEP S CHHINA, KAMALPREET

ABSTRACT
The interactions between solid surfaces and cells are crucial to many biological phenomena for all biomaterials. A material is said to be biocompatible, only when no or minimal adverse reactions ensue at the blood/tissue - material interface, and high resistance to biodegeneration. Nanoscale modification of the implant surface can alter the chemistry and/or topography. Different methods have been described to modify or to embellish titanium substrates with nanoscale features. Such changes alter the implant surface interaction with ions, biomolecules and cells. These interactions can favorably influence molecular and cellular activities and alter the process of osseointegration. Here we present a review of these surface interactions and its applicability in practice.

INTRODUCTION
The biocompatibility of an artificial material in the body is complicated. The artificial implants, once implanted in vivo, induce a cascade of reactions in the biological micro-environment through interaction of the biomaterial with body fluid, proteins, and various cells [1, 2, 3, 4]. The sequence of local events often leads to the classic foreign body response and the formation of a fibrous tissue capsule around an implant. It is clear that a major factor influencing this unfavorable reaction of the body is the biomaterial surface. Both the chemical composition of the surface and the surface topography are believed to be important in bone contacting implants. Primary stability is the first step of the osseointegration of implants. This is related to the implant design, mechanical anchorage and bone structure. The primary stability gives way to secondary anchorage with time, which is characterized by a biological bonding at the bone-implant interface. Thus, the nature of the initial bone-implant interface determines the ultimate success or failure of implant. Tissue compatibility is also an issue of prime importance issue while determining the implant success.

SURFACE CHARACTERISTICS OF DENTAL IMPLANTS
Biocompatibility is multifactorial as simultaneous stimuli from implant materials properties i.e. morphological, chemical, or electrical surface qualities can elicit reactionary responses from the surrounding biological environment that can affect the host response. The quality of titanium surfaces has been described in terms of surface chemistry, which refers to the critical surface tension (CST) or surface energy [6]. CST is related to the contact angle of a liquid drop on the surface and, thus, provides an indicator of the potential of cell adhesion or surface wettability [7]. It has been observed that chemically activated and hydrophilic sandblasted and acid-etched (SLA) surfaces resulted in a greater percentage of bone-implant contact in the first weeks of osseointegration [8]. The surface properties of the implants can be changed by different methods of cleaning, sterilization, and storage [2, 9, 10]. For example, it has been observed that discs with an active SLA surface sterilized by gamma irradiation and continuously submersed in isotonic NaCl presented less contamination with hydrocarbons and carbonates from the atmosphere, producing
a chemically clean and reactive surface [11].
The chemical composition and surface microstructure can regulate the adsorption of components present in extracellular fluid as a result of alterations in the surface energy. In vitro studies showed that rough and chemically activated surface provides the ideal conditions for direct protein adsorption and alter the adsorption of fibronectin and albumin due to modifications in their ionic state [12].

Titanium is found to be well tolerated and nearly an inert material in the human body environment. Under optimal situations, titanium is capable of osseointegration with bone [1]. Moreover, titanium forms a highly stable passive layer of TiO2 on its outer surface and provides superior biocompatibility. Even if this passive layer gets damaged, TiO2 is immediately rebuilt. The oxide film protects the metal substrate from corrosion and is of particular importance due to its physicochemical properties such as crystallinity, impurity segregation etc, have been found to be quite relevant.

**ADVANCES IN SURFACE MODIFICATION**

Various advances have been introduced in the field of surface modification of implants. Few of these are:

1. **Physical approaches**
   a. Compacting nanosized particles of Titanium dioxide onto the metal core.
   b. Ion beam deposition

2. **Chemical approaches**
   a. Acid etching
   b. Sol – gel deposition (colloidal particle adsorption) of calcium phosphate, aluminium, zirconia, titanium and other materials

3. **Lithography and other optical methods.**
   a. Peroxidation
   b. Discrete crystalline depositions which superimposes a nano-topography

4. **Biomimetics**
   a. Alkali treatment
   b. Anodization- Acid etching and exposure to hydrogen peroxide increases the adsorption of RGD and mineralization. Leads to the formation of a titanium gel layer. Sodium titanate is formed allowing the deposition of hydroxyapatite.
   c. Plasma nitriding: Titanium implants are exposed to a gas atmosphere containing a mixture of nitrogen and hydrogen in the ratio of 20:80 at low pressure and ionized by a continuous current, leading to deposition of nitride onto the metallic surface. It has the advantage of reduced treatment time, lower treatment temperature, reduced cost and increased environmental cleanliness. This produces surfaces with increased wettability and hydrophilic characteristics and cell adhesion apart from modifying chemical characteristics and surface topography.

Laser lock technology has introduced implant with a 2 mm wide collar with the uppermost 0.5 mm is smooth and lower 0.7 mm of the implant surface has grooves of 5-8 µ to prevent epithelial down growth. The lowermost 0.8 mm of the collar having grooves of 10-12µ helps in developing a strong bone-implant interface and retains crestal bone. Studies have demonstrated that calcium phosphate coatings provide osteoconductive surface to the titanium implants [13]. The dissolution of calcium phosphate coatings in the peri-implant region increases ionic strength and saturation of blood leading to the precipitation of biological apatite nanocrystals onto the implant surface. This biological apatite layer incorporated proteins and promoted the adhesion of osteoprogenitor cells that produced osteoid. Also, it was shown that osteoclasts were able to degrade the calcium phosphate coatings through enzymatic degradation and created resorption pits on the implant surface [14].

Hybrid implants i.e. titanium implants with zirconia collars demonstrates lower level of crestal bone loss as compared to implants with titanium collars as it enhances the fibroblast and osteoblast adhesion and proliferation.

Flouride modified titanium implants are those that undergo additional cleaning procedure in hydrofluoric acid after the process of blasting. This leads to the formation of fluoridated hydroxyapatite and fluoroapatite in the calcified tissues further leading to increase in bone implant contact.

**NANOSTRUCTURED BIOMATERIALS**

Using nanotechnology for regenerative therapy becomes obvious when examining nature [15]. Bone is a nano scaled composite that consists of collagen, non-collagenous proteins (laminin, fibronectin, vitronectin), and water) and hard inorganic components (hydroxyapatite, HA, Ca10(PO4)6(OH)2) [16, 17]. 70% of the bone matrix is composed of nanocrystalline HA [18].

Nanostructured biomaterials possess unique surface and
mechanical properties similar to the bone and hence are considered to be the future generation biomaterials [22, 23, 24]. Owing to very high number of atoms on the surface, nanograined materials possess large surface energy. Thus, they exhibit entirely different behavior compared to the micron-sized grains. The bone-forming cells generally attach themselves to the surface whose roughness is of nanometer range.

Nano-materials exhibit unique surface properties such as surface chemistry, wettability, and energy, due to their increased surface area and roughness as compared to the traditional or microstructured implant materials. Material surface properties mediate specific proteins (such as fibronectin, vitronectin, and laminin) adsorption and bioactivity, thus regulating the cell behavior and dictating tissue regeneration [16]. Increased alkaline phosphatase levels, increased collagen matrix, increased primary retention of the implant, and greater shear strength is some of the factors that have popularized these materials recently.

On metal surfaces, enhanced cell metabolic activity has been observed, such as the upregulation of bone sialoprotein and osteopontin [19], as well as a threefold increase in osteoblastic cell adhesion as compared with the surfaces without nanostructure. Furthermore, enhancement of calcium and phosphorus deposition has been observed on nanocrystalline titanium alloys and on CoCrMo surfaces but it was not observed on pure titanium [20, 21]. The nano roughness arises because of the fact that human bones consist of inorganic minerals of grain size varying from 20 to 80 nm long and 2 to 3 nm in diameter [25]. The variation in the surface energy due to the nanosurface roughness leads to desirable cellular responses on nanostructured titanium and other materials resulting in high osseointegration [26, 27, 28, 29, 30, 31]. The cell adhesion behavior on submicron, nanometer structured titanium surface was investigated and the obtained results were compared with a flat smooth titanium surface [26]. The study demonstrated that both nanometer and submicron surfaces have very high surface energy and adhesion of bone cells was very high. Additionally, nanograined alloys made of Cp Ti, Ti–6Al, 4V, and CoCr as well as nanoceramic biomaterials such as alumina, titania, and hydroxyapatite also exhibit increased cell adhesion [32, 33]. When the grain size was decreased from 167 to 24 nm, 51% increased osteoblast adhesion and fibroblast adhesion responsible for encapsulation was reduced by 235%.

Though different types of cells were utilized for cell culture studies on the alloys and ceramics, the cell density was observed to be relatively higher for the nanomaterials when compared to conventional counterparts. Apart from the roughness, the pore size on the surface also has an influence on the protein adhesion. The protein, victronectin, is generally adsorbed on pores of smaller sizes on the other hand, the protein that decreases cell adhesion such as laminin, generally adsorbs to bigger pore size [34]. Increased osteoblast adhesion was also observed on nano HA coated Titanium alloy and further bone ingrowth toward implant was noted indicating ceramic surface coatings leading to high osseointegration [35].
protein adsorption, and potential mineralization phenomenon [37]. Changes in wettability and altered protein adsorption lead to altered cell adhesion, likely involving both integrin and non-integrin receptors. The potential for mineralization and epitaxic crystal growth in support of early bone bonding could dramatically alter the biomechanical environment of the healing implant in favor of stability. Recently, a set of unique structures ranging from mesoporous nanoscaffolds, nanoflowers, nanoneedles, nanorods, and octahedral pyramids were fabricated by tuning the hydrothermal conditions such as reaction medium composition, concentration, temperature, and time duration systematically [38]. The cytotoxicity of surface modified Ti was assessed using human primary osteoblastic cells, and more than 90% of the cells were found to be viable after 24 h of incubation. Various studies on protein adsorption have revealed that the nano-modified surface structures on titanium adsorbed more proteins, suggesting that these promote cell adhesion/attachment.

**INTERACTION OF SURFACES AND BLOOD**

Blood interactions with implant material leads to protein adsorption this being dependent on the surface properties of the implantable material. This occurs through a complex series of steps of adsorption and displacement, more commonly known as the Vroman effect [39]. A hydrophilic surface is better than a hydrophobic surface for blood coagulation. Consequently, dental implants manufacturers have developed high hydrophilic and rough implant surfaces that in turn exhibited better osseointegration than conventional ones [40]. Adsorption of proteins such as fibronectin, vitronectin on the surface of dental implants has been shown to promote cell adhesion by cell-binding RGD domain [41]. After proteins adsorption, the osseointegration is characterized by platelet adhesion and fibrin clots formation at the injured blood vessels site. Previous studies have shown that implants in contact with platelet-rich plasma (PRP) having a platelet concentration of approximately 10^6 protein/μL have a positive effect on peri implant bone regeneration and osseointegration. At lower concentrations of platelet rich plasma, the effect was not optimal, while higher concentrations resulted in a paradoxically inhibitory effect on peri implant bone regeneration. Few studies that were not in agreement with effect of PRP on the osseointegration of dental implants, have also been documented [42].

**INTERACTIONS BETWEEN SURFACES AND MESENCHYMAL STEM CELLS**

Following clotting around the implants, several cells interact with implant surfaces for healing. Mesenchymal stem cells (MSCs) are attracted to the injured site by chemotactic action of implant with neighboring bone and gingival tissue factors have a determinant role in peri implant tissue healing. The integration of implant with neighboring bone and gingival tissue depends on successful crosstalk between old tissue and implant surface. The challenge in dental implant research is the capability of the surface to guide cells colonization and differentiation. Cell migration, adhesion, and proliferation on implant surfaces are a prerequisite to initiate the tissue regeneration. Authors have shown that some factors present in tissues and secreted during the inflammatory phase are able to attract MSCs to the injured site [43,44].

In the microenvironment, MSCs are stimulated by some specific factors to differentiate into the adequate cell line. Under the influence of these factors, MSCs switch to osteoblastic cells in contact to bone tissue while they differentiate into fibroblastic lineage in the gingival tissue region. These two differentiation pathways are in concurrence around dental implants. In some cases, implants are encapsulated by fibrous tissue due to the proliferation and differentiation of MSCs into fibroblastic cells. In response to cytokine, fibroblasts migrate and generate a capsule of collagen, the first step in generation of gingival tissue or rejection on contact to bone. This fibrous capsule prevents bonding between implant surface and juxtaposed bone and causes a failure of the implant[45]. On the other hand, both the differentiation of MSCs into fibroblastic lineage and the fibroblastic adhesion are desired in the gingival upper part of dental implants. Fibroblasts adhesion has been shown to be lower on nanoscale surface compared to conventional surfaces [46]. Moreover, nanometer size features have been shown to decrease fibroblast adhesion and proliferation [47, 48]. The micro- and nanoscale surface properties of the implant i.e. surface chemistry, surface roughness, and wettability could affect bone formation [49]. Research has specifically
demonstrated that nanorough Ti [50] and nanostructured Ti can enhance osteoblast adhesion and differentiation compared to their nanosmooth control [51]. Furthermore, surfaces with micro- and nanopores have shown to enhance greatly osseointegration [52, 53]. Surface properties may control the steps of adhesion, proliferation, and differentiation of MSCs and, thus, condition tissue integration.

TISSUE INTEGRATION

Branemark et al. described the osseointegration as a direct structural and functional bone to implant contact under load. The challenge in developing new implant surface consists in increasing the clinical success rate as well as decreasing the tissue healing time for immediate loading of implants, particularly in aesthetic situations. Implant surface with various roughnesses have been used to increase the total area available for osteoapposition. Kubo et al. [54] observed a substantial increase by 3.1 times in bone-titanium interfacial strength by Ti nanotube (300 nm) at 2 weeks of implantation in femur rats. These results suggest the establishment of nanostructured surfaces for improved osteoconductivity. Moreover, Ogawa et al. [55] have prepared titanium nanostructure by physical vapor deposition and tested their osseointegration in the femur of rats. They found an increased surface area by up to 40% and a greater strength of osseointegration for the nanostructured compared to an acid-etched surface [55].

In particular, Le Guehennec et al. [56] studied the osseointegration of 4 implant surfaces in the femoral epiphyses of rabbits after 2 & 8 weeks of healing. In this study, the bone-implant contact and bone growth inside the chambers were compared for four different implant surfaces and shown that biomimetic coating method may enhance the bone apposition onto titanium. In order to prevent coating delamination and implant loosening, the Calcium phosphate coating should dissolve or degrade under osteoclastic activity at a similar rate than bone apposition. The preferred result should be a direct bone-implant coating without the presence of fibrous tissue. Another advantage of these calcium phosphate coatings is related to their preparation by biomimetic methods at physiological temperature and pH from simulated body fluids. Calcium phosphate crystals have characteristics that resemble bone mineral in terms of size and composition. Furthermore, it is possible to incorporate biologically active drugs such as antibiotics or growth factors during the precipitation of calcium phosphate coatings on titanium implants [57]. These molecules could be locally and gradually released in the peri-implant bone region for either preventing bacterial infections or stimulating bone growth.

EFFECTS OF NANOTOPOGRAPHY ON OSSEOINTEGRATION

Depiction of broad range of nanoscale topography effects observed in cellular protein adsorption is altered by nanoscale modification of bulk material. It is believed that, the changes in initial protein–surface interaction control osteoblast adhesion [58]. When implants come into contact with a biological environment, protein adsorption (e.g. plasma fibronectin) that occurs immediately will mediate subsequent cell attachment and proliferation. Altering the surface energy or wettability of a material is a classical approach to changing cell interactions with the surface. Nanotopography specific effects on cellular behavior have been demonstrated using a wide range of different cell types including epithelial cells, fibroblasts, myocytes, and osteoblasts. Interestingly, osteoblasts were observed to adhere specifically at particle boundaries. Since nanophase metals have higher percentages of particle boundaries at the surface, this may explain the greater numbers of osteoblasts on nanophase compared to conventional metals. Both cell specificity and extent of cell adhesion are altered, too. Depending on the nano-architecture of the cell, spreading may be affected. Lim [56] more directly related protein adsorption, cell adhesion and the active process of attachment by measurement of increased focal adhesion kinase (FAK) activity. Surface roughness at the nanoscale is an important determinant of protein interactions that ultimately direct cell activity in control of tissue formation at implant surfaces [59].

Nanotopographical features of a surface affect both cell adhesion and motility. On comparison of cell morphology and cytokine production on deep grooves and hemispherical nanopillars, the cells appeared partially aligned to the grooves and had a cytokine release similar to that found from cells on flat surfaces. Osteoprogenitor cell adhesion was enhanced on poly-L-lactide (PLLA) and polystyrene (PS) surface with nanoscale and micron-scale roughness compared to smooth surfaces.
Cell proliferation and osteoblast differentiation appears to be enhanced by nanoscale topography, too. Webster [29,32] observed increased osteoblast proliferation on the nanoscale materials. Several investigators have demonstrated the relative diminution of fibroblast adhesion compared to osteoblast adhesion when nano- and micron-structured surfaces were evaluated [61, 60]. For example, on nano-sized materials, the affinity ratio between osteoblasts and fibroblasts was 3 to 1 compared to conventional materials, the ratio was 1:1 [62]. Bacterial adhesion and proliferation is also diminished on nanophase materials [63]. Decreased bacterial colonization on nanostructured titanium oxide and zinc oxide has been observed even though these surfaces promote osteoblast differentiation and adhesion.

The topographical and chemical properties of the implant surface strongly influence the properties of the layer. Since cells and proteins range in size from nanometer to micrometer, these are relevant length scales for the problem. Equally important is the ability of cells to communicate through the extracellular matrix by signal molecules. These bioactive signal molecules control the regeneration during tissue healing and some proteins stimulate healing near the implant.

**BIOCOMPATIBILITY OF TI-BIOCERAMIC NANOCOMPOSITES**

The application of Ti-bioceramic nanocomposites has focused attention on the biocompatibility of synthesized bulk materials. For Dental Implants, hybrid Ti-x vol% 45S5 Bioglass, Ti-x vol% SiO2, and Ti-x vol% HA bionanocomposites (0 ≤ x ≤ 20) were produced by the combination of mechanical alloying (MA) and powder metallurgical process [64, 65, 66, 67, 68, 69]. It has been demonstrated that metal (Ti, Ti6Al4V, and CoCrMo) surfaces utilizing submicron to nanometer particles, due to higher amounts of particle boundaries at their surfaces, promoted the adhesion of osteoblasts as compared to metals composed of respective micron particles [31]. Cytotoxicity tests of the extracts of studied Ti-45S5 Bioglass materials under wear conditions are shown. The relative viability of the cells (RVC) decreases when fraction increases. It is important to note that the RVC of nanoscale Ti-45S5 Bioglass is higher in comparison with microcrystalline titanium. The wear and fretting accelerates the corrosion of the studied samples in a biological environment such as cell culture medium. Two factors may influence cell growth on the disks: adsorbing protein onto the disks and released metal ions from the disks.

A quantification study provided evidence of significant differences in the amount of calcium and phosphorus deposition by osteoblasts as well as their precipitation from culture media between common orthopedic (Ti6Al4V, CoCrMo) alloys due to nanometer particle sizes [31]. Also chromium was detected at the concentration of 4.4 ± 0.7 and 4.1 ± 0.6 mg/L, respectively. Chromium is one of the essential elements for human, so slight amount of this element may contribute to cell proliferation, and resulting in higher cell growth.

**CONCLUSION**

Nanoscale surface modification have shown to alter the chemistry and/or topography of the implantable material surface. Various methods have been described to modify titanium substrates with nanoscale features. Such changes have been shown to alter the implant surface interaction with host bio-environment. These interactions have been shown to favorably influence molecular and cellular activities and alter the process of osseointegration.

As the disciplines of immunology continue to understand the process of wound healing, development of biomaterials plays a complementary role as an interdisciplinary approach to developing implant surfaces, which mimic and promote accelerated wound healing processes. At this moment, both a hydrofluoric acid modified titanium endosseous implant with nanoscale features and calcium phosphate nanofeature-modified titanium implants are available for clinical use. The potential risks and benefits of manipulating biomaterial interfaces at the nanoscale will be defined by long-term clinical evaluation of such endosseous devices.

**BIBLIOGRAPHY**

- Webster, T.J. (2003). Nanophase


- Kilpadi, K.L., Chang, P.L., and


S. Puckett, R. Paretta, and T. J. Webster, “Nano rough micron patterned titanium for directing osteoblast morphology and...


Applications of piezosurgery in implantology

DEVANAND SHETTY, SUYOG DHARMADHIKARI, KHUSHABU DESHMUKH

ABSTRACT
Piezosurgery is a new and innovative method that uses piezoelectric ultrasonic vibrations to perform precise and safe osteotomies. It was first invented by Tomaso Vercelotti to overcome the limitations of traditional instruments in oral bone surgery. It provides substantial improvement in implant surgery, benefiting the surgeon by ease of use and the patient by minimizing surgical trauma and promoting rapid healing. This article discusses about the atraumatic extraction of fractured root and sinus lift procedure using this novel technique.

INTRODUCTION
Piezosurgery is a new and innovative method that uses piezoelectric ultrasonic vibrations to perform precise and safe osteotomies. It was first invented by Tomaso Vercelotti to overcome the limitations of traditional instruments in oral bone surgery. In 2005, the US Food and Drug Administration extended the use of ultrasonics in dentistry to include bone surgery. Piezoelectric units provide clinicians with the ability to cut the mineralized tissue selectively. The units’ low kHz frequency allows the soft tissue to “move” with the vibrating insert, thus preventing incision or damage to soft tissue. With higher ultrasonic frequencies, this tandem movement does not occur, resulting in incision or other damage to soft tissue. This “selective cutting action” is very desirable in bone surgery. For example, with piezoelectric bone surgery, a lateral sinus window access can be created without cutting the Schneiderian membrane. Other soft tissues benefiting from this selective cutting action in surgery are nerves, blood vessels, and mucosa. Another characteristic of Piezosurgery units is the microvibration of the inserts. These microvibrations allow clinicians to make precise and narrow bone incisions, with cuts as small as 0.5 mm to 0.7 mm. The surgeon also benefits from good tactile sensation. Bone saws and dental drills do not have this level of control, precision, and tactile sensation because greater force often is needed with many rotary instruments and/or there is partial or complete loss of control of some parts of the cutting surface at any given time. This loss of control can result in damage to underlying structures, especially soft tissue, such as nerves and the sinus membrane in dentistry. Piezosurgery units use chilled saline as an irrigant, which serves several functions. Because the irrigant is chilled, it provides a cooling effect to the insert and mineralized tissue to help prevent overheating of the bone and bone cells. This cooling combined with the specific waveform of the unit’s insert cutting edge causes minimal inflammation or necrosis in the bone.

CASE 1
ATRAUMATIC EXTRACTION OF FRACTURED TOOTH
In this case root fracture was noticed in apical third of first premolar as seen in IOPA (figure 6). Patient gave consent to extract tooth atraumatically using piezosurgery (figure 1and 2) as it was potential future implant site. The coronal mobile portion of tooth was removed and root pieces were then mobilized using piezosurgery tip (figure 3). Figure 4 and 5 represents extraction socket with intact socket walls and extracted root pieces respectively. Figure 7 shows healing socket after 1 month post extraction.

RESULT
- This operation enabled us to preserve alveolar bone, which is important for implant placement.
- It also prevented fracturing of thin buccal cortical plate of bone.
CASE 2

MAXILLARY DIRECT SINUS LIFT PROCEDURE

In this case all posterior maxillary teeth were missing (figure 8). On radiographic examination (figure 13), there was less vertical bone available for implant placement due to pneumatisation of maxillary sinus. Sinus lift procedure was carried out using piezosurgery. Midcrestal incision was given (figure 8) followed by mucoperiosteal flap reflection. Bony window was made using piezosurgery tip which was then pushed using osteotome to form roof of chamber. Membrane was carefully reflected from bone and bone grafting and membrane placement was done (figure 11). Incision is then suture back (figure 12). Postoperative OPG shows sufficient vertical bone after sinus lift procedure. (figure 14)

RESULT

- Decreased Chance Of Perforation Of Sinus Membrane,
- Improved Visibility,
- Decreased Bleeding During Surgery,
- Decreased Surgical Trauma.

DISCUSSION

The high predictability of endosseous implant has led to routine use and an expectation for success. However the ultimate success relies on several factors, the most important of which is the availability of bone. The horizontal bone deficiencies are managed quite predictably with localised bone augmentation procedure. However vertical bone deficiencies are much more challenging. The edentulous posterior maxilla is challenging as a result of general lack of bone volume resulting from pneumatisation of maxillary sinus along with resorption of alveolar crestal bone and omnipresent poor quality of the area. Historically the failure rate for implants in posterior maxilla is higher than any other anatomic location. Therefore procedures are needed to increase vertical bone height in posterior maxilla.

In 1980, Boyne and James first described a procedure to graft sinus floor with autogenous bone for placement of blade form implant. Access to sinus was gained through Caldwell-Luc procedure. Since then several techniques have been described including variation of lateral window osteotomy and use of osteotome to elevate sinus floor from alveolar crest. Numerous studies have validated the safety and efficacy of this sinus lift procedure. The most common intraoperative complication of conventionally performed sinus lift is perforation of the Schneiderian membrane,
which occurs in 14%-56% of cases (generally due to accidental slipping of the osteotome and can cause postoperative complications such as infection. In non-comparative observational studies, Vercellotti et al. reported a perforation rate of only 1 out of 21 (4.8%)7, Blus et al. reported a perforation rate of only 2 out of 53 membranes (3.8%)8, and there were no perforations at all during actual bone cutting in the series of 100 cases described by Wallace et al.6 These low rates are attributed to the use of ultrasound Frequencies of only 25-30 kHz, lower than those that cut soft tissue (ultrasonic scalpels use frequencies of >55 kHz)9; even contact between osteotome and soft tissue due to accidental slipping may inflict no incisive damage. Other aspects of ultrasonic osteotomy that have been noted in papers on sinus lift include the advantages of improved visibility and the possibility of more conservative cuts, and the disadvantage that the procedure was lengthier with the ultrasonic osteotome than with conventional instruments, though again the difference was not statistically significant.

The tooth extraction prior to implant placement should be atraumatic, however the method to achieve this has never been addressed in detail before. Tooth extraction has been done with same techniques either using forceps or by newer instrument11. In both, tooth mobilization is achieved by forcefully tearing the Sharpey fibers away from bundle bone which leads to alteration of bundle bone surrounding socket and blood vessel disruption. Vibrating syndesmosome tips of piezosurgery are developed recently for tooth and root extraction. They are brought into PDL space between root and socket to cut PDL fibers surrounding tooth socket up to or greater than 10mm. Thus when roots or teeth are mobilized after severing apical PDL fibers, the coronal portion of socket has not been submitted to violent rip. At this stage nearly atraumatic extraction can be done.

CONCLUSION

The use of piezosurgery devices for dental procedures has numerous advantages when compared with traditional hard & soft tissues methods like absence of the macrovibrations, ease of use, control and safer, precise cutting, particularly in complete anatomical areas. Since it has physical & mechanical properties like sparing of vital, neurovascular bundles, and better visualisation of the surgical field the use of the device and the procedures in the everyday dental practice should be considered.

REFERENCES

- Jeff Thomas, Piezoelectric Ultrasonic Bone Surgery: Benefits for the Interdisciplinary Team and Patients departments microsurgery Nov/Dec 2008, (2), issue 5
- Boyne P J, James R A, grafting


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