



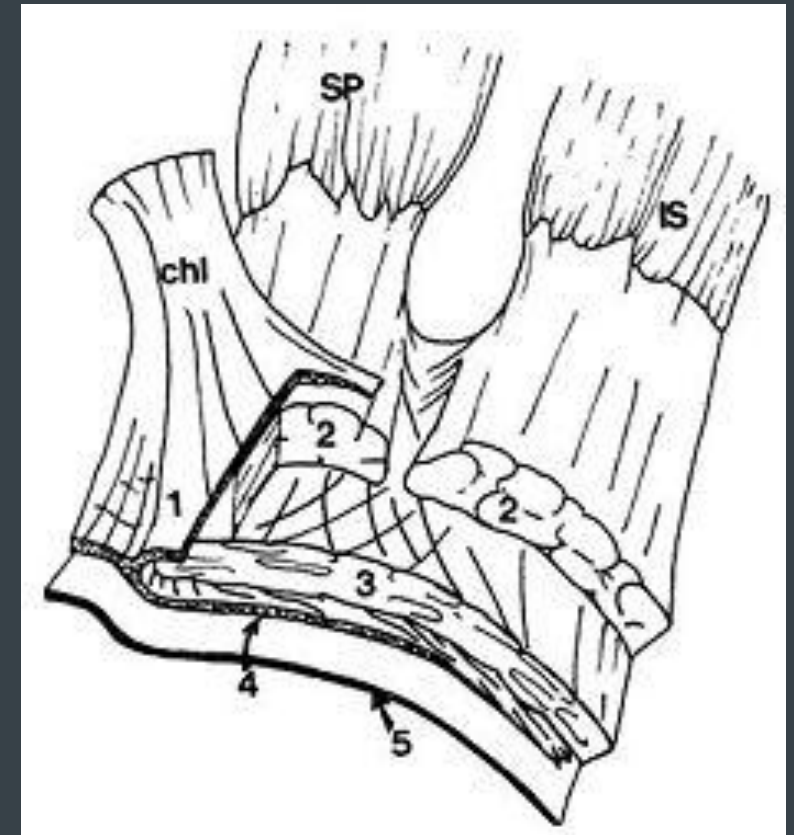
Tendon injury in the shoulder: the rotator cuff

Raymond Y L Liow

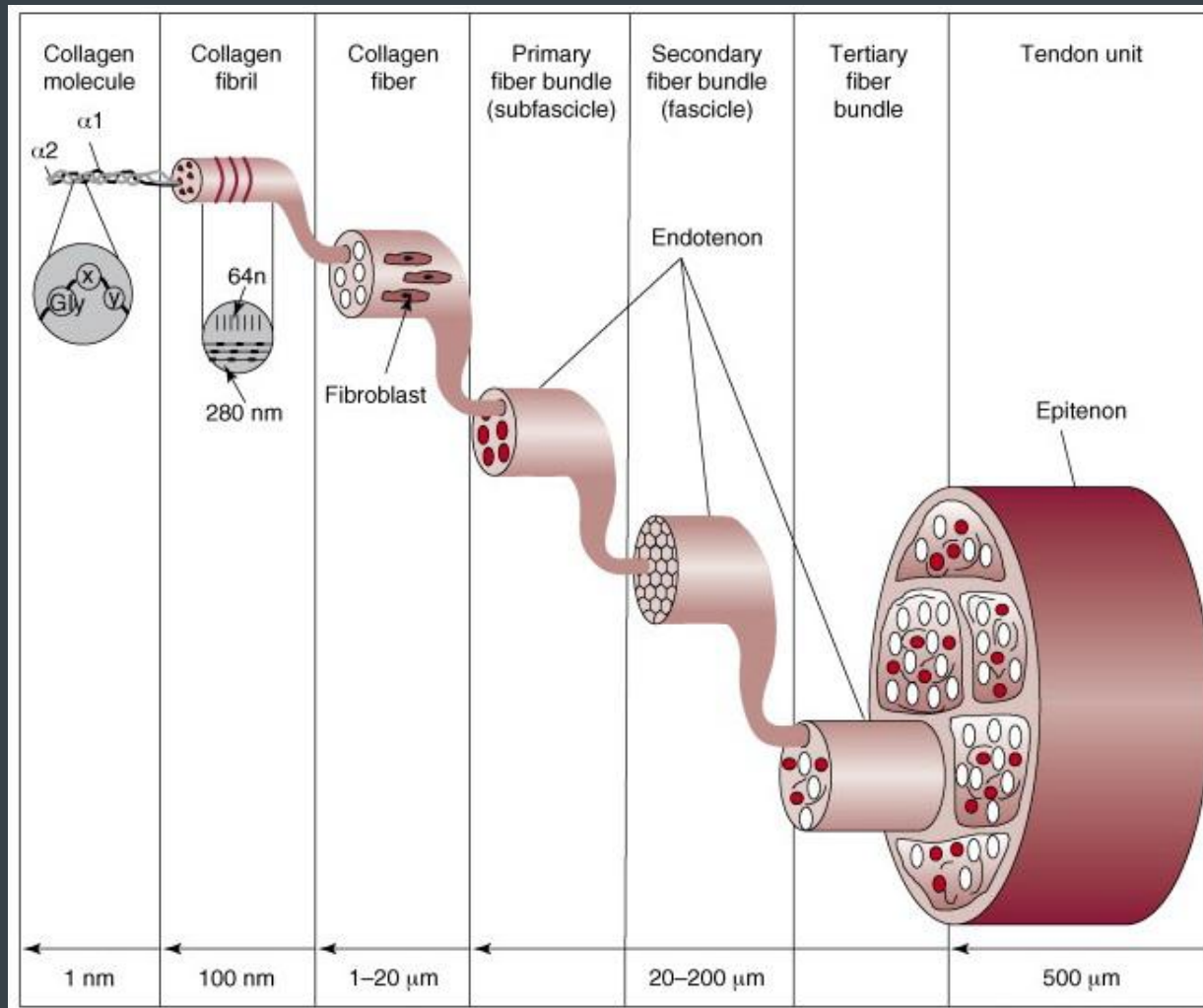
North Tees & Hartlepool NHS Trust

Rotator cuff tendon

- Layer 1
 - CH ligament, superficial fibres
- Layer 2
 - main cuff, parallel fibres
- Layer 3
 - thick cuff, smaller bundles, non-uniformed orientation
- Layer 4
 - RC cable, perpendicular-oriented fibres for force distribution; deep part CH ligament
- Layer 5
 - capsule, random fibre orientation

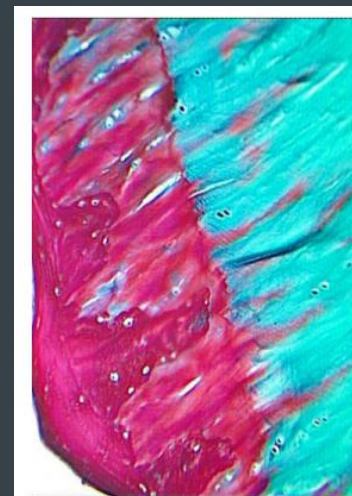
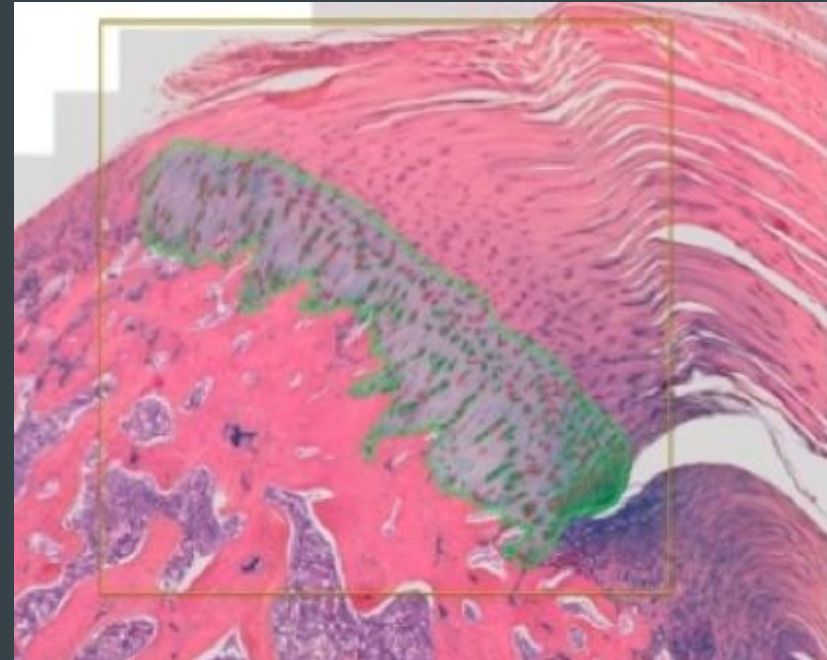


Tendon structure



Rotator cuff insertion

- Enthesis
- 4 distinct zones
 - Tendon
 - Non mineralised fibrocartilage
 - Mineralised fibrocartilage
 - Bone
- Sharpey's fibres
 - Bundles of collagen III
 - Extends from bone into the fibrocartilagenous zone
 - “Anchor” points





Tendon homeostasis

- Maintenance of robust tendon
- Balance between attrition and synthesis of collagen
- Collagen synthesis by tenocyte
- Remodelling of collagen fibres my EC matrix



Tendon homeostasis

- Interplay of cells, matrix components, enzymes, GF, cytokines, proteins
- Age-related changes
- Disease e.g. diabetes
- RC tendinopathy, impingement and Calcific tendinopathy
- RC tears
- A systematic review of histological and molecular changes in RC disease. Dean, Franklin & Carr, BJR 2012,1:158-66
- Pathology of torn rotator cuff tendon. Matthews et al, JBJS (Br) 2006, 88B:489-95



Rotator cuff tears

- Tears – lead to reparative response
- Proliferation blood vessels and fibroblasts – granulation tissue
- Fibroblasts – mitotic activity – secrete ECM, Collagen III & I, GAG.
- Maturation to form scar tissue

- Large tears – reduced fibroblastic activity
- Small tears – synovial proliferation, indicative of better healing response
- Simultaneous resolution, regeneration & repair – features of chronic inflammation



Tendon healing

- 3 stages
- Stage 1 Inflammation <48hours
 - Inflammatory response
 - Neutrophils, platelets – fibrin clot
- Stage 2 Proliferation >48 hours
 - Macrophage – proteinase & collagen III formation
 - Fibrovascular scar
- Stage 3 Remodelling 4-8 weeks
 - Disorganised collagen remodelled
 - Replacement of collagen III with collagen I
 - Still weaker, prone to re rupture

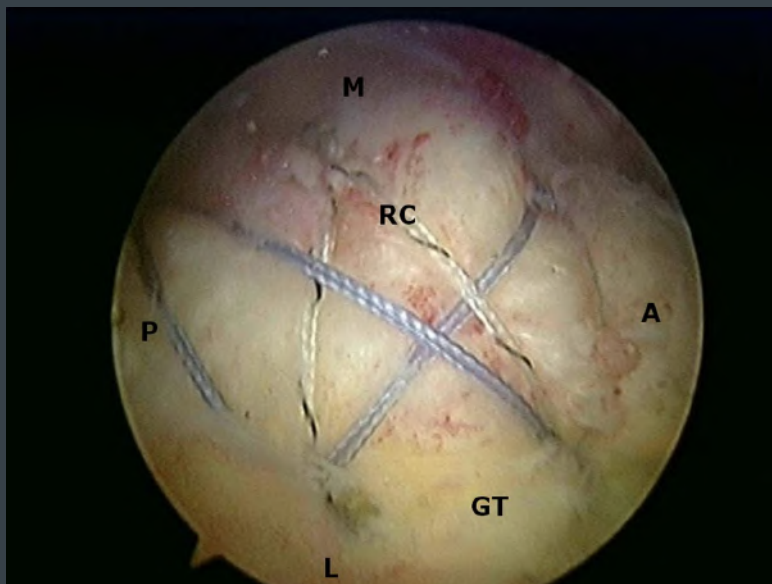
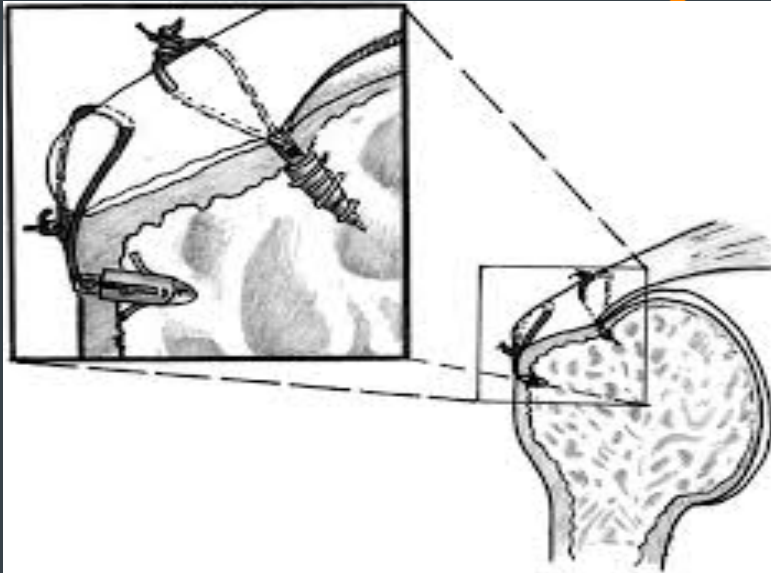


Rotator cuff repairs

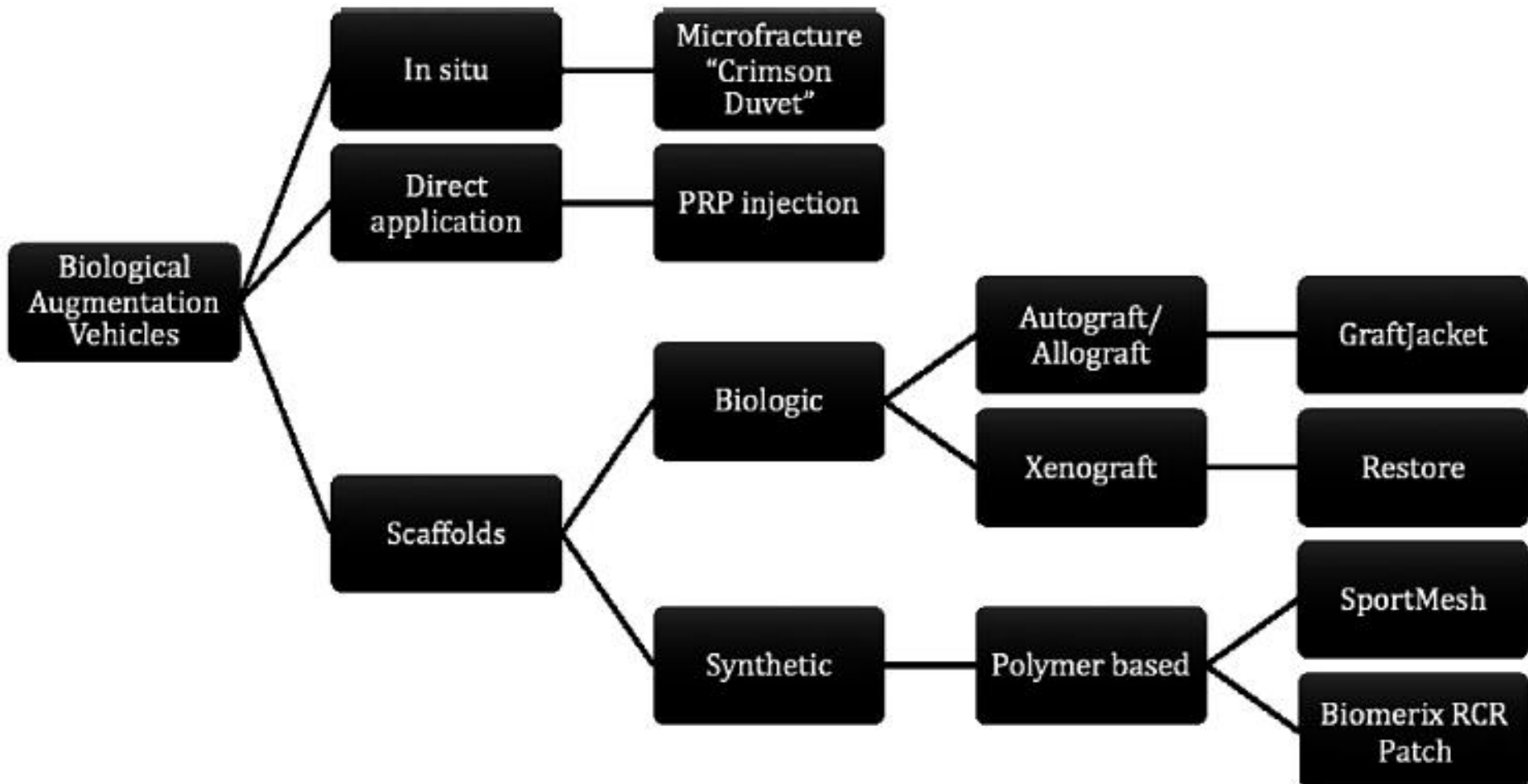
- Aim of RC repair is to facilitate tendon healing
- Optimise mechanical and biological environment
- Achieve 4 zone enthesis organisation

- High initial fixation strength
- Tension free
- No gaps
- Maintain mechanical stability
- Biologic healing ensues

Rotator cuff repairs



Biological augmentation





Microfracture

- Snyder & Burns: microfracture – “crimson duvet”
- Multichanneling/venting
- Bone marrow material escape to tendon repair bed
- Contains BMP and stem cells
- Some Level 1 evidence of improved healing in RC repairs



Platelet rich plasma

- Platelet rich fibrin matrix
- No real benefit ? Matrix inhibits healing
- No improved healing in RCT's and meta analysis



Tissue scaffolds

- Scaffolds – for large massive tears,
- Has role in augmentation RC repair, onlay
- Poor for gap-bridging



Future

- Mesenchymal pluripotent stem cells
- Gene therapy – introducing fibroblast with matrix secreting genes (via viral vector)