



Faculty of dentistry
5th year = Amal batch



Prosthodontics 3

Sheet

Slide

Number

#14

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Some extra information and pictures were taken from sheet 14 (batch of 2014)

Dental Oral Implantology in Prosthodontics

- Many implants' systems have been introduced during the past years ranging from ceramics to those coated with hydroxyapatite.
- The original implants were made from titanium. There are many types and configurations of implants.
- Other implants made of zirconia were introduced.

The aim of these lectures is to know the terms and be familiar with them.

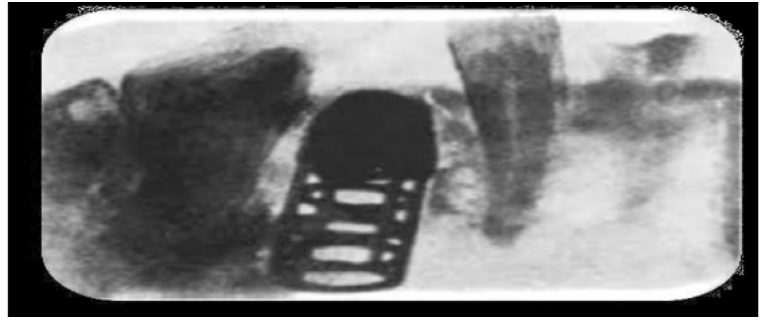
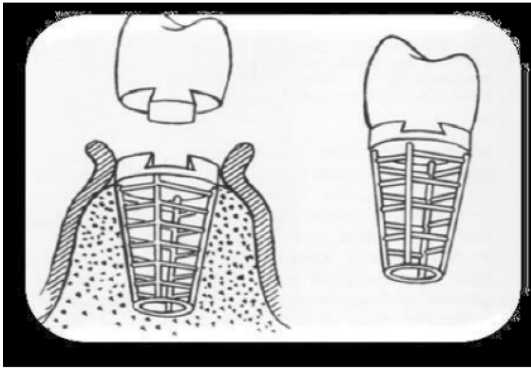
1. History of dental implants:

- a. Researches have traced the start of dental implants to the ancient Egyptians and South American people. According to Scharr and Chen (1993) in the 19th century, dentists used many different types of alloplastic materials such as gold, porcelain, ivory, and Indian rubber and PMMA in attempt to replace missing teeth.



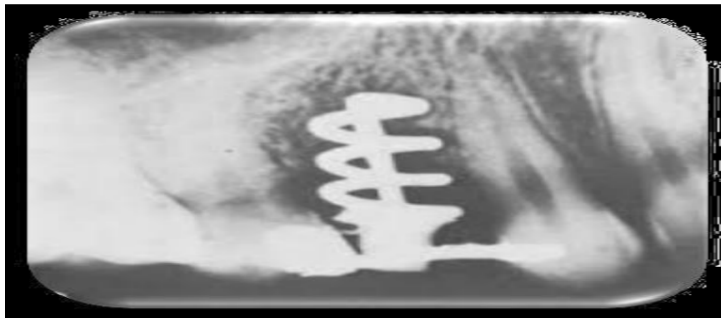
During old times, , they used to replace rich people's teeth by poor people' teeth and splint them with gold wires.

- b. Greenfield (1913): introduced the endosseous implant. It consists of two pieces, a hollow-cylinder [basket] root, made of platinum soldered with suprastructure where the crown is placed. This technique has eventually failed.

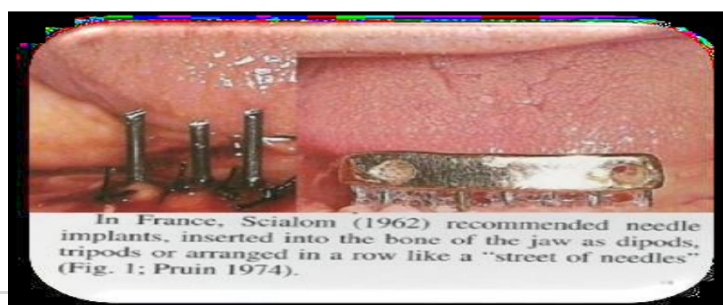


- c. Stock (1939): inserted the first Co-Cr screw shaped implant in fresh extraction socket, which is an immediate placement. He discovered that the primary stability is mandatory for any implant system. So without primary stability 80% the dental implants might fail. This has also failed.
- d. Formiggini (1947): introduced implants with the spiral design. There is no osseointegration, it is similar to basal implants. These implants have failed. It depends on the mechanical lock of the screw in compact bone (not the spongy bone). It failed because of high rate of resorption.

These days it is similar to basal implants [we see like them on social media]; immediate implants with immediate loading within 3 days without any surgery or pain. It will fail and cause bad smell.

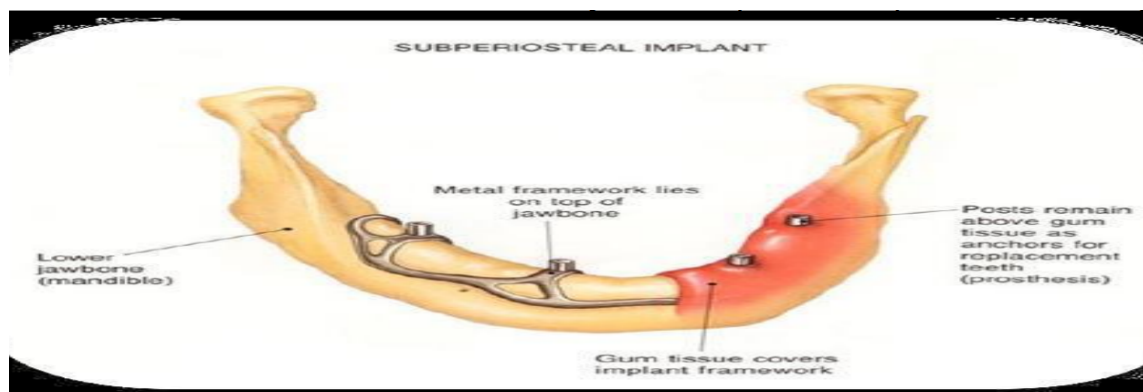


- e. Scialom (1962): they introduced street of needle design or double helix design (co-cr), and then put suprastructures like blades. They were inserted just on the mucosa, causing inflammation, they also failed.



- f. Dahl (1943): introduced the subperiosteal dental implants then they have been modified by Goldberg and Gershkoff in 1949, this implant system is still existing in the USA, made of co-cr framework. Mainly used in a highly resorbed lower ridge where dental implants are less than 4mm in height. The shortest dental implant is 6 mm.

A flap should be elevated from retromolar to retromolar exposing the bone, then take the impression and set your design the same as a co-cr, four rods emerging from the gingiva, it just rests on the bone, after that reposition the flap back to its place (so there is no real osseointegration here, it is just a mechanical rest on the top of alveolar bone), it's very difficult to be done in upper arch.



- g. Linkow (1964): introduced the vent implant made from chrome nickel alloys. Against osseointegration, with fibro-osteointegration. Some schools believe in fibrointegration but ours doesn't.

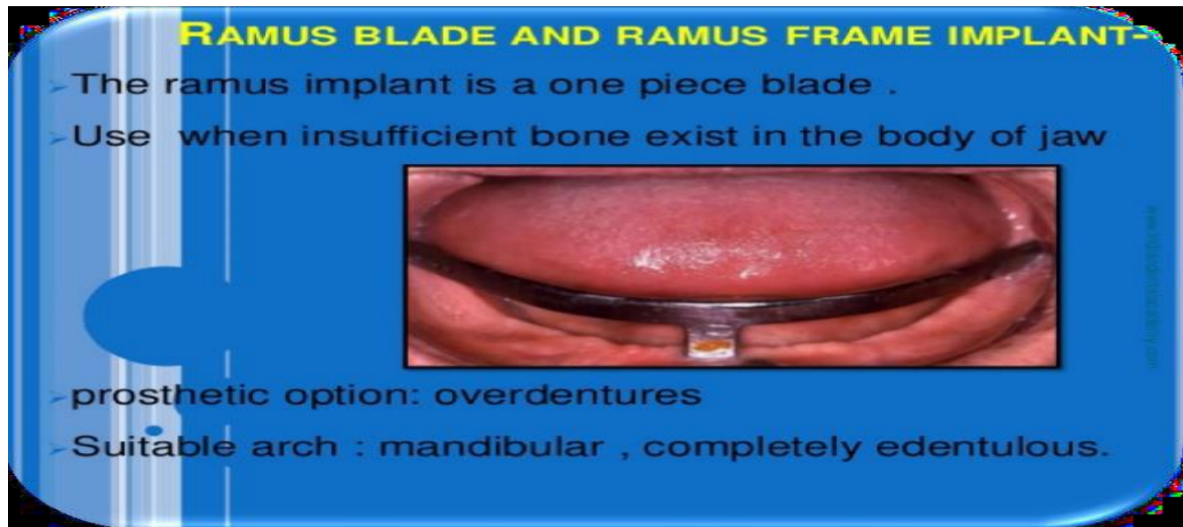
Used for ridges that are narrow bucco-lingually . Eventually they failed. It can be made of titanium or ivory. Its design has a blade that is inserted in bone and an abutment where the crown is placed.

Blade implants still exist and are made from titanium, sometimes it works .

The Dr. explained a case that he treated * a picture showing a failed implant where the implant is coming out from the bone and emerging from the gum*.

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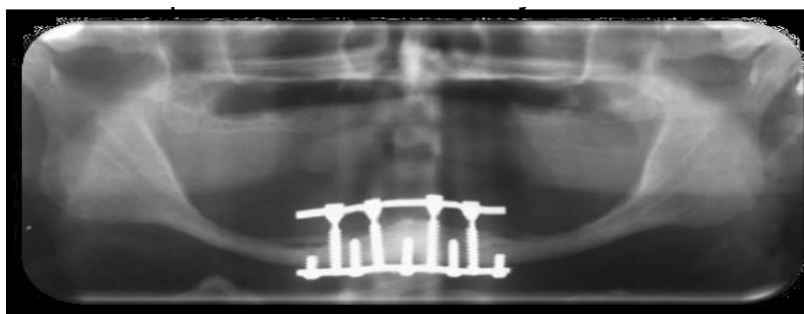
- h. Roberts and Roberts (1970s): introduced the ramus frame implants like a tripod extending from the symphysis anteriorly, to the ascending ramus of the mandible posteriorly, in an attempt to replace the teeth of the lower arch where an over denture is attached to the frame.



- i. Smaull (1975): introduced the "mandibular stable implants" similar to trans-fixation screws that are used in fractures of the mandible or maxilla, two or three screws approached extra orally from the lower border of the mandible to the top of the alveolar ridge then secured by screws from the bottom and add the supra structure from top, still existing.

It's a major surgery. It depends on mechanical lock.

- j. Bosker (1986): introduced TMI trans-mandibular implant (from canine to canine) for severely atrophied mandible posteriorly. It is purely made of gold and is done by extraoral approach (where conventional osseointegrated implants are not indicated), it is a major surgical procedure done under GA, not frequently done, very expensive.



It depends on the mechanical lock as the dr said so for example we put seven of them, three in the bone and four exposed to the oral cavity.

In 1952 at the University of Gothenburg professor Branemark (he is an orthopedic) and his team, more or less by chance they discovered the biocompatibility of titanium in animals, when they were investigating wound healing. From that time till 1965 the titanium material was subsequently subjected to further laboratory and clinical experiments. In 1969, Branemark et. al described the direct bone contact to a metallic surface as the osseointegration. Followed by professor Schroeder et al (1977).

Worldwide there are more than 600 implant systems, in Jordan they range from 100-150 implant systems. Any implant system should be recommended by the ADA, but most of them are not, because they are not followed up by an academic institution (they should be subjected to specific criteria: 5 year follow up in 2 or 3 recognized dental centres with 75% success rate after those 5 years).

2. Osteointegration (1st school):

Histological definition: is a process of direct structural and functional connection between the Living bone and the surface of the alloplastic material (titanium) which happens during functional loading at a microscopic level, also called "functional ankylosis".As defined by branemark et al (1969),Shroeder et al (1977).

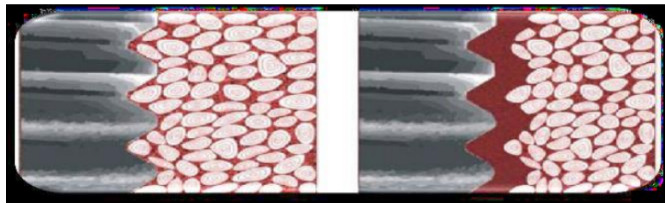
Clinical definition: a time dependent healing process, clinically it is asymptomatic rigid fixation of alloplastic material which is achieved and maintained in bone during functional loading. As defined by Zarb and Alberkston (1991).

3. Fibrointegration (2nd school):

Which is fibrous tissue between the interface surface of the Implant and the bone to mimic the PDL.

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 achieved. The failure rate was more than 75 % after 5 years.

Any fibrous tissue between the bone and metal is considered a non-integrated failed, according to osseointegration concept.



The picture on the left side shows osteointegration, no space between the implant surface and the bone, while the picture on the right side shows connective tissue between the implant surface and bone.

4. **Implant materials:**

Many materials have been used for implants, such as: gold, stainless steel, silver, platinum, iridium and titanium. In addition to non-metallic materials such as: Indian rubber, ivory, porcelain, polymers, ceramics, carbon and zirconia.

Pure titanium is the material of choice, pure titanium: (99.6%) titanium, (0.4%) a corrosion resistant alloy (nickel).

Because titanium is:

- Biocompatible with the living tissues.
- Excellent mechanical properties; 6 times stronger than the cortical bone once it's osteointegrated to the bone.
- - Histological sections showed intimate contact between the bone and implant surface.
- Corrosion resistance; since it contains Nickel.
- The chemical properties of titanium determined by the surface oxide layer which has different chemical, physical, and mechanical properties from pure titanium (kasemo, 1983). Titanium oxide is the one responsible for osteointegration not the material itself, one exposed to the biological tissues.

- They were wondering if Ti is harmful to the human body or not. Titanium ions were found adjacent to bone, and in peri-implant mucosa.
- They were also found in the regional lymph nodes as well as other organs such as liver, spleen and kidney.
- **But:** eventually it was proven that it is safe and inert material.
- It was found in another study that the daily intake of Titanium ranged from 0.3-1 mg from vegetables and other foods. The daily excretion rate through the urine is 0.3mg, plus they found that the biological half-life of titanium was about 320 days, preventing it from accumulation in the human body.

22:55 minutes

- Zirconia was introduced recently, they kept working on it for about 6-8 years, zirconia is a good material.
- Friodent 1 or 2 Or called friodent 1 or 2 , friodent 1 : is made of ceramic, has excellent results, osseointegration was excellent and rapid(3months), its main problem was the fracture "crack" between the supra structure porcelain crown and the fixture screw), then titanium was introduced.
- Titanium is used as plates for maxillofacial fractures and other parts of the body. While zirconia is used mainly in dental implants.
- Now to compare between titanium and zirconia: (The following comparison was taken from external resources as the record wasn't clear enough)
 - a. Titanium has a better tracking record than zirconia regarding its success and use.
 - b. Titanium is slightly better than zirconia when it comes to osteointegration.
 - c. Zirconia is having an advantage when it comes to esthetics.
 - d. Titanium is stronger, more durable and more versatile.
 - e. Zirconia has lower fracture toughness.

5. Implant coating materials

These are materials that produce a rough surface on the implants to increase the surface area, to increase the strength of bonding between the implant surface and bone when compared to a smooth surface. (Schroeder 1991)

- a. Titanium plasma spray (TPS): they processed them under very high temperature about 3000c, 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. (Doesn't exist anymore)
- b. Sandblasted large grit acid etch (SLA): in this type the healing time (osteointegration) is reduced to the half, 2.5 months in the maxilla and 1.5 months in the mandible (STILL USED).
- c. Hydroxyapatite: was used in the mid-80s, it was also used as a synthetic bone material for small localized limited defects or undercuts, it's an excellent material, with the advantages:
 - Rapid osteoinduction (less than 3 months).
 - High success rate in the first 3 years, after that the material dissolves.

Disadvantages:

- 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 resorption/ failure.
- d. Bioactive materials (SLA active), 2 weeks only for mandibular healing and 3 weeks in maxilla, but it is at the expense of price.
 - e. Laser.

Materials	Type	Histological appearance	Type of osseogenesis
Stainless steel, CoCr, gold alloys, and polymethyl methacrylate	Biotolerant	fibrous tissue between bone and metal	"distant" as there is a distance between bone and the metal (fibrous tissue)
Titanium and Ceramics	Bioinert; no any reaction with the soft tissues.	close intimate contact with bone surface with no gaps	Contact bone
Bioceramics and Hydroxyapatite	Bioactive	chemical bond to bone	True bond

6. 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.
- a. Submucosal inserts implants: were used in the past they don't exist anymore, inserted underneath the mucosa after elevation of flap (it's not placed in the bone but on the bone below gingiva), consists of button like retention device; a female and male part (one part in the CT and the other on the fitting surface of the overdenture), it failed.

Disadvantages: mobility, accumulation of food debris, acute bacterial infections, poor retention, poor survival rate. 31:20 minutes

- b. Titanium Mucosal Inserts: the same idea, but part of it is in the bone with a slight depth, few millimeter (2-3 mm) in bone (there is drilling in the bone but with minimal preparation), same idea of male and female parts, it failed.
- c. Subperiosteal implant: Consist of metallic framework either from CoCr or titanium, restricted to the mandible [severly atrophied mandible], has Low success rate with time, with possible spread of infection along with its metal posts.

An incision is made from retromolar pad area from one side to the other side, flap is reflected and then an impression is taken for the bone, a cast for the bone is produced and the design is made and adapted.

Flap is reopened (major surgery) and the framework is inserted, allowing the posts to project inside the oral cavity where the overdenture will fit on them. Specially used when the mandible is highly resorbed therefore endosseous implants can't be used.

- d. Transosseous dental implants: or the transmandibular implants or "staple" implants, carried out under GA and limited to the mandible, and as we said it needs an extra oral approach (from submental to submental), so it's a major surgery, results in extraoral scar after healing in the submental area.

7. Another classification, depending on the steps of surgery:

- a. One step surgery: non submerged (Strawman).
- b. Two steps surgery: submerged (a 2nd surgery is needed).

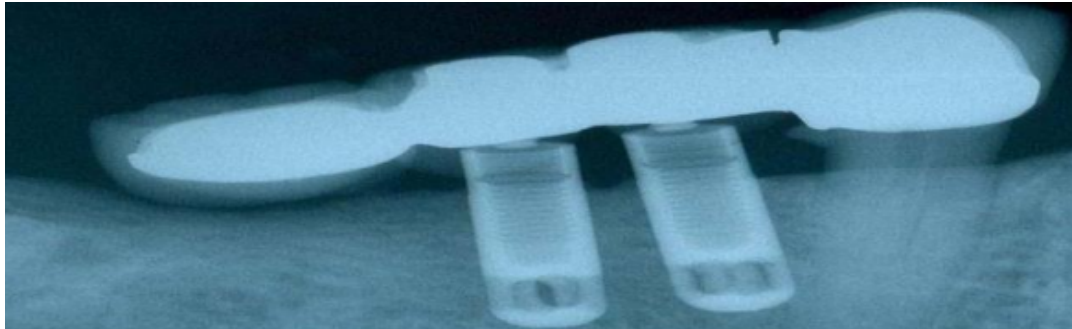
From 2014 sheet:

Endosseous dental implants:

**The root form endo-osseous implants can be classified according to the number of surgical steps: 1- the ITI system (International Team of Implantology) ,One surgical step: non submerged(strawman).

2- Two surgical steps: submerged (you re-open to reach it by 2nd surgery).

- The Dr. mentioned some brand names for implants.
- From 2014 sheet: IMZ (German) , not available anymore , plastic placed inside ; mimics PDL and gives up and down movement acting like a stress breaker. Has to be replaced every 8 months. No available literature after 2000 about it.



Root form of implants:

We have two implant designs: **bone level** and **tissue level**.

Mostly, we use the bone level. The bony level ends at the level of the alveolar bone but the tissue level extending 5mm above the bone. We have thick keratinized mucosa at the molar area use tissue level since it has a better emergence profile. The collar of tissue level is 5mm above bone.

Bone level more aesthetic for the anterior area, the collar is 0.5mm we can use it when we have missing 6 and the 5 & 7 are the abutment and the distance between them mesio-distal is short, and with limited interarch space.

Now we move to the second topic for this lecture.

Indications and Contraindications for Implants

Before selecting any candidate for dental implants:

- a. The patient's motivation and cooperation towards maintaining good oral hygiene is important.

Patients with bad OH are contraindicated for any dental prostheses even a single dental implant, so if we have a patient with bad OH and with good

quality and quantity of bone we have to monitor the patient at least for one month so if the patient maintains good OH then go for dental implant .

- b. Bone growth for the alveolar ridge. (That's debatable)
Some people prefer to do dental implants after the age of 18-19 years and that's different between males and females.

But why don't we do dental implants before the age of 19 years?

Because the growth of the jaws is not complete, so it's preferable to do it after the age of 19. They did clinical trials on a 16 year old patient, after loading still there was bone growth. So it's debatable but it is preferable not to do any dental implants before the age of 19 years either in females or males, the same are for crowns also.

1.Indications of dental implants:

a. Completely edentulous individuals in one or both arches:

- At least 6 –fixtures are need for “ Implant supported prosthesis “. If there is good quality and quantity of bone regarding length and diameter we need at least 6-8 implant in the maxilla (very rare to do this procedure) to support prostheses like separate bridges that we called (implant support prostheses), it's the same as supported by natural abutment .

- More than 2 fixtures “Implant retained overdentures” either by ball, bar or magnetic attachment. Where there is no bone posteriorly specially in the mandible usually put it in the canine area.

b. Partially edentulous individuals:

** Long span where it's not possible to restore it by conventional bridges (like a bridge from canine to seven) so if there is a good height and width of bone we can place 3 implants and connect them either with 3 unit bridge or separate crowns of these abutments of the implants.

**In free end saddle patients, extra care should be taken to avoid any injury to the ID nerve

From sheet 2014:

**In case of Kennedy class I (bilateral free end saddle) where there is no anatomical contraindications, especially in the mandible because of more resorption in posterior area -premolar and canine area- due to the nature of bone and as we know we lose our posterior teeth before our anterior teeth. Here we put bilateral implants.

** Kennedy class 2, where the patient refused to prepare the adjacent sound teeth. If you manage to replace co-cr RPD/acrylic with fixed option for example bridges in a bounded saddle, abutments must be sound and healthy with no periodontal problems but implants are preferred since the success rate of bridges is 80% lasting for 15 years while success rate of well maintained implants is > 25 years, 92% in the mandible and about 80 % percent in the maxilla; better than bridges.

**Kennedy class 3 patients, if the teeth are sound with no caries or periodontal problems implants are a better choice.

** A patient with compromised denture bearing area which may reduce the retention especially in the mandible.

** A patient with hyperactive gagging reflex elicited by removable prostheses. Especially in upper arch. So all the procedures were done under GA.

** A patient with psychological and emotional problems to wear a denture especially females.

** Parafunctional habits, the force generated by the patient will affect the bone healing so implant failure, so we try to get rid of or reduce this habit because it may lead to frequent fractures of the implant (most probably it's not indicated until the problem of bruxism is solved).

**Implants can be done for patients with poor muscular coordination, like patients with Parkinson's disease, and even epileptic patients.

46:16

** Hypodontia like congenital missing lateral incisor (most of the time the orthodontist refer these cases to prosthodontist), if it was found that the space is good and the length is good but the width is not enough (not more than 2.5mm) it's really difficult to replace it by a dental implant, usually the diameter of an implant is at least 2.9 mm.

2.Contraindications of dental implants:

Intraoral Contraindications:

- Unfavorable inter-arch space especially in the class 3 relationship, it's not an absolute contraindication, in the past we have counted class 3 relationship 100% before we start, because the abutment is solid and straight without any angulation, but nowadays we have "angulated abutments"(10-30 degrees).
- Pathological lesions in the alveolar ridge like: infected remaining root and cyst that should be removed before starting a dental implant.
- Oral mucosal lesions like: leukoplakia, lichen plans. We have to treat them before.
- Poor OH (very important). Intra oral conditions like gingivitis and abscess must be treated before starting the dental implant procedure because everything can be transmitted to dental implant except caries, it's a metal gingivitis that can lead to peri-implantitis.

3.Relative contraindication of dental implants:

a.Insufficient bone quality and quantity. So we go for advanced options like bone augmentation and bone grafting.

b.Hematological diseases such as anemia; all lead to postoperative infections, delayed healing and failure of osteointegration.

c.Metabolic bone disorders like osteoporosis “spongy bone “- it’s not really an absolute contraindication- , Paget’s disease “sclerotic bone “.

d.Patients with psychological problems.

**From The Dr’s experience, psychological problems are an absolute contraindication. Most of dental schools have psychiatric clinics where patients are sent before surgery to assess their condition.

e.HIV patients.

f. Age:there is no age limit for dental implants. Starting from 19 years old up to whatever age if you have good quality and quantity of bone. (the Dr did an implant for 92 years old patient)

g. Radiation therapy: August et al (1998): no longer absolute ConIN to implant placement, but reduced success rates usually reported around 70% can be expected. If the patient had recent radiotherapy he must wait for at least one year.

The use of hyperbaric oxygen therapy {HBO}: 100% pressurized oxygen for proximately 90 min for 20 sessions pre-surgery and 10 post-surgery. There are hyperbaric chambers in the hospital but in the past they used to put the patients deep in water.

**Oral effects of radiation:

1. Xerostomia
2. Mucositis
3. Hypo vascularity
4. Fibrosis
5. Hypoxia

6. Osteoradionecrosis

H. Diabetes: If it's controlled (less than or 7) then go for dental implant, if it's uncontrolled (more than 7) its an absolute contraindication because it will affect bone healing, increase alveolar bone loss, increase inflammatory tissue destruction and increase periodontal diseases. If it's controlled they have good success rate.

i. Osteoporosis, bisphosphonates and Paget's' disease Bisphosphonates: oral bisphosphonates and intramuscular is a relative contraindication while IV bisphosphonates is an absolute contraindication because it causes BRONJ (bisphosphonates associated osteonecrosis of the jaws).

j. Heavy smoking is contraindicated because of high failure rates. Since it affects healing (oseointegration) and the blood supply to that area.

4. Absolute Contraindications:

a. Patients with cardiovascular diseases like congenital heart diseases, rheumatic vulvar defects or artificial valves, uncontrolled hypertension, angina pectoris and recent myocardial infarction, we have to wait at least 6 months to one year after that so a dental implant can be done and we still give the patient prophylactic measures, and take the consent and referral from his cardiologist .

b. Drugs and alcohol addictions: Drug/alcohol themselves there are not contraindicated .Patient themselves are contraindicated due to the lack of motivation to maintain good oral hygiene, biologically ,little evidence that chemical addictions can alter the successful integration of implants .

GOOD LUCK !