

“The Use of Barrier Membranes in Pre-Implant Bone Grafting”

Goal:

1. To review the basic and biological principles behind Guided Bone Regeneration (GBR).
2. To establish, which methods and materials associated with GBR are available.
3. To compare how the oral environment can alter treatment planning and surgical agendas.

Basic Principles of GBR

- GBR acts to prevent the migration of unwanted soft tissue cells to a defect site through the use of mechanical barriers.

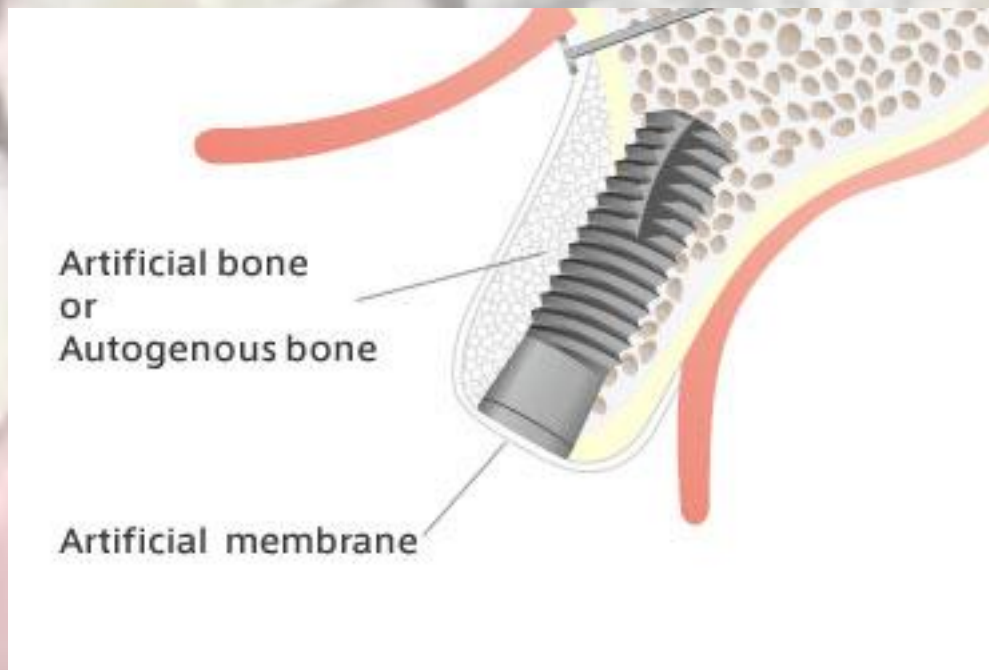


Fig. 1: Depicts the basic idea behind GBR through the use of a mechanical barrier with a bone graft.

Basic Principles of GBR



- Design Criteria for GBR Membranes:
 1. Biocompatibility
 2. Space for Ingrowth
 3. Cell Occlusiveness
 4. Tissue Integration
 5. Clinical Manageability

Biological Principles of GBR

- Bone quality developed from GBR depends on:
 1. *The species* (evolution hierarchy)
 2. Bone healing potential (age, nutrition)
 3. Type of membrane
 4. Load-sharing pattern of the fixation method
 5. Local conditions (vascularity, origin of bone)**

Biological Principles of GBR

Blood supply in a pre-prosthetic setting:

- It may be easier to stimulate bone formation when treatment involves an edentulous state.
- The incision location and design on an edentulous ridge could also dictate GBR success.

Blood supply in a periodontal setting:

- A periodontal setting can alter GBR procedures if the bony defect decreases site-specific quality of the overall bone marrow.
- Bone replacement grafts (BRG) are used to treat osseous defects.

The local blood supply in both scenarios is the basis behind treatment success!!!!

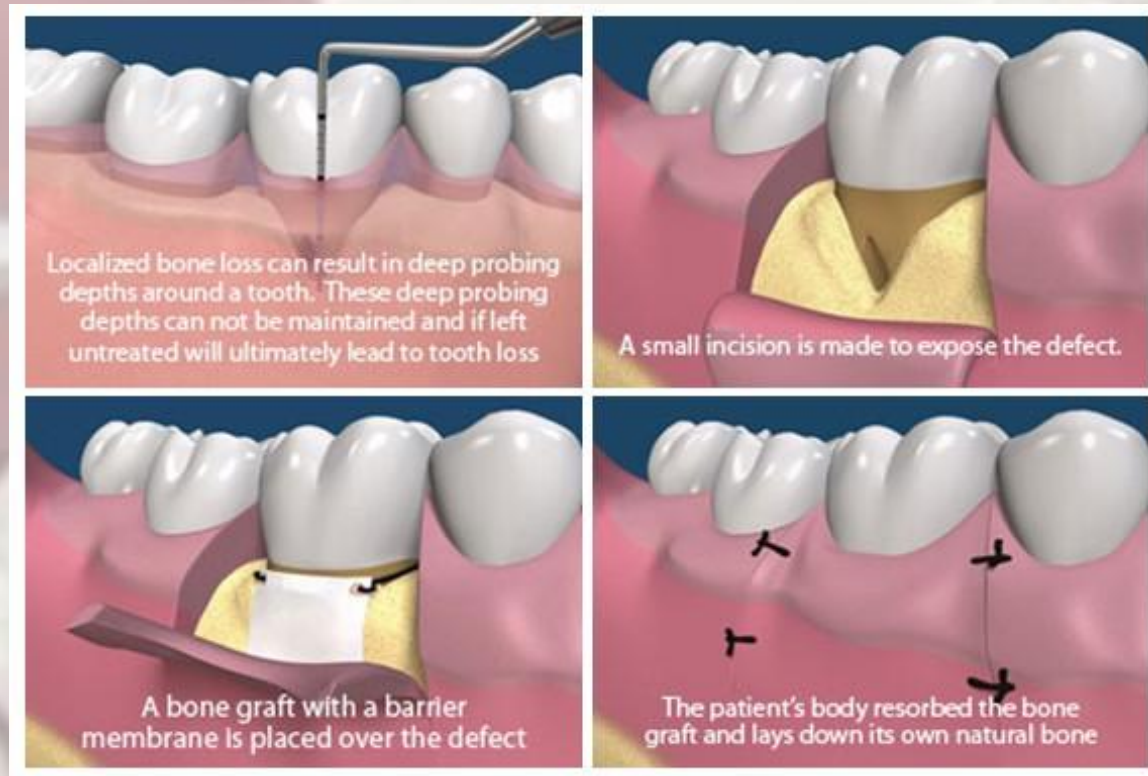


Fig. 2: GBR procedure in the presence of an osseous defect.

This process shows the combination of a BRG, membrane, and GBR.

Methods

- Implant placement requires adequate bone volume in order to be successful.
- Various methods exist when attempting to restore insufficient bony support for implant usage.
- These include: Onlay bone grafting, distraction osteogenesis, Le Fort I osteotomy, edentulous ridge expansion, and GBR.

Methods

- Vertical Bone Augmentation

MORE UNPREDICTABLE!!!! But why?

= Requires longer healing time, excellent primary wound closure, anatomical difficulties, technical complications

→ Indications?

= Remaining bone height is too small, disapproving crown to implant ratios, unfavorable esthetic outcomes

Methods

- Vertical Bone Augmentation

- Techniques?

- = 2-staged approach, combined with purely autogenous bone grafting and GBR

- = Non-resorbable titanium reinforced micromesh membranes

- Results?

- = 5.8mm vertical gain, or 93.5% defect fill

NOTE: Alloplastic biomaterials of rigid structure have also been proven to be effective for augmenting vertical bone loss.

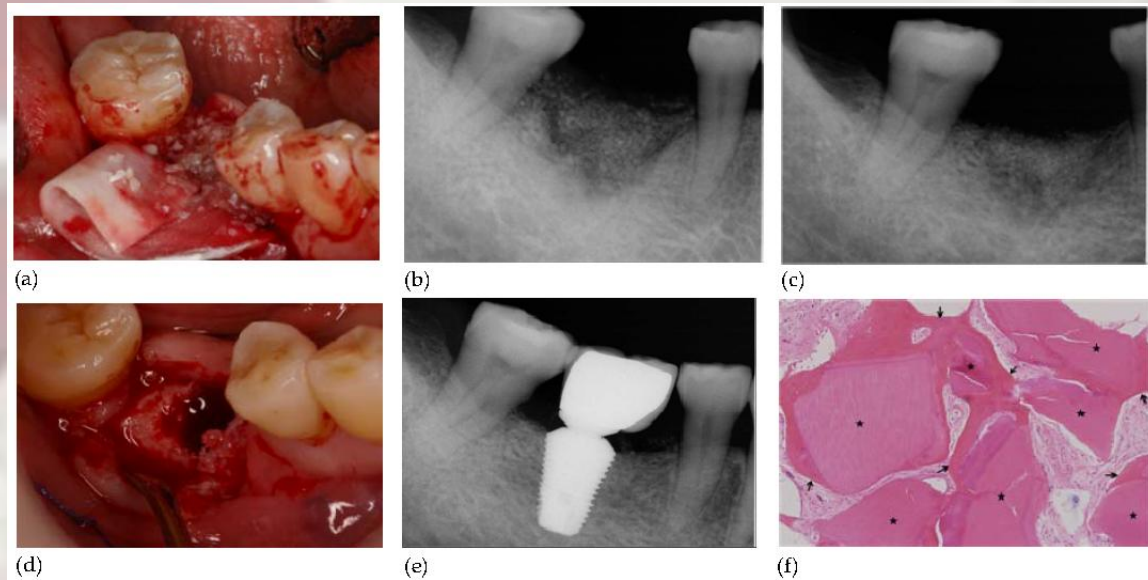


Fig. 3: Vertical Augmentation

a) Autogenous bone graft and collagen membrane, b) PA 3 weeks after bone graft, c) PA 6 months after bone graft, d) Implant installed 6 months after bone graft, e) PA after final prosthetic delivery, f) Microphotograph 6 months after AutoBT transplantation.

Methods

- Horizontal Bone Augmentation
 - Defect morphology = dehiscence, fenestration and infrabony defects
 - Edentulous ridge expansion (ERE)
 - Great for narrow edentulous ridges
 - Complications?
 - = Adequate spongy bone must be present between buccal and lingual/palatal plates, inclined implant insertion

Methods

- Horizontal Bone Augmentation

- Techniques?

- = Synthetic resorbable membrane with autogenous bone in combination with anorganic bovine bone-derived mineral (ABBM)

- = Autogenous particles combined with ABBM create a more osteogenic graft

- Results?

- = Horizontal increase of 5.52mm, with some reaching up to 9mm

Methods



Fig. 4: Horizontal bone augmentation using a resorbable collagen membrane combined with autogenous bone particles.

Materials

- GBR requires the use of certain biomaterials in order to be successful, such as:
 1. Barrier membranes
 2. Bone grafts
 3. Growth factors
- Biomaterials can be organized into 4 groups based on their mode of action:
 1. Osteogenic materials (fuel bone cells)
 2. Osteoinductive materials (encourage differentiation)
 3. Osteoconductive materials (facilitate proliferation)
 4. Osteopromotive materials (act as a scaffold)

Materials



Membranes

- Nonresorbable = ePTFE, dPTFE, Titanium-reinforced mesh
- Resorbable = Synthetic (PGA, PLA), Natural (Collagen)
- Liquid = Atrisorb

Bone grafts

- Autologous (Autografts)
- Homologous (Allografts)
- Heterologous (Xenografts)
- Synthetic (Alloplastic grafts)

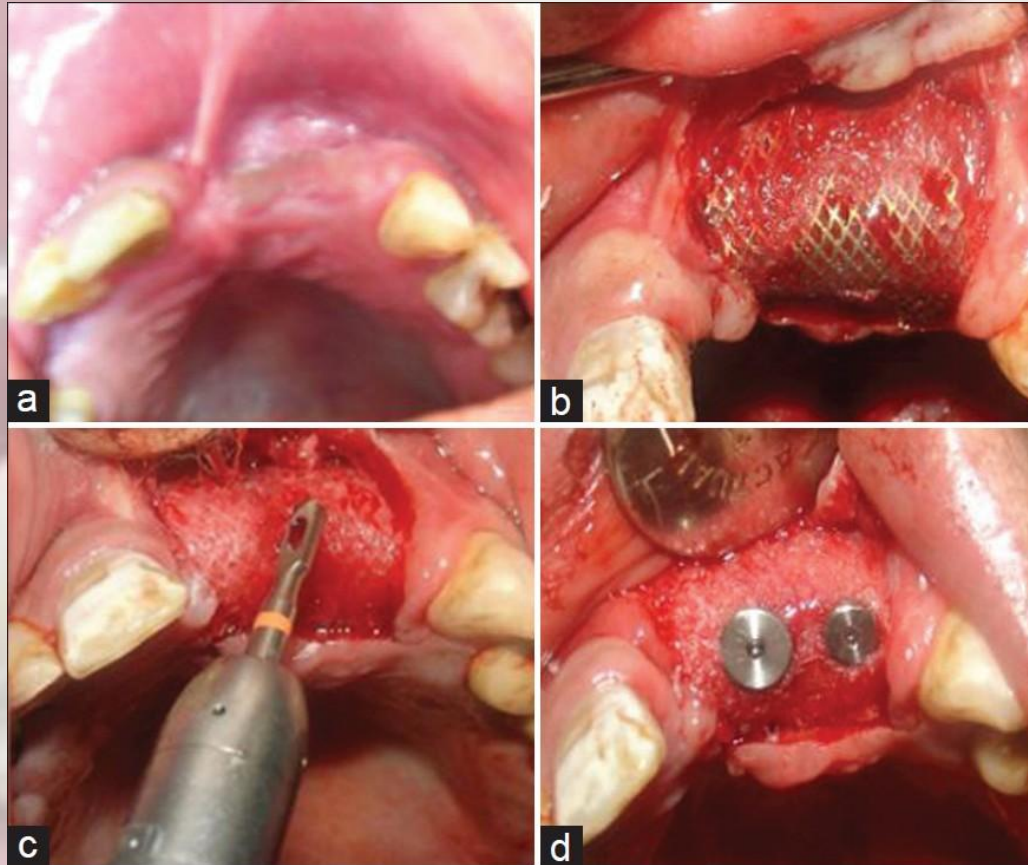


Fig. 5: Titanium Mesh Membrane

a) Deficient ridge, b) 6 months post-augmentation with some new bone deposited on mesh, c) Removal of mesh in order to get histological specimen, d) Two inserted implants in the augmented ridge.



Fig. 6: Liquid Membrane

At the time of exposure, the Atrisorb material is still intact.

Conclusion

- GBR is successful in augmenting bone for implant placement, yet complications exist.
- Further investigation needs to be carried out in order to understand which biomaterials and augmentation techniques are best suited for specific clinical situations.
- Precedence should be awarded to surgical agendas that are:
 1. Simpler/noninvasive
 2. Little risk of complication
 3. Achieve the desired result within the shortest time frame

A close-up photograph of a dental procedure. A tooth is shown with a silver-colored filling. A dental tool, likely a scaler or explorer, is being used to work on the filling. The tooth is surrounded by other teeth, and the background is a soft, pinkish-red color.

THANK YOU

FOR YOUR ATTENTION!

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