

Flapless (Minimally Invasive) Approach for Dental Implant

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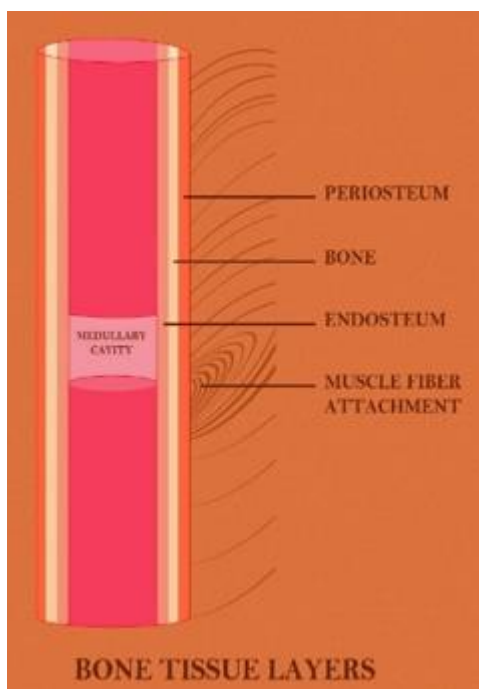
1. Introduction

Flapless dental implant is a **minimally invasive** procedure where the dental implant is placed **without raising the alveolar mucosa and the periosteum**, by just creating a hole using tissue punches thus leading to reduced trauma and lesser healing time. Before we go into details of flapless dental implant and its advantages and disadvantages let's see a bit about the structure of the bone, periosteum and the gingival mucosa to understand the benefits of the flapless approach.

The Bone: The bone is a hard tissue that is responsible for the structural integrity, protection and support to the body. It is a highly complex structure that has a high mineral composition and nerve supplies and also is responsible for the production of red blood corpuscles. Histologically bone is classified in two types (i) compact or cortical bone (ii) cancellous or spongy bone.

Compact bone - Compact bone is a dense and hard type of bone tissue found in the bodies of vertebrates.

It makes up the outer layer of most bones and provides strength, support, and protection. Composed of tightly packed osteons, or Haversian systems, compact bone appears solid to the naked eye. Despite its solid appearance, compact bone contains tiny channels called Haversian canals that house blood vessels, nerves, and lymphatic vessels, for delivery of nutrients and removal of waste products to and from the bone cells.



Cancellous bone - Cancellous bone, also known as trabecular or spongy bone, is the softer, less dense inner part of bone tissue. Unlike compact bone, which forms the outer layer of mandible cancellous bone is found at the ends of long bones and in the interior of flat bones. It has a spongy or honeycomb-like structure composed of trabeculae. This network creates spaces filled with bone marrow, where blood cells are produced and stored.

The macroscopic structure that surrounds this complex is called the periosteum and endosteum.

Cancellous bone is lighter and more flexible than compact bone but still provides structural support to bones while also facilitating metabolic activities, including the exchange of nutrients and waste products within the bone marrow. Its structure allows for strength and resilience while reducing the overall weight of the skeleton.

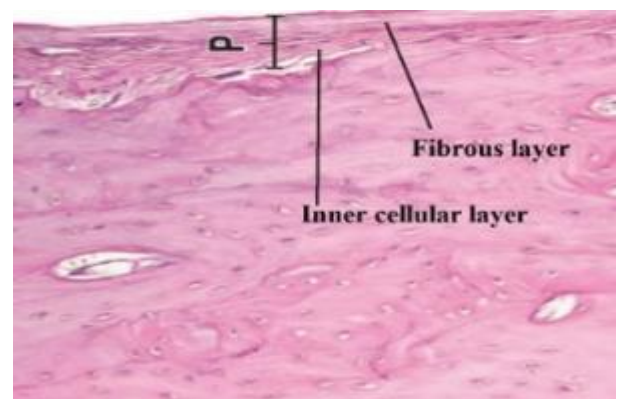
The Periosteum: The periosteum is a dense layer of connective tissue that covers the outer surface of bones. It's a tough, fibrous membrane that serves several important functions which include

- Protection
- Nutrient Supply
- Attachment
- Bone Repair

The periosteum also contains cells involved in bone growth and repair, such as osteoblasts (responsible for bone formation) and osteoclasts (involved in bone resorption or breakdown). It's essential for the overall health and function of bones by supporting their growth, maintenance, and healing processes.

Microscopic structure of periosteum – The periosteum consists of two layers;

- Outer fibrous membrane
- Inner cellular layer



Periosteum under microscope at 40x zoom

Outer fibrous layer: is irregular, dense connective tissue with more collagenous matrix and a smaller number of cells. This layer further subdivides into:

- The superficial layer which is more vascular and receives periosteal vessels
- Fibro - elastic deep layer

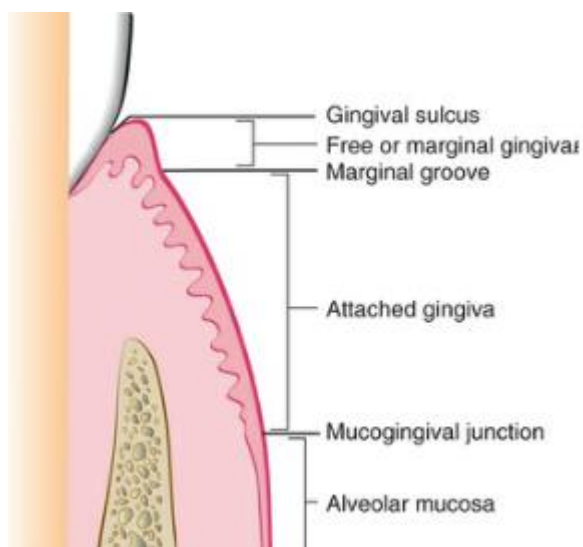
Inner cellular layer is made up of osteoprogenitor cells; it is also known as the osteogenetic layer. The Inner layer contains osteoblasts in young developing bones. Although in adult bones, osteoblasts may be absent, they appear whenever required. Osteoprogenitor cells are multipotent stem cells; they can undergo mitotic division and differentiate into osteoblasts. The inner layer also has lot of blood vessels with many microvessels; stimulated pericytes derived from the endothelium of these microvessels may augment the osteoblast formation from the osteoprogenitor cells.

Blood vessels supplying the periosteum hold a small caliber and branches in to supply the Haversian and Volkmann canals. Sharpey's fibers, clusters of periosteal collagen fibers, protrude the bone matrix and bind the periosteum to the bone. These fibers exist more at the attachment of ligaments and tendons to bone.

The periosteum is thick in initial years of life; the thickness of the periosteum decreases as age advances. Periosteum thickness differs with the site of the bone also. The periosteum is not present in sesamoid types of bones.

The Gingival Mucosa: The gingiva, commonly known as the gums, is the soft tissue that surrounds and protects the teeth. It's a crucial part of the oral cavity, providing support and stability to the teeth while acting as a barrier against potential infections. Gingiva is made up of dense, fibrous tissue covered by a mucous membrane. It's firmly attached to both the teeth and the underlying bone. The gingiva is divided anatomically into

- Marginal gingiva
- Attached gingiva
- Interdental gingiva



Parts of gingiva

The marginal gingiva refers to the edge or border of the gums that surrounds the teeth. It's the part of the gingiva that forms

a cuff or collar - like structure around the tooth, creating a seal that helps prevent bacteria and debris from getting underneath the gums. This portion of the gingiva is also known as the free gingiva

Attached gingiva The attached gingiva is a specialized part of the gum tissue that is firmly bound to the underlying bone and the roots of the teeth. It's the portion of the gingiva that lies between the free and the mucosa lining of the mouth.

Key characteristics of the attached gingiva include:

- Firm Attachment
- Resilience
- Appearance

Interdental gingiva refers to the gum tissue found in the spaces between adjacent teeth. This area includes the portion of the gingiva that occupies the interdental spaces, forming a triangular shape between the teeth.

MUCOSA of Edentulous Jaw

What happens when flap is elevated

Implants already being an invasive procedure is made to be more invasive when incision is made followed by flap elevation leading to the increased complications which include swelling bleeding and pain. These leads to more crestal bone resorption. This resorption occurs as when the mucoperiosteal flap is being raised the periosteum is being detached from the bone so the blood supply which the bone was receiving from the periosteum gets lost leading to bone loss. Along with it when the implant is inserted in the site it leads to bone remodeling, which leads to loss of bone.

Advantages of Flap Elevation:

There are various advantages of flap elevation in implant dentistry

- Elevation of flap leads to clear visualization of bone at the surgical site
- This helps in proper instrumentation
- Location of surgical site
- Curettage of bone
- Finding of any bony defect

Complications of Flap Elevations:

Along with the advantages there are also various disadvantages of flap elevations:

- The incision needs to be made at the surgical site which may lead to scar formation
- The mucoperiosteal flap elevation leads to loss of blood supply from the periosteum to the bone
- Increased blood loss at the surgical site
- The tear of periosteum may lead to more swelling and other post - op complications
- Loss of cortical bone
- More technique sensitive as proper suture is need to achieve desired result.

The Flapless Technique (Minimally Invasive Implantology)

Procedure

Flapless dental implant is also technique sensitive procedure where instead of making a long incision and raising a muco - periosteal flap only a round incision is made exactly at the site of implant placement by using tissue punch which can be hand piece driven or manual.



Tissue Punch Handpiece Driven Tissue Punch Hand Driven

The flapless procedure starts from the initial planning where the implant needs to be placed. The materials which are needed for the planning includes (i) Casts, (ii) Radiographs (CBCT/RVG) & (iii) Intra Oral Photographs. As flapless procedure is highly technique sensitive procedure accurate planning is the key for a successful implant placement. A surgical guide may sometimes prove to be of use for placement of implants.

After the planning and preparing the patient for the dental implant a small round incision is made with a tissue punch at

a precise location. The incised flap is mobilized and raised with the help of periosteal elevator along with the periosteum. The drilling begins with a lance drill at the center of the punch followed by regular final drills and implant placement. Healing collar or cover screw can be placed according to the primary stability that is obtained post implant placement.

Benefits of Flapless Dental Implant

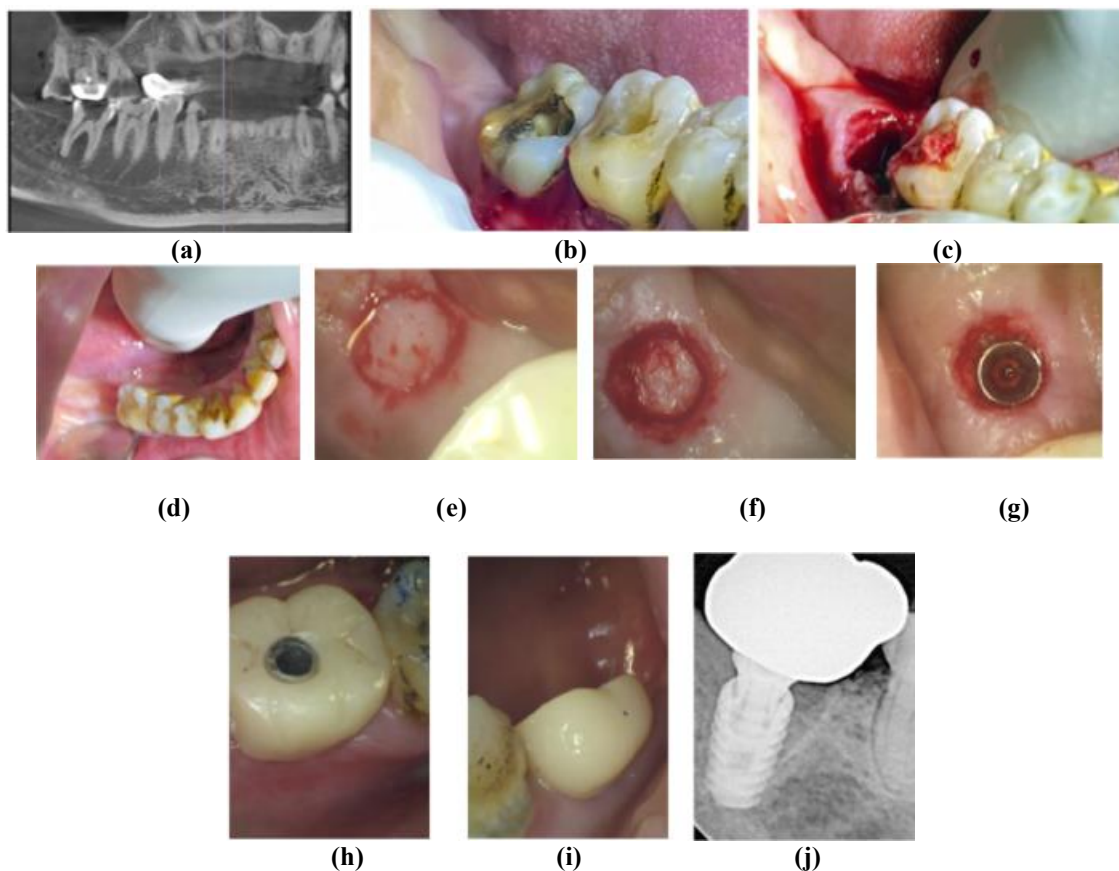
- Faster healing of soft tissue
- Minimal interference on the blood supply
- Reduced bleeding
- Reduced surgical time
- Increase on patient comfort
- High survival rates

Limitation of Flapless Technique

- A blind technique.
- Risk of damaging anatomic structures
- Difficulty of keratinized gum
- Impossibility of evaluating and treating bone defects

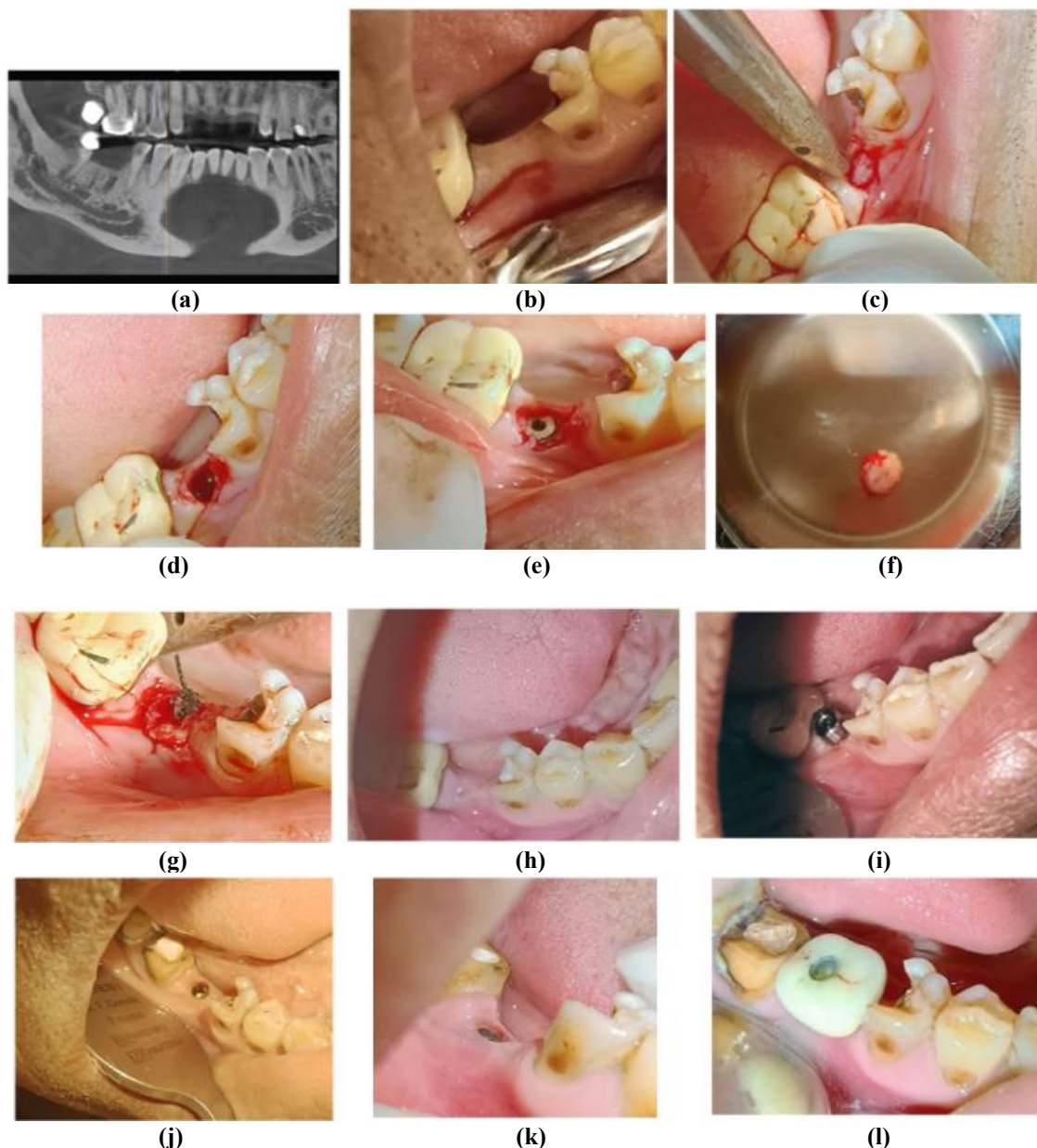
Case 1

A female of 45 years reported to the clinic with decayed lower right 2nd molar. Extraction of the tooth was done and delayed implant with flapless technique was planned to reduce the operative time and for not to affect the keratinized mucosa. The patient was physically fit with no medical history.



A) Pre - Op X - Ray B) Pre - Op - Clinical C) Extraction Done D) Healing Achieved After 3 Months E) Incision Made with Tissue Punch F) Flap Raised G) Implant Placed H) Crown Placed I) Crown Placed J) Post - Op XRay

Case 2



A) Pre - Op X - Ray B) Pre - Op - Clinical C) Incision Made with Tissue Punch D) Flap Raised E) Implant Placed
 F) Soft Tissue Graft Preserved G) Preserved Graft Replaced H) Healing Achieved After 3 Months I) Healing Collar Placed
 J) K) Healing Of Gingiva Achieved L) Crown Placed

References

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