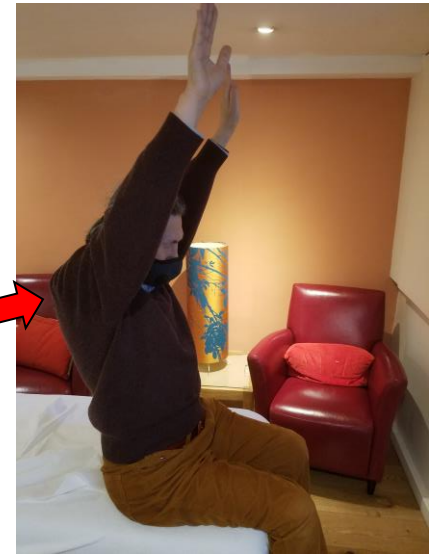


Managing Frozen Shoulder

Prof. Eyal Lederman DO PhD

Clinical example



Patient 66 yrs.
FS for 3 month, presenting with loss of all ROMs + pain
After 8 weeks (8 sessions x1/week)

 Affected side

Working definition

**Loss of active and passive ROM of
the shoulder**

(In the absence of any other underlying pathology)

Cause?

Primary:

Unknown

Secondary:

Intrinsic:

all other shoulder conditions

Extrinsic:

Ipsilateral breast surgery, cervical radiculopathy, chest wall tumor, cerebrovascular accident, Parkinsons's, humeral shaft fracture, scapulothoracic abnormalities, acromioclavicular arthritis, or clavicle fracture.

Systemic:

diabetes mellitus, Dupuytren's , hyperthyroidism, hypothyroidism, hypoadrenalism

Interesting bits

Prevalence 2-5% in general pop

Mean duration from onset: 15 months (range 3–36)

Mean age at onset = 53.4 years (range 40-60)

F X1.5>M

20% report bilateral symptoms

No recurrences

In long-term 59% had normal or near normal shoulders

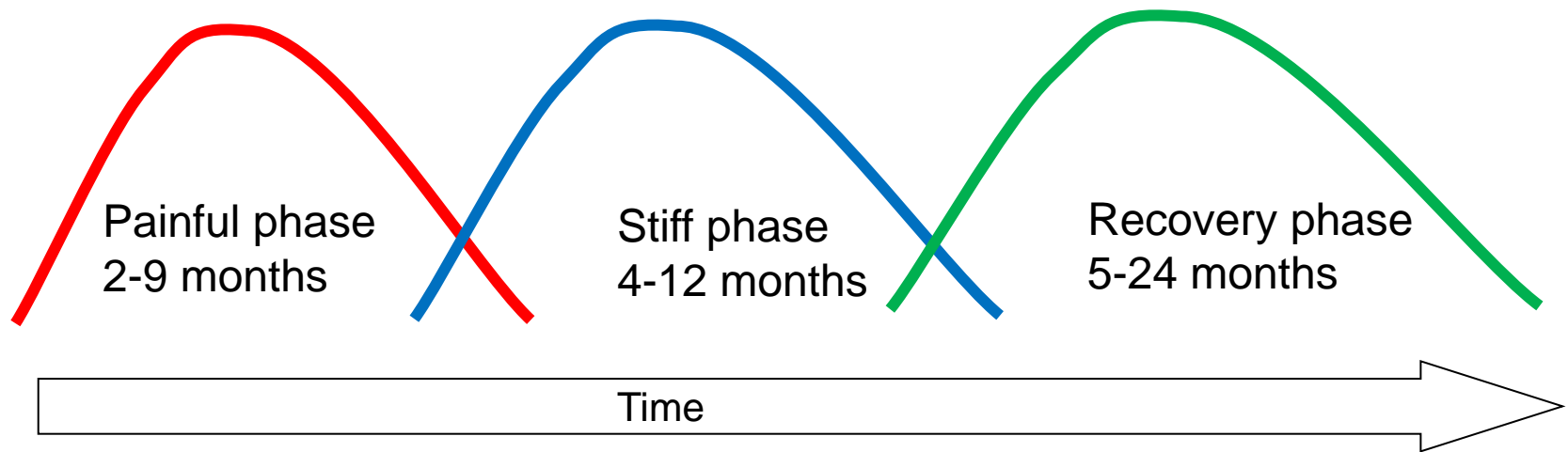
41% reported some ongoing symptoms (mild in 94%)

Mild pain being most common

6% had long-term severe pain and functional loss.

Some patient may have long-term ROM loss but few have functional loss

Timeline of condition?



Evidence demonstrates that most ROM improvement occurred early, with prolonged limitations that can last for multiple years

Avoid the confusing and potentially harmful repetition of the natural history of the disease as a three-phase, self-limiting condition.

DOI: <https://doi.org/10.1302/2058-5241.5.190032>

C.K. Wong, W.N et al 2017 Natural history of frozen shoulder: fact or fiction? A systematic review, *Physiotherapy*, 103:1:40-47,

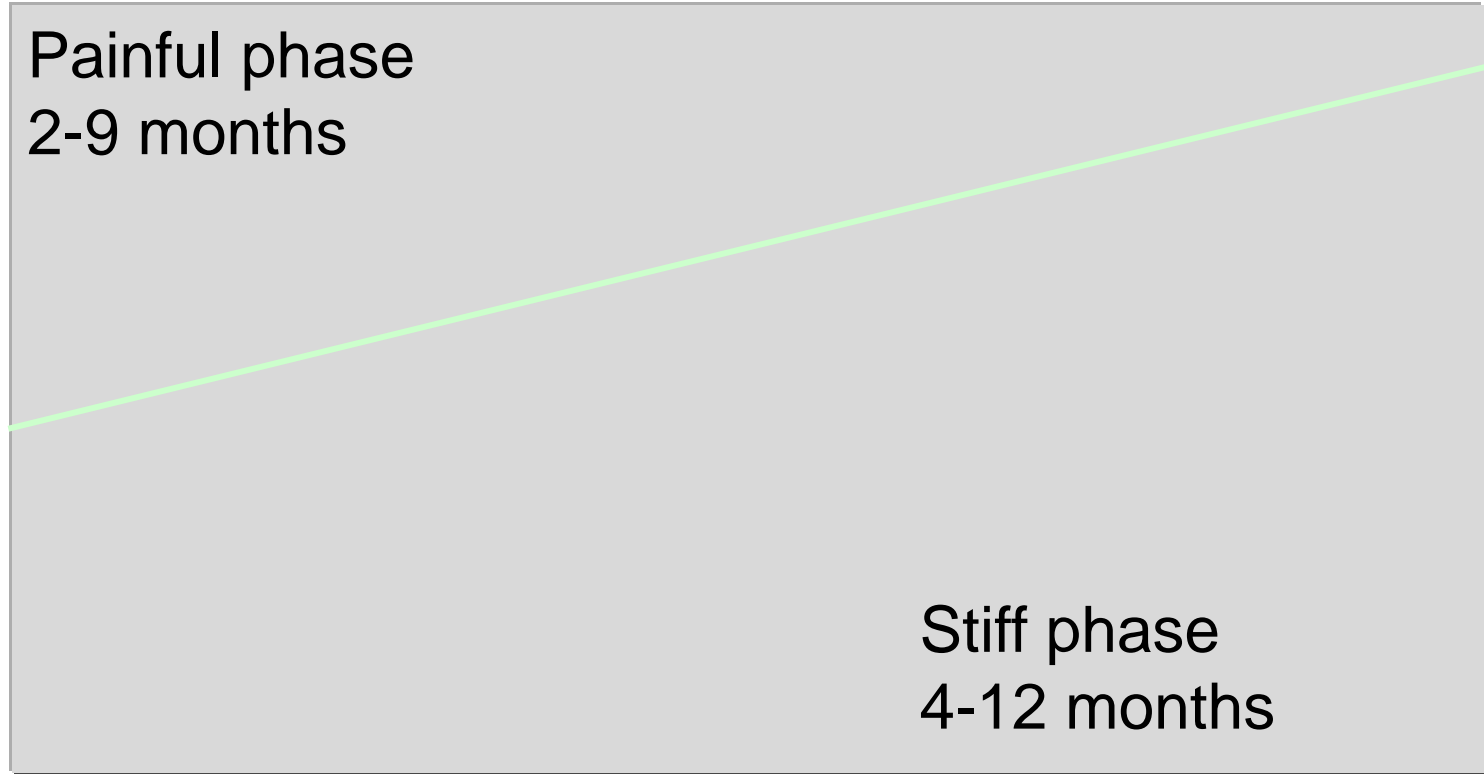
Chaloumas D, Biddle M, McLean M, Millar NL. Comparison of Treatments for Frozen Shoulder: A Systematic Review and Meta-analysis. *JAMA Netw Open*. 2020;3(12):e2029581.

doi:10.1001/jamanetworkopen.2020.29581

Wong PL, Tan HC. A review on frozen shoulder. *Singapore Med J*. 2010 Sep;51(9):694-7

Shaffer B, Tibone JE, Kerlan RK. Frozen shoulder. A long-term follow-up. *J Bone Joint Surg Am*. 1992 Jun;74(5):738-46

Timeline of condition



Why painful?

Synovitis + synovial thickening in upper and ventral areas of the joint in over 50%.

Fibroblasts proliferation and chronic inflammatory cells



[Hand GC](#), [Athanasou NA](#), [Matthews T](#), [Carr AJ](#). The pathology of frozen shoulder. J Bone Joint Surg Br. 2007 Jul;89(7):928-32.

Emig EW, Schweitzer ME, Karasick D, Lubowitz J. Adhesive capsulitis of the shoulder: MR diagnosis. AJR 1995;164 :1457 -1459

[Uthoff HK](#), [Boileau P](#). 2007 Primary frozen shoulder: global capsular stiffness versus localized contracture Clin Orthop Relat Res. Mar;456:79-84.

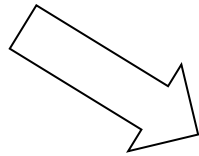
[Kilian O](#), [Kriegsmann J](#), [Berghäuser K](#), et al 2001 The frozen shoulder. Arthroscopy, histological findings and transmission electron microscopy imaging] Chirurg. Nov;72(11):1303-8

Neoinnervation and neoangiogenesis

Increased expression of nerve growth factor receptor and new vascularisation and nerve fibres were found in the shoulder capsular

Biological dimension – immune disorder?

Capsular inflammation modulated by mediators including inflammatory cytokines, growth factors, enzymes, and matrix metalloproteinases



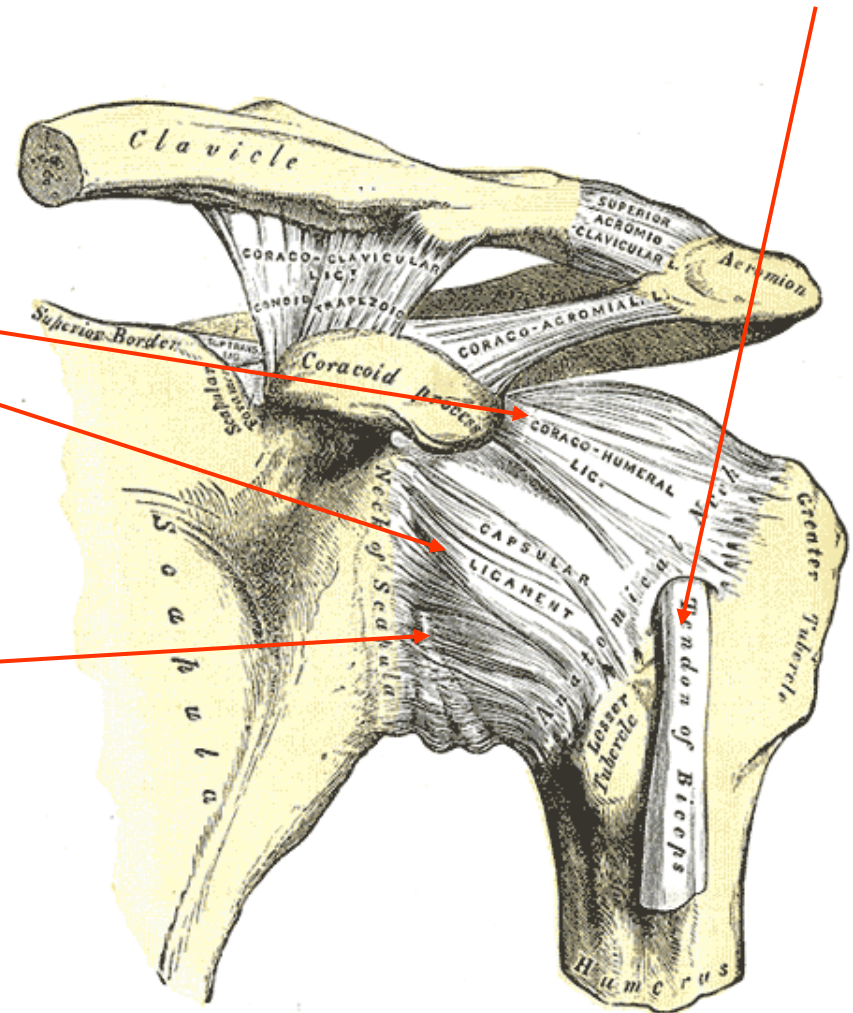
Capsular fibrosis associated with proliferation of fibroblasts and myofibroblasts controlled by an abnormal cytokine production

Why stiff

Contracted biceps tendon (increasing the force on the humeral head, leading to corresponding areas cartilage)

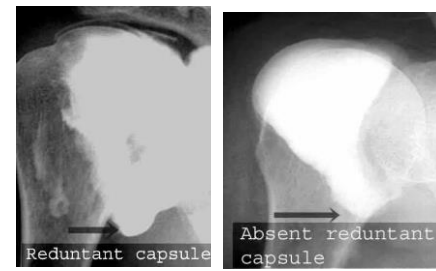
Dupuytren's like contractures esp. coracohumeral ligament and rotator interval

Fibroplasia / fibrosis / tendinosis capsule



Intraarticular adhesions not commonly found

Why stiff (and painful)

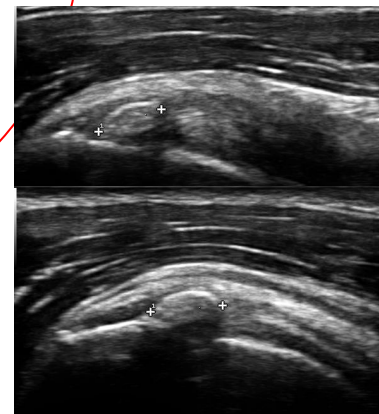
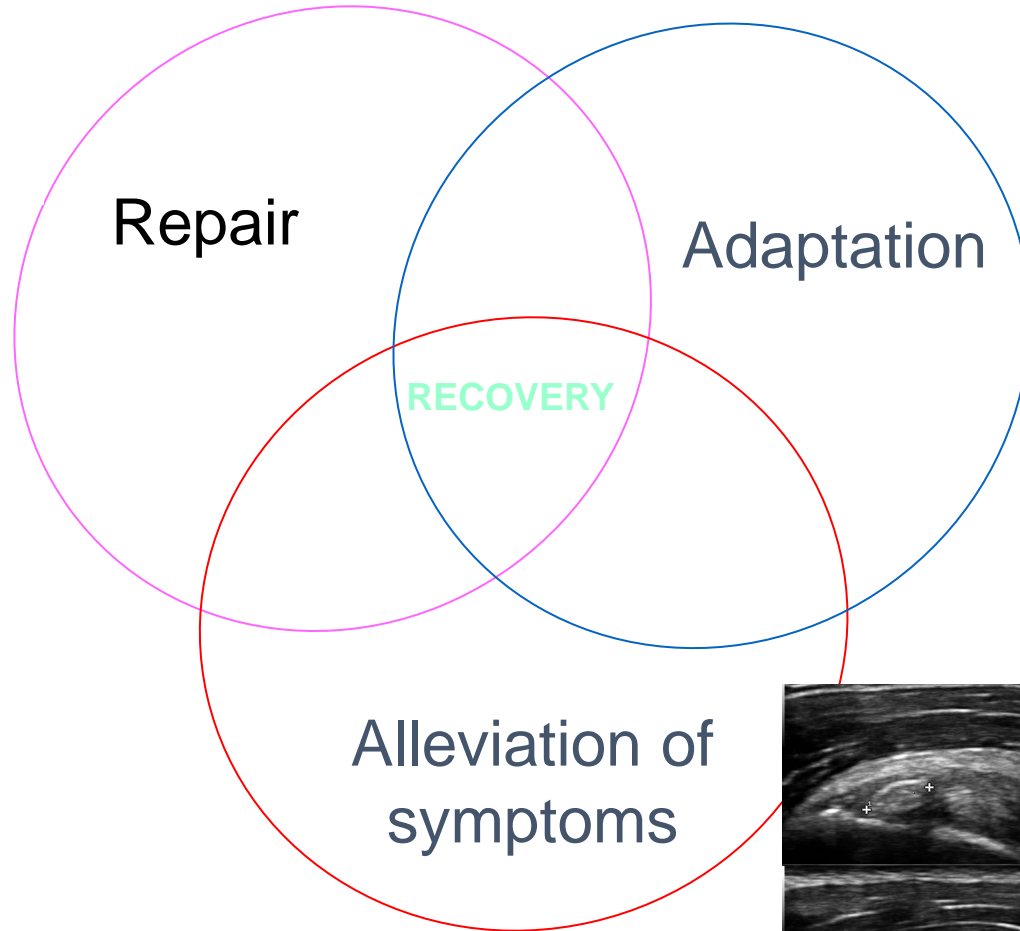


Process Approach

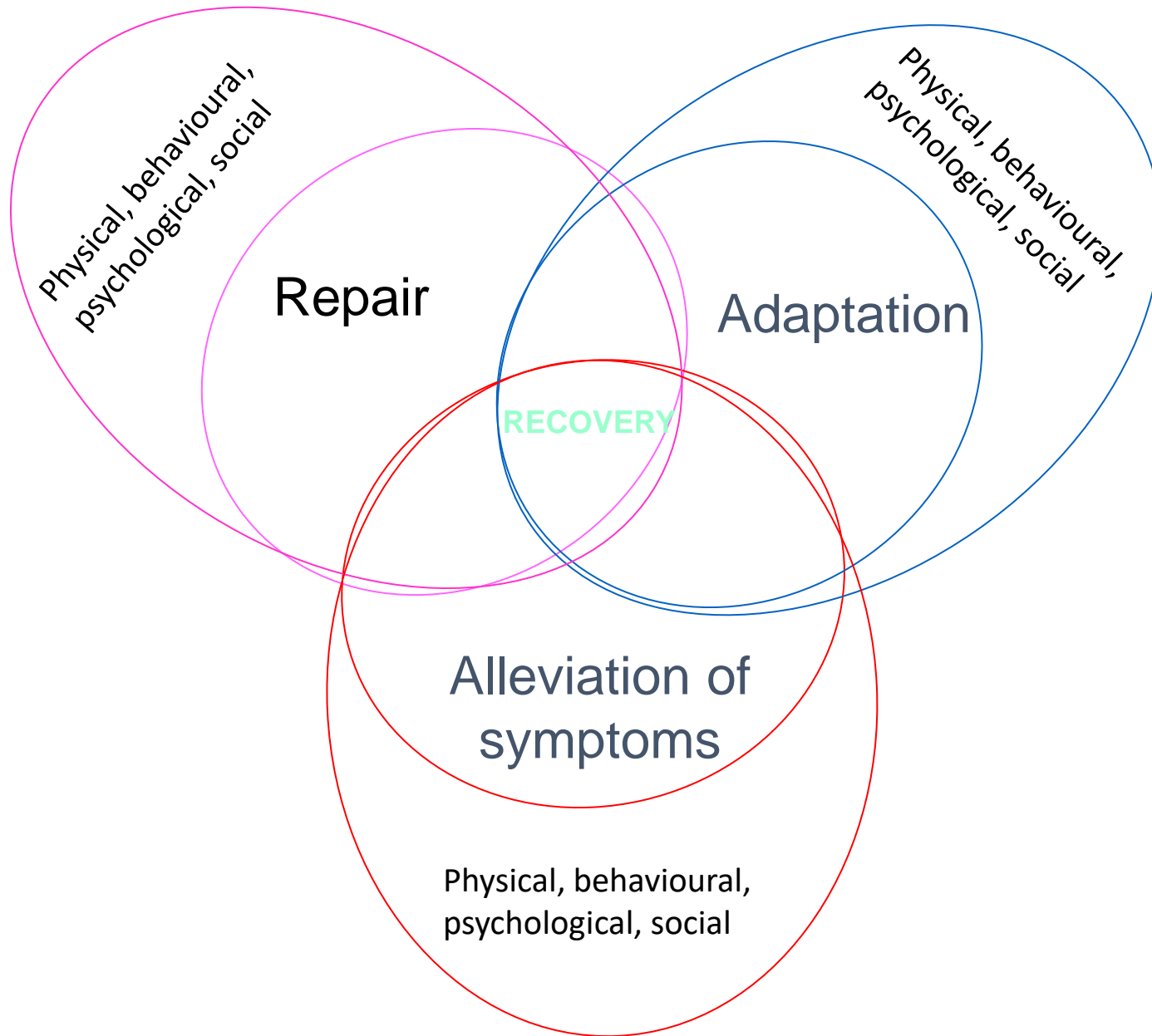
Create with the patient environments in which their recovery processes can be optimised

Functional improvements in all musculoskeletal and pain conditions is associated with three key recovery processes

Process Approach and recovery processes



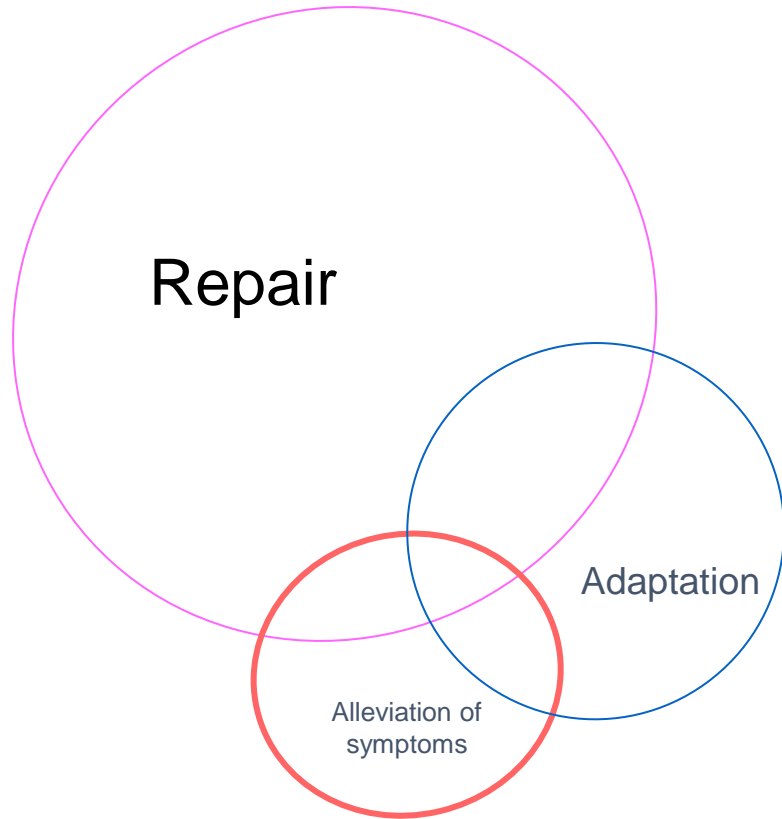
Recovery environments



Recovery environments: management considerations

<i>Process</i>	<i>Condition</i>	<i>Specific management</i>	<i>Shared management</i>
<i>Repair</i>	<p>All acute conditions, max 8 weeks: All tissue damage, Joint & muscle sprains, post surgery, blunt trauma, Painful phase of frozen shoulder</p>	<p>Moderate cyclical and repetitive loading Applied locally to affected area Gradual loading Pain-free / tolerable movement Can be either active or passive Any movement pattern but preferably functional. Extra-functional is OK</p>	<p>Psychological Ease movement pain related anxieties, catastrophising, support, reassurance, comfort, Sooth and calm Therapeutic relationship: trust, non-judgmental, empathic.. Contextual factors</p> <p>Cognitive Inform Plan Identify patient outcome goals Provide choice</p> <p>Behavioural Support recovery behaviour Raise awareness to avoidance behaviour</p>
<i>Adaptation</i>	<p>All chronic conditions: Post immobilisation contracture, ROM rehab, postural and movement re-education/rehab, CNS damage/rehab, structural/biomechanical change, enhance/recover human performance Stiff phase of frozen shoulder</p>	<p>Active Task specific whole and goal movement Functional Repetition Overloading Discomfort likely and generally OK</p>	
<i>Alleviation of symptoms</i>	<p>Acute/Chronic pain/discomfort Acute/chronic stiffness</p>	<p>Many treatment modalities may be beneficial depending on patient expectations.. Sleep & relaxation Physically: Active may be better than passive movement Cyclical movement may be better than static approaches Functional or extra-functional</p>	

Treatment strategy acute injuries



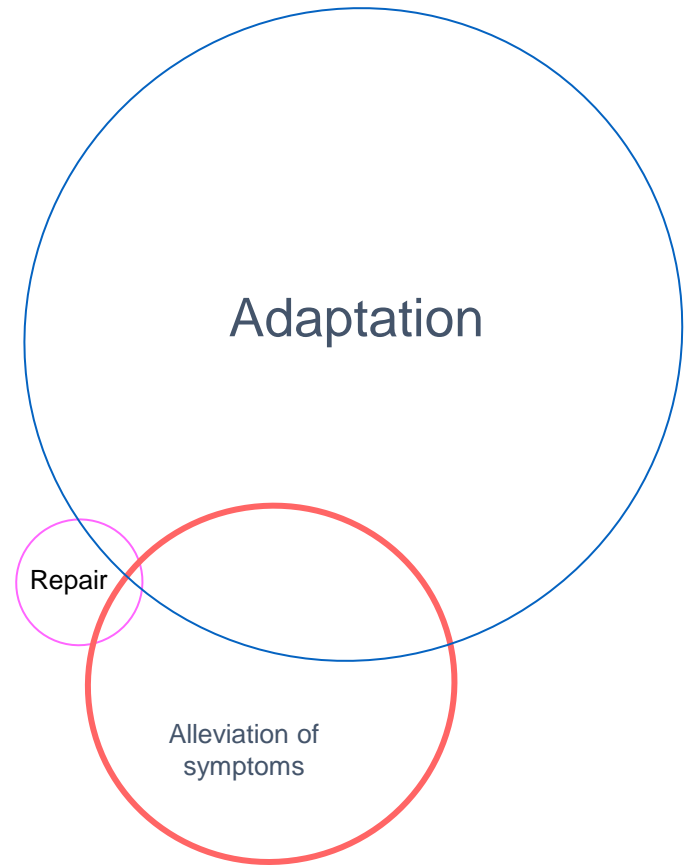
Acute phase

Long term

Consider this management

<i>Process</i>	<i>Condition</i>	<i>Specific management</i>	<i>Shared management</i>
<i>Repair</i>	All acute conditions, max 8 weeks: All tissue damage, Joint & muscle sprains, post surgery, blunt trauma, first phase of frozen shoulder,	Moderate cyclical and repetitive loading Applied locally to affected area Gradual loading Pain-free / tolerable movement Can be either active or passive Any movement pattern but preferably functional. Extra-functional is OK	<p>Psychological Ease movement pain related anxieties, catastrophising, support, reassurance, comfort, Sooth and calm Therapeutic relationship - trust, non-judgmental, empathic.. Contextual factors</p> <p>Cognitive Inform Plan Set goals Provide choice</p> <p>Behavioural Support recovery behaviour Raise awareness to avoidance behaviour</p>
<i>Adaptation</i>			
<i>Alleviation of symptoms</i>			

Post immobilisation / contractures

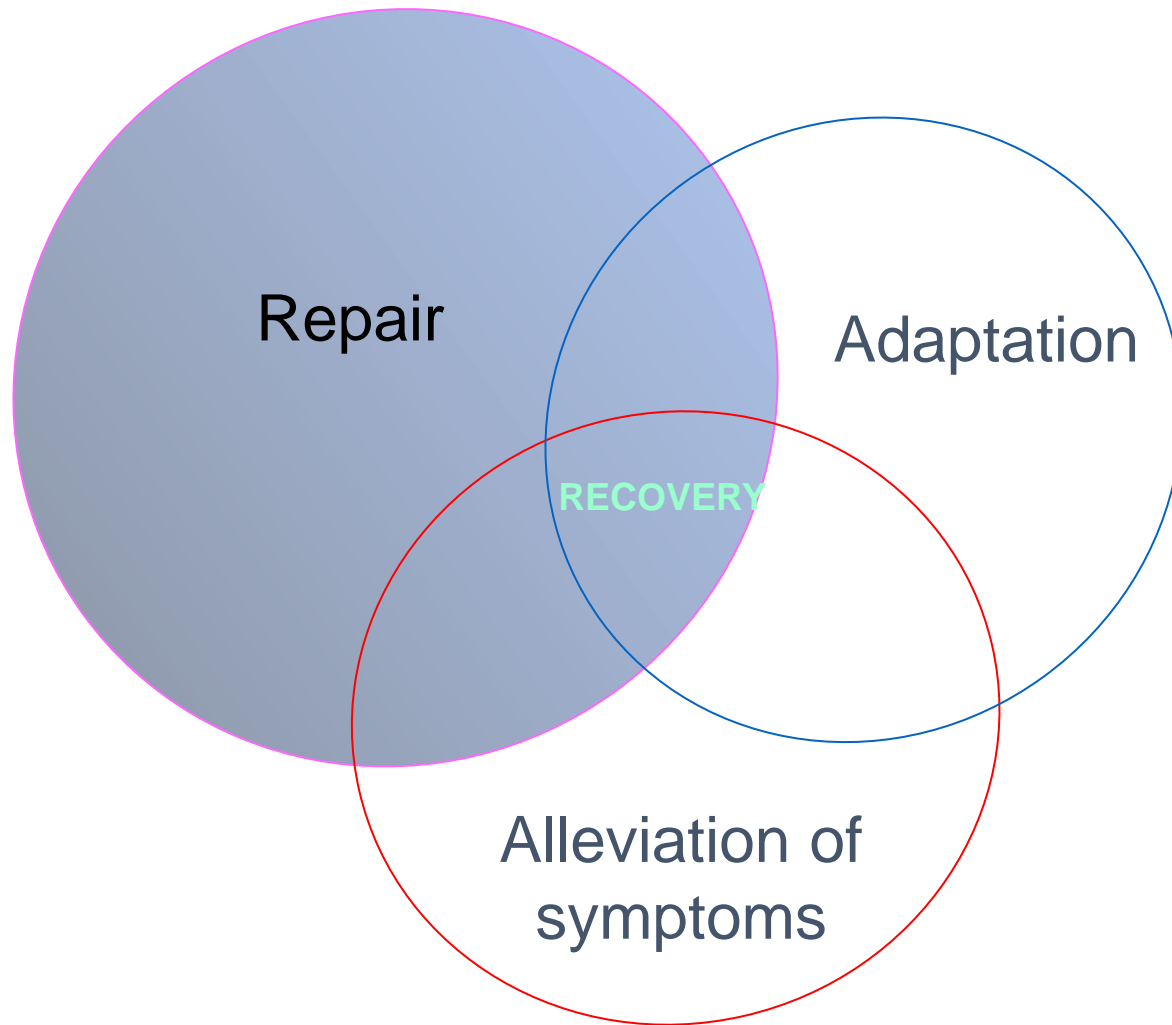


Reduced ROM

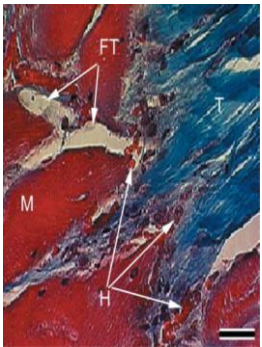
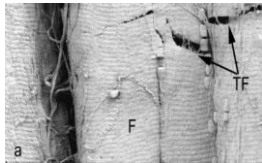
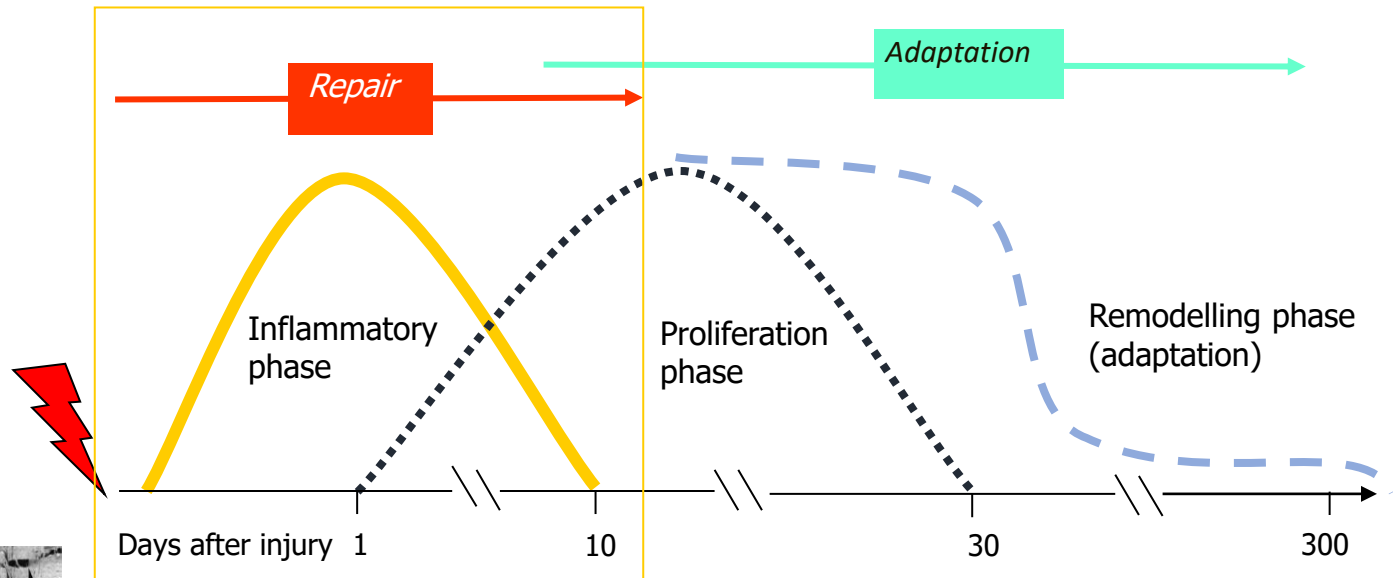
Consider this management

<i>Process</i>	<i>Condition</i>	<i>Specific management</i>	<i>Shared management</i>
<i>Repair</i>			<p>Psychological Ease movement pain related anxieties, catastrophising, support, reassure, comfort, Sooth and calm Therapeutic relationship - trust, non-judgmental, empathic.. Contextual factors</p> <p>Cognitive Inform Plan Set goals Provide choice</p> <p>Behavioural Support recovery behaviour Raise awareness to avoidance behaviour</p>
<i>Adaptation</i>	All chronic conditions: Post immobilisation contracture, ROM rehab, postural and movement re-education/rehab, CNS damage/rehab, structural/biomechanical change, enhance/recover human performance	Active Task specific whole and goal movement Functional Repetition Overloading Discomfort likely and generally OK	
<i>Alleviation of symptoms</i>			

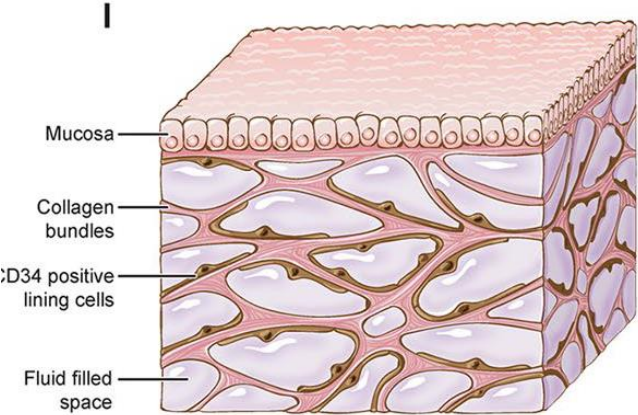
Recovery by repair



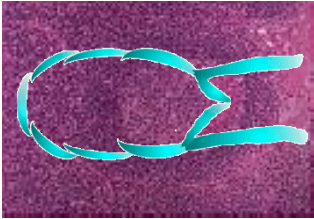
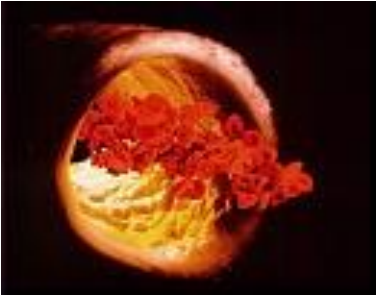
Repair process



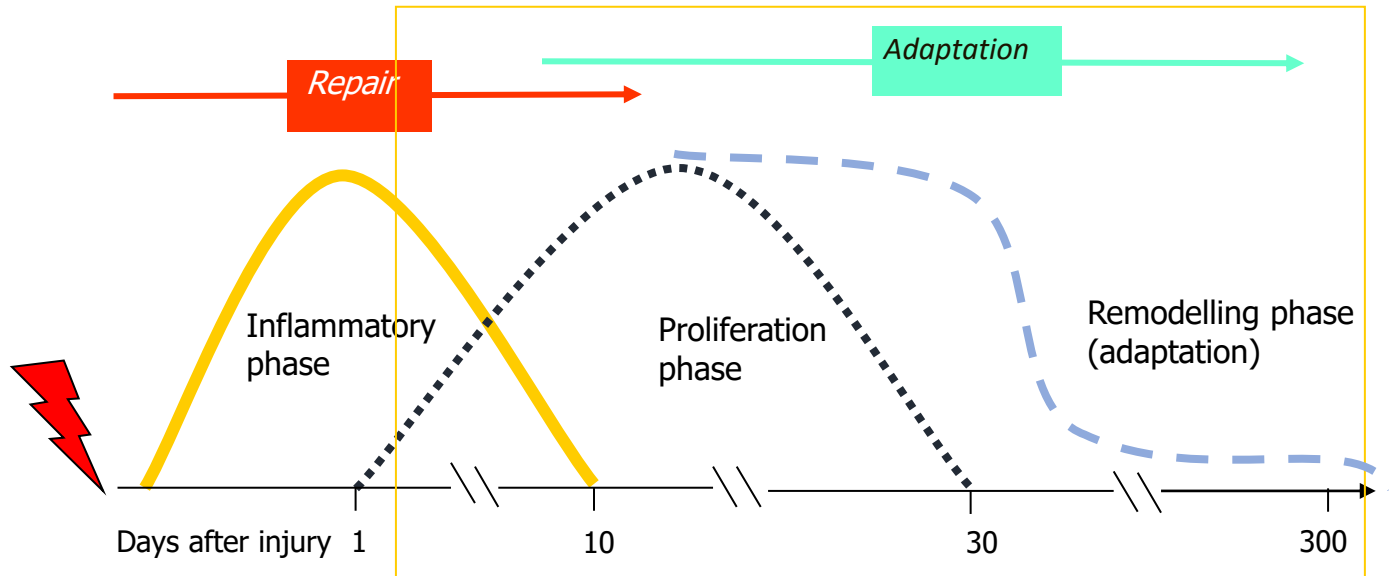
Interstitial & synovial pumps



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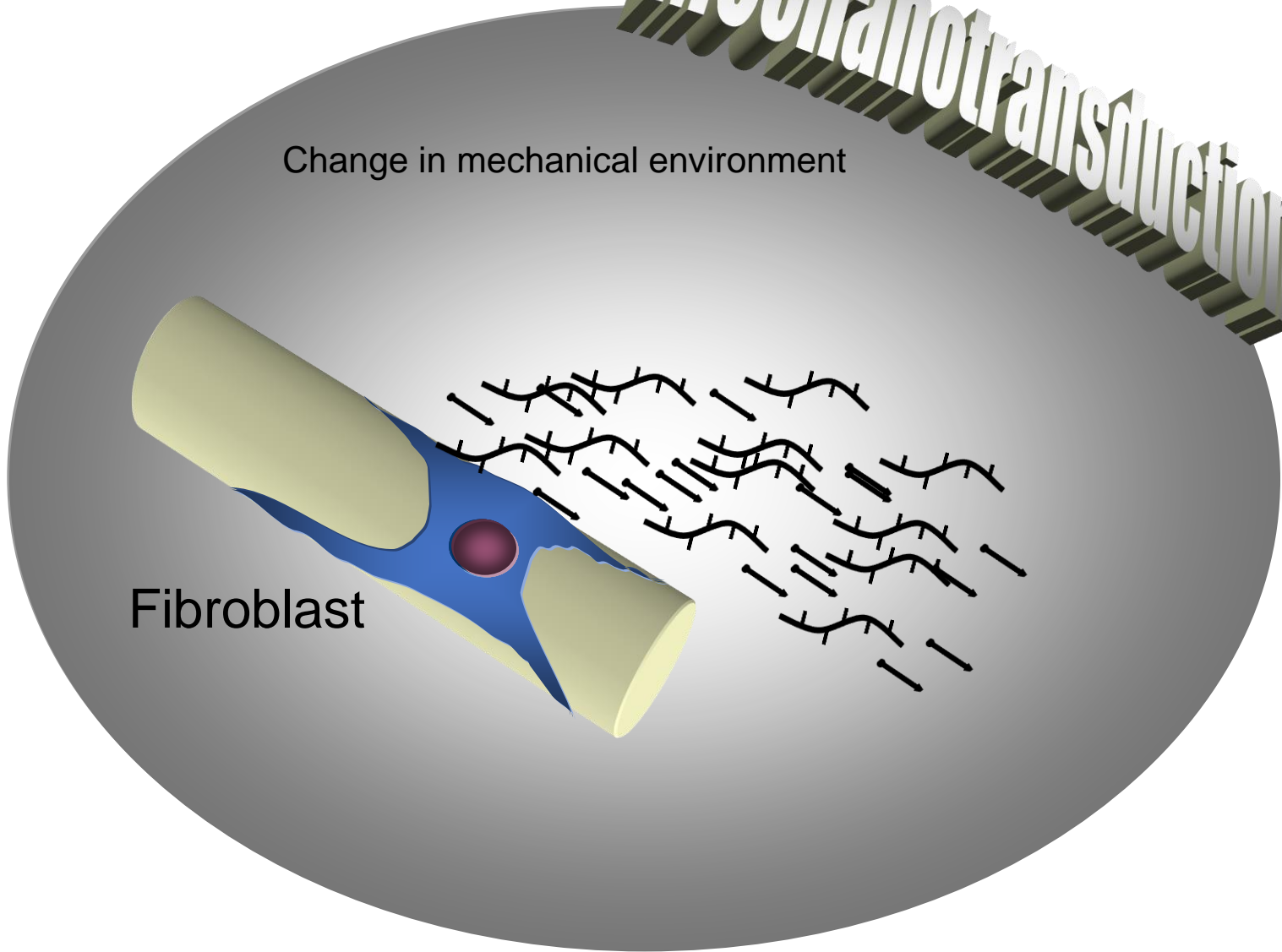
Repair process



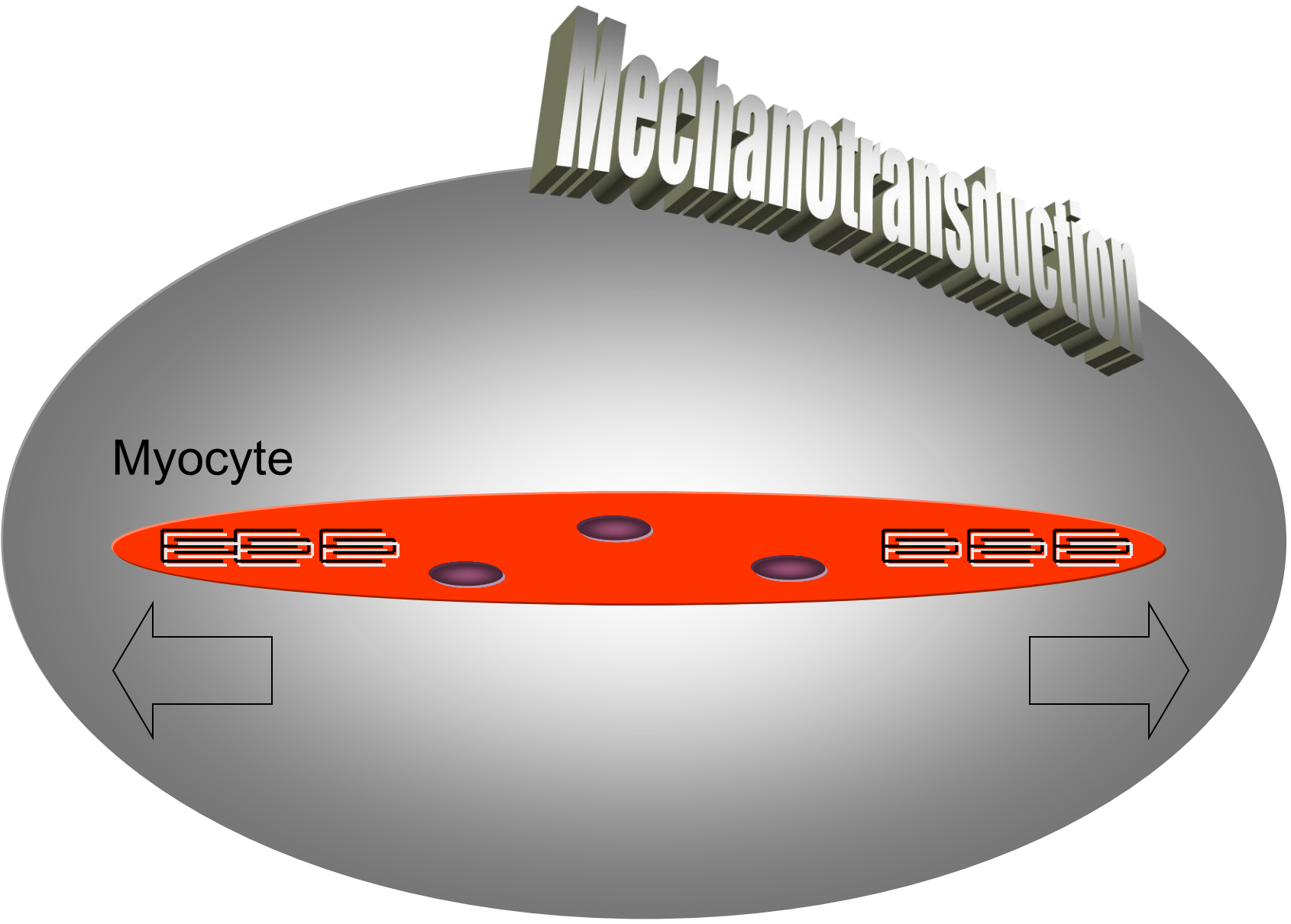
Mechanotransduction

Change in mechanical environment

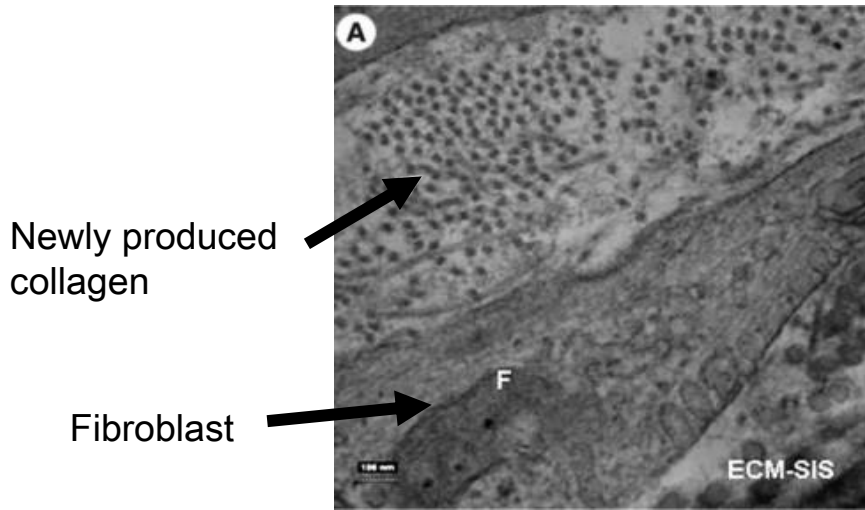
Fibroblast



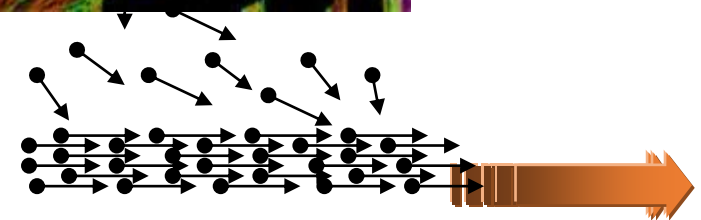
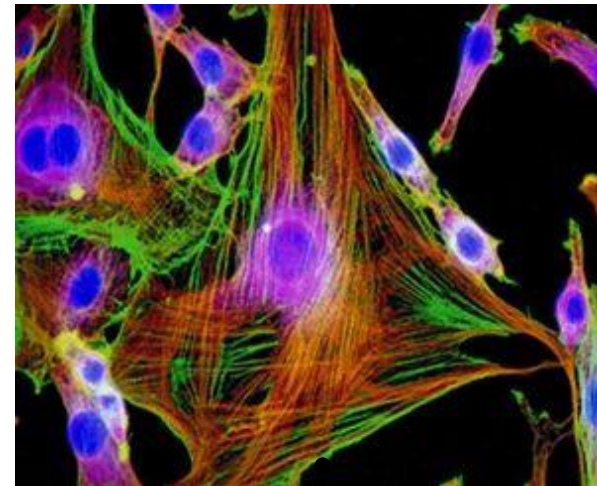
Mechanism of elongation in muscle



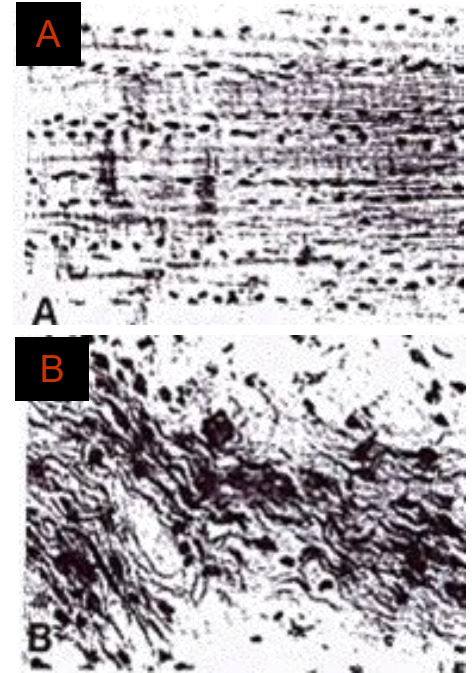
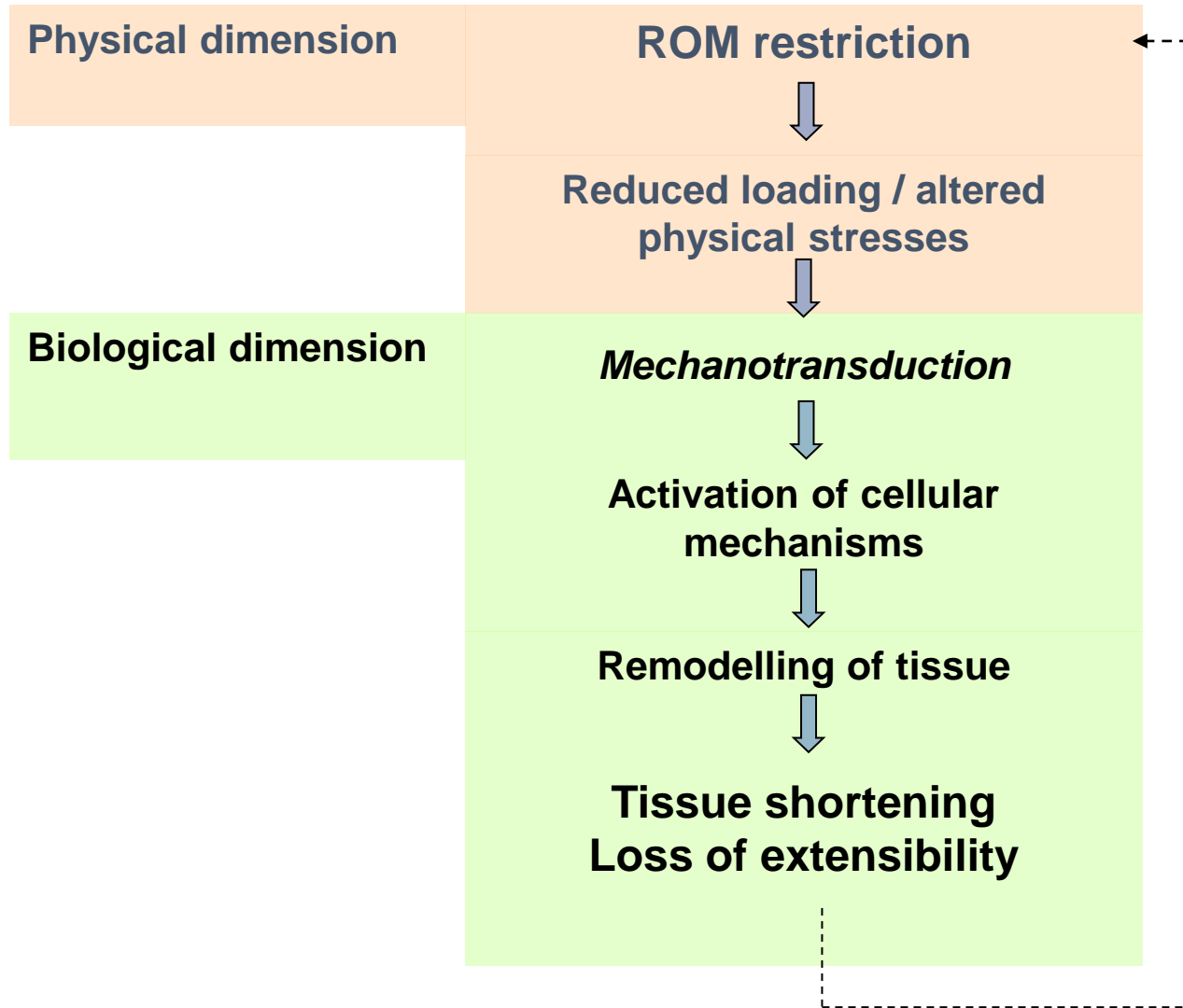
Deposition and alignment of collagen in extra cellular matrix



Fibroblast

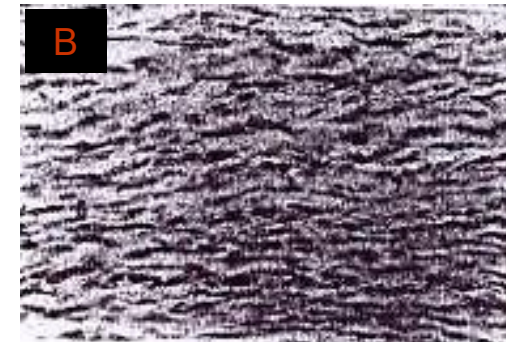
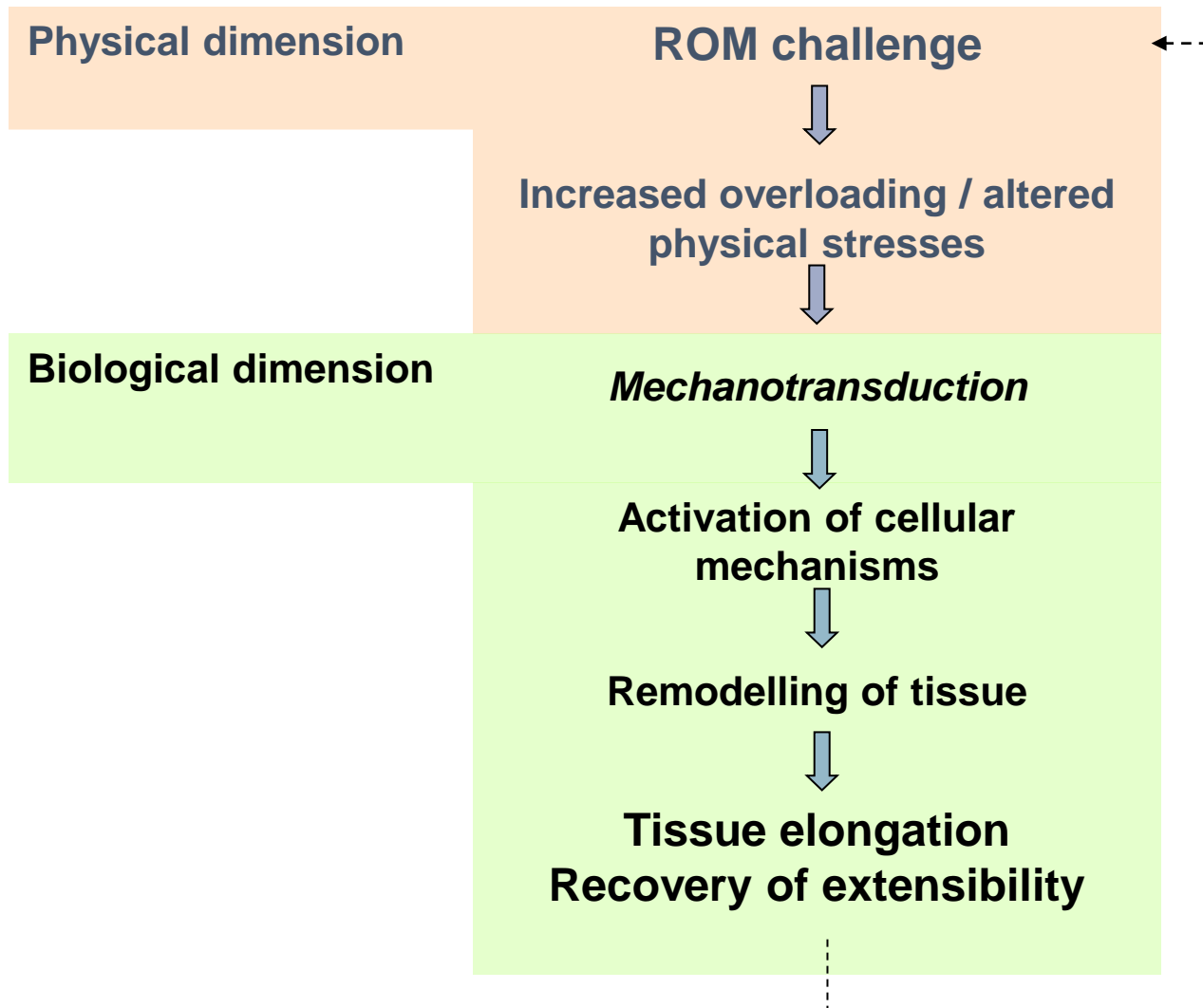


From the physical to the biological dimension



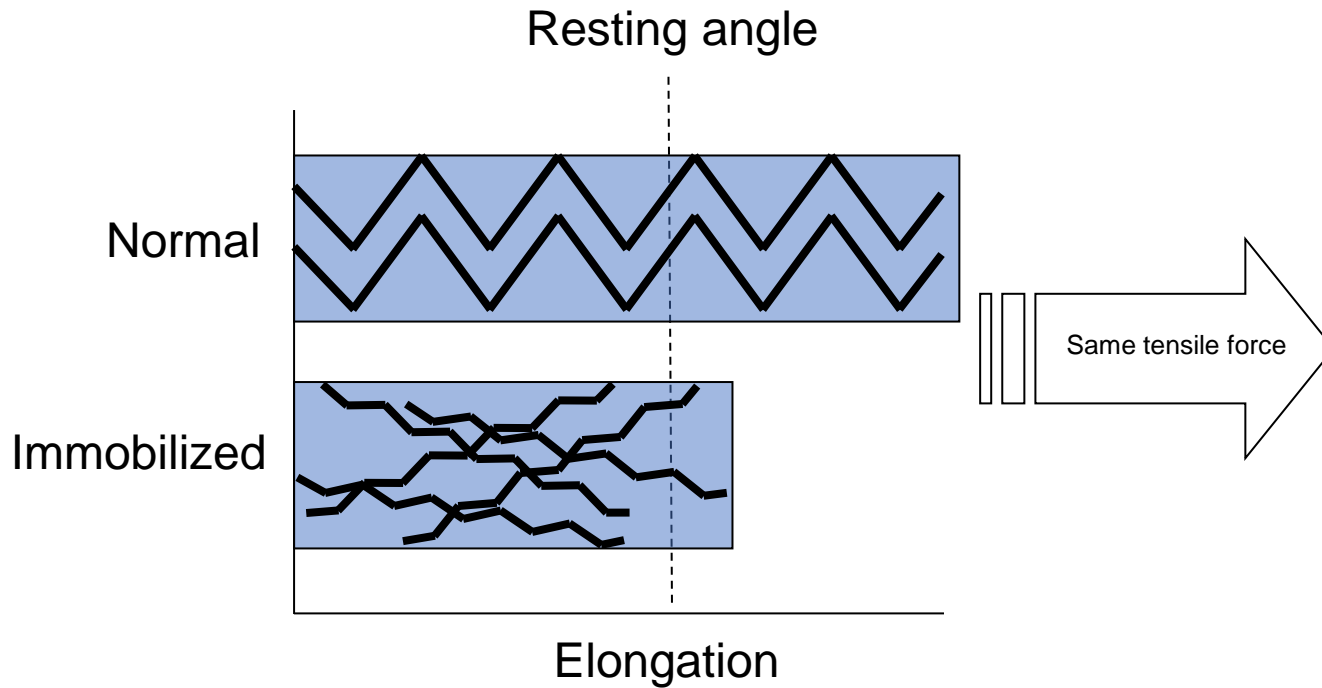
A. Normal ligament
B. Ligament after 6 weeks of immobilisation

Recovery: from the physical to the biological dimension



A. Effects of immobilisation
B. Effects of 6 weeks of passive movement

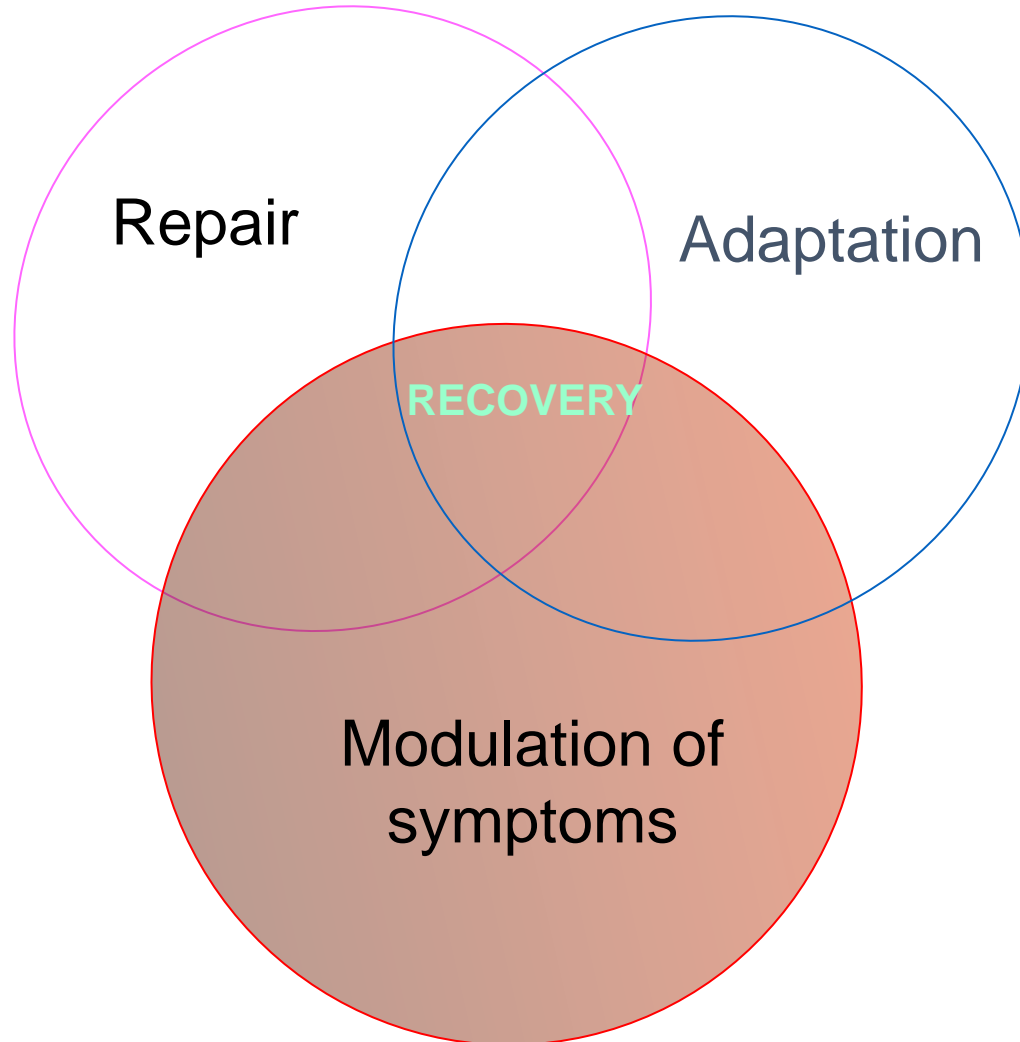
Tissue extensibility



Repair - recovery environment

<i>Process</i>	<i>Specific management</i>	<i>Shared management</i>
<i>Repair</i>	Moderate cyclical and repetitive loading Applied locally to affected area Gradual loading Pain-free / tolerable movement Can be either active or passive Any movement pattern but preferably functional. Extra-functional is OK	
<i>Adaptation</i>		
<i>Alleviation of symptoms</i>		


Recovery processes

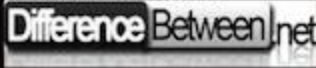


Acute inflammation

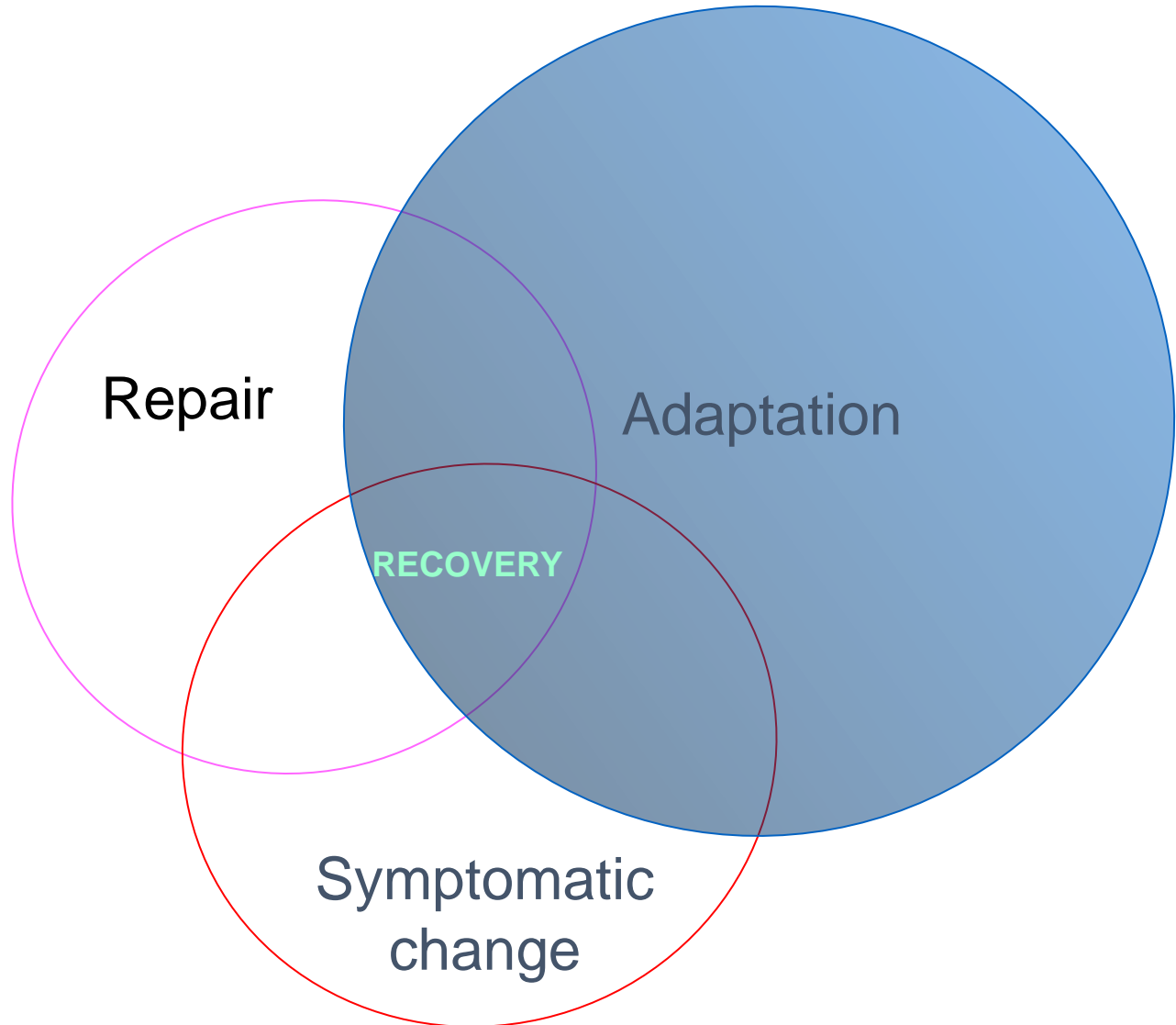
 Resolution

 Chronic sensitisation?

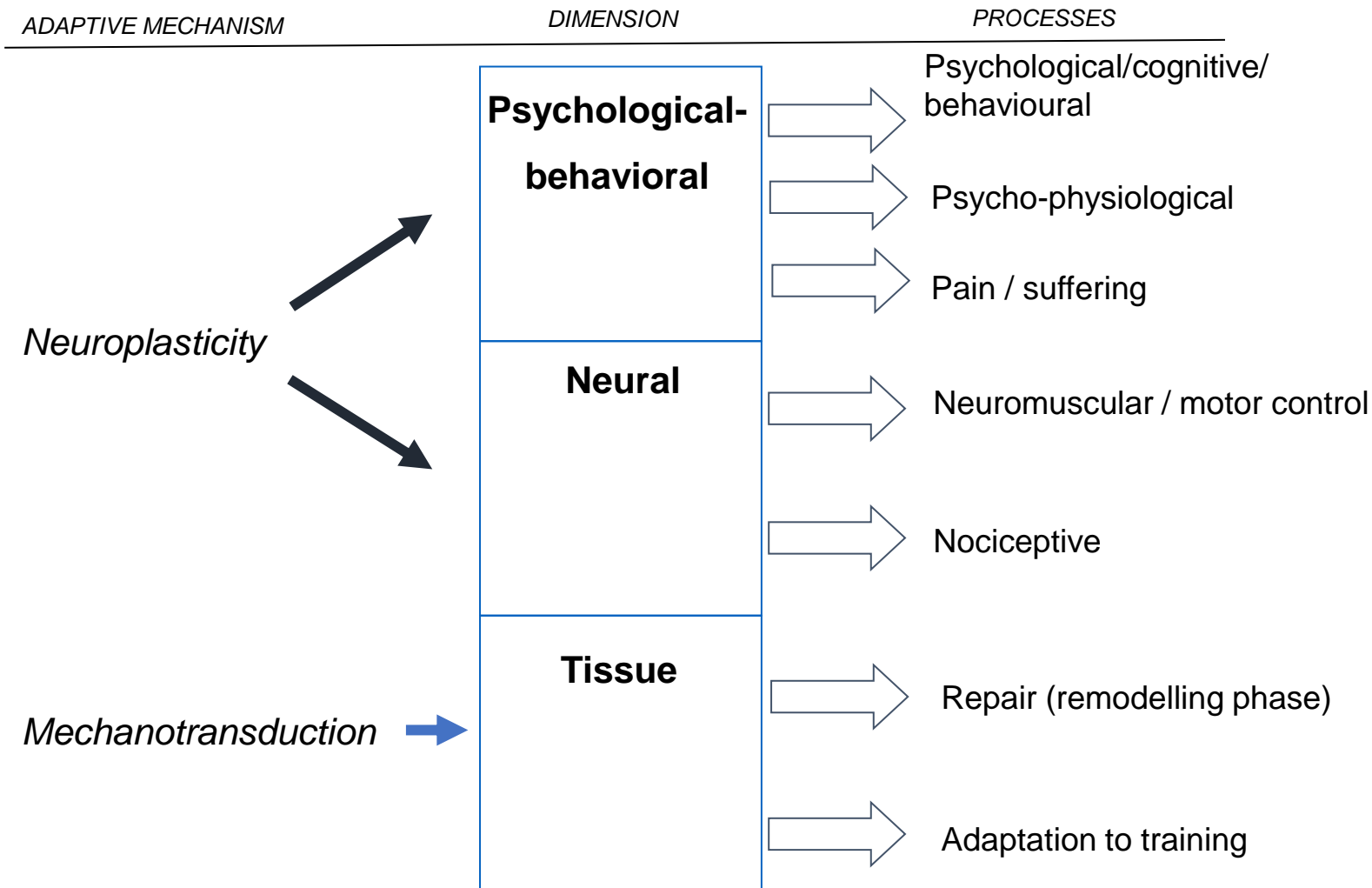
 Chronic inflammation

Initial short term response of the body to adverse stimuli.	Long term inflammatory reaction that lasts for months or years.
Not specific.	Specific, involves acquired immunity.
Response to physical and chemical damages, pathogen invasion, tissue necrosis, etc.	Response to prolonged irritation of chemicals, foreign particles, infection that cannot be overcome for a long time.
Involved immune cells: dendritic cells, Kupffer cells, histiocytes, resistant macrophages, mast cells.	Involved immune cells: macrophages, neutrophils, lymphocytes.
Response: (1) redness, (2) increased blood flow, and (3) edema.	Response: fibrosis and angiogenesis.
Cardinal signs: pain, heat, redness, and swelling.	No cardinal signs.
	

Recovery by adaptation



Adaptation: whole person multidimensional event



Behavioral drivers of task and tissue adaptation

Specificity (whole and goal)

Repetition

Intensity

Specific tissue adaptation



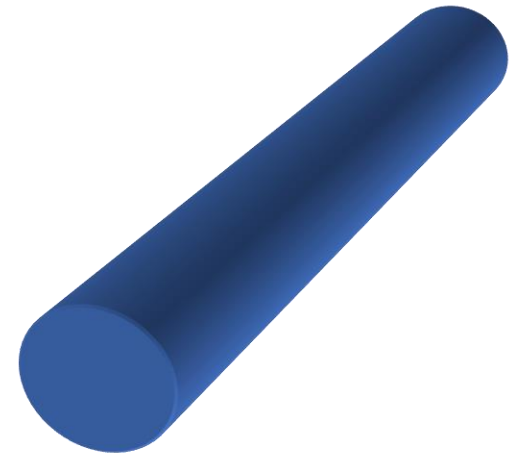
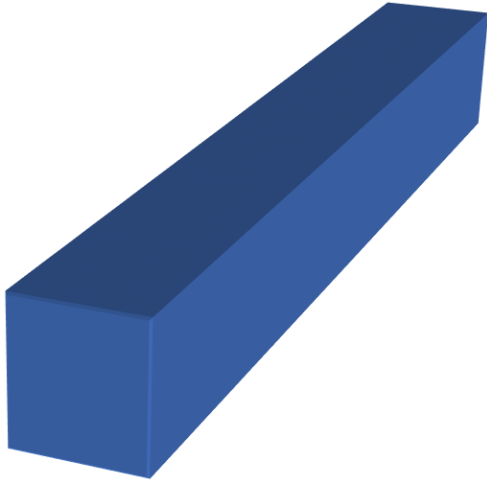
<https://www.youtube.com/watch?v=wd4YPslh7h0>

Neuromuscular adaptation



Specificity

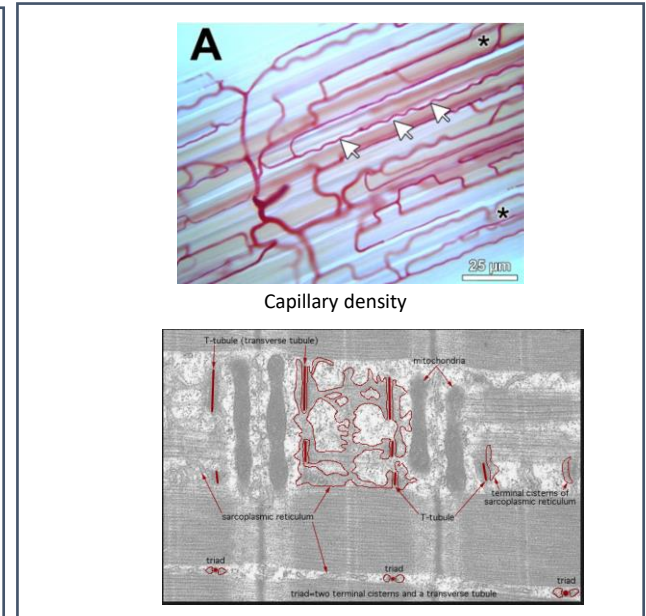
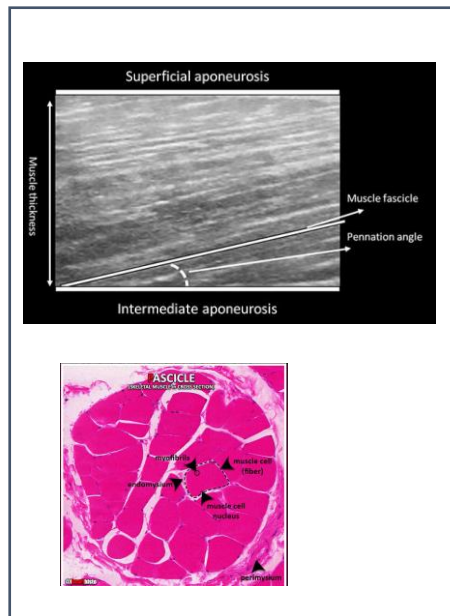
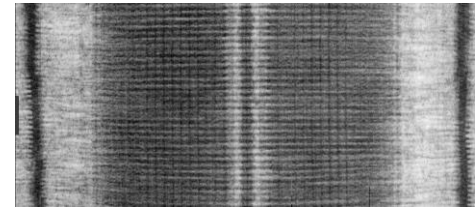
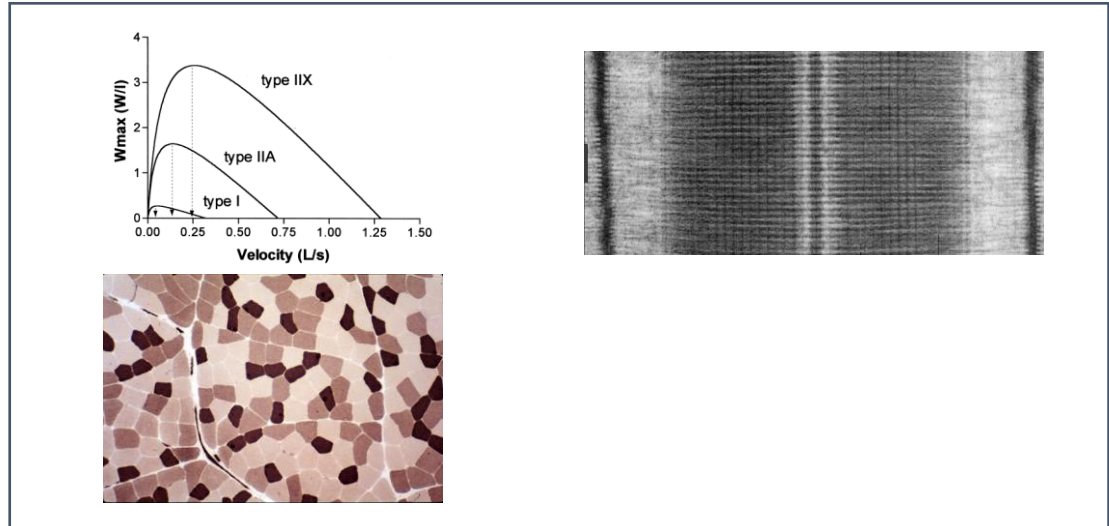
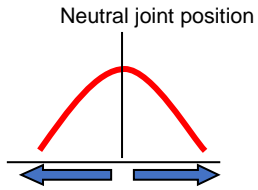
Tissue, motor, and physiological adaption is specific for the practiced task.....



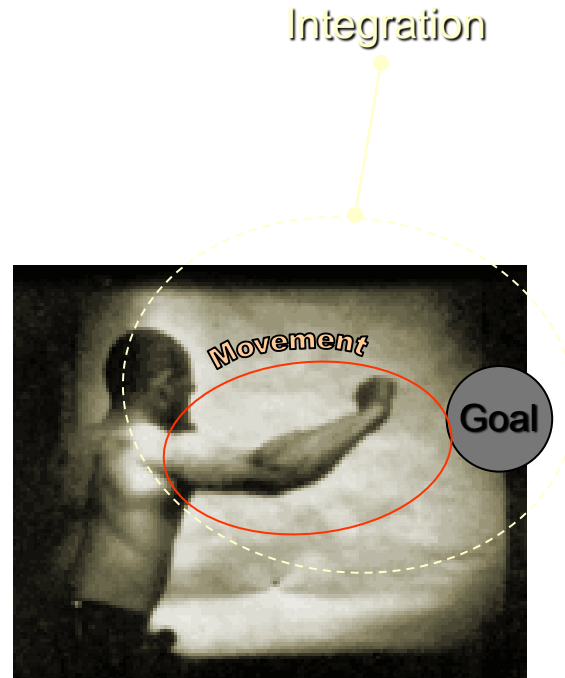
Lederman E. 2010 Neuromuscular Rehabilitation in manual and physical therapies. Elsevier

Goldspink, G. et al. (1992). Gene expression skeletal muscle in response to stretch and force generation. *American Journal of Physiology*, 262, R356-R363.
[Abe T](#), [Kumagai K](#), [Brechue WF](#) 2000 Fascicle length of leg muscles is greater in sprinters than distance runners. *Med Sci Sports Exerc.* Jun;32(6):1125-9.

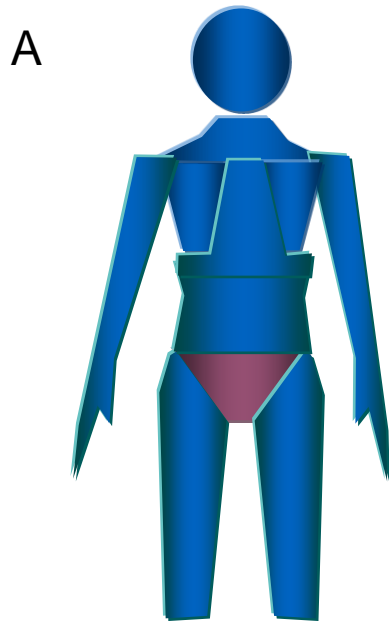
Some specific adaptations in muscle



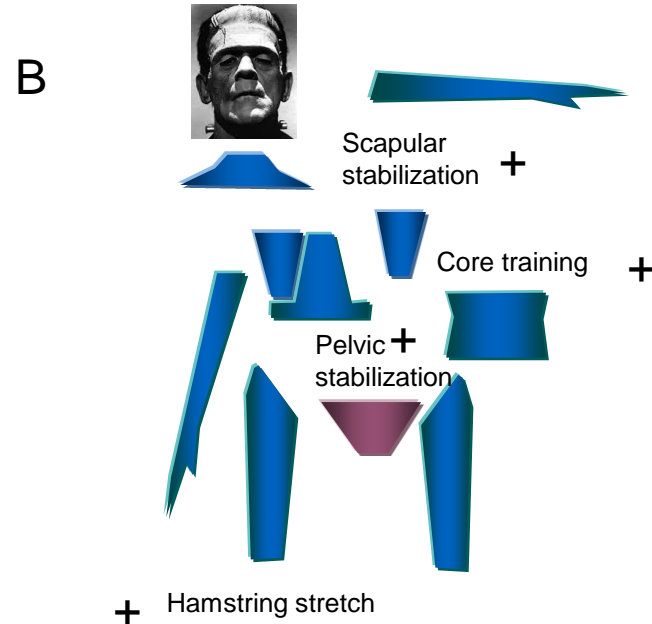
Goal movement



Whole system/person organisation



Body organized as a whole for movement



No closed / isolated muscle systems in the body...

Functional management

Functional movement - the unique movement repertoire of an individual

Functional rehabilitation - helping a person recover their movement capacity by using their own movement repertoire (whenever possible).

Extra-functional – a movement pattern outside the individual's movement repertoire

The life gym

Shared

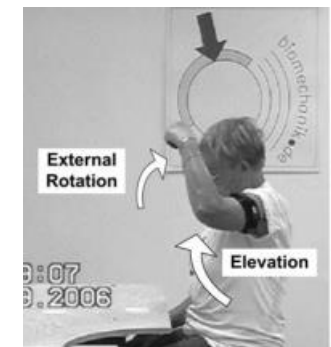
+

Unique



GH loading levels during daily activities

Activity	F (%BW)
Abduction	
75° without weight	85
45° with 2 kg weight	88
45° without weight	51
Flexion	
120° without weight	121
90° with 2 kg weight	128
90° without weight	78
Extension, supine position, elbow flexed, 118N resistance at elbow	82
Lifting 1.4 kg coffeepot, straight arm	103
Nailing 15 cm above head	88
Steering	
Slow, 7 N m, both hands	42
Fast, 7 N m, both hands	40
Fast, 7 N m, one hand	108
Slow, 12 N m, both hand	107
Wheel fixed, both hands	151
Walking with 2 crutches, full support	118
Lifting 10 kg laterally	14
Putting 2.5 kg into shelf, 60 cm in front	69
Combing	
Typical	65
Maximum	96

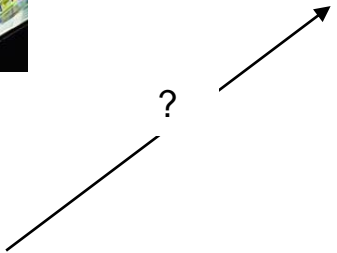
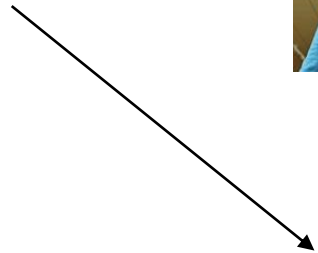


Functional task specific vs. extra-functional

ROM loss

Practice the task
(Functional, task specific training)

Goal task



Practice a dissimilar task
(extra-functional)

Matching management to process

Painful phase

1-2 months!

- Pain <5 VAS
- Undisturbed sleep
- Transformation from protective to restorative behaviour

Stiff phase

2-3 months!

Painful phase



Painful phase



Painful phase – physical challenges



Message from research: management during painful phase

Frozen shoulder: the addition of mobilisation significantly improved pain, flexion ROM, abduction, and disability

Cyclical and repetitive passive or active movement
Stay within pain-free ranges
Use normal physiological movement

Satpute K, Reid S, Mitchell T, Mackay G, Hall T. Efficacy of mobilization with movement (MWM) for shoulder conditions: a systematic review and meta-analysis. *J Man Manip Ther.* 2022 Feb;30(1):13-32

Jain TK, Sharma NK **2014 The effectiveness of physiotherapeutic interventions in treatment of frozen shoulder/adhesive capsulitis: a systematic review.** *J Back Musculoskelet Rehabil.* 2014;27(3):247-73.

Dundar U et al 2009 Continuous passive motion provides good pain control in patients with adhesive capsulitis. *Int J Rehabil Res* 2009; 32:193-8.

Don't stretch in the painful phase

Supervised neglect yields better outcomes than intensive physical therapy and passive stretching

Stiffness phase



Stiffness phase



Stiffness phase



Stiffness phase



Stiffness phase



Stiffness phase – physical challenges



Patient centred outcomes

1.4 / 10 is the smallest difference in an outcome which a patient perceives as beneficial

3 / 10 is the score below which patients consider themselves well

Patient centred management

- Patient sets therapeutic goals
- Patient assess improvements by functionality and pain




Clinical assessments = may be false positive or just irrelevant



Functional = patient/client centred in terms of impact on daily living/empowerment/ability to adapt, etc.

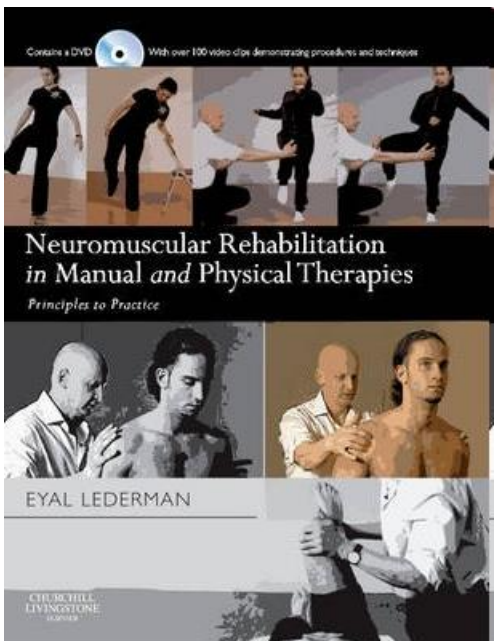
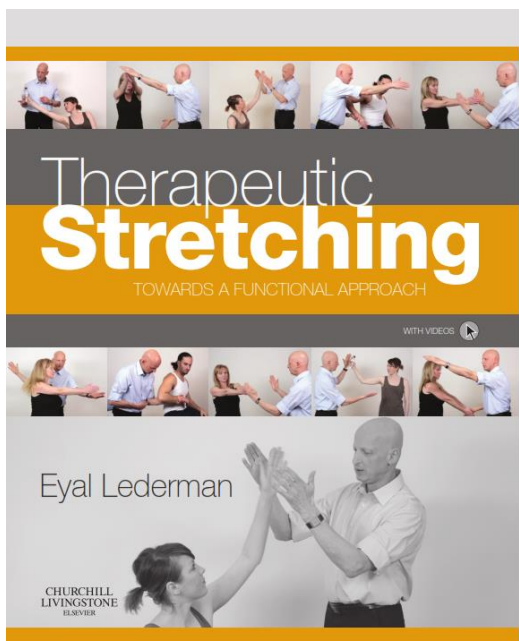
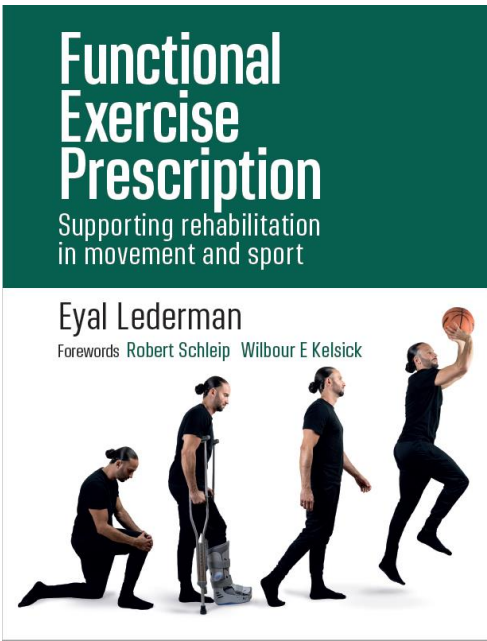
Psychological consideration

Recovery environments: management considerations

<i>Process</i>	<i>Condition</i>	<i>Specific physical management</i>	<i>Shared management</i>
<i>Repair</i>			<p>Psychological Ease movement pain related anxieties, catastrophising, support, reassurance, comfort, Sooth and calm Support autonomy and internal locus of health (provide therapeutic companionship?) Install sense of control (& hope?) Therapeutic relationship - trust, non-judgmental, empathic..</p>
<i>Adaptation</i>			<p>Accept and work with contextual factors</p> <p>Cognitive Inform and empower Co-plan management Acknowledge and work with patient's goals Provide choice</p> <p>Behavioural Support/encourage recovery behaviour Raise awareness to avoidance behaviour</p> <p>Physical Functional movement Frequent exposure to activity</p>
<i>Alleviation of symptoms</i>			

Frozen shoulder - positive narrative

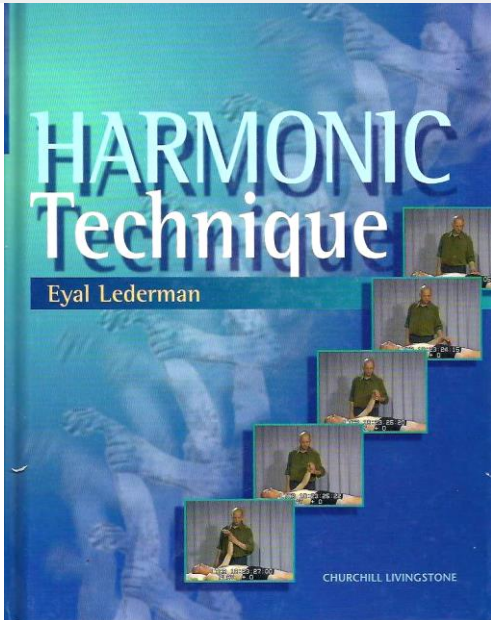
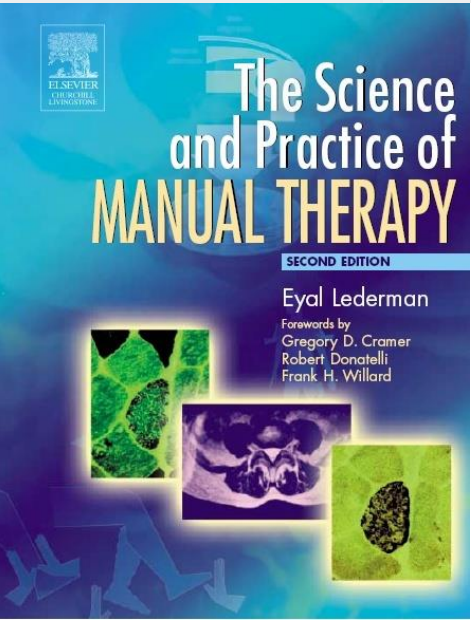
- It is self-limiting condition
- Treatment is 4-8 painful phase, another 8-12 weeks for stiff phase
- Reassure 1: Does not leave permanent disability
- Reassure 2: Use of the arm will not cause further damage
 - “your painful shoulder is as strong as your other shoulder”
 - “the shoulder is fully intact”
- Increase functional use of the arm at end-ranges
- Use simple pain and functional scales to demonstrate improvements (0-10)



22 & 24 Jun 23

Simplifying the shoulder: a process approach
Zoom + 1-day practical

Prof. Eyal Lederman



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