DENTAL IMPLANT

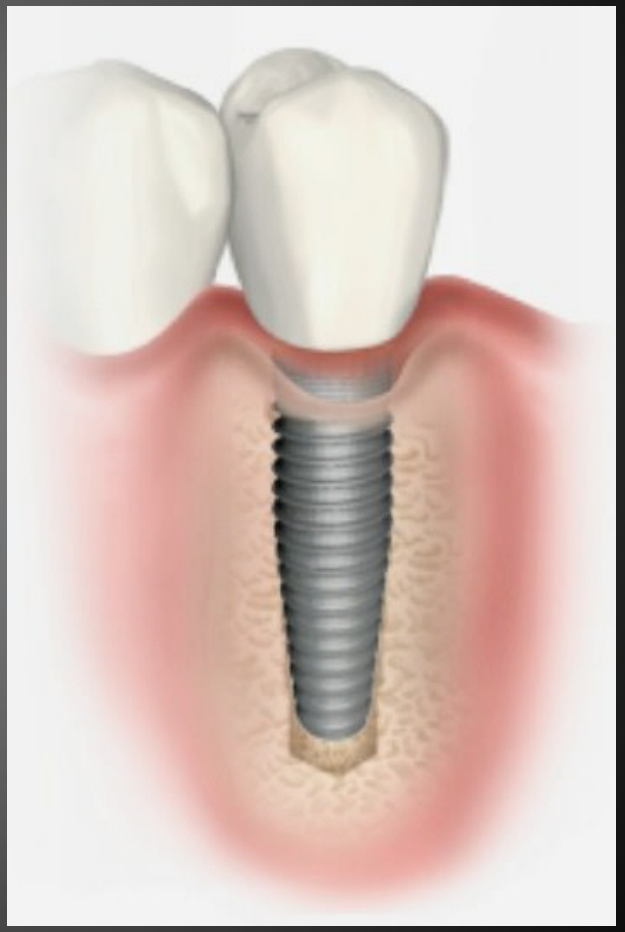





What is dental implant?

A dental implant (also known as an endosteal implant or fixture) is a surgical device used to replace one or more missing teeth by fusing the bone and supporting a crown, bridge of teeth, denture. Implant is placed surgically into the jaw bone.

The term "dental implant" refers to that portion of the structure in the bone.



Other Functional Components

Other Functional Components

Other functional components may be attached to make the device functional:

- Abutment (pass through the gums)
- Abutment screw (to secure the abutment to the implant)
- Prosthetic teeth (which attach to the abutment)

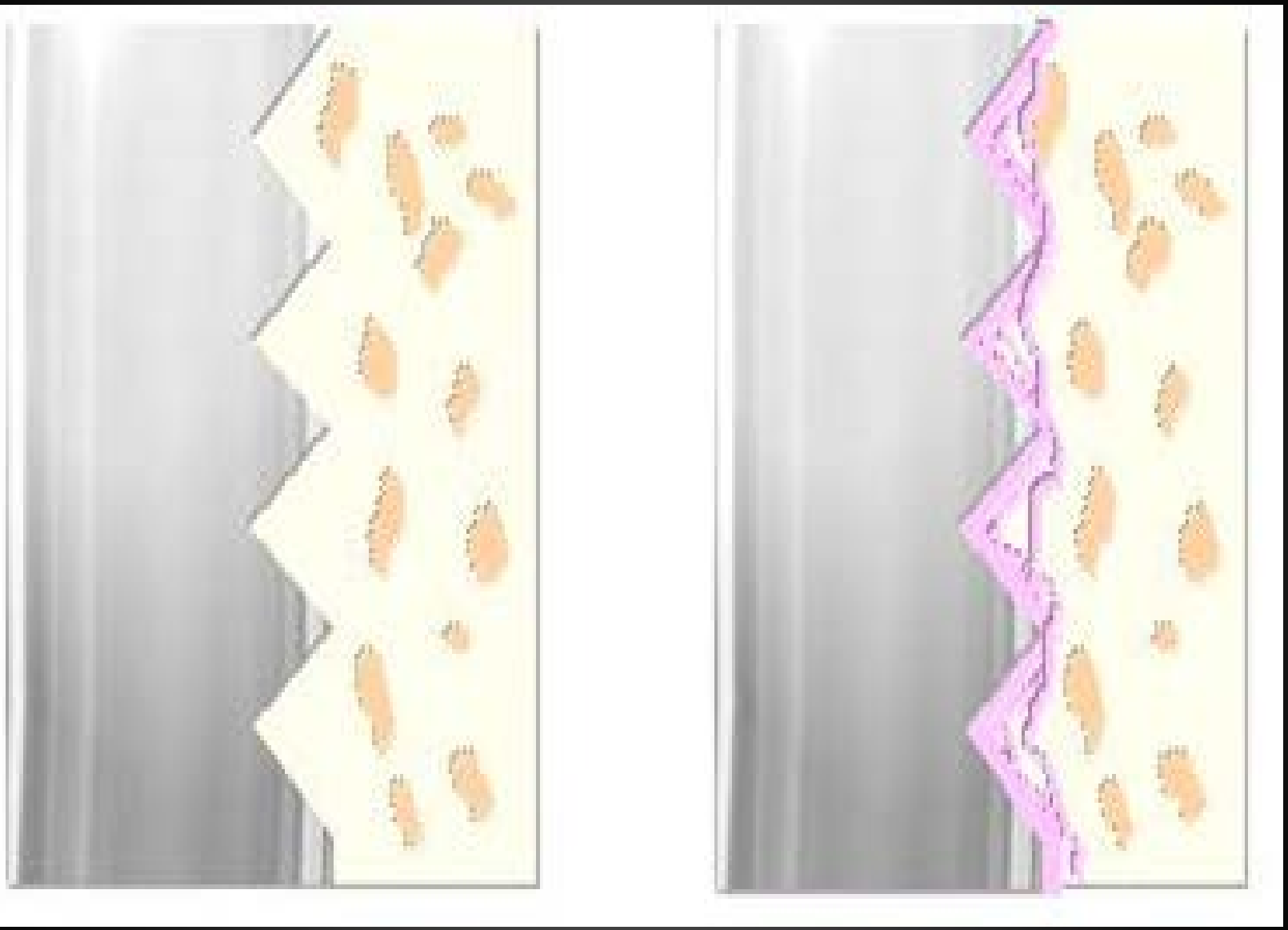
Collectively, the dental implant and components create the dental prosthetic.

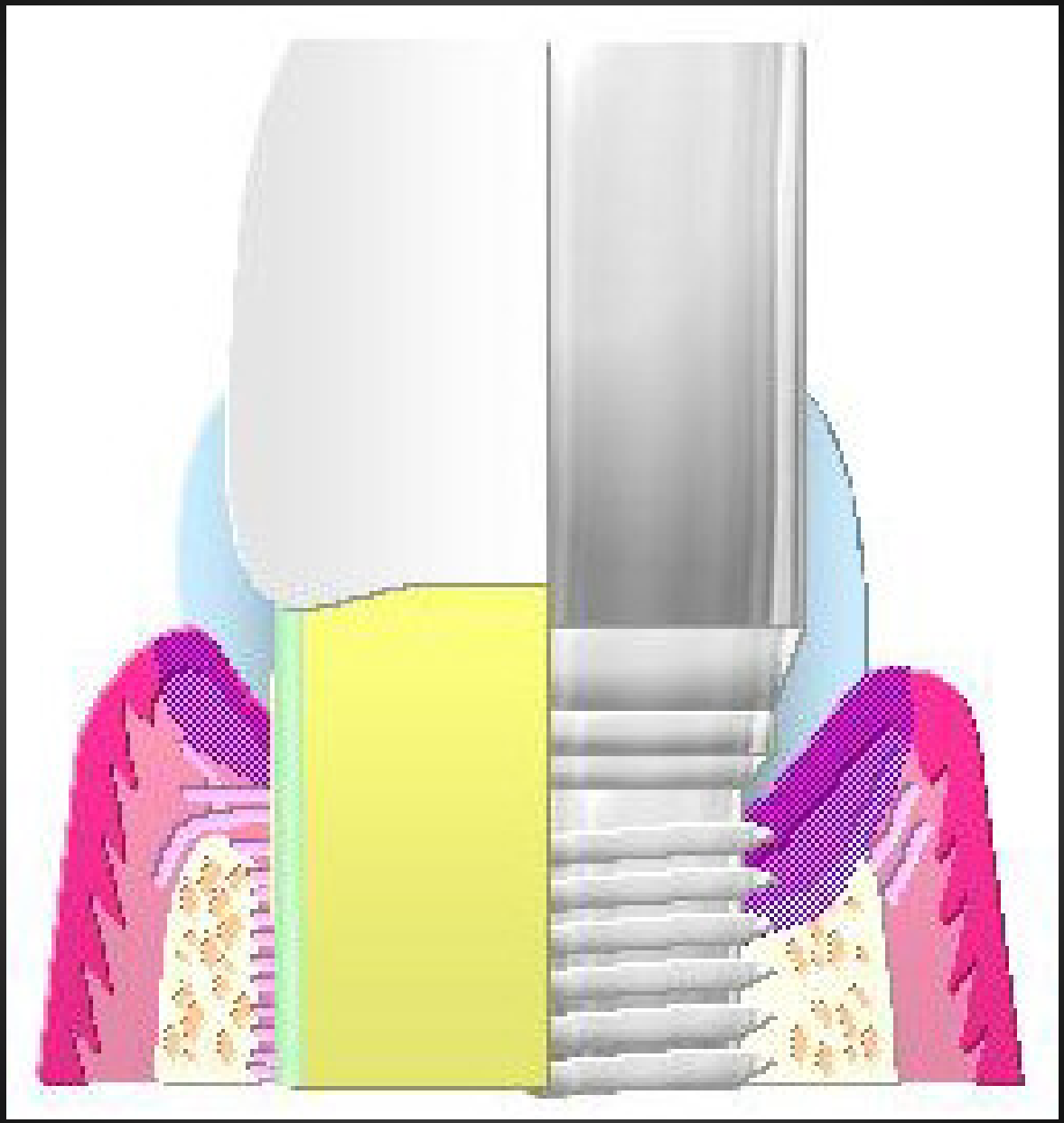
Osseointegration

In 1952, Professor Per-Ingvar Branemark, a Swedish (Europe) surgeon, while conducting research into the healing patterns of bone tissue, accidentally discovered that when pure titanium comes into direct contact with the living bone tissue, the two literally grow together to form a permanent biological adhesion. He named this phenomenon *"Osseo integration".*

Osseointegration

The modern dental implant forces the biological process of osseointegration where a material (commercially pure titanium, titanium alloy and some ceramics) forms a structural and functional connection between living bone and the surface of a implant without causing the body to recognize it as a foreign material.





Long term success of dental implants

The prerequisites to long term success of dental implants are healthy bone and gingiva.

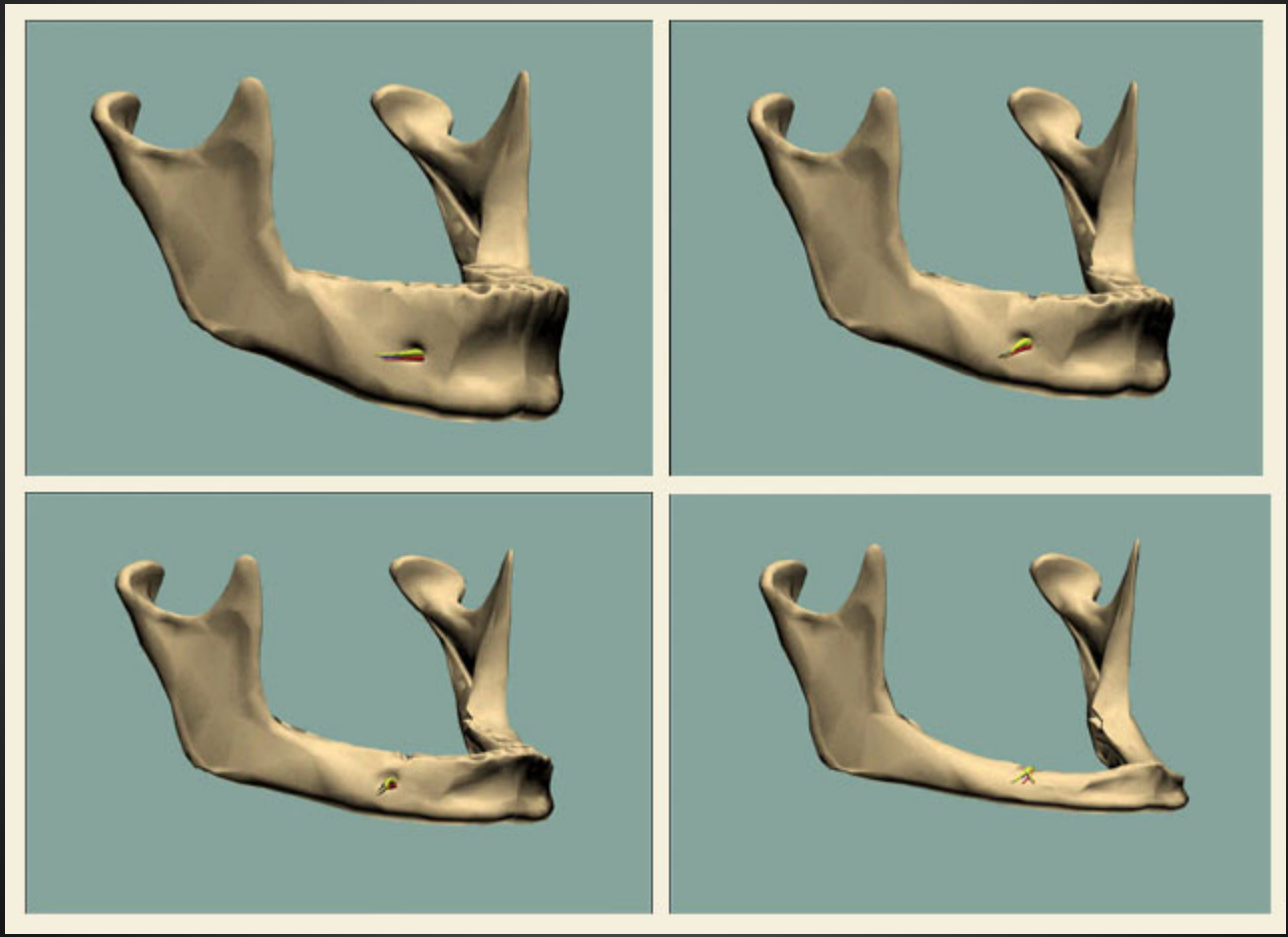
In the presence of healthy tissues, a well integrated implant with appropriate biomechanical loads can have long term success rates of 93-98% for the fixture and 10-15 year lifespans for the prosthetic teeth.

Pre-prosthetic procedures

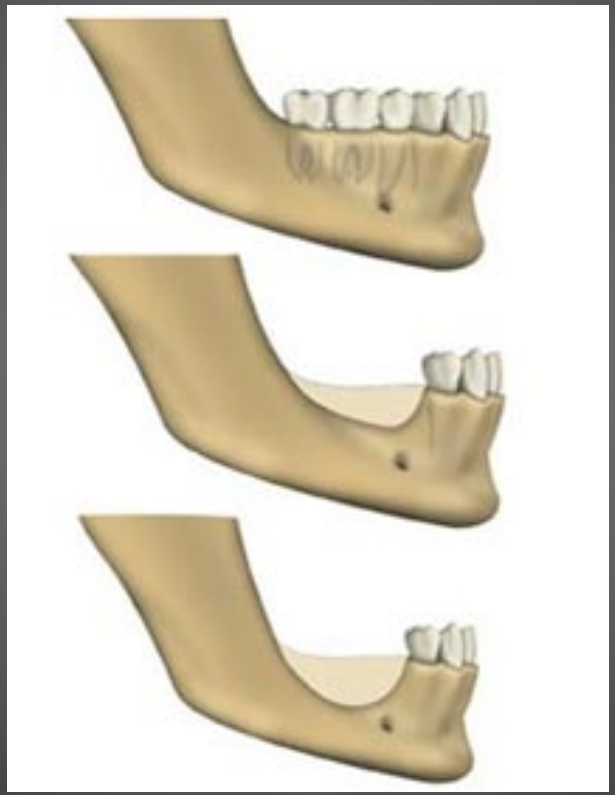
When a tooth is lost the tissues of the mouth remodel and atrophy preventing the placement of dental implants or lowering long term survival. A group of operations, referred to as pre-prosthetic procedures, have been developed to rebuild the bone height, width, gingiva and connective tissue.

Bone loss

Bone loss



Bone loss



Guided bone and tissue regeneration

Bone substitutes

Guided bone and tissue regeneration

Guided bone regeneration or **GBR**, and **guided tissue regeneration** or **GTR** are dental surgical procedures that use bone substitutes and barrier membranes to direct the growth of new bone and gingival tissue at sites having insufficient volumes or dimensions of bone or gingiva for proper function, esthetics or prosthetic restoration.

Guided bone regeneration is predominantly applied in the oral cavity to support new hard tissue growth on an alveolar ridge to allow stable placement of dental implants. Used in conjunction with proper surgical technique, GBR is a reliable and validated procedure.

INDICATIONS FOR TREATMENT

Factors precluding wear of a removable prosthesis

- Poor anatomy for denture support
- Poor oral muscular coordination
- Poor mucosal tissue tolerance
- Para functional habits
- Unrealistic expectations
- Hyperactive gag reflex
- Psychological inability to wear
- Unfavourable number and location of abutments
- Single tooth loss

Indications

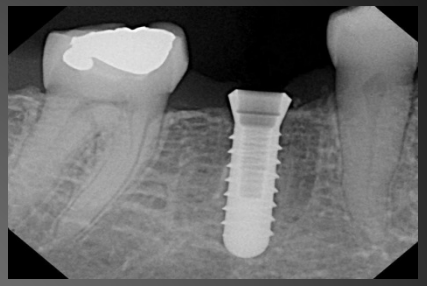
- Fully edentulous
- Partially edentulous
- Single tooth

INDICATIONS - FULLY EDENTULOUS

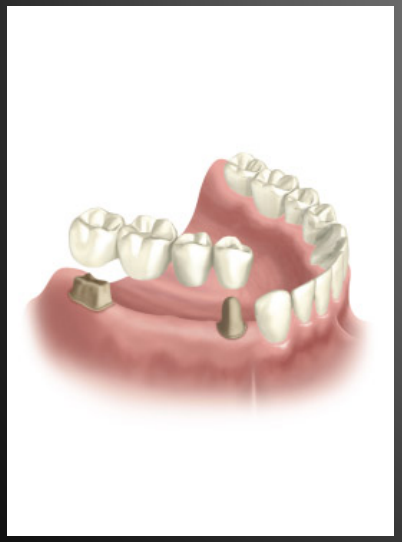
- Poor retention
- Functional disturbances
- Psychological disturbances

Uses of Implants

- single tooth replacement



- multiple teeth replacement



bridge

denture

Planning

Planning for dental implants focuses on the general health condition of the patient, the local health condition of the mucous membranes and the jaws and the shape, size, and position of the bones of the jaws, adjacent and opposing teeth.

Contraindications to placing dental implants

ABSOLUTE CONTRAINDICATIONS

Implants can not be placed in these situations:

- Heart diseases affecting the valves (valvulopathy)
- Recent infarcts
- Severe cardiac insufficiency, cardiomyopathy
- Active cancer, certain bone diseases (osteomalacia, Paget's disease, brittle bones syndrome, etc.),
- Certain immunological diseases, immunosuppressant treatments, clinical AIDS, awaiting an organ transplant,
- Certain mental diseases,
- Strongly irradiated jaw bones (radiotherapy treatment),
- Treatments of osteoporosis or some cancers by bisphosphonates
- Children: not before the jaw bones have stopped growing (in general 17-18 years).

On the other hand advanced age does not pose problems if the patient's general condition is good.

Contraindications to placing dental implants

RELATIVE CONTRAINDICATIONS

The indication to place implants will be evaluated on a case-by-case basis, with the greatest caution:

- Diabetes (particularly insulin-dependent),
- Angina pectoris (angina),
- Seropositivity (absolute contraindication for clinical AIDS),
- Significant consumption of tobacco
- Certain mental diseases,
- Radiotherapy to the neck or face (depending on the zone, quantity of radiation, localization of the cancerous lesion etc.),
- Certain auto-immunes diseases,
- Drug and alcohol dependency,
- Pregnancy

Contraindications to placing dental implants

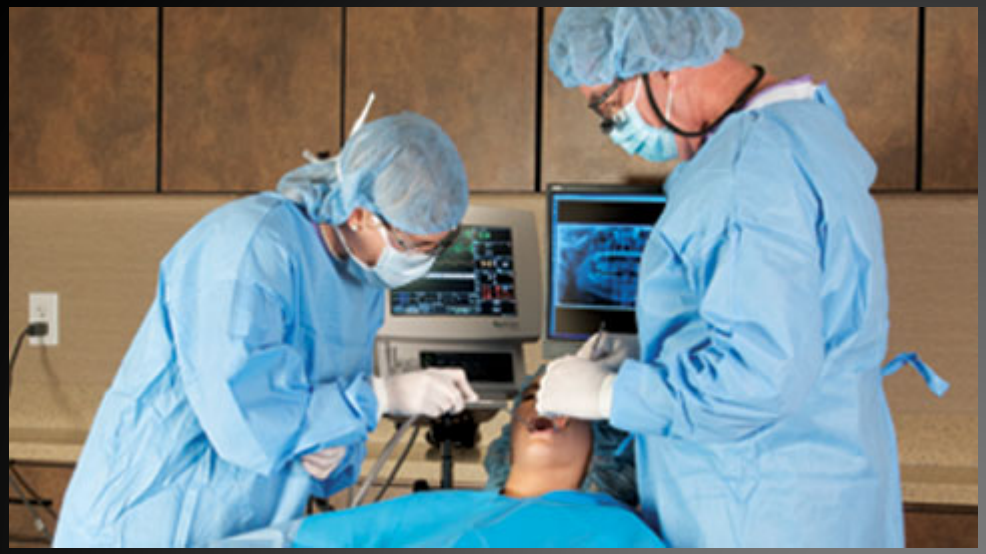
RELATIVE LOCAL CONTRAINDICATIONS

The indication to place implants will be evaluated on a case-by-case basis, with caution:

An insufficient quantity of bone.

- Certain diseases of the mucous membranes of the mouth.
- Periodontal diseases (loosening of the teeth); it is necessary to clean up the gums and stabilize the disease first.
- Severe grinding or clenching of the teeth.
- An unbalanced relationship between the upper and lower teeth.
- Infections in the neighboring teeth (pockets, cysts, granulomas), major sinusitis.
- Poor hygiene of the mouth and teeth.

SURGICAL REQUIREMENTS



SURGICAL REQUIREMENTS

- Standardised surgical protocol
- Surgical environment
- Implant equipment
- Fully evaluated and prepared patient
- Trained staff

SURGICAL REQUIREMENTS

- Aseptic technique
- Gentleness
- Precision

Placing the implant (basic surgical procedures)

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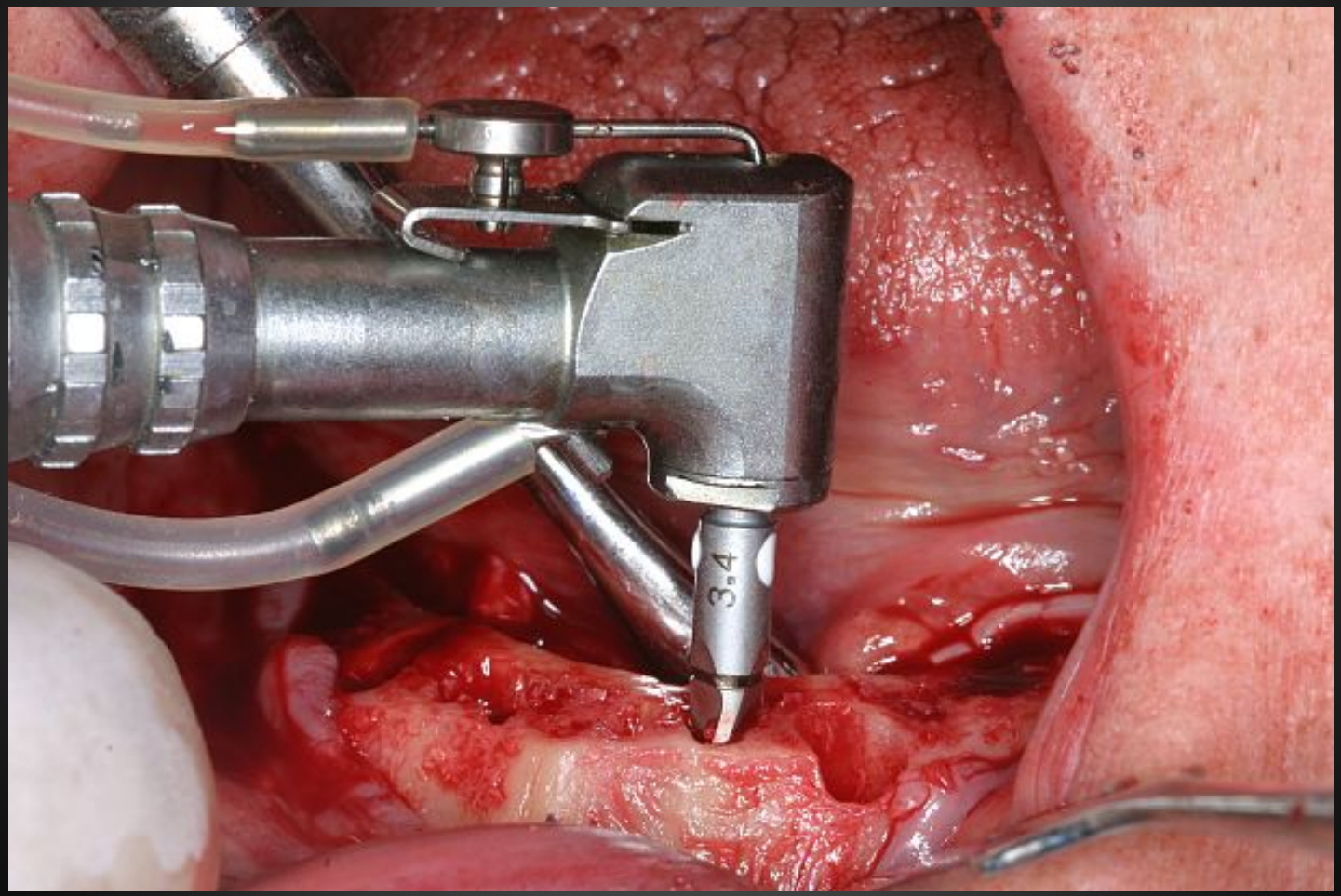


Placing the implant (basic surgical procedures)

Most implant systems have five basic steps for placement of each implant:

1. Soft tissue reflection: An incision is made over the crest of bone, splitting the thicker attached gingiva roughly in half so that the final implant will have a thick band of tissue around it. The edges of tissue, each referred to as a *flap* are pushed back to expose the bone. Flapless surgery is an alternate technique, where a small punch of tissue (the diameter of the implant) is removed for implant placement rather than raising flaps.

Placing the implant (basic surgical procedures)

2. Drilling at high speed: After reflecting the soft tissue, and using a surgical guide/stent as necessary, pilot holes are placed with precision drills at highly regulated speed to prevent burning or pressure necrosis of the bone.

3. Drilling at low speed: The pilot hole is expanded by using progressively wider drills (typically between three and seven successive drilling steps, depending on implant width and length). Care is taken not to damage the osteoblast or bone cells by overheating. A cooling saline or water spray keeps the temperature low.

Placing the implant (basic surgical procedures)

4. Placement of the implant: The implant screw is placed and can be self-tapping, otherwise the prepared site is tapped with an implant analog. It is then screwed into place at a precise torque so as not to overload the surrounding bone (overloaded bone can die, a condition called osteonecrosis, which may lead to failure of the implant to fully integrate or bond with the jawbone).

Placing the implant (basic surgical procedures)

5. Tissue adaptation:

(a)The gingiva is adapted around the entire implant to provide a thick band of healthy tissue around the *healing abutment*.

(b)In contrast, an implant can be "buried", where the top of the implant is sealed with a *cover screw* and the tissue is closed to completely cover it. A second procedure would then be required to uncover the implant at a later date.

Healing abutment

Cover screw

Timing of implants after extraction of teeth

There are different approaches to placement dental implants after tooth extraction:

- Immediate post-extraction implant placement.
- Delayed immediate post-extraction implant placement (2 weeks to 3 months after extraction).
- Late implantation (3 months or more after tooth extraction).

Loading of dental implants

There are also various options for the loading of dental implants, classified into:

- Immediate loading procedure.
- Early loading (1 week to 12 weeks).
- Delayed loading (over 3 months)

Healing time

For an implant to become permanently stable, the body must grow bone to the surface of the implant (osseointegration). Based on this biologic process, it was thought that loading an implant during the osseointegration period would result in movement that would prevent osseointegration, and thus increase implant failure rates. As a result, 3–6 months of integrating time (depending on various factors) was allowed before placing the teeth on implants (restoring them).

Healing time

Later research suggests that the **primary implant stability** of the implant in bone is a more important determinant of success of implant integration, rather than a certain period of healing time. As a result, the time allowed to heal is typically based on the density of bone the implant is placed in and the number of implants splinted together, rather than a uniform amount of time. When implants can withstand high torque (35Ncm) and are splinted to other implants, there are no meaningful differences in long-term implant survival or bone loss between implants loaded immediately, at 3 months, or at 6 months. The consequence is that single implants, even in solid bone, require a period of no-load to minimize the risk of initial failure.

One-stage, two-stage surgery

After an implant is placed, the internal components are covered with:

- a healing abutment (passes through the mucosa, and the surrounding mucosa is adapted around it
  - a cover screw (flush with the surface of the dental implant, and is designed to be completely covered by mucosa; after an integration period, a second surgery is required to reflect the mucosa and place a healing abutment)

The choice of one vs two-stages, now centers around how best to reconstruct the soft tissues around lost teeth.

Immediate placement

Strategy to preserve bone and reduce treatment times includes the placement of a dental implant into a recent extraction site.

One the one hand:

-it shortens treatment time and can improve esthetics because the soft tissue envelope is preserved;

On the other hand:

-implants may have a slightly higher rate of initial failure;

Prosthetic procedures

The prosthetic phase of restoring an implant requires an equal amount of technical expertise as the surgical because of the biomechanical considerations, especially when multiple teeth are to be restored. The dentist will work to restore :

- the vertical dimension of occlusion,
- the esthetics of the smile,
- and the structural integrity of the teeth to evenly distribute the forces of the implants.

Closed Tray Impression

Peek
Impression
Cap

Impression
Transfer
Closed-Tray

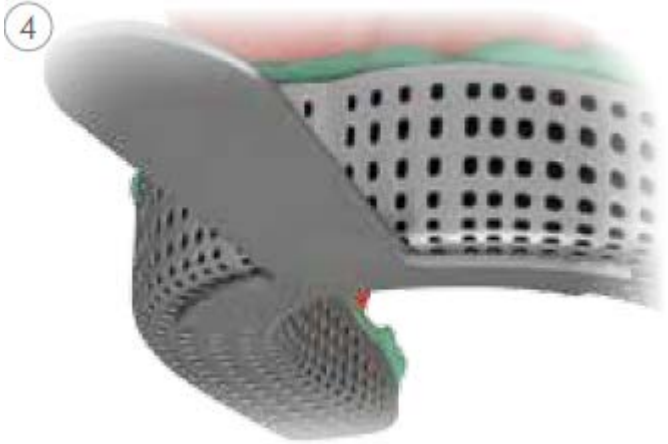
Analog

Screw

STEP 1
Place the impression post accurately into the implant and hand-tighten the guide screw.

STEP 2
Push the impression cap at the top of the impression transfer.

STEP 3
Take the impression using an elastomeric impression material (polyvinyl siloxane or polyether rubber).



STEP 4
Use a standard impression tray.

5

STEP 5
Mount the impression transfer on the analog using the screw (ref. 5052).

6

STEP 6
Reposition the impression transfer in the tray.
Push the impression transfer until you feel the complete engagement firmly seated on the impression cap.

Open tray impression

Open tray impression post

Analog

Screw for open tray impression post

STEP 1
Place the impression post accurately into the implant and hand-tighten the guide screw.

STEP 2
Make perforations in the custom-made impression tray (light cured resin) according to the individual situation so that the positioning screw of the impression post sticks out.

STEP 3
Take the impression using an elastomeric impression material (polyvinyl siloxane or polyether rubber).

STEP 4
Reposition and fix the analog in the impression using the screw.

Instruments

Risks and complications

Risks and complications
During surgery

Placement of dental implants is a surgical procedure and carries the normal risks of surgery including infection, excessive bleeding and necrosis of the flap of tissue around the implant. Because the surgeon is blind to the location of the tip of the drill when it is in the bone, nearby anatomic structures can also be injured such as the inferior alveolar nerve, the maxillary sinus and blood vessels. An inability to place the implant in bone to provide stability of the implant (referred to as primary stability of the implant) increases the risk of failure to osseointegration.

Risks and complications Immediately after surgery and the first 6 months

Immediate post-operative risks

- Infection (pre-op antibiotics reduce the risk of implant failure by 33% but have no impact on the risk of infection)
- Excessive bleeding
- Flap breakdown (<5%)

Risks and complications Immediately after surgery and the first 6 months

Failure to Integrate

An implant is tested between 8 and 24 weeks to determine if it's integrated. There is significant variation in the criteria used to determine implant success, the most commonly cited criteria at the implant level are the absence of pain, mobility, infection, gingival bleeding, radiographic lucency or peri-implant bone loss greater than 1.5mm.

Dental implant success is related to:

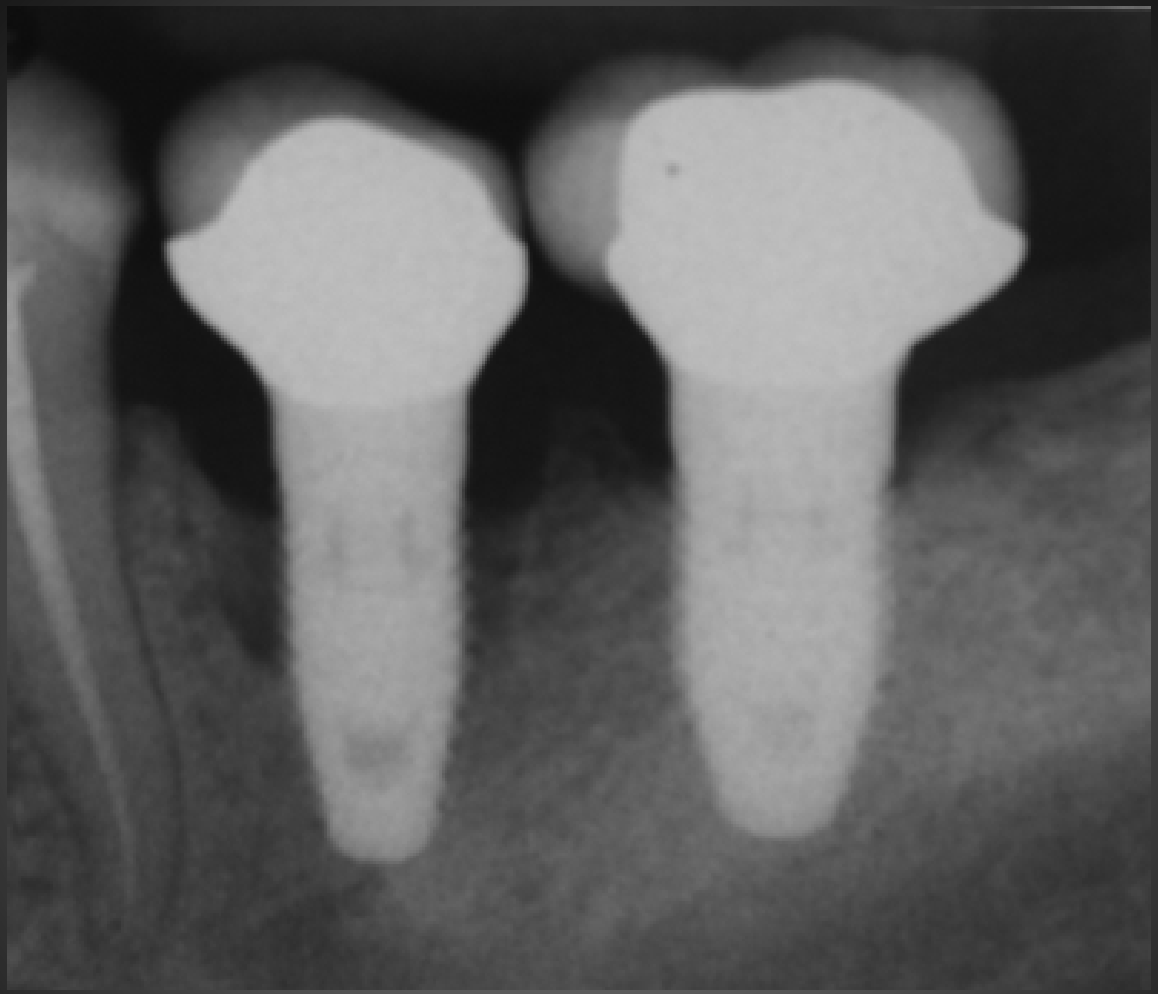
- **operator skill,**
- **quality and quantity of the bone available at the site,**
- **patient's oral hygiene,**
- **primary implant stability (the most important factor).**

While there is significant variation in the rate that implants fail to integrate (due to individual risk factors), the approximate values are 1-6%.

Risks and complications
Long term based on type of prosthesis

The long-term complications that result from restoring teeth with implants relate, directly, to the risk factors of the patient and the technology.

- Esthetics (a high smile line, poor gingival quality and missing papillae, difficulty in matching the form of natural teeth, bone that is missing, atrophied or otherwise shaped in an unsuitable manner, unrealistic expectations of the patient or poor oral hygiene)
- biomechanical factors (the geometry of the implants does not support the teeth in the same way the natural teeth did such as when there are cantilevered extensions, fewer implants than roots , a poor crown-to-root ratio)
- grinding of the teeth
- technological risks (the implants themselves can fail due to fracture or a loss of retention to the teeth they're intended to support).
- peri-implantitis (the destructive inflammatory process affecting the soft and hard tissues surrounding dental implants)



Periimplantitis progression over 5 years in heavy smoker

COMPONENT FAILURE

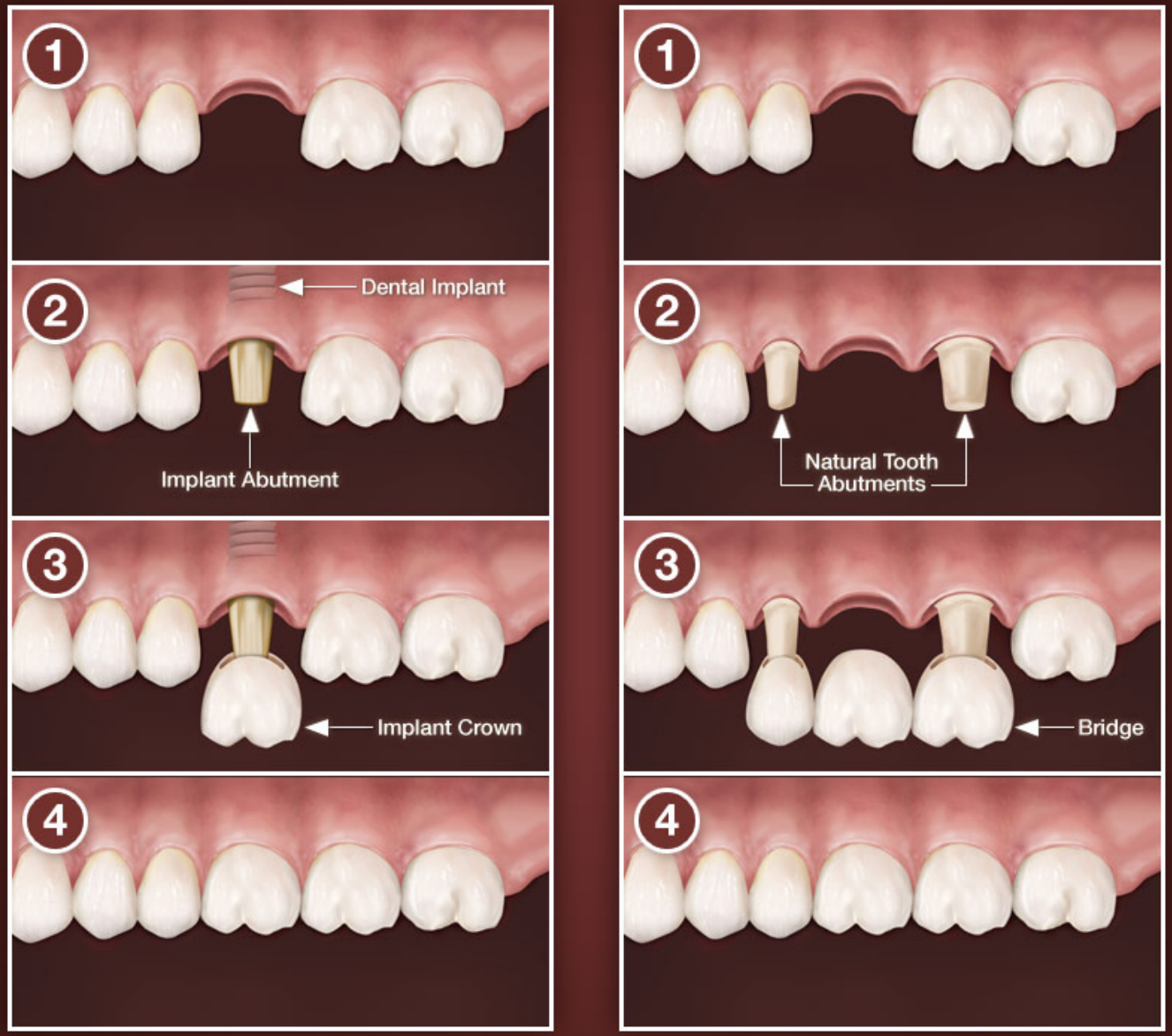
- Fractured fixture
- Fractured abutment screw
- Fractured punch blade
- Fractured screw driver tip
- Fractured castings

MANAGEMENT OF FAILURE

- Failing implants FAIL
- Removal
- Abandon
- Alternative site
- Larger diameter
- Replacement after healing

Dental Implant Option
VS
Bridge Option

Dental Implant vs Bridgework

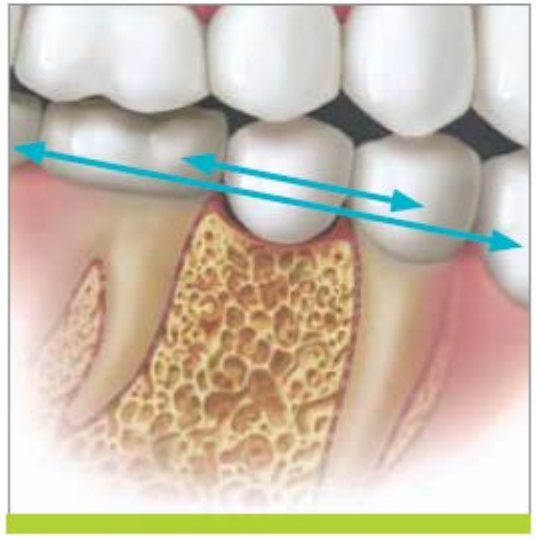


Dental Implant Option VS Bridge Option

After the implant is placed, bone will grow and integrate onto the surface to hold it securely.

A metal abutment connects the implant to a final crown that matches your natural teeth.

Two healthy teeth must be ground down to anchor the bridge.



If either anchor tooth is lost, another healthy tooth must be ground down and a longer bridge put into place.