

Definition of dental implants

A dental implant is biomedical device usually composed of an inert metal or metallic alloy that is placed on or within the osseous tissues.

Classification:**1 – Endosteal implants:**

- a- Root form
- b- b- Plate\ Blade forms
- c- Endodontic stabilizer implants

2 – Ramus frame implant**3 –Transosteal implants****4 – Subperiosteal implants****5 – Intramucosal inserts****Important factors**

Bone Quality

Associated structures

inferior alveolar nerve

mental nerve

maxillary antrum

nasal floor

incisive canal

Pathology *

retained dental remnants

periapical pathology

cysts

other pathology

Osseo integration: represents a direct connection between bone and implant without interposed soft tissue layers

Factors influencing osseointegration

1-The biocompatibility

2-Design of the implant

3-Surface conditions of the implant

4-The status of the host bed

5-The surgical technique at Insertion

6.The loading conditions applied afterwards

The implant- bone interface:

The relationship between endosseous implants & the bone consists of two mechanisms

. 1-Osseointegration

Bone is in intimate but not ultra-structural contact with the implant

. 2-Fibrousseos integration;

Soft tissue such as fibers &/or cells, are interposed between the two surfaces.

Normal peri implant mucosa:

The mucosal tissues around intraosseous implants form a tightly adherent band consisting of a dense collagenous lamina propria covered by stratified squamous keratinizing epithelium. The implant-epithelium junction is analogous to the junctional epithelium around natural teeth, in that the epithelial cells attach to the titanium implant by means of hemidesmosomes and a basal lamina.

The Histologic examination of the sections revealed that the two soft tissues units, the gingiva and the peri-implant mucosa, have several features in common. The oral epithelium of the gingiva is well keratinized and is continuous with a smooth junctional epithelium that faces the crown of the tooth and ends at the cemento-enamel junction(arrow). The supra-alveolar connective tissue is about 1mm(arrow) high and the periodontal ligament about 0.2-0.3mm wide. The principal fibers extend from the root cementum in a fan-shaped pattern into the soft and hard tissues of the marginal periodontium.

The outer surface of the peri-implant mucosa is also covered by a well –keratinized oral epithelium, which in the marginal border connects with a barrier epithelium is facing the abutment part of the implant. The barrier epithelium is only a few cell layers thick and terminates about 2 mm apical of the soft tissue margin. In a zone that is about 1-1.5mm high, between the apical level of the barrier epithelium and the alveolar bone crest, the connective tissue appears to be in direct contact with the TiO₂ layer of the implant. The collagen fibres originate from the periosteum of the bone crest and extend towards the margin of the soft tissue in directions parallel to the surface of the abutment.

Collagen fibres are nonattached and run parallel to the implant surface, owing to the lack of cementum. This is an important difference between periimplant and periodontal tissues. However, some reports have suggested that microscope irregularities and porosities like those found on plasma sprayed titanium surfaces may favor the appearance of fibres oriented perpendicularly to the implant surface.

Periodontal tissues versus peri-implant tissues

The soft and hard tissues surrounding an osseointegrated implant show some similarities with the periodontium in the natural dentition.

- The absence of a periodontal ligament in the peri- implant region.
 - The orientation of the collagen fibres of the soft tissues around the implants, which are non-attached and parallel to the implant surface, while the gingival fibres around teeth are perpendicular and attached to the root cementum.
- The response to a pathological insult. the coronal portion of the implant and/or abutment is surrounded by a thin layer of collagen fibres arranged circumferentially and with minimal vascular structures. This low vascularity soft tissue band may affect the defense mechanisms around an implant as compared to those seen in tissues around teeth with a periodontal ligament. If plaque accumulates on the implant surface, the subepithelial connective tissue is infiltrated by large numbers of inflammatory cells and the layer of epithelial cells appears ulcerated and loosely adherent.

Microbiologic findings in periimplantitis: -

Bacterial flora is associated with periodontitis and periimplantitis. It has shown that pathogens associated with periodontal disease are a gram – negative, black – pigmented anaerobic flora. Failing implants were clinically characterized by increased mobility and periimplant radiolucency and probing depths greater than 6mm where as associated with periodontal pathogenesis, including *Actinobacillus actinomycetemcomitans*, *Prevotella intermedia*.

Clinical considerations:

Although treatments with dental implants have been proven to be effective, infections leading to loss of bone and exposure of implant surfaces to microorganisms can occur. These infections have been found to be similar to that of periodontitis that occur around natural dentitions and this is called peri-implantitis. The frequency of peri-implantitis has been reported in the range of 1-19%. The wide ranges for the frequencies seem to be due to differences in defining the peri-implantitis.

The difference between the natural tooth & implant surface is that presence of P.D.L. that joins the tooth with the soft tissues & bone. While in case of implants there is no PDL and the implant is organically fixed to the bone by what called the osseointegration. At the neck of the implant, the fibers run parallel to the fixture & there is no real attachment between the implant surface & soft tissue. While in case of natural tooth, junctional epithelia attached the tooth at CEJ and it acts as anatomical barrier that prevent spread of infection. So in cases of implants it is important to keep good O.H. because this is weak point & bacteria can pass through causing pei-implantitis .

Probing gingiva and peri implant mucosa

Probing pocket depth and probing attachment level measurements at implant sites can be obtained only if the force used during probing is light. If higher force is applied, the attachment between the implant and the mucosa may be affected and may reach up to the alveolar bone crest so minimum force is required of not more than 0.44. Peri-implant probing depth (3-4mm normal)

Radiographic examination

Proper clinical examination must precede the radiographic examination with little possible dose of radiation. Failure to diagnose or treat pathologic conditions in and around the remaining teeth can affect the results of implant therapy.

The parallel technique is recommended to:

- (1) Show the horizontal dimension of the intended implant site.
- (2) For preliminary estimate of its vertical dimensions.

The best thing is to carry a cross sectional tomography because the conventional tomography deliver lower doses than the computed tomography and it is therefore preferred. Multi directional tomography provides the best image quality due to smaller amounts of shadows from the surrounding tissues.

Biologic width denotes the dimensions of periodontal and periimplant soft-tissue structures such as the gingival sulcus, the junctional epithelium, and the supracrestal connective tissues.

Numerous studies have shown that bone resorption around the implant neck does not start until the implant is uncovered and exposed to the oral cavity. This invariably leads to bacterial contamination of the gap between the implant and the superstructure. Bone remodeling will progress until the biologic width has been created and stabilized.

This width progress not only apically, along the vertical axis, but according to studies conducted by Tarnow et al, there is also a horizontal component amounting to 1–1.5 mm. This is the reason to maintain a minimum distance of 3 mm between 2 implants and platform switching in the esthetic reconstruction zone in order to obtain intact papillae and stable inter-implant bone

Response to plaque accumulation:

Peri implant mucositis: The peri implant mucosa seems less affected than the normal gingiva in response to plaque associated lesions.

Peri implantitis: An infection that involve bone tissue and may lead to implant failure.

Risk factors

- 1-Tobacco use
- 2-Poorly controlled systemic conditions (e.g., diabetes mellitus, osteoporosis, post-irradiated jaws)
- 3-History of periodontitis and noncompliance to treatment
- 4-Poor oral hygiene
- 5-Parafunctional habits (e.g., bruxism)
- 6-Iatrogenic factors (e.g., lack of primary stability and premature loading during the healing period)

Additional Influential Factors

- Implant Design
- Prosthetic Connection
- Mechanical Failures and Cement Contamination
- Surgical Errors

Failure sometimes happens in implant therapy. Such failures occur due to complications that take place either early following the installation of the implant device or later when the implant supported reconstruction has been in function for various periods of time

Early implant failures are the result of events that may prevent osseointegration from occurring and include among others

- 1-Improper preparation of the recipient site which results in undue hard tissue damage such as necrosis of the bone
- 2-Bacterial contamination and extensive inflammation of the wound that may delay healing of the soft and hard tissues
- 3-Improper mechanical stability of the implant following its insertion
4. Premature loading of the implant.

Late failures occur in situations during which osseointegration of a previously stable and properly functioning implant is lost

That such late failures are often the result of excessive load and/or infection
excessive load

Forces applied to the restoration placed on implants are, at least in part, transferred to the bone. Factors such as occlusal force (trauma from occlusion) in relation to

- 1-size of implant
- 2-surface features of implant
- 3- quality of the host bone, must obviously be considered.

Infection

The host response to biofilm formation on the implant includes a series of inflammatory reactions which initially occur in the soft tissue but which may subsequently progress and lead to loss of supporting bone. The tissue destruction in the bone compartment starts in the "marginal", i.e., neck region, of the implant and crater-like bone defects develop and become visible in the radiograph

Clinical features of peri-implantitis were described by Mombelli as including

- 1-Radiographic evidence of vertical destruction of the crestal bone.
- 2-Formation of a peri-implant pocket in association with radiographic bone loss.
- 3-bleeding after gentle probing, possibly with suppuration.
- 4-Mucosal swelling and redness.
- 5-No pain typically.

Complications of untreated peri-implantitis:

- 1- Infection.
- 2- Implant losing.
- 3- Bone destruction.
- 4- Gingival recession.
- 5- Implant fracture.

Treatment of peri-implantitis:

1- Initial phase of treatment

- a - Occlusal therapy.
 - * Change in prosthesis design.
 - * Improvement in implant number & position.
 - * Occlusal adjustment.

b- Anti-infective therapy. (Non-surgical treatment)

- * Local removal of dental plaque.
- * Polishing.
- * Sub gingival irrigation with 0.12% chlorhexidine.
- * Systemic antimicrobial therapy.
- * Oral hygiene procedures.
- * Laser therapy

2- Surgical techniques of treatment.

A - peri-implant resective therapy:

Apically displaced flap technique that includes:

- * Correct horizontal bone loss.
- * Reduce pocket depth.
- * Surface polishing implantoplasty.

B - Peri-implant regenerative therapy:

- * Guided bone regenerative GBR.
- * Bone graft technique.

C - Removal of failed implants.

3 - Maintenance phase (follow up & recall):

After surgical intervention, all patients are placed on a close recall schedule; maintenance visits every 3 months are advised as a minimum. This allows for monitoring of plaque, levels, soft tissue inflammation, and changes in the level of the bone

A - Examination and evaluation:

- * Status of the peri-implant soft tissue (gingiva) whether it is healthy or inflamed (GI).
- * Plaque & calculus accumulation (PLI).
- * Width of attached mucosa (gingiva).
- * Probing pocket depth. Peri-implant probing depth (3-4mm normal)
- * Sulcus bleeding index (S.B.I) this is performed by inserting P.D. probe inside the pocket & move the probe from mesial to distal side & wait for 30 sec. bleeding provoking indicate presence of inflammation.
- * Rate of sulcus fluid flow (GCF flow). This is done by using the intra crevicular method by inserting an absorbent filter paper inside the pocket & Then left for 30 sec. to evaluate the rate of GCF flow.

B - Instructions given to the patient to keep good oral hygiene

Homework therapy to control the dental plaque by using interdental brush, single tuft brush, dental floss, & super dental floss.