GBR membranes

IMPLANTOLOGY YEAR COURSE
Module 3

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Membranes

Non resorbable

Resorbable

Membranes

Requirements:

- Occlude cells
- Biocompatable
- Good handling properties
- Low complication rate
- Tissue integration

Membranes - cell occlusion

Cell occlusion:

Exclude connective tissue cell invasion but still allow nutrient transfer.

Studies have shown that macroporous membranes have lower complication rate than totally occlusive barrier membranes

Membranes - biocompatability

In general:

Inert materials less of an issue than degradable materials

Membranes - biocompatability

Degradable materials:

The material, the intermediate breakdown products and the final breakdown products all need to be taken into account

Membranes - tissue integration

Tissue integration:

Non-porous, non textured materials result in fibrous tissue capsulation - no tissue attachment

Materials which integrate with tissues allow the tissues to improve mechanical stability of membrane

Non-resorbable membranes

Non-resorbable membranes ePTFA

PTFE - polytetrafluoroethene (Teflon)

PTFE (Teflon) – Roy Plunckett 1938

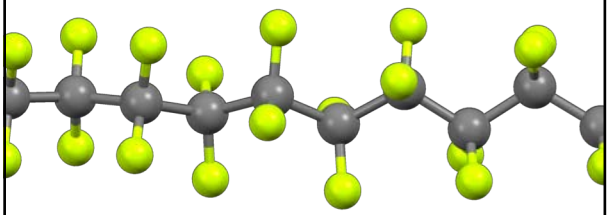
1938 – working on refrigeration gases (CFCs)

PTFE (Teflon) – Roy Plunckett 1938

1938 – working for DuPont

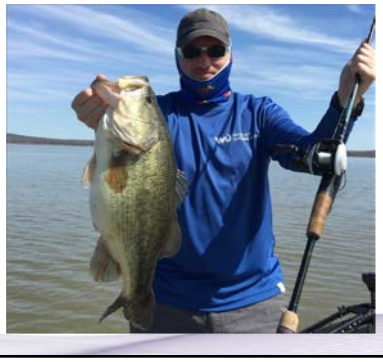
PTFE (Teflon) – Roy Plunckett 1938

1938 – working on refrigeration gases (tetraflouroethylene)



PTFE (Teflon) – Manhattan Project

PTFE (Teflon) – Fishing Tackle



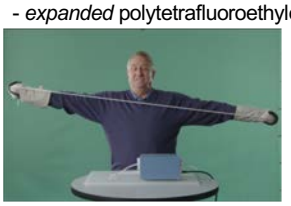
Non-resorbable membranes ePTFA

Tefal

- Extremely strong bonds C-F
- No known enzyme can cleave C-F bond
- Allows material to be biologically inert

Non-resorbable membranes ePTFA

ePTFE - *expanded* polytetrafluoroethylene

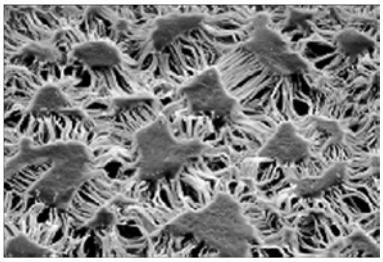


- William Gore - chemist
- Until 1957 worked for DuPont!
- Started a company in his basement in 1958, making PTFE insulated computer cabling.

Non-resorbable membranes - ePTFA

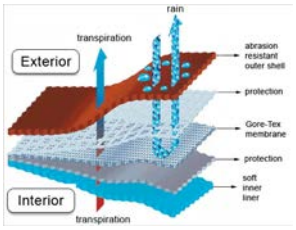
I decided to give one of these rods a huge stretch, fast, a jerk... and it stretched 1000%

Non-resorbable membranes - ePTFA



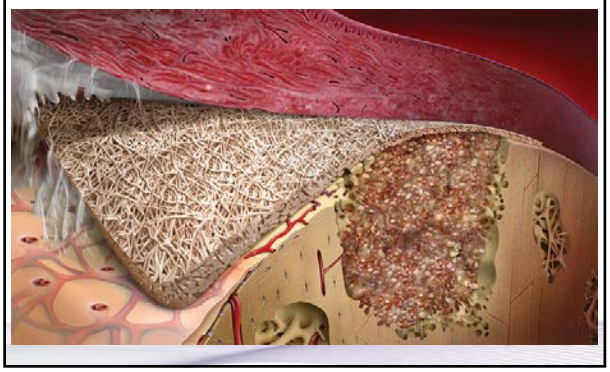
Non-resorbable membranes ePTFA

ePTFE - *expanded* polytetrafluoroethylene (Gore-Tex)



Allows passage of gases & vapour but not liquids

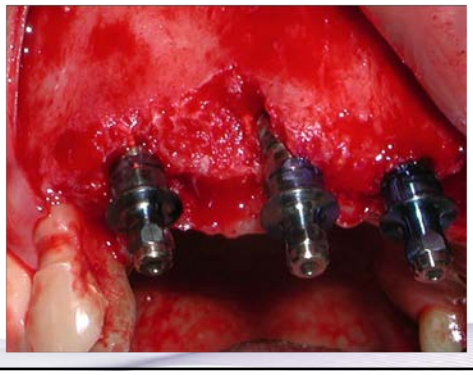
Non-resorbable membranes ePTFA (GoreTex)



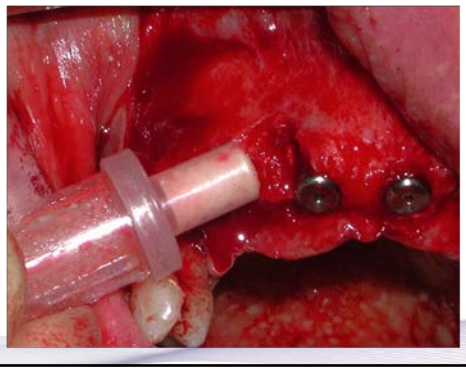
Non-resorbable membranes ePTFA (Gore)

- Used in perio & oral surgery 1980s - early 1990s
- Wound dehiscences common
- Infections common
- Hydrophobic - difficult to handle
- Needed pins & tacks
- No tissue integration
- Second surgery to remove

Non-resorbable membranes ePTFA (Gore)



Non-resorbable membranes ePTFA (Gore)



Non-resorbable membranes ePTFA (Gore)

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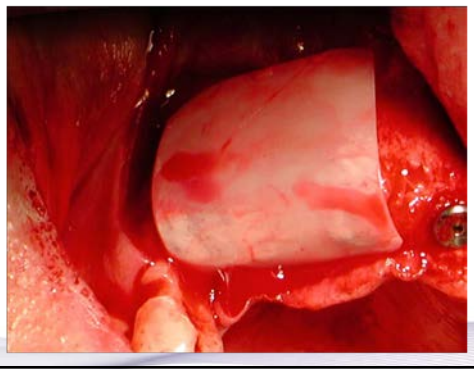

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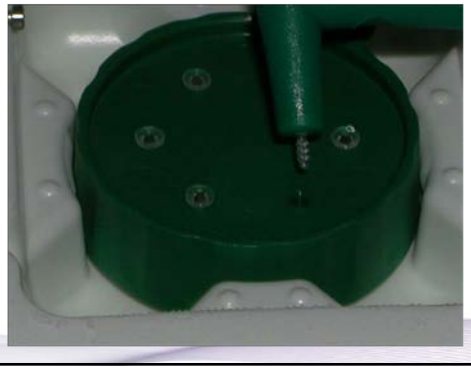

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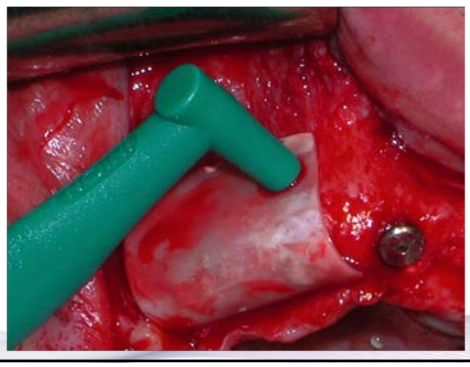

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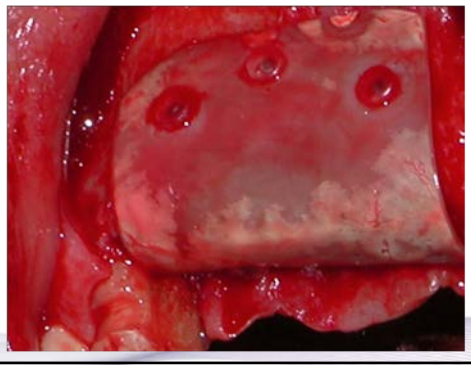

Resorbable membranes

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Resorbable membranes

Synthetic

+

Organic

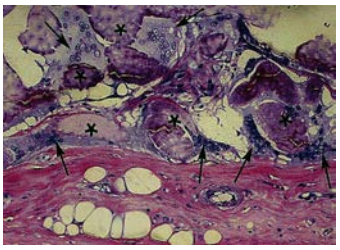
Resorbable membranes - synthetic

Polymers - PGA (polyglycolides)/PLA (polyactides)

- Synthetic - unlimited availability
- Fully degrade (Krebs cycle) to water & CO2
- Associated with foreign body reactions
- Associated with inflammatory respones

Resorbable membranes - synthetic

Polymers - PGA (polyglycolides)/PLA (polyactides)



Large multinucleated giant cells (arrowed)

Resorbable membranes - organic

Collagen - non cross linked/cross linked

- Type I or Type I & III
- Porcine dermis, equine, bovine dermis/tendon
- Bioresorbable
- Haemostatic
- Hydrophilic - handling properties
- Enzymic degradation by macrophages/PML

Resorbable membranes - organic

Collagen - Geistlich Bio-Gide

Resorbable membranes - organic

Collagen - Creos

Resorbable membranes - organic

Collagen

- Complete degradation 6 - 16 weeks
- Good nutrient permeability
- Low incidence of dehiscences/infections
- Resorbs quickly if exposed (soft tissues heal fast)
- Bilayer design

Resorbable membranes - organic

Collagen - double layer technique

For increased support in larger defects

Resorbable membranes - organic

Collagen - can be secured with resorbable tacks

For increased support in larger defects

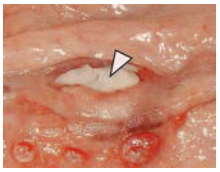
Resorbable membranes - organic

Collagen - cross-linked

- Prolongs barrier function times (>12 weeks)
- Prolongs degradation
- Decreases nutrient permeability
- Increased incidence soft tissue dehiscences
- Associated with infections and severe inflammatory responses

Resorbable membranes - organic

Collagen - cross-linked showing dehiscence (canine)



- Resists bacterial enzymtic degradation
- Becomes infilltrated with bacteria and colonised

Conclusion – collagen membranes

Advised collagen membranes:

- Non cross-linked collagen material of choice
- Good handling characteristics
- Hydrophilic
- Stick to bone well (often no need to tack)
- Low risk of post operative complications
- Eliminates need for second surgery
- Can use double layer technique

New Developments

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Resorbable membranes - organic

PRF - Platelet Rich Fibrin

Resorbable membranes - organic

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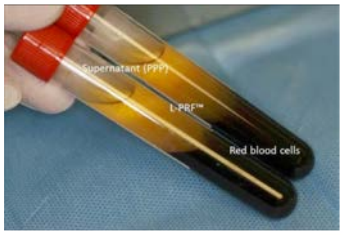
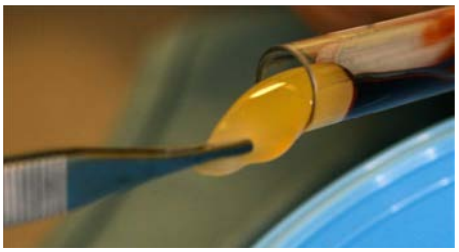
Resorbable membranes - organic

PRF - Platelet Rich Fibrin



Resorbable membranes - organic

PRF - Platelet Rich Fibrin



Resorbable membranes - organic

PRF - Platelet Rich Fibrin

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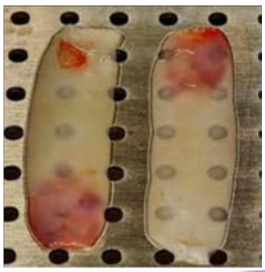
Resorbable membranes - organic

PRF - Platelet Rich Fibrin



PRF - Platelet Rich Fibrin

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THE END