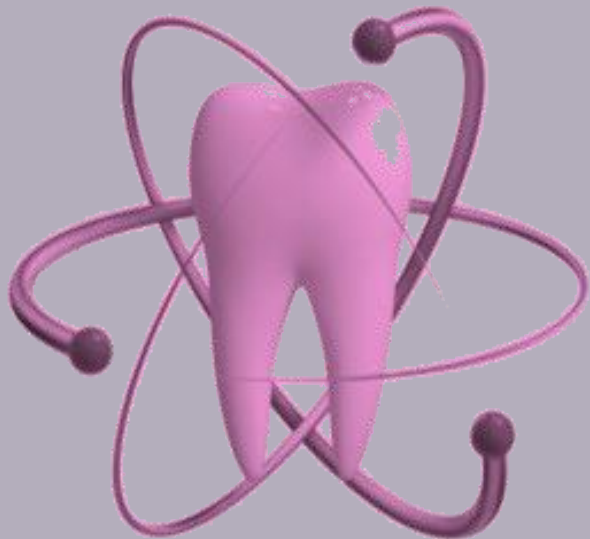


Dental Implant

Part II

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2020-2021



Department of
Prosthodontics

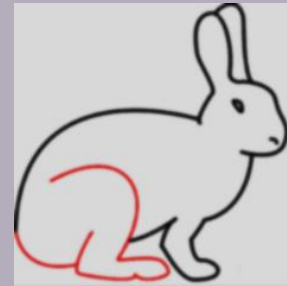
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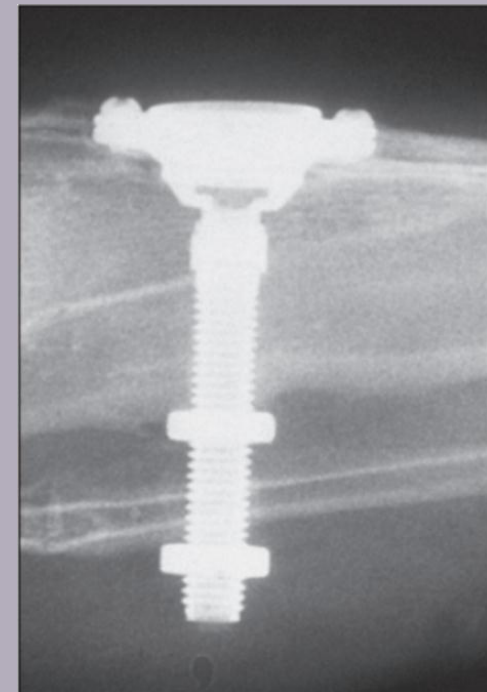


Osseointegration

- When the concept of osseointegration was introduced to the international dental community in the early 1980s, it represented a radically new concept in implant dentistry.
- The phenomenon of **osseointegration** was discovered by Professor Per-Ingvar Brånemark
- These implants were made of titanium, and when an implant was placed in a rabbit tibia, bone was deposited on its surface, firmly anchoring the implant in the surrounding bone.

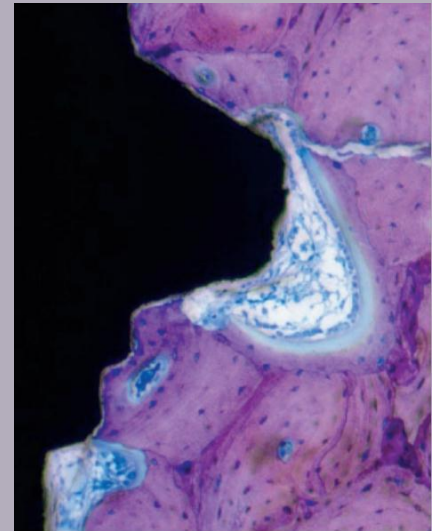


A radiograph of the titanium optical chamber embedded in a rabbit tibia bone.



Osseointegration

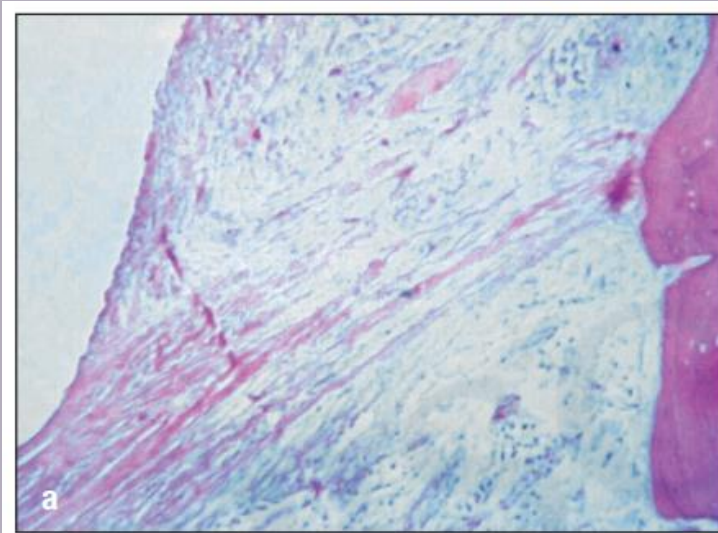
- Histologic appearance resembled a functional ankylosis with no intervention of fibrous or connective tissue between bone and implant surface.
- When bone forming cells (osteoblasts) attach themselves to the titanium implant, a structural and functional bridge forms between the body's bone and the newly implanted, foreign object. This process resulted from remodeling within bone tissue is called Osseointegration.



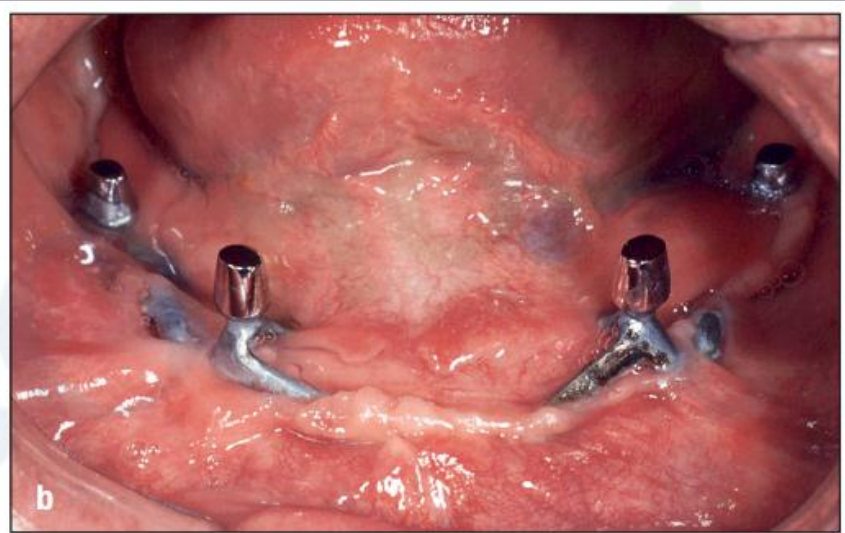
- **Osseointegration** is defined as a time dependent healing process whereby clinically asymptomatic rigid fixation of alloplastic materials is achieved, and maintained, in bone during functional loading (Zarb &Albrektsson,)

Osseointegration

- The implant material is an important factor for Osseointegration to occur.



(a) Subperiosteal implants of chrome-cobalt are enveloped by fibrous connective tissue.



(b) Epithelial migration led to the formation of extended peri-implant pockets, which in turn developed into chronic infection. The infection led to exposure of the implant struts and eventual loss of the implant.

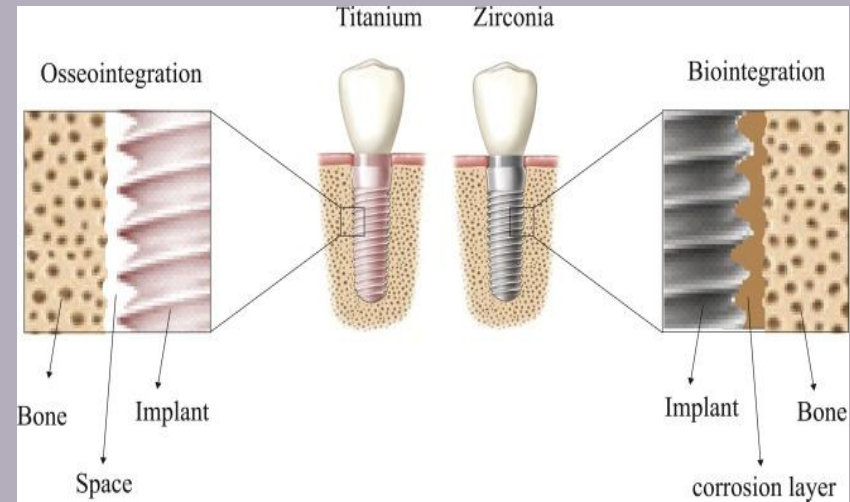
Prerequisites for Achieving Osseointegration

The successful outcome of any implant procedure is mainly dependent on the interrelationship of the various components of an equation that includes the following:

- 1. Biocompatibility of the implant material
- 2. Macroscopic and microscopic nature of the implant surface & designs
- 3. The status of the implant bed in both a health and a morphologic (bone quality) context
- 4. The surgical technique per se
- 5. The undisturbed healing phase
- 6. Loading conditions
- *The challenge confronting the clinician is that these several factors must be controlled almost simultaneously, if a predictably successful outcome is to be expected.*

1. Biocompatibility of the implant material

- This is the property of implant material to show favorable response in given biological environment in a particular function. It depends on the corrosion resistance and cytotoxicity of corrosion products.



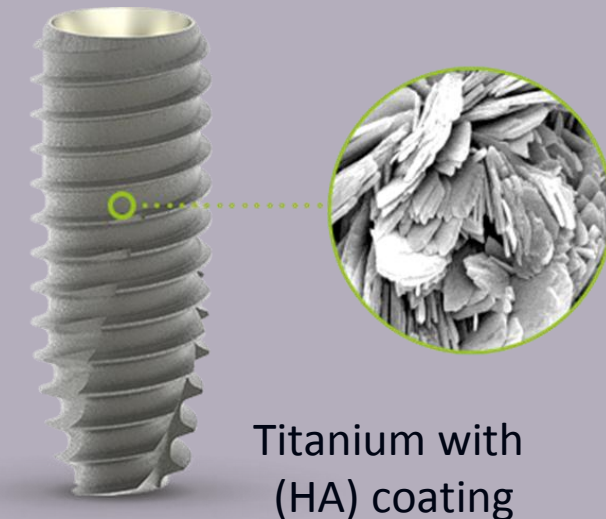
- Clinical significance of corrosion: Implant bio-material should be corrosion resistant. Corrosion can result in roughening of the surface, weakening of the restoration, release of elements from the metal or alloy, toxic reactions. Adjacent tissues may be discolored and allergic reactions in patients may result due to release of elements.

1. Biocompatibility of the implant material

- Today, the most accepted material
- 1) Cp titanium (commercially pure titanium)
- 2) Titanium alloy (titanium-6aluminum-4vanadium)
- 3) Zirconium
- 4) Hydroxyapatite (HA), one type of calcium phosphate ceramic material



Zirconium



2. Macroscopic and microscopic nature of the implant surface & designs

- Different implant materials and designs are being used to obtain surfaces increasing osseointegration.

A. Implant design (root-form)

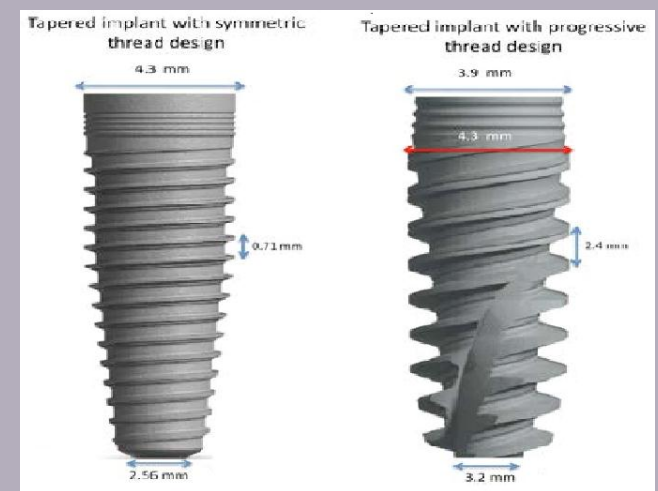
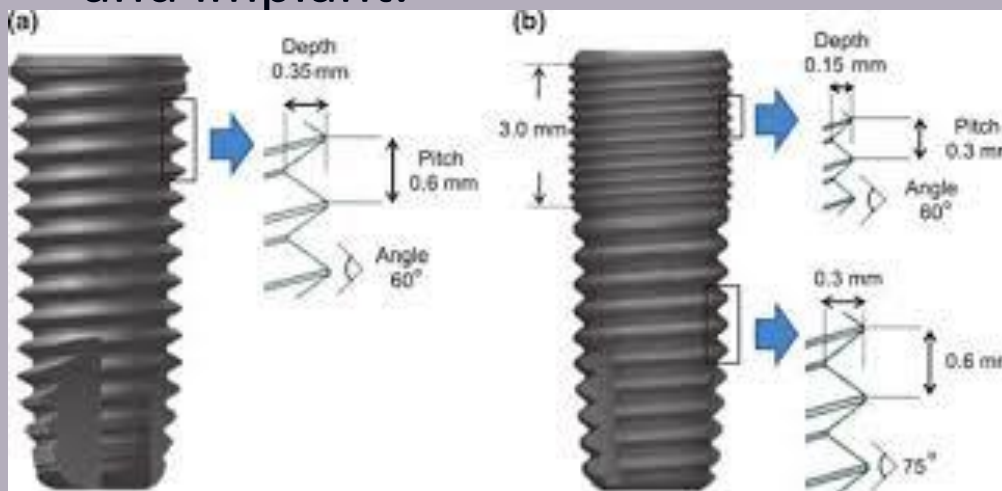
- ❑ Cylindrical Implant
 - most conducive
- ❑ Threaded Implant: most implant forms have been developed as a serrated thread.
 - a. to maintain a clear steady state bone response.
 - b. to enhance initial stability
 - c. to increase surface contact.



2. Macroscopic and microscopic nature of the implant surface & designs (cont.)

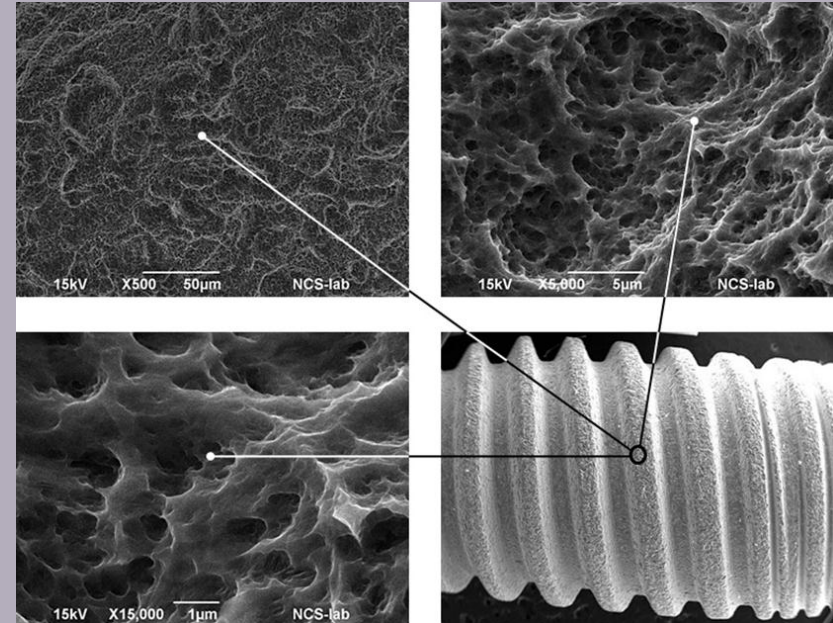
B. Implant surface

- Increased pitch (the number of threads per unit length) and increased depth between individual threads allows for improved contact area between bone and implant.



B. Implant surface

- Mild rough surface increases the contact area between bone and implant surface.
- Reactive implant surface by anodizing (Oxide layer), acid etching or HA coating enhanced osseointegration



3.The status of the implant bed in both a health and a morphologic (bone quality) context

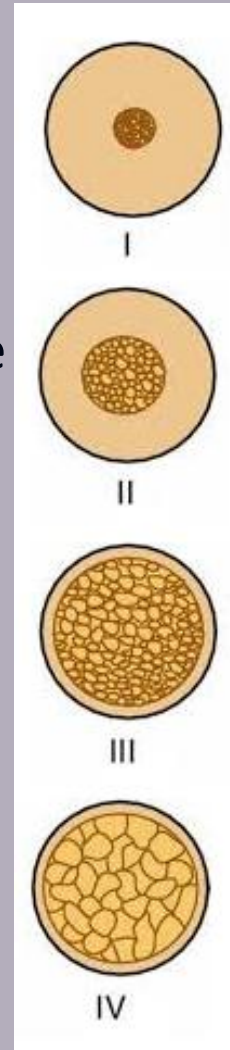
Good bone quality and healthy surgical site

Quality I: Was composed of homogenous compact bone, usually found in the anterior lower jaw.

Quality II: Had a thick layer of cortical bone surrounding dense trabecular bone, usually found in the posterior lower jaw.

Quality III: Had a thin layer of cortical bone surrounding dense trabecular bone, normally found in the anterior upper jaw but can also be seen in the posterior lower jaw and the posterior upper jaw.

Quality IV: Had a very thin layer of cortical bone surrounding a core of low-density trabecular bone, It is very soft bone and normally found in the posterior upper jaw. It can also be seen in the anterior upper jaw.





4.The surgical technique per se

- Minimum possible trauma and minimal tissue violence at surgery is essential for proper osseointegration.
- Careful cooling while surgical drilling is performed at low rotatory rates
- Use of sharp drills
- Use of graded series of drills
- Proper drill geometry is important, as intermittent drilling.
- The insertion torque should be of a moderate level because strong insertion torques may result in stress concentrations around the implant, with subsequent bone resorption.

5.The undisturbed healing phase

- Micromovement of the implant is thought to disturb the tissue and vascular structures necessary for initial bone healing.
- Excessive micromovement of the implant during healing prevents the fibrin clot from adhering to the implant surface. Eventually, the healing processes are reprogrammed, leading to a connective tissue–implant interface as opposed to a bone-implant interface.

6. Loading conditions

1- Delayed loading:

After the placement of dental implants, a 3 – 6 month load-free healing period.

Advantages: allow the optimal period to ensure successful healing and the bone formation required osseointegration.

Disadvantage: a. long treatment time.

b. Delayed restoration of esthetic and function.

2- Immediate loading:

It means placing a full occlusal load onto the implant via the prosthesis, within 72 hours after placement.

Advantages: a. allow for shorter treatment time.

b. allow for immediate restoration of function and esthetics.

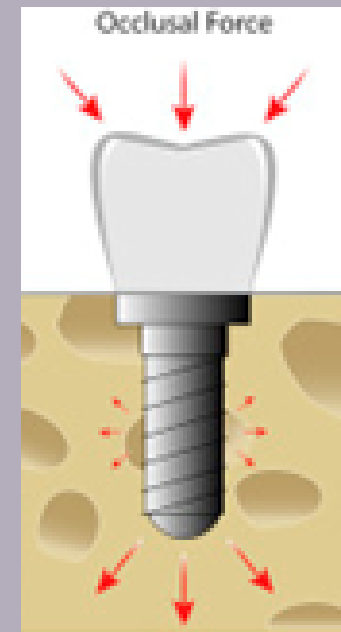
Disadvantage: an increased risk of implant failure because the increased vertical or lateral force upon the implant during the healing phase results in implant motion, aberrant healing and fibrous tissue encapsulation.

The Biomechanics of Dental Implants

- In all incidences of clinical loading, occlusal forces are first introduced to the prosthesis and then reach the bone-implant interface via the implant.

This is affected by:

- 1) Force directions and magnitudes,
- 2) Prosthesis type,
- 3) Prosthesis material,
- 4) Implant design,
- 5) Number and distribution of supporting implants,
- 6) Bone density, and
- 7) The mechanical properties of the bone-implant interface.





Prosthetic Attachments

They include:

1. Implant abutment
2. Implant superstructure

Prosthetic Attachments

Implant abutment: it is the portion of the implant that supports or retains a prosthesis or implant superstructure.

It is classified, based on method by which prosthesis or superstructure is retained to the abutment, into:

1- Screw retention



2- cement retention





Prosthetic Attachments

Super structure: is defined as the superior part of multiple layer prosthesis that includes the replaced teeth and associated structures.

The superstructure for completely edentulous patients

- ❑ Implant-retained removable overdenture
- ❑ Implant-supported removable overdenture
- ❑ Fixed detachable prosthesis (Hybrid prosthesis)
- ❑ Implant supported Fixed prosthesis:
 - 1) Screwed-in Fixed Bridge
 - 2) Cemented Fixed Bridge



Treatment-Planning Determinants for edentulous mandible Implant-Retained Versus Implant-Supported Overdentures Versus Fixed Prostheses

1. Alveolar ridge resorption
2. Amount of keratinized attached mucosa
3. Oral compliance
4. Esthetics
5. Cost
6. Patient preference



*THANK
YOU*

