GUIDED TISSUE REGENERATION

Dr. E.Ahila MDS

Reader

Department of periodontology

- “Guided Tissue Regeneration (GTR)” was given by Gottlow in 1986.

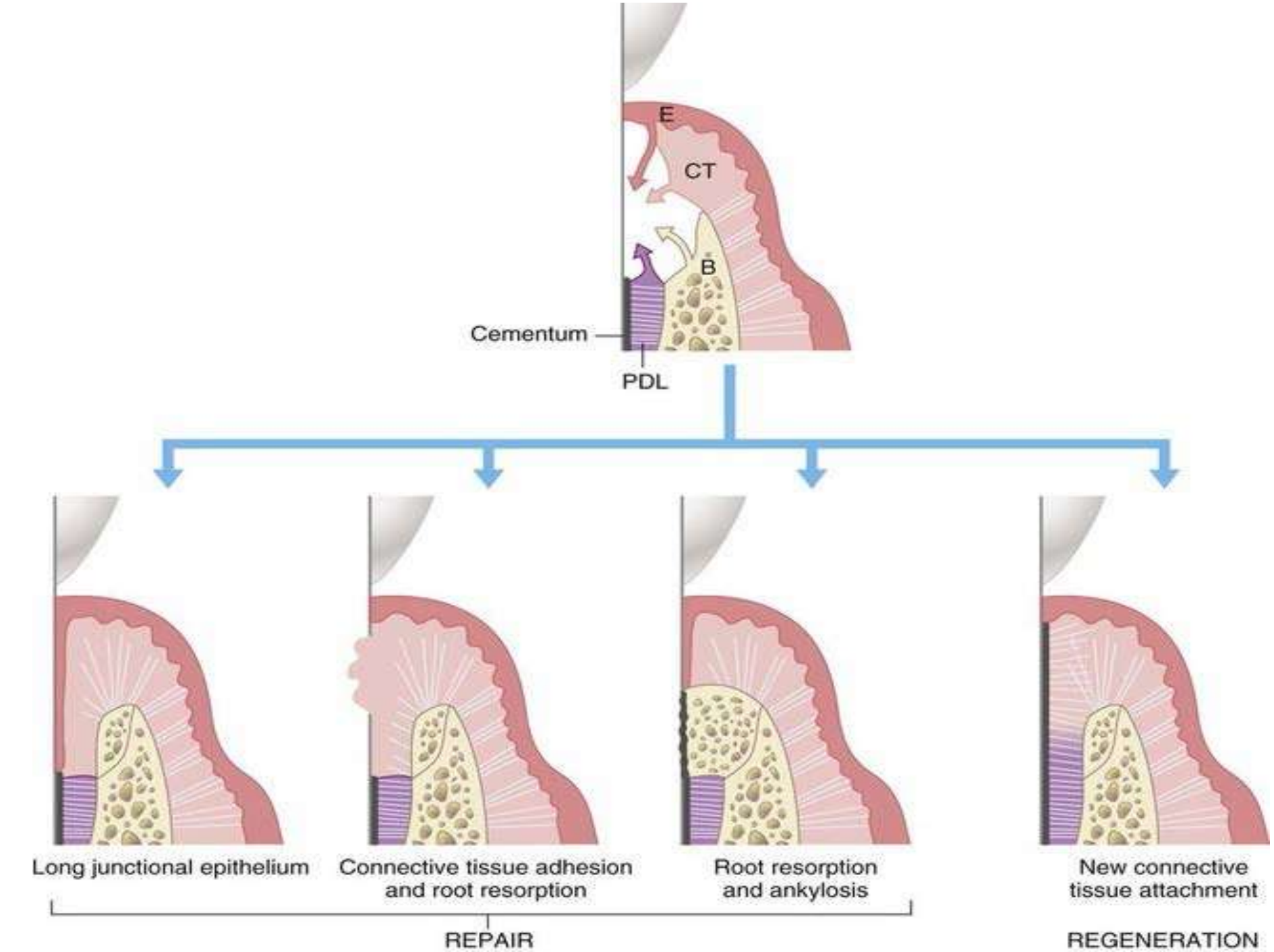
- The 1996 World Workshop in Periodontics defined GTR as “procedures attempting to regenerate lost periodontal structures through differential tissue responses.

- The rationale behind using GTR membranes is to exclude epithelium and gingival connective tissue, maintain space between the defect and tooth, and stabilize the clot.

- The ultimate goal of periodontal therapy is full regeneration of the periodontium destroyed by periodontitis, to their orginal form, function and consistency.

- Regeneration is defined as a reproduction or reconstruction of a lost or injured part in such a way that the architecture and function of the lost or injured tissues are completely restored.

(Glossary of periodontal terms, 1992)


E
CT
B
Cementum
PDL
Long junctional epithelium
Connective tissue adhesion and root resorption
Root resorption and ankylosis
New connective tissue attachment
REPAIR
REGENERATION

- It is important to restore the various components of the periodontium in their appropriate locations amounts and relationship to each other – a process referred to as tissue regeneration.

- The most common healing of a periodontal wound is characterized by the epithelization of the interface of the flap in contact with the radicular surface, forming the long junctional epithelium.

- The kind of healing of wound by these which does not completely restore the architecture of function is referred to as REPAIR.

- Repair simply restores the continuity of the diseased marginal gingiva and reestablishes a normal gingival sulcus at the same level on the root as the bone of the preexistent periodontal

- Regeneration, on the contrary to repair, is defined as that type of healing which completely replicates the original architecture and function of Periodontium.

- Periodontal regeneration implies healing which involves the formation of new cementum, periodontal ligament and alveolar bone.

- During the process of regeneration, the new periodontal ligament formed gets embedded into the new cementum, and the gingival epithelium gets attached to the tooth surface previously denuded by disease. This kind of attachment is termed as New attachment**.**

- Periodontal Regeneration requires

- Restoration of alveolar bone height.
- Regeneration of gingival connective tissue destroyed by inflammation.
- Formation of new acellular extrinsic fiber cementum on previously exposed root surfaces.
- Synthesis of Sharpey's fibers and their insertion into root surfaces

- **Melcher's Hypothesis**

- Melcher suggests that, under physiological conditions, only cells from periodontal ligament can synthesise and secrete cementum to attach newly-synthesised collagen fibres of periodontal ligament or lamina propria of gingiva to tooth

Melcher AH (May 1976). "On the repair potential of periodontal tissues". *J. Periodontol.* 47 (5): 256–60.

What is Guided tissue regeneration?

- “It is a technique of Periodontal treatment wherein repopulation of Periodontium is achieved, by guiding the periodontal ligament progenitor cells to reproduce in the desired location, by blocking contact of epithelial and gingival connective tissues with the root using a barrier membrane during healing.”

Rationale for GTR

Re establishment of connective tissue attachment on the previously diseased root surface is preferable for the following reasons;

- A Connective tissue attachment usually favours more regeneration of bone.
- A Connective tissue attachment also consists of a reservoir of cells with the potential to form new bone, cementum and PDL.
- A Connective tissue attachment can also mean a normal junctional epithelium, suggesting a shallower pocket depth & thus facilitating maintenance.

- GTR - HISTORICAL ASPECTS

- Use of barrier membranes to direct bone regeneration was first described in the context of orthopaedic research by *Hurley et al*., in 1959 (J Bone Joint Surg 1959, 41A:1243-1254)

- He described the use of barrier membrane in fracture with tissue loss, which could help in regeneration of bone, making-up for the lost tissue.

HISTORY

- The first application of barrier membranes in the oral cavity was by Nyman, Lindhe, Karring and Gottlow in 1980.
- Nyman et.al Reported partial regeneration of Periodontal tissues when a Millipore filter was interposed between the gingival tissue on one side and exposed root surface & surrounding alveolar bone on other side.

- *Nyman, Lindhe ,Karring.* J.Clin. Periodontol; 7; 394-401, 1980

- Gottlow et.al evaluated clinically and histologically the use of Teflon membranes made of ePTFE in 12 patients with Periodontal defects. The Results showed varying amounts of New connective tissue Attachment on all treated teeth.

  (J.Clin.Periodontol,13;604,1986)

- Warner et.al treated 12 teeth with Periodontal defects with PTFE membranes Clinical evaluation after 3 & 6 months revealed significant gain in Clinical attachment.

  (J.Dent Research, 67; 756, 1988)

INDICATIONS

- GRADE II FURCATION DEFECTS
- CAN ALSO BE USED FOR GRADE III FURCATIONS BUT LESS PREDICTABLE.
- TWO & THREE WALLED VERTICAL DEFECTS.
- INTER PROXIMAL & CIRCUMFERENTIAL INTRABONY PERIODONTAL DEFECTS.
- MILLER'S CLASS II AND III GINGIVAL RECESSION.
- LOCALIZED RIDGE AUGMENTATION.
- AUGMENTATION AROUND IMPLANTS.
- TREATING BONY DEFECTS AFTER ROOT RESECTION.

CONTRA INDICATIONS FOR GTR

1. REGENERATIVE MEMBRANE SHOULD NOT BE PLACED WHERE ACTIVE INFECTION EXISTS.

2. DEFECTS WITH SEVERE HORIZONTAL BONE LOSS.

3. DEFECTS THAT DO NOT ALLOW FOR CREATION AND MAINTENANCE OF SPACE.

4. AREAS WITH INADEQUATE GINGIVA WHERE FLAP CAN BECOME STRETCHED AND TENSED.

5. IN CASE OF FAILING ENDOSSEOUS IMPLANTS.

6. TO THOSE WHO ARE ALLERGIC TO GTR MATERIAL.

5. NON COMPLIANT PATIENTS.

IDEAL PROPERTIES FOR A GTR MATERIAL - Scantlebuly et al 1993, Hardwick et al, 1995

SAFETY

The materials must be bio-compatible. Be non toxic, non antigenic & induce little or no inflammation.

EFFICACY

A device should have a specific design for each clinical application based on a biologic rationale.

CLINICALLY MANAGEABLE

The properties of the membrane should permit easy manipulation on the chair side.

COST-EFFECTIVE

Should be less expensive and affordable

BIO-ABSORBABLE

The membrane should preferably be Bio-absorbable.

TISSUE INTEGERATION

- The product should be integrated with the Periodontal tissues in order to eliminate or reduce epithelial down growth.

CELL OCCLUSIVE

- It should serve as a barrier to prevent epithelial cells and at the same time permit selective Repopulation of wound surface by PDL cells.

SPACE MAINTENANCE

- It appears that the space defined and protected by the membrane determined the volume of bone that could be Regenerated.

•**Minabe (1991)** classified the membrane in to two types.

1. Non resorbable membrane
2. Resorbable membrane.

NON RESORBABLE MEMBRANE

- e-PTFE
- Titanium reinforced ePTFE membrane.
- Nucleopore & Millipore filters.
- Silicon Barriers
- Sterlized rubber dam

- RESORBABLE MEMBRANE

- Collagen (Periogen, Biomend)
- Polylactic acid
- Polyglycolic acid polymer.
- (Guidor, Vicryl, Atrisorb, Resolut, Epiguide)

CLASSIFICATION OF GTR MEMBRANES - GOTTLOW ET AL (1993)

- FIRST GENERATION – Non absorbable
- SECOND GENERATION - Absorbable
- THIRD GENERATION - GTR membranes incorporate with
  Growth factors,
  antibiotics,
  adhesion factors

FIRST GENERATION-NON RESORBABLE

1. MILLIPORE (Cellulose) FILTERS
2. ePTFE (GORE TEX)
3. DENSE PTFE (Tefgen)
4. Ti- ePTFE (GORE TEX)

SECOND GENERATION-RESORBABLE natural orgin

COLLAGEN OF PORCINE ORIGIN	(BIO-GUIDE)
COLLAGEN DERIVED FROM BOVINE ACHILLES TENDON	(BIO-MEND)®,(PERIOGEN)
COLLAGEN DERIVED FROM BOVINE CORIUM	(AVITENE), (NEO-MEM)
COLLAGEN FROM OX PERITONEUM	(CARGILE MEMBRANES)
COLLAGEN OF FISH ORIGIN	(PERIOCOL-GTR)
OXIDIZED CELLULOSE MEMBRANE	(SURGICEL)
ALLODERM	ALLOGENIC SKIN MATRIX
DURAMATER	

- **SECOND GENERATION-RESORBABLE synthetic**

1. **GUIDOR - Poly-DL-lactide**
2. **VICRYL PERIODONTAL MESH -Polyglactin 910**
3. **EPIGUIDE - Polylactic acid**
4. **RESOLUTE - Poly-DL-lactid**
5. **MEMPOL - Polydioxanon**
6. **ATRISORB - Poly-DL-lactid**
7. **INION - Carbonate**

THIRD GENERATION GTR MEMBRANES

Atrisorb-D Free flow

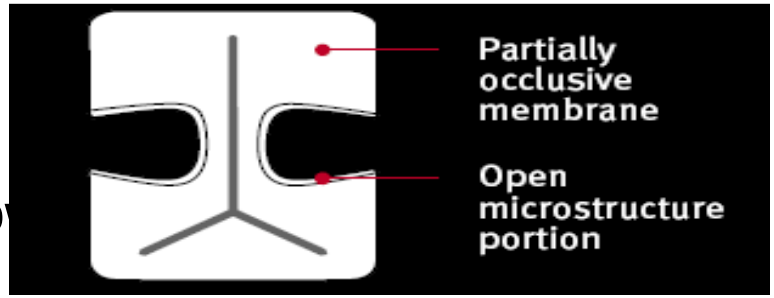
Haemostatic collagen material (Collistat)

Collagen membrane enriched with chondroitin-sulphate (PAROGUIDE)

ePTFE MEMBRANE

Gore–Tex membrane has two structural designs.

1. Open microstructure collar
   Corresponding to the coronal aspect of the device.
   1.0 mm thick
   low density 0.2g/ml and 90% porous.



   -To promote connective tissue in gro
   -To support wound stability
   -To inhibit epithelial apical migration.

2. Remainder of device is partially occlusive.
   0.15mm thick
   higher density (1.5g/ml)
   30% porous.
   Space making for regeneration
   Prevent collapse of flap on to the root surface

Titanium reinforcement ePTFE - Hardwick et al ’95

Titanium is set between two layers of ePTFE.

- Improved space provision because of rigidity.
- Improved mechanical strength
- Most biocompatible

Resin ionomer

- Has excellent space making.
- Difficult to fabricate in situ for tissue integration.

Rubberdam

- Little rigidity to assure space maintenance.
- Tedious to manipulate.
- Exhibits no tissue integration.

Biobrane

- A composite non absorbable device made of knitted nylon fabric mechanically bonded into a **semi-permeable silicone** membrane and coated with collagen peptides. (Aukhil 1986)
- Advantages - Well tolerated by tissue
- Disadvantages - Limited space providing property

RESORBABLE MEMBRANES

Duramater :

- Obtained from cadavers.
- Histological observations show limited tissue integration and resorbed within 2 weeks of surgery.
- Use of cadaveric durameter may represent a risk to acquire disease not only for recipient but also for operator.

Cargile membranes :

- Procured from bovine intestines (ox cecum).
- Limited inhibition of epithelial apical migration .
- Resorbed by 4 weeks post surgery.
- Is difficult to handle at the surgery.

POLYLACTIC ACID (PLA) AND POLYGLYCOLIC ACID POLYMERS (PGA).

Polymers are synthesized by co-polymerization of different forms of PLA or PGA.

POLYLACTIC ACID WITH CITRIC ACID ESTER

- (GUIDOR matrix barrier) acetyl –tributylcitrate

- I st to get FDA approval
- It is double layered.
- External layer designed to allow integration of the overlying gingival flap , contains rectangular perforations (400-400cm2)

- Between external and internal layers there is internal spacers, creating a space into which tissue can grow.

- The internal layer has smaller circular perforations (4000-5000cm2).

- The outer spacers to ensure a space between the barrier and root surface.

- With this design gingival recession is minimal
- Resorption-6-12 months

- Resolut is currently the only other resorbable barrier for guided tissue regeneration approved in the United States.

- manufactured from pure lactide and glycolide polymers arranged into a uni-layer matrix

- Within the body, the resorption of these materials is minimal for approximately 4-6 weeks and is essentially completed by 5-8 months.

- **Atrisorb**
- Consists of polymer of lactic acid, poly (DL-Lactide) dissolved in N–methyl-2 pyrrolidone.

- **Atrisorb-D**

- -Barrier that contains an antibiotic- doxycycline 4%
  -Provides controlled release of doxycycline for a period of 7 days.
  -Proven to prevent bacterial colonization of the barrier.

ATRISORB - Free Flow GTR Barrier:

Advantages:

Eliminates cutting, trimming or handling of barriers.
Reduces surgical time
Unique flowable polymer readily adapts to root morphology.
Bioadhesive
No stabilizing sutures required
Adheres directly to tooth and surrounding bone
Complete bioabsorption within 9-12 months.

As the barrier sets in site – it develops a porous structure.
Pores at the surface – 150 microns (approx)
center of the barrier – 10 microns.
Outer pores allow tissue integration

POLYURETHANE

- Organic polymers containing the urethane group – NH-CO-O-
- Clinically more pronounced inflammation was resulted when compared to other membranes.

Porous polylactic acid + polyglycolic acid+tetracycline

The release kinetics of tetracycline depended mainly upon hydrophilicity of tetracycline and porosity of the membrane.

POLYLACTIC ACID WITH ALGINATE FILM

- Alginate is intended to act as potential vehicle
- for the growth factors to promote osteogenesis.

Alginate - towards bone

Polylactic acid is towards flap.

NATURAL PRODUCTS.

Collagen

- Type I collagen used is derived from bovine deep flexor tendon BIOMEND – Semiocclusive (effective pore size 0.004 μm).
- completely resorbed in four to eight weeks.

Another Type I collagen used is derived from calf pericardium

- Cross linked by diphenylphosphorylazide.
- cross linking procedure may allow for pronounced tissue ingrowth.
- Completely absorbed in 2 weeks.

Bio-Gide has a natural collagen structure (of porcine origin)

- Excellent wound healing characteristics
- Reduced risk of dehiscence formation
- High degree of tissue compatibility, decomposes without compromising the soft tissue
- Even when expositions do occur, the membrane still does not have to be removed.
- Easy handling
- Quickly adaptable – adheres to the defect because it is hydrophilic.
- Tear-resistant with high tensile strength can be attached with pins and suturing material.
- Barrier function is sufficiently long and lasts 4 - 6 months

Oxidized cellulose mesh :

- A hemostatic dressing used as a GTR device
- Resorbed completely within 4 weeks of implantation.
- It may delay healing of bone tissue, because of acidic nature.

MEMBRANE STABILIZATION

- The Resor-Pin is a resorbable pin with which resorbable membranes can be easily and securely attached to bone.
- Biocompatible lactide copolymer (L-lactide-co-D, L-lactide) in the ratio 70:30,
- Remains functionally stable for at least 6months.
- Mass degradation completes by about12months.
- Due to the slow resorption time of the Resor-Pin

wound healing is not disturbed.

GTR Membranes

Flap Design

- Conventional – Does not favour primary closure

  - Causes membrane to be partially Exposed and causes Bacterial Contamination of Membrane

  - Causes regenerated tissue to be exposed after Membrane removal

  - Causes increased Gingival Recession

- Modified Papilla Preservation Flap
- Simplified Papilla Preservation Flap

SURGICAL PROCEDURE

PRIMARY INCISIONS:

Raise a full thickness flap utilizing vertical incisions extending a minimum of 2 teeth anteriorly &1 teeth distally to the teeth being treated.

DEFECT PREPARATION

Debride the osseous defect & plane the root surfaces.

SELECTION & PLACEMENT OF BARRIER MATERIAL

Trim the membrane according to the size of the area being treated .

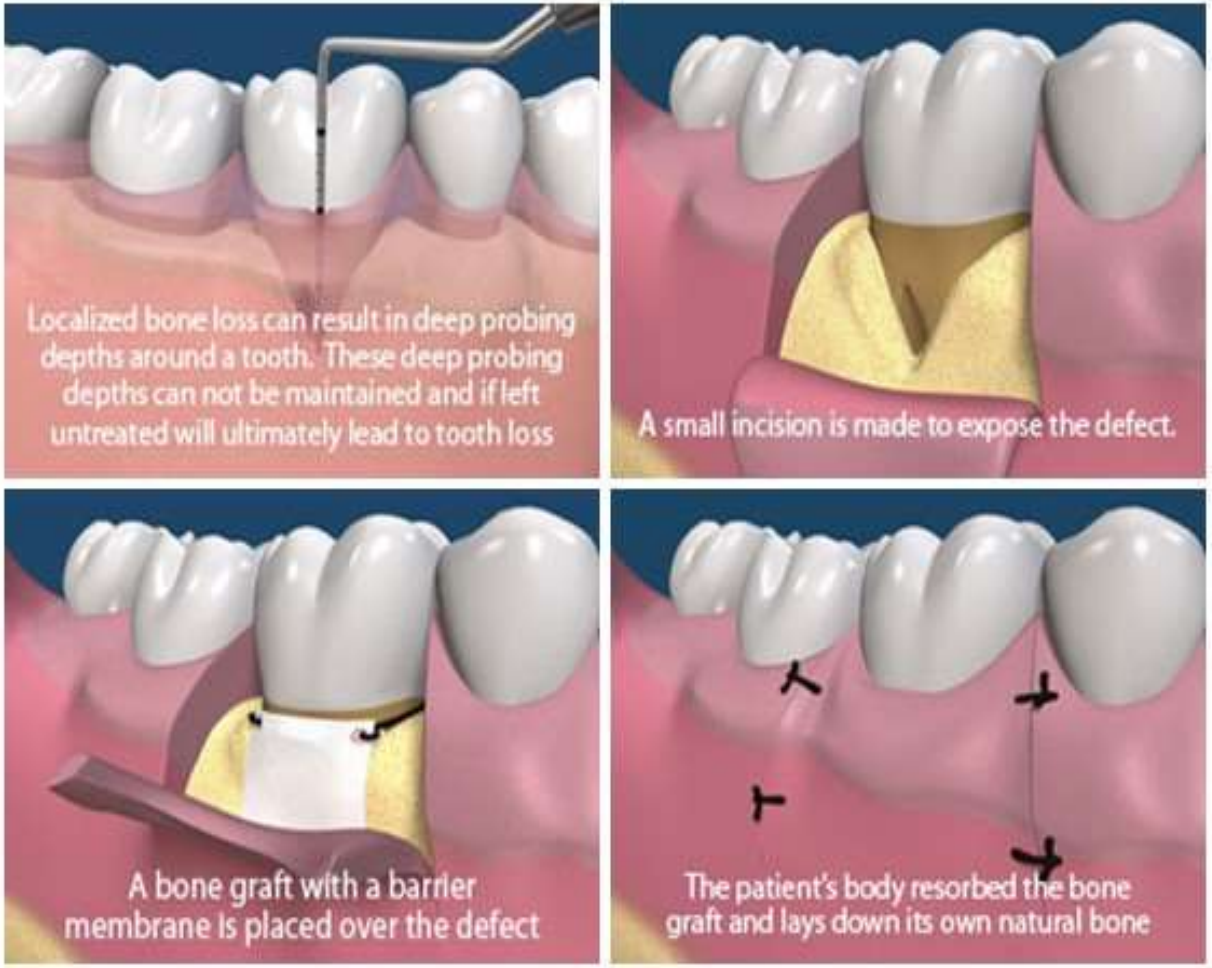
The membrane should extend approximately beyond 2 to 3 mm on all the sides.

SUTURE MATERIAL

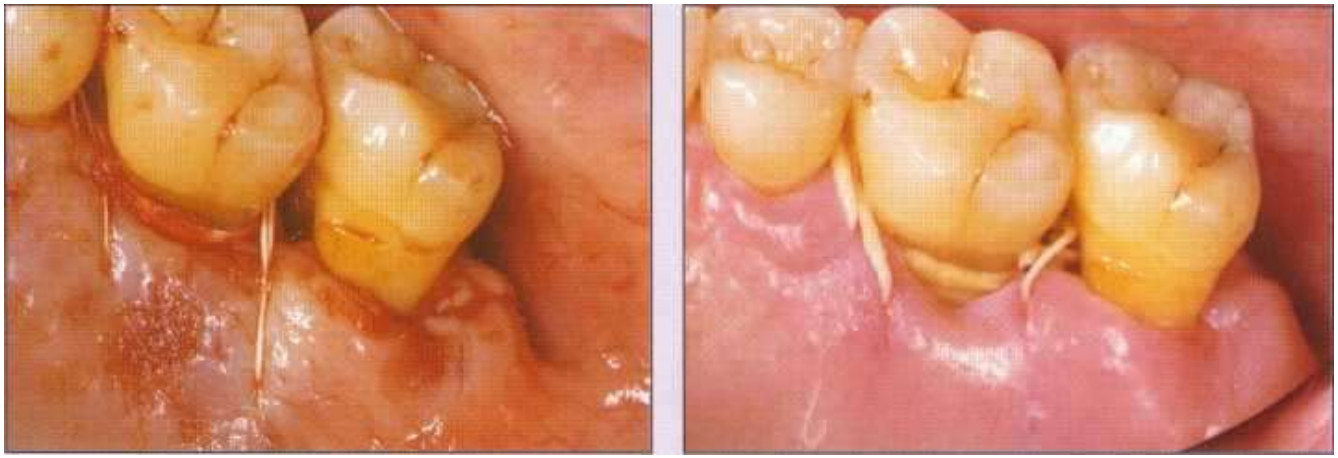
Suture the membrane around the tooth with sling suture.

Silk or monofilament suture may be used in areas away from the material

The flap margin should ideally be 2 to 3 mm coronal to the material


Localized bone loss can result in deep probing depths around a tooth. These deep probing depths can not be maintained and if left untreated will ultimately lead to tooth loss
A small incision is made to expose the defect.
A bone graft with a barrier membrane is placed over the defect
The patient's body resorbed the bone graft and lays down its own natural bone

Membrane Exposure

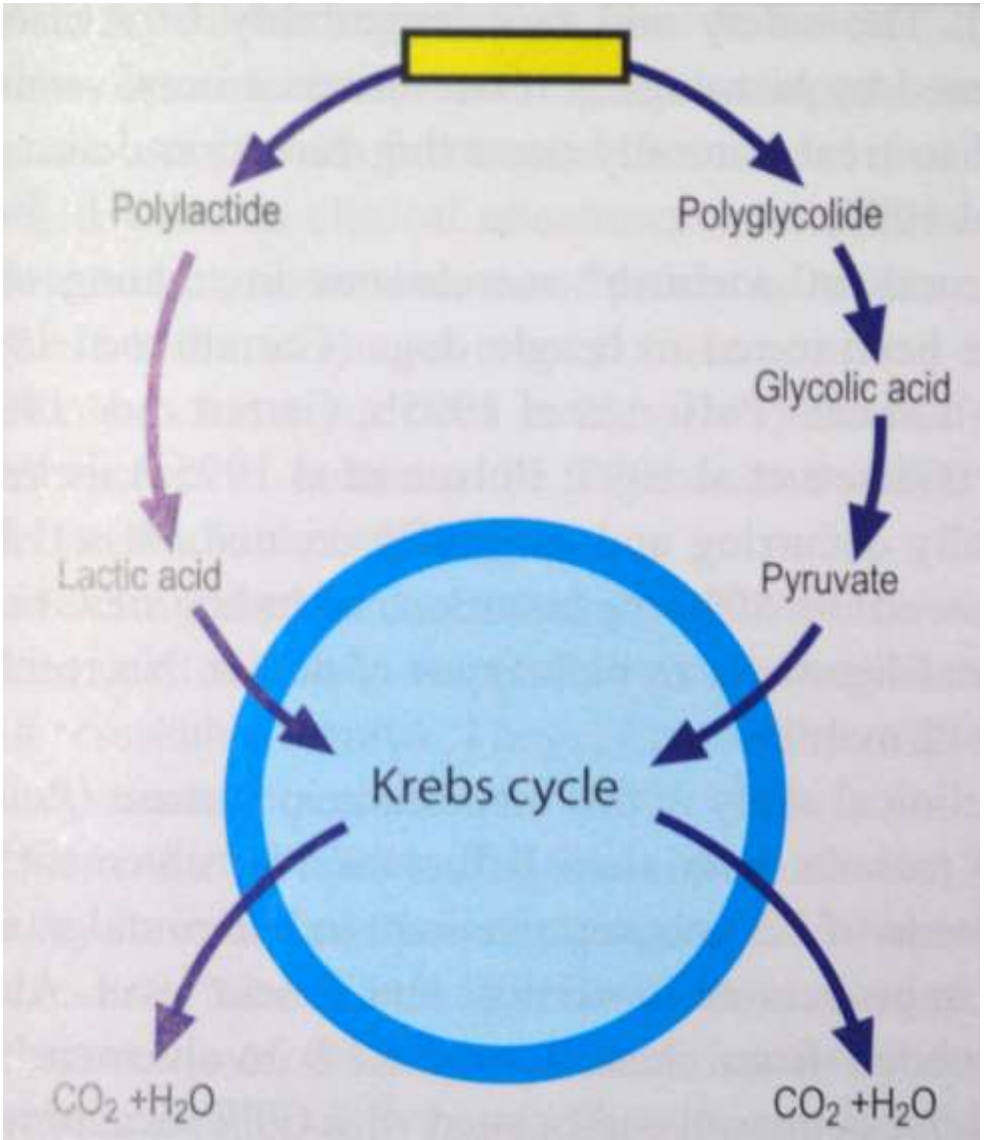


MEMBRANE EXPOSURE

- Prevalance-50% -80% *(Becker et al 1988, Cortellini et al 1993, De Sanctis et al1996)*

- Associated with reduced CAL *(Nowzare et al 1994, De Sanctis et al1996)*

Biodegradation of Resorbable Membranes



RESORBABLE BARRIERS

Degradation of synthetic polymers

- Polylactide and polyglycoside membranes
  are broken down by the enzymes in the Krebs cycle-Takakis et al 1999
  Occurs in two stages
    1. A random non-enzymatic cleavage of the polymer.
    2. Loss of mechanical strength and weight.
- Degradation occurs by hydrolysis.
- Degradation is depended on pH, the presence of mechanical strain, enzymes and bacterial infection.
- Modification of poly (L-lactide) by cross linking (or) addition of D-lactide or glycolide results in rapid degradation .

Non-biosorbable Membranes

- Removed after 4-6 weeks
- An incision is made extending one tooth mesially and distally to the border of the barrier.
- After reflecting the covering tissue flaps, the barrier can be removed with-out compromising the newly regenerated tissue.

- Collagen Degradation
- The collagen used is a cross-linked variety of porcine or bovine origin.
- When a collagen membrane is implanted in the human body it is resorbed by the enzymatic activity of macrophages and polymorphnuclear leucocytes (Tatakis et al. 1999).

- Tetracycline are incorporated into collagen membranes to delay degradation – (Ofer Moses ,2001)
- Biodegradation time can be controlled by adding carbonate apatite in to collagen/ composite membrane.

Complications

- Membrane Exposure
- Erythema
- Suppuration
- Sloughing or Perforation of Flap
- Membrane Exfoliation
- Post Operative Pain

Post Operative Regime

- Systemic Antibiotics
- Plaque Control with Antiseptic gels / Mouthwashes
- Non-Resorbable Membrane removal in 4 – 6 week
- Monthly Professional Maintenance Program for One Year.

SURGICAL PRINCIPLES

PRE SURGICAL

1. EXPLAIN PATIENTS ABOUT OBJECTIVE, ADVANTAGES AND DISADVANTAGES.

2. INSTRUCT IN PATIENT'S ORAL HYGIENE.

3. PROPER SCALING & ROOT PLANING.

4. NO VIGOROUS SUBGINGIVAL INSTRUMENTATION AS THIS MAY PREDISPOSE TO RECESSION IN SITES RECEIVING GTR.

5. PREFERABLY PRESURGICAL ANTIBIOTICS.

SURGICAL PRINCIPLES

POST OPERATIVE

1. PATIENT ADVISED NOT FLOSS TREATED SITES FOR 4 WEEKS.
2. CHX MOUTH WASH 0.12% FOR 2 WEEKS.
3. SYSTEMIC ANTIBIOTICS AND ANALGESICS.
4. NON RESORBABLE SUTURES REMOVED AFTER 2 WEEKS.
5. RECALLED EVERY WEEK.
6. NON ABSORBABLE MEMBRANES SHOULD BE REMOVED BETWEEN 6-8 WEEKS.

NON ABSORBABLE Vs ABSORBABLE

NON ABSORBABLE	ABSORBABLE
NEEDS SECOND SURGERY	NO NEED FOR SECOND SURGERY
PATIENT DISCOMFORT	PATIENT COMFORT
MORE CHAIRSIDE TIME	LESS CHAIRSIDE TIME
EXPENSIVE	LESS EXPENSIVE
IN CASE OF INFECTION REMOVAL IS EASY.	IN CASE OF INFECTION REMOVAL IS NOT EASY.

STUDIES WITH ePTFE GTR MEMBRANES

 # First used by Gottlow et.al in 1984. They used the membrane in Macaca fascicularis monkeys. Results after 3 months showed considerably more new attachment in test sites.

 # Pontoriero et.al, 1987, treated class II furcation defects in humans using Gore-tex material and their results confirmed complete resolution of furcation defects in more than 90% of treated sites. (J.Clin.Periodontol 1987).

 # Caffese.et.al, 1990, evaluated the effects of GTR using Gore-tex (ePTFE) in the treatment of class II furcation defects in six Beagles. They found significant connective tissue and bone fill. (J.Periodontol 1990)

CLINICAL USE OF GTR ePTFE IN GRADE II FURCATION

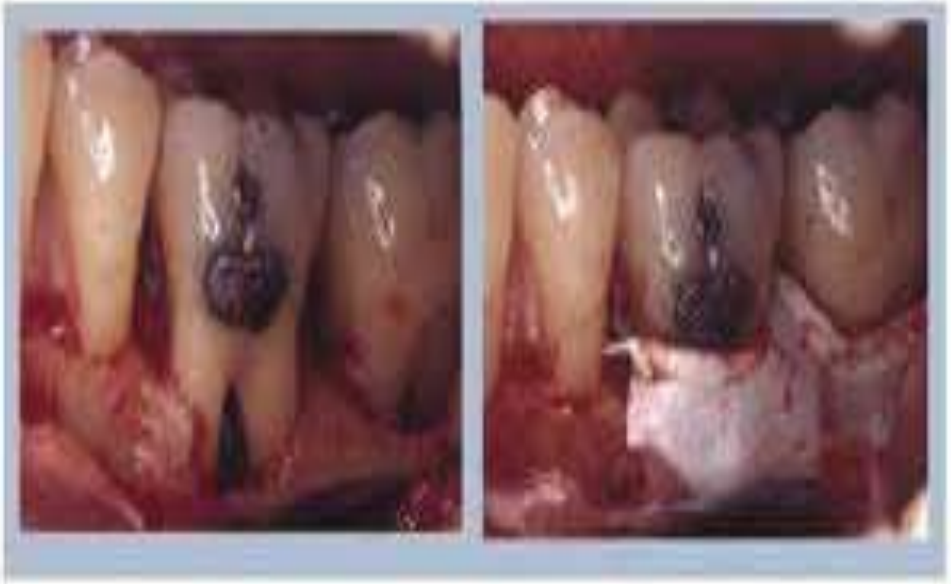


Fig. 6. GTR with expanded polytetrafluoroethylene (PTFEe) membrane.

NATURAL RESORBABLE MEMBRANE

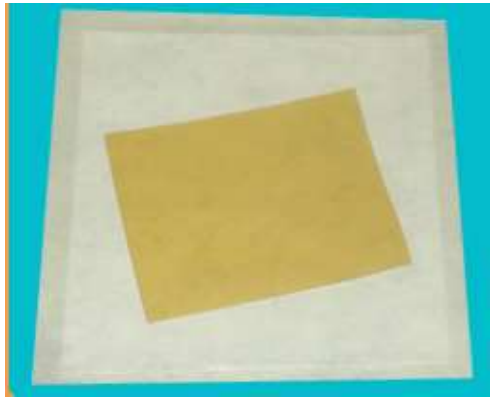
COLLAGEN

RATIONALE FOR USING COLLAGEN AS A BARRIER IS BASED ON THE FOLLOWING FACTS;

1. **Collagen is an extracellular macromolecule of the Periodontal connective tissue and is physiologically metabolized.**
2. **It is chemotactic for fibroblasts.**
3. **It is haemostatic.**
4. **Is a weak immunogen and a scaffold for migrating cells.**

COLLAGEN GTR MEMBRANES

PERIOCOL GTR



ALLODERM

Collagen barriers presently available are

TRADE NAME	SOURCE	CONTAINS
BIOMEND® BIOMEND EXTEND®	BOVINE TENDON	100% TYPE I COLLAGEN
PERIOGEN®	BOVINE DERMIS	TYPE I & III COLLAGEN + CHONDROITIN-4-SULPHATE
BIOGUIDE®	PORCINE DERMIS	TYPE 1 & III COLLAGEN
AVITENE® NEOMEM™	BOVINE CORIUM	TYPE I MONOLAYERED COLLAGEN
BIOSTITE®	CAT SKIN	COLLAGEN + HYDROXYAPATITE

FATE OF IMPLANTED COLLAGEN

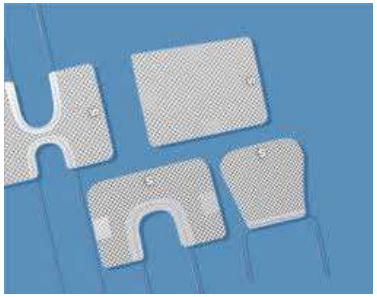
1. Enzymatically degraded by macrophages and PMN'S.

2. Resorption velocity can vary greatly, depending on collagen source and modifications.

3. Enzyme collagenase initiates membrane resorption at specific sites which is then degraded to amino acids by gelatinases and other enzymes.

4. A bovine collagen membrane usually gets resorbed in 4-8 weeks.

COMMERCIALLY AVAILABLE POLYMER BARRIERS



- **Tsung hung chen et al in 2013** the clinical evidence on the efficacy of guide tissue regeneration (GTR) with/without osseous grafting (OG) in treating periodontal furcation Class II defects. The GTR group obtained greater vertical/horizontal bone fill and vertical attachment level gain than the OFD group in maxillary molars. The GTR + OG group achieved better clinical outcomes than the GTR group did in all the comparing outcomes in mandibular molars.

- Roberto Pontoriero, et al in 2010

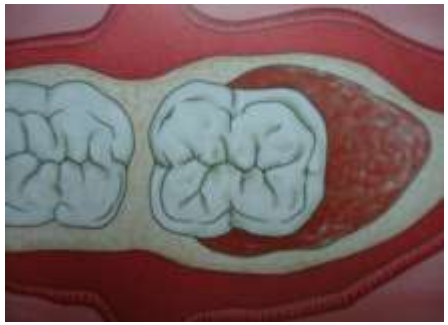
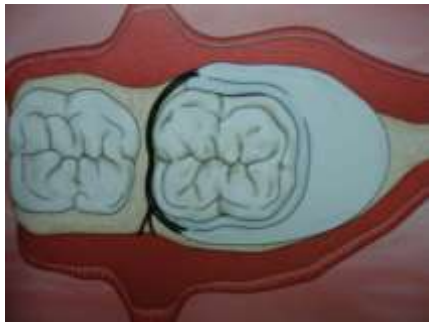
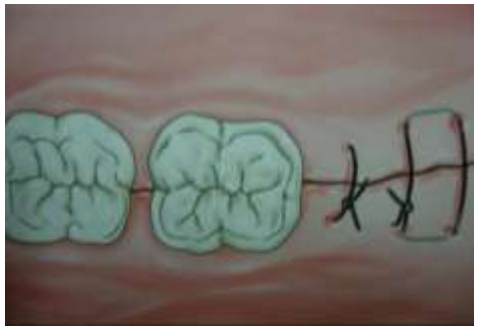
  The findings demonstrated that the treatment of degree II furcation defects at mandibular molars using the principles of guided tissue regeneration in 19 sites out of 21 resulted in the resolution of the furcation defect. Conventional therapy reached the same goal in less than 20% of the cases treated. At degree III furcation defects, complete resolution occurred in 4 out of 16 sites treated with guided tissue regeneration. Partial resolution occurred in 9 out of 16 sites, while at 3 sites, a degree III involvement persisted

- Richard T. Kao, et al 2015 Fifty-eight studies provided data on patient, tooth, and surgical-site considerations in the treatment of intrabony defects. Biologics (enamel matrix derivative and recombinant human platelet-derived growth factor-BB plus b-tricalcium phosphate) are generally comparable with demineralized freezedried bone allograft and GTR and superior to open flap debridement procedures in improving clinical parameters in the treatment of intrabony defects.

- Leonardo trombelli et al in giuded tissue regenration in gingival recession 10 yr follow up study showed marked difference in recession depth and clinical attachment levels .

- **Tsung hung chen A systematic review and meta-analysis of guided tissue regeneration/osseous grafting for the treatment of Class II furcation defects journal of dental science.**
- Trombelli guided tissue regeneration in gingival recession 10 yr follow up study journal of clinical periodontology 2005 :32

DISTAL MOLAR DEFECT

MEMBRANE ADAPTATION FOR PROXIMAL DEFECT



Guided bone regeneration

- GBR is a surgical procedure that uses barrier membranes with or without particulate bone grafts or/and bone substitutes.
- Osseous regeneration by GBR depends on the migration of pluripotential and osteogenic cells (e.g. osteoblasts derived from the periosteum and/or adjacent bone and/or bone marrow) to the bone defect site and exclusion of cells impeding bone formation(e.g. epithelial cells and fibroblasts)

Pioneer work on guided bone regeneration

- Murray et al (1957) treated bone femoral defects in dogs
- After an appropriate healing period it was noted defect was filled with bone consistent with the orginal cortex.
- They suggested that the soft tissue that grows at a faster rate than bone hinders bone formation in the healing area should be prevented to promote bone formation.

3 conditions were necessary for formation of new bone

- Presence of blood clot
- Preserved osteoblast
- Contact with living tissue

- To ensure successful GBR, four principles need to be met:
- exclusion of epithelium
- connective tissue
- space maintenance,
- stability of the fibrin clot
- primary wound closure

- Guided bone regeneration is used to enhance bone growth of the alveolus for implant placement and around peri-implant defects
- Studies by Dahlin showed that if a barrier membrane was placed in direct contact with the surrounding bone surface and a space was created, only cells from the neighboring bone or bone marrow can migrate into this bone defect, without in-growth of competing soft tissue cells from the overlying mucosa

- The principle of selective cell repopulation has been useful in preparing the implant placement site.

- -Using a barrier membrane at an extraction site
- -deficient alveolar ridge

- BONE AUGMENTATION
- membrane materials used in experimental and clinical studies to achieve GBR
- polytetrafluoroethylene (PTFE),
- expanded PTFE (ePTFE),
- collagen,
- freeze-dried dura mater allografts,
- polyglactin 910,
- polylactic acid,
- polyglycolic acid

- The barrier concept to selectively permit osteoprogenitor cells to colonize the site so that an increased volume of bone may be formed.
- The deficient alveolar site is surgically exposed,degranulated, and the cortical plates are perforated.
- Graft materials are used as volumetric scaffolds and a membrane is used to seal the area.
- Titanium-reinforced ePTFE has helped maintain the space targeted for regeneration

- Local alveolar ridge deficiencies
- Osseous fill around immediate implants
- Dehiscence and fenestration associated with implants.
- Bone defect associated with failing implants
- Residual bone lesions

- There are two approaches of GBR in implant therapy: GBR at implant placement (simultaneous approach) and GBR before implant placement to increase the alveolar ridge or improve ridge morphology

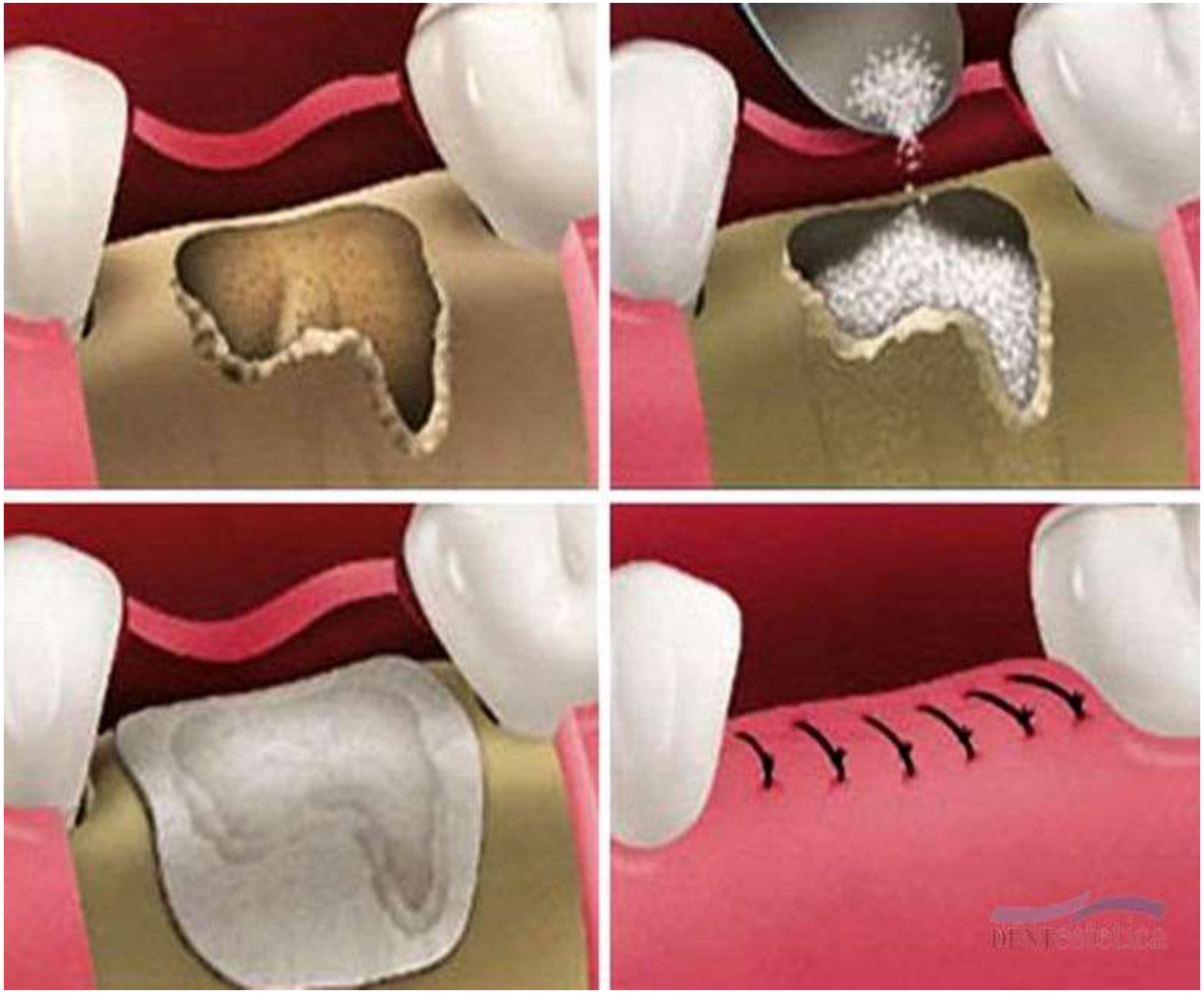
The PASS principle should be observed for bone and soft tissue regeneration:

(1) Primary closure of the wound,

(2) Angiogenesis,

(3) Space creation and maintenance,

(4) Stability of the wound.



References

- Carranza's clinical periodontology tenth edition
- CARLOSR . QUINONE&S RAULG . CAFFESSE Current status of guided periodontal tissue regeneration *Periodontology 2000, Vol. 9, 1995, 5568*
- GARYG REENSTEI&N J ACK G. CATON Biodegradable barriers and guided tissue regeneration *Periodontology 2000, Vol. 1. 1993,3645.*
- Igor Tsesis Eyal Rosen, Aviad Tamse, Silvio Taschieri,Massimo Del Fabbro,Effect of Guided Tissue Regeneration on the Outcome of Surgical Endodontic Treatment: A Systematic Review and Meta-analysis Guided Tissue Regeneration and Outcome of Surgical Endodontic Treatment.
- Tsung hung chen A systematic review and meta-analysis of guided tissue regeneration/osseous grafting for the treatment of Class II furcation defects journal of dental science..
- Trombelli guided tissue regeneration in gingival recession 10 yr follow up study journal of clinical periodontology 2005 :32