**Dental oral implantology in prosthodontics**

Many implant systems have been introduced into the dental market, varying in shapes , materials, and coating ( ceramic , calcium hydroxide..).

we’ll go through:

1. History , since It is not a recent topic in dentistry.
2. Materials
3. Different implant systems
4. Indications and contraindication.

**History**

* Researchers traced the beginning of the dental implants to the ancient Egyptian and South American cultures since 18th century .
* **19th** century: dentists used many alloplastic material such as gold, porcelain, ivory and Indian rubber to replace missing teeth
* **Greenfield**1913 :introduced Endosteal dental implants which consists of 2 pieces of hollow basket that is inserted in the bone made of platinum , and its suprastructure that appears in the mouth.
* **Stock1939** : inserted the first Co/Cr screw shaped implant in freshly extracted socket , Where he noticed that the primary stability is mandatory for any implant system .
* **Formiggini**1947 **:** introduced a spiral design , but unfortunately it failed because of high rate of bone resorption on xray
* **Chercheve**1962*:*introduced the double helical design.
* **Scialom** 1962: they introduced street of needle design (similar to the street of columns in jerash),they were inserted just on the mucosa , they also failed.
* **Dahl**1943, introduced the subperiosteal dental Implants then they have been modified by Goldberg and Gershkoff in 1949 , this implant system is still existing , made of co/cr, Mainly used in the mandible where the bone is less than 4mm in height , we have to open a flap from retromolar to retromolar exposing the bone , then take the impression and set your design the same as a co/cr , emerging from the gingiva , it just rests on the bone after that reposition the flap back to its place ( so no real osseointegration here , it is just a mechanical resting on the top of alveolar bone )
* **Linkow**1964 : introduced the vent implant made from chrome nickel alloys, used for ridges that are narrow bucco-lingually. eventually they failed ,, not osteointegrated by any means just mechanically inserted inside the bone
* **Roberts and Roberts**1970s***,*** introduced the ramus frame implants like a tripod extending From the symphysis anteriorly back to the ascending ramus of the mandible. attached by clips to the over denture
* **Small**1975, introduced the "mandibular stable implants" ,similar to trans-fixation screws that are used in fractures of the mandible , it's made of alloys and approached **extra orally** from the lower border of the mandible (submental area) to the crest of the alveolar ridge ( it is like a major surgery ) then screwed . it is mechanical , nothing to do with osseointegration . 3 screws 2 of them are approached extraorally the incison in the submental area then they reflect a flap like transfixation screws like in fractures
* **Bosker**1986, introduced the trans-mandibular implant (TMI) system , this is where the mandible is less than 4 mm especially in the posterior area , they are completely made of gold , very expensive and done under general anesthesia. still existing the dr saw 2 cases with an Egyptian dr called Allattar

**\*\***the only two implant systems that can be approached extraorally:

**Small (**mandibular stable implants )**, bosker(**trans-mandibular implant)**.**

* The real story started in 1952 ,accidentally professor Branemark (orthopaedic surgeon) and his team discovered the biocompatibility of Titanium in animals and remarked how it had the tendency to fuse with bone by investigating the bone healing and the difficulty of removing titanium screws calling this phenomena osteointegration .
* He placed titanium screws in rat femurs and remarked how the screws were tighter than when originally put in . he did the experiments from 1952 until 1965 he started with animal studies and clinical trial and his first patient was in 1967 which means that after 15 yrs of animal studies he started the clinical trials on humans .then He was followed by Schroeder in 1977.
* in 1969 Branemark described this phenomena and called it "osseointegration”
* there are more than 1000 dental implant systems manufactured by different companies. In Jordan there are more than 30 systems in Korea 4 types and china too so most of these systems are not recomonded by ADA the American dental association .
* **Osseointegration** by definition: is a process of direct structural and functional connection between the Living bone and the surface of the alloplastic material (titanium) which is achieved under functional loading at a **microscopic** level , they called it “functional ankylosis" . histological definition
*
* definition by **Zarb** 1991: A time dependent healing process where byclinically asymptomatic rigid fixation of alloplastic material is achieved and maintained in bone during functional loading; this is the **clinical** definition not at the microscopic level*.*
* linkow and Weiss supported the **Fibrointegration** which is fibrous tissue between the interface surface of the Implant and the bone to mimic the PDL like the natural teeth , their debate was that there should be a gap (connective tissue) between the alloplastic material and the bone resembling the pdl
* no primary stability will be there. the failure rate was more than 75 % after 5 years.
* Any fibrous tissue between the bone and metal is considered a non-integrated failed implant.
* Implant materials ; Many different implant materials were known : gold, silver, stainless steel, titanium, palladium and in addition to non metallic materials such as Indian rubber, ivory, porcelain, poly methyl methacrylate,Ceramics, carbon, and nowadays zirconium being the latest one having good results but still under clinical trials .

**Pure titanium**

(99.6%) titanium ,(0.4%) a corrosion resistant alloy (nickel)

1. Biocompatible with the living tissues
2. Excellent mechanical properties; **6** times stronger than the cortical bone once its osteintegrated to the bone
3. Histological sections show intimate contact between the implant and bone surfaces.
4. Corrosion resistance ; since it contains Nickel
5. The chemical propereties of titanium is determined by the surface of the outside layer
* U cant remove those implants with a forceps u need drills with a diameter slightly larger than the implant's

once the pure titanium is exposed to the biological environment ,an oxide layer forms on its surface ( chemical and physical property ) , this oxide layer is the cause of osseointegration.

there were fears from it being deposited into different organs and tissues (liver, spleen, lymphnodes), eventually it was proved that it is safe and inert material.Also it was found that the daily intake of Titanium ranged from 0.3-1 mg from vegetables and other foods and excreted through the urine , also they found that the biological half life of titanium was about 320 days, preventing it from accumulation in the human body.

**coating materials**

a material that produces rough surface on the implants to increase the surface area and the bone

the surface shouldn’t be smooth

1. titanium plasma spray (TPS) it was used until the end of 90s ,we had to wait for at least 5 months for the maxillary healing, and 3 months for the mandible.
2. sandblasted large grit acid etch , here the healing time reduced to the half, 2.5 months in the maxilla and 1.5 months in the mandible
3. hydroxyapatite, tried in the mid 80s, with the advantage of rapid osseoinduction ( less than 3 months ) , high success rate in the first 3 years BUT after 5 years of function it had high failure rates, it showed cracks or even complete loss of coating, also invasion of microorganisms through these cracks down to the bone causing peri-implantitis leading to failure.
4. Bioactive materials, 2 weeks only for mandibular healing and 3 weeks in maxilla ,but it is at the expense of price.

**Methods of coating**

* sandblasting
* Acid etch methods ( like composite )
* Laser methods (one of the latest methods

 **Comparison between different materials**

1. Stainless steel, CoCr, gold alloys, and polymethyl methacrylate:

-Type: biotolerant to the tissue

-Histological appearance: fibrous tissue between bone and metal.

-type of osteogenesis: "distant" as there is a distance between bone and the metal (fibrous tissue)

1. Titanium and Ceramics:

-Type: Bioinert; no any reaction with the soft tissues.

-Histological appearance: close intimate contact with bone surface with no gaps.

1. Bioceramics and Hydroxyapetite:

-Type : Bioactive

-Histological appearance: chemical bond, true bond

**Classification of dental implants**

The most widely used classification of dental implants is the one according to the **form** and **Position**:

* Intramucosal implants
* Titanium mucosal inserts
* Subperiosteal implants
* Transosseous dental implants
* Endosseous dental implants, (the one used nowadays).

Endosseous dental implants is the one with real osteointegration while the others are totally different

**Sub-mucosal implants**

 the device was used in the past and was inserted in mucosa and not in bone , in thought that it helped to retain the denture

-made of metal ;like a button/ball.
-forbidden -by ‘Granstelberg’- due to poor retention and poor survival.

Works like an anchor to hold the denture

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**Titanium mucosal inserts**

* Almost the same with a slight insertion of the tip of material inside the bone
* Was used to help retain the denture

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**Subperiosteal**

**Still used these days**

-consists of a metal framework similar to CO-CR .
-Overlying the bone
-Restricteduse in the mandible , can’t be used in the upper arch.
-Low success rate
-The possible risk of infection spread (infection spreads downward through the rods leading to bone resorption )

The Dr saw one case using this type of implant and it is still surviving in the patients’ mouth.

the use of 3D (especially by plastic surgeons) has made implants a much easier task than before .
Before a flap was opened from retromolar to retromolar area and an impression of bone taken, framework was made and then inserted and 3 rods appear in the oral cavity to attach the denture .
Now 3D has made it applicable to design and work easier.

-Can be used when the mandible is 6 mm short

Note :Some systems might use short dental implants .
Strama/Ipr system introduced the 4 mm implants one year ago with a larger diameter of 4.8 mm especially for the posterior mandible where the thickness of bone was minimal or the nerves were close to the implant to help in cases of short mandible and surgical bone grafts may help as well

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**Transosseuos implants**

- also known as staple implants

Transmandibular and transosseuos implants generally need general anaesthesia and an extra oral approach

-need to consider risks of GA to patients especially compromised ones
-restricted to use in the mandible only
-surgical procedure needs an extraoral approach
-it is a major surgery
-results an extraoral scar.

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classifying implants according to surgical steps :

* One step surgery .by swiss dentist , the only one that uses ITI system, what the Dr works by

Without submerging the implant and covering it by mucosa

* Two step surgery : you submerge the implant and then reopen and put a gingival former and then connect it with the prosthetic part

-Branemark system( little bit complicated) , nobelpharma , biocare , ,replace , nobeldirect , nobelperfect . depending on the modification of the component..( different brand names)

As it advanced it ended up with Replace and Taper .Not similar to the original one - less number of components and cheaper-

ASTRA excellent implant system . very expensive

IMZ ( german) , not available anymore , plastic placed inside ; mimicsPDL.Has to be replaced every 8 months

Friodent 1 or 2 Or called friolent 1 or 2 ,friodent 1 : Made of ivory, have excellent results, osseointegration was excellent and rapid(3months), its main problem was the fracture between the supra structure crown porcelain and the ceramic fixture)

(Naming system now uses friodent)

Dr was naming different brandnames…
-Integral used hydroxyapatite

**ROOT FORM OF IMPLANTS (the dr didn’t mention this part in our lec.)**

* Best is the one that is similar to the natural root form
-Fredman started this idea and ITR continued

-There are other implant system and coating

- a Calcified type was used but within months it dissolved

Note :PDL resembling one has to be changed every 8 months – results in 1mm apical movement -

**Indications for Dental Implants
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-Before selecting any candidate for dental implants, patient must be motivated and shows cooperation towards maintaining good oral hygiene.

-Give the patient a chance ; do scaling and polishing for patients with poor oral hygiene and monitor them for 1 month before placing any implant.

Bone growth and patient's age \*

Preferable after the age of 18 and it usually differs between females and males

Usually we start after 19 or after the bone growth has stopped

Female bone grows till the age of 19 while the male bone growth stops at a younger age .

Mandible stops at a younger age than maxilla.

***Completely edentulous in the upper arch***

***Either 6-implant-supported-fixed prosthesisby means of crowns and bridges***

 ***or 2***-implant retained over-dentures By means of ball attachment , bar attachment or magnet .

***Partially edentulous long span***

* In long span we don’t prefer to use a conventional bridge (e.g from molar to canine) so if there is a good quality and quantity of bone we can place 3 implants and connect them either with one or separate parts

In kennedy class 1 or 2 when we have a vital structure to be careful around which is the ID nerve . when posterior teeth are lost before the anteriors , bone resorption tends to be very high .

if you manage to replace co-cr RPD/acrylic with fixed option for example bridges in a bounded saddle , abutments must be sound an healthy with no periodontal problems but implants are preferred since the success rate of bridges is 80 percent lasting for 15 years while success rate of well maintained implants is > 25 years , 92 percent in the mandible and about 80 percent in the maxilla ; better than bridges

***Case of missing lateral or central***

-We prefer to place an implant than to prepare the adjacent teeth .

***-Patient with compromised denture bearing area***

no retention we go for overdenture

***Patient with gag reflex***

-They cant tolerate by any means partial or complete dentures

***Patients with psychological and emotional problems*** towards dentures reminds them of aging

***Unrealistic prosthodontic expectations*** . they wont be happy with the partial denture so we go for implants

***Parafunctional habits/bruxism***

The force generated could be a factor to increase failure rates of implants , so we try to get rid of or reduce this habit.

Frequent fractures of the implant

***Poor muscular coordination***

Parkinson patients and epileptic patients

***Hypodontia***

When we have missing upper laterals we are mainly concerned about lack of **width** for placing teeth(2.5mm or less ?). If we had space we would place implants especially in young patients

**Contraindications** We can divide them into absolute and relative contraindication  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Intraoral contraindication

-Unfavourable interarch relationship , especially in class 3 and class 2 div 1

-Pathological lesions in the alveolar ridge , such as infected remainig root or cyst . any other pathology such as lichen planus or leukoplakia

-Poor oral hygiene , gingival hyperplasia , calculus , lesions , abscess

Relative contraindications :

-Insufficient bone quality and quantity

>Haematological diseases such as anaemia; less osteointegration , postoperative infection , delayed healing

>Metabolic bone diseases like osteoporosis , spongy bone , paget disease

\*Patient with psychological problem are absolutely contraindicated, don’t do surgery or implants for them. Most of dental schools have psychiatric clinics where patients are sent before surgery to assess their condition.

HIV is relative contraindication

* There is no age limit. 19 up to whatever age. the Dr placed an implant a year ago for a 77 year old patient.
* **Radiation**
* In 1998 it was said that it is not an absolute contraindication for implant placement . Wait at least one year before treatment . we treat them with hyperbaric oxygen therapy with precise 100 percent of oxygen for 90 minutes in each session for 20 sessions pre-surgery and 10 sessions post-surgery to enhance oxygen supply to the tissues
* Now theres hyperbaric chambers but in the past they put the pts deep in the sea

* Effects of radiation :
* Xerostomia , mucositis ( inflammation around the tissues not peri-implantitis) , hypo vascularity , fibrosis , hypoxia , osteoradionecrosis in the direction of radiation beam
* No issues with controlled diabetic patients , the problem is with the uncontrolled groups. The reason is delayed healing and infections .
* Osteoporosis , bisphosphonates and pagets’ disease
* \* bisphosphonates: oral bisphosphonates is a relative contraindication while IV bisphosphonates is an absolute contraindication because it causes osteonecrosis

Heavy Smokers are contraindicated because of high failure rates

* 6 years ago we would tell the patients not to quit but at least try to reduce the amount of cigarretes

Since 6 years it became an absolute contra indication The pt should stop smoking 1 week before the surgery and 8 weeks after (the healing period)

also in absolute contraindication are patients with recent cardiovascular diseases , congenital heart disease , rheumatic valve defects or artificial valves ,uncontrolled hypertension.
Recent myocardial infarction , wait 6 months , preferably one year

**Drug/alcohol addicts**

Contraindicated due to the lack of maintaining oral hygiene.

Assessment of patients and treatment planning it should be done by the implant team "AKA implant joint" which consists of oral surgeon ,prosthodontist,trained technician and oral hygienist.

If there was lesions in the soft tissues we usually wait 3-4 weeks while bone lesions wait 4 months for healing (its either wait for a month for healing or wait 4 months I cant hear it very well)

**Patients general assessment**:
1-patient's complain
2-medical history
3-psychological assessment
4-social history
5-dental history

**Local assessment:**
It contains of extra-oral and intra-oral examination.The intra-oral assessment should include:
1-Type of mucosa :In the past,they preferred keratinized mucosa for implants because of its high success rate but nowadays ,both keratinized and non-keratinized can be used as we depend more on bone quality and the oral hygiene of the patient.
2-Health of remaining dentition and periodontium
3-The alveolar ridge form and shape
4-Related mucosal soft tissue attachment
5-Inter-arch space and inter-occlusal space horizontally and vertically
\*its very important to check the interarch space before doing the implants

1-Panoramic x-ray(OPG) :used as routine prodecure for any implant patient.It is used to determine the length of the fixtures roughly using metal spheres (5mm) with surgical stent.
**Length of the implant**= actual sphere size (5mm) \* bone height on x-ray
 sphere size on x-ray
\_You should take 2 mm margin of safety from any vital structure.

2-Lateral cephalometric x-ray: to determine the inclination of the ridge

3- periapical x-ray

4-CT scans and CBCT

**Additional assessment:**
1-study and diagnostic casts

2-Magnetic Reasonance Tomographic: was used in the past but it is more useful for soft tissues

3-Multiple Planner Computerized Tomography :very expensive,used mainly for plastic surgeries.
4-Ridge mapping: it is a simple prodecure to assess the width of the bone with the help of conventional method,osteometer or electronic device.

Manually its done using for ex a file

You first anesthetize the area and then put the file through the soft tissues until it touches the bone and mark the length with the stopper in three placed buccal ,lingual and the top of the ridge then take an impression and transfer those readings to the cast to determine the bone thickness there.



**Osteometer**: an instrument used for ridge mapping,very painful .It has three tripoding points and gives a direct measurement of ridge width.

I used the sheets of last year and the one before it to write this sheet

The dr will give us the slides please read them he didn't add alots of extra information in the lec

Good luck