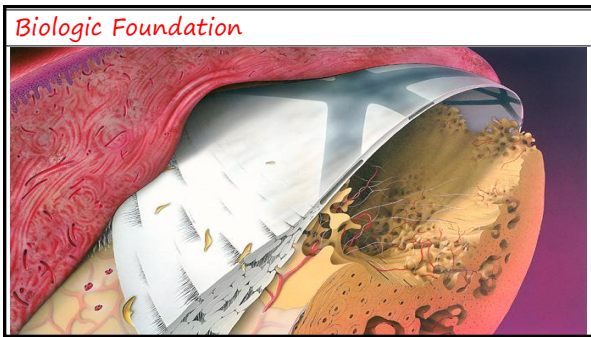
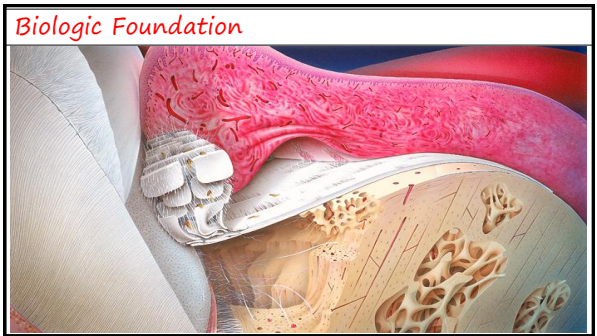
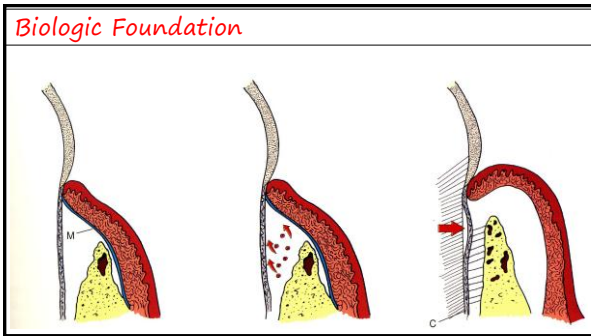


Biologic Foundation

Compartmentalization *(Melcher AH, 1976)*

Cell type	Effect
Gingival epithelium	Long junctional epithelium
Gingival connective tissue	Connective tissue attachment Root resorption
PDL cells (mesenchymal cells)	Cementum & PDL fibers
Alveolar bone	Ankylosis



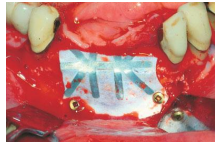
Membranes

Non-resorbable membranes

Bio-resorbable membranes

Membranes... Requirements

- Biocompatibility
- Cell exclusion
- Space maintenance
- Tissue integration
- Ease of use & handling
- Biological activity



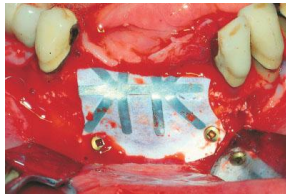
Membranes... Non-Resorbable

Expanded polytetrafluoroethylene (ePTFE)

- Miscellaneous membranes
 - Millipore membrane
 - Rubber dam

Membranes... Non-Resorbable

- Preservation of keratinized gingiva
- Thick overlying surgical flap



Membranes... Non-Resorbable

Healing is allowed for 4-6 weeks after membrane placement (longer periods are better; 12-16 weeks)

- No probing for 3-6 months after membrane removal
- Radiographic evidence of bone formation 6-12 months

PERFECT ORAL HYGIENE / TISSUE PERFORATION
 Infection → Membrane removal

Membranes... Non-Resorbable



Membranes... Bio-Resorbable

Polyglycoside synthetic membranes
 (Polylactacid, polylactate/polygalactide copolymers)

Collagen
 Type I or Types I + III (Porcine or Bovine)

Calcium sulfate

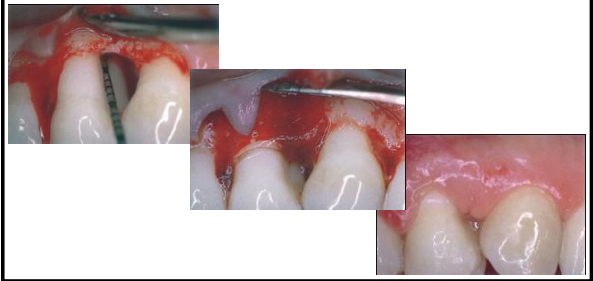
Membranes... Bio-Resorbable

They are easier to manage

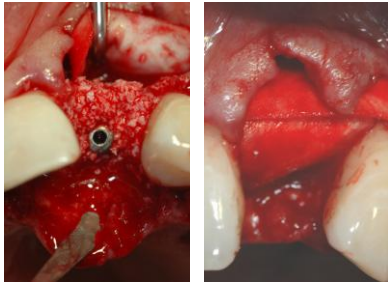
- More tissue compatible than non-resorbable membranes
- Timing for resorption can be regulated
- Second surgery for membrane removal is not required

Lack of rigidity

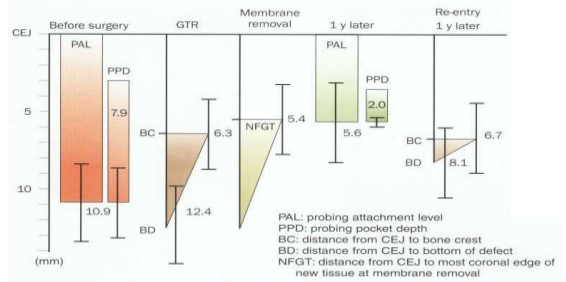
Membranes... Bio-Resorbable



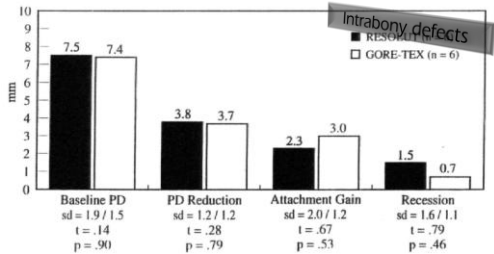
Membranes... Bio-Resorbable



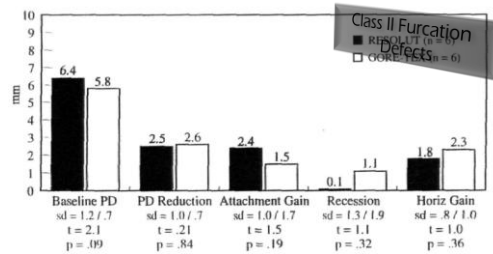
Membranes... Results



GTR... Results



GTR... Results



Membranes... Non-Resorbable vs. Bio-Resorbable

Membrane category	Advantages	Disadvantages	Commercial examples
Nonresorbable	<ul style="list-style-type: none"> Numerous studies demonstrate their success May be titanium reinforced Remain intact until removal Easily attached with titanium or resorbable tacks Greater bone fill if membrane not exposed Minimal tissue response if membrane not exposed 	<ul style="list-style-type: none"> Require a second surgery for removal Increase patient morbidity If exposed, must be removed Can be technique sensitive 	<ul style="list-style-type: none"> ePTFE membranes, e.g., Gore-Tex (Gore Medical, Flagstaff, Ariz.) Titanium-reinforced Gore-Tex
Resorbable	<ul style="list-style-type: none"> Numerous studies demonstrate their success Does not require surgical removal Decreased patient morbidity Improved soft-tissue healing Tissue-friendly reaction to membrane exposure Cost effective; one surgery only Does not have to be removed if exposed 	<ul style="list-style-type: none"> Uncertain duration of barrier membrane function Difficult to tack down Slightly less bone fill than nonresorbable membranes Inflammatory response from tissues may interfere with healing and GBR Can be technique sensitive 	<ul style="list-style-type: none"> Neomem (bovine collagen matrix; Citagene Inc., Laval, Que.) Bio-Gide (porcine collagen matrix; Geistlich AG, Wolhusen, Switzerland) Oxsis (cross-linked collagen barrier; Implant Innovations Inc., Palm Beach Gardens, Fla.) <p><i>Hirakis, 2006</i></p>

GTR... Membranes +/- Bone Grafts

	PD Reduction	CAL Gain	REC Change
6 Months			
GTR with DFDBA (Test) (N = 16)	3.64 (1.23) P = 0.41	2.72 (0.84) P = 0.32	-0.85 (0.98) P = 0.92
GTR alone (Control) (N = 14)	4.00 (1.12)	3.11 (1.19)	-0.88 (0.89)
12 Months			
GTR with DFDBA (N = 15)	3.37 (1.16) P = 0.06	2.29 (0.61) *P = 0.008	-1.08 (1.07) P = 0.54
GTR alone (N = 14)	4.12 (0.84)	3.27 (1.10)	-0.85 (0.91)

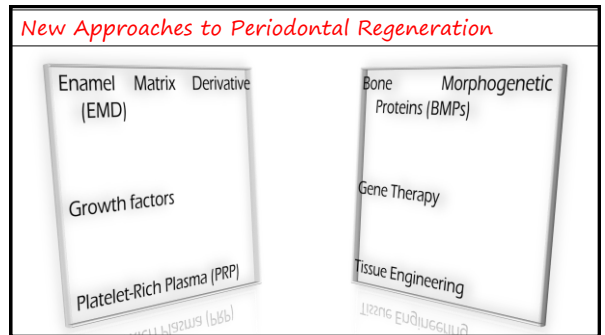
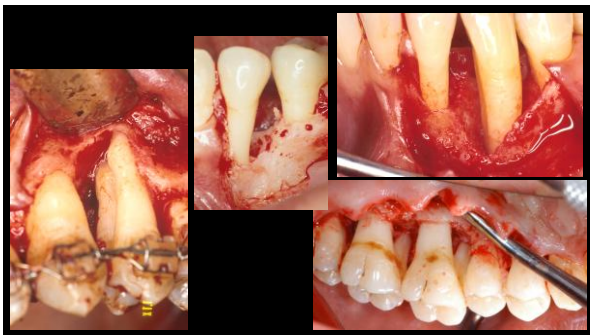
Trejo et al, 2000

GTR... Membranes +/- Bone Grafts

	Resorption	Bone Fill	Defect Resolution	Percent Defect Fill
GTR with DFDBA (N = 15)	-1.10 (1.22) P = 0.223	3.72 (2.03) P = 0.262	4.73 (1.18) P = 0.455	65.5
GTR alone (N = 13)	-0.61 (0.77)	4.85 (3.14)	5.35 (2.91)	58.4

Trejo et al, 2000

**New Approaches
to
Periodontal Regeneration**



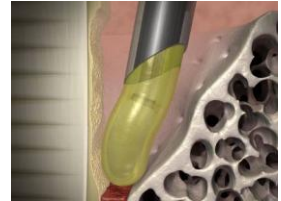
... Enamel Matrix Derivative

- Induction of cementogenesis
- Hertwig's Epithelial Root Sheath
- Porcine origin
- Amelogenins + Ameloblastin + Enamelin + PGA
- Precipitates to the root surface



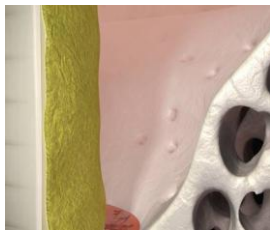
... Enamel Matrix Derivative

- Root conditioning with PrefGel®
- Application of Emdogain®



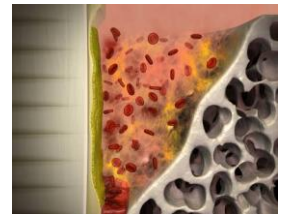
... Enamel Matrix Derivative

- Precipitation of amelogenins on root surface (matrix formation)



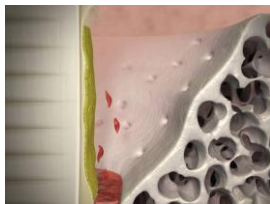
... Enamel Matrix Derivative

- Clot formation
- Granulation tissue



... Enamel Matrix Derivative

- Migration & adhesion of mesenchymal stem cells (MSCs)
- Proliferation of MSCs



... Enamel Matrix Derivative

- Cytokine production
- Proliferation & differentiation of MSCs



... Enamel Matrix Derivative

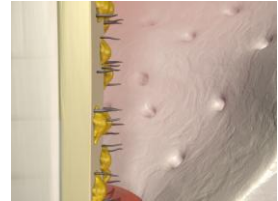
Differentiation into cementoblasts

Deposition of cementum



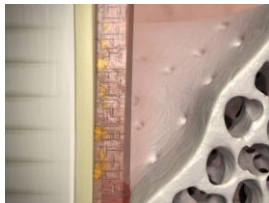
... Enamel Matrix Derivative

Insertion of periodontal ligament fibers into newly-formed cementum



... Enamel Matrix Derivative

Filling of defect with newly-formed periodontal tissues



... Enamel Matrix Derivative

Parallel formation of alveolar bone in the defect



... Enamel Matrix Derivative

Periodontal regeneration with a new functional attachment



... Enamel Matrix Derivative

Regeneration of cementum

Bone formation

PDL formation

No recession

No junctional epithelium

... Enamel Matrix Derivative

Table 5. baseline defect characteristics expressed in mm (mean ± SD)

Treatment	PPD	GR	CAL	CEJ-BDD	CEJ-crest	Intrabony depth
EMD	8.2 ± 1.1	1.7 ± 1.3	9.9 ± 1.4	11.0 ± 1.9	7.1 ± 1.2	3.9 ± 1.5
GTR	8.3 ± 1.3	1.6 ± 1.4	9.9 ± 1.7	10.8 ± 1.8	7.0 ± 1.3	3.8 ± 1.7
EMD+GTR	8.4 ± 1.0	1.4 ± 0.8	9.8 ± 1.2	10.9 ± 1.8	7.2 ± 1.3	3.7 ± 1.5
OFD	8.2 ± 1.1	1.5 ± 0.7	9.7 ± 0.8	10.7 ± 1.9	6.9 ± 1.8	3.8 ± 1.2

Table 6. Changes of clinical parameters at 1 and 5 years compared to baseline (mean ± SD)

Parameter	OFD	EMD	GTR	EMD+GTR
ΔPPD (mm) 1 year	3.3 ± 1.1	4.6 ± 1.2	4.4 ± 1.4	4.4 ± 0.8
ΔPPD (mm) 5 years	2.7 ± 1.2	4.3 ± 1.7	3.9 ± 1.6	4.0 ± 1.0
ΔGR (mm) 1 year	1.7 ± 0.5	1.3 ± 0.6	1.3 ± 1.0	1.5 ± 0.7
ΔGR (mm) 5 years	1.7 ± 0.5	1.3 ± 0.7	1.2 ± 1.0	1.5 ± 0.7
ΔCAL (mm) 1 year	1.6 ± 1.0	3.4 ± 1.1	3.2 ± 0.8	3.0 ± 1.0
ΔCAL (mm) 5 years	1.3 ± 1.2	2.9 ± 1.6	2.7 ± 0.9	2.6 ± 0.7

Sculean et al, 2004

... Growth Factors

	Platelet-derived growth factor	Fibroblast growth factor-2	Bone morphogenetic proteins	Enamel matrix derivative	Transforming growth factor-beta	Insulin-like growth factor-1, 2
Periodontal ligament cells						
Cell proliferation	++	+++	++	++	-	+
Chemotaxis	++	+++	+	++	0	++
Collagen synthesis	+	-	+	+	+	+
Protein synthesis	+	+	+	+	+	+
Matrix gene expression	++	++/-	?	+	+	+

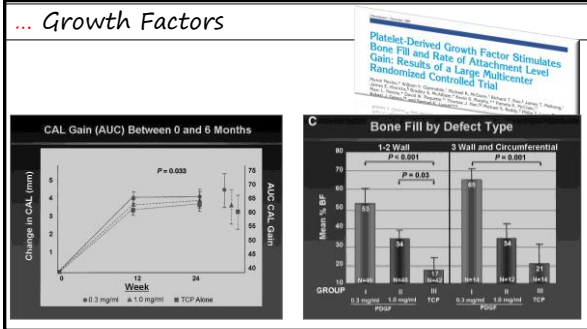
... Growth Factors

	Platelet-derived growth factor	Fibroblast growth factor-2	Bone morphogenetic proteins	Enamel matrix derivative	Transforming growth factor-beta	Insulin-like growth factor-1, 2
Cementoblasts						
Cell proliferation	+++	?	-	++	++	++
Chemotaxis	++	?	?	?	?	?
Collagen synthesis	+	?	++	++	+	+
Protein synthesis	+	?	++	++	+	+
Matrix gene expression	+/-	?	++	++/-	+/-	+/-

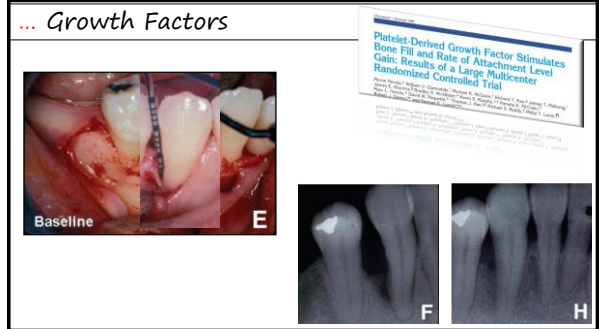
... Growth Factors

	Platelet-derived growth factor	Fibroblast growth factor-2	Bone morphogenetic proteins	Enamel matrix derivative	Transforming growth factor-beta	Insulin-like growth factor-1, 2
Osteoblasts						
Cell proliferation	++	+++	0	++	+++	++
Chemotaxis	+++	+++	+	++	+++	+
Collagen synthesis	0	+	0	+	++	+
Protein synthesis	0	+	ND	+	+/-	0
Matrix gene expression	+/-	++/-	++	++/-	++	++
Alkaline phosphatase synthesis	0	-	++	++	+/-	0

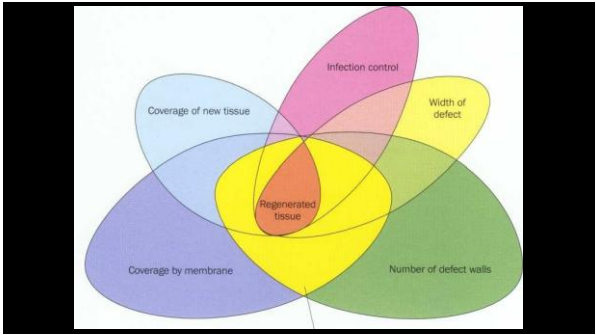
... Growth Factors



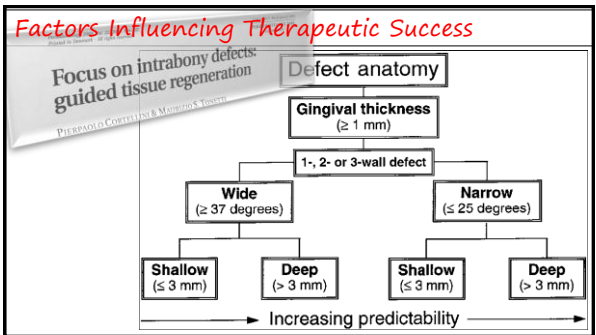
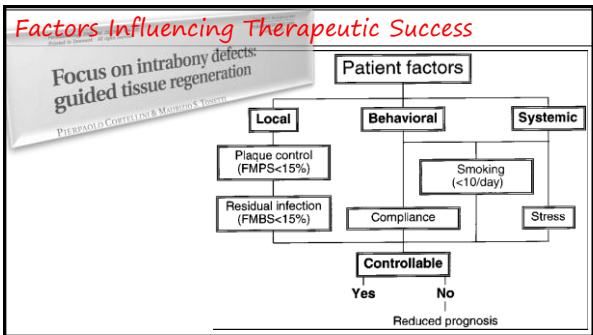
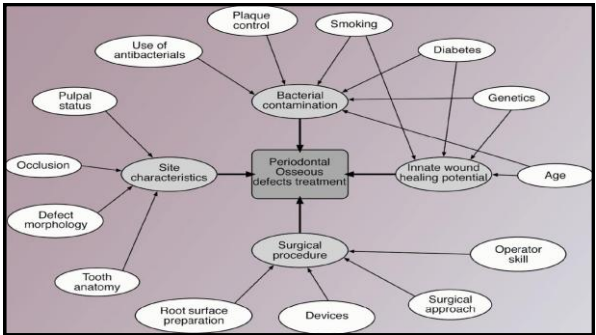
... Growth Factors



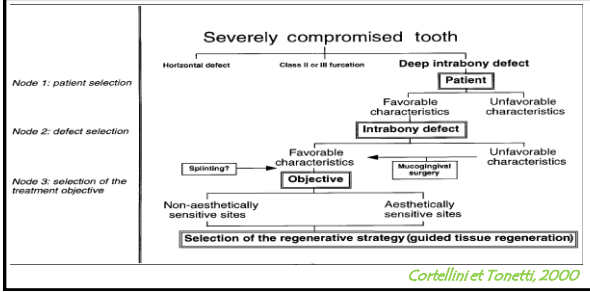
Factors Affecting GTR



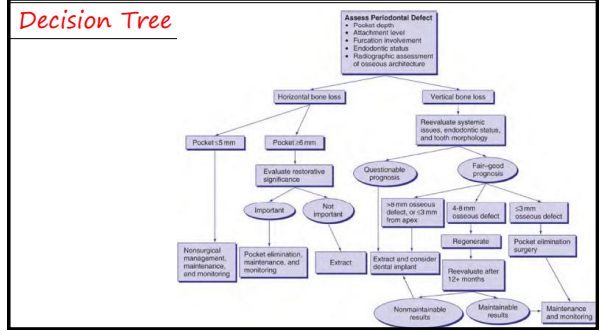
← GTR		
Vertical	Morphology of osseous defect	Horizontal
Class II	Furcation involvement	Class III
Less	Gingival recession	More
Wide	Width of keratinized gingiva	Narrow
Thick	Gingival thickness	Thin
Wide	Interdental space	Narrow
None	Tooth mobility	Remarkable
Good	Oral hygiene	Poor



Selection... Patient, Defect, Objective



Decision Tree



Thank You...