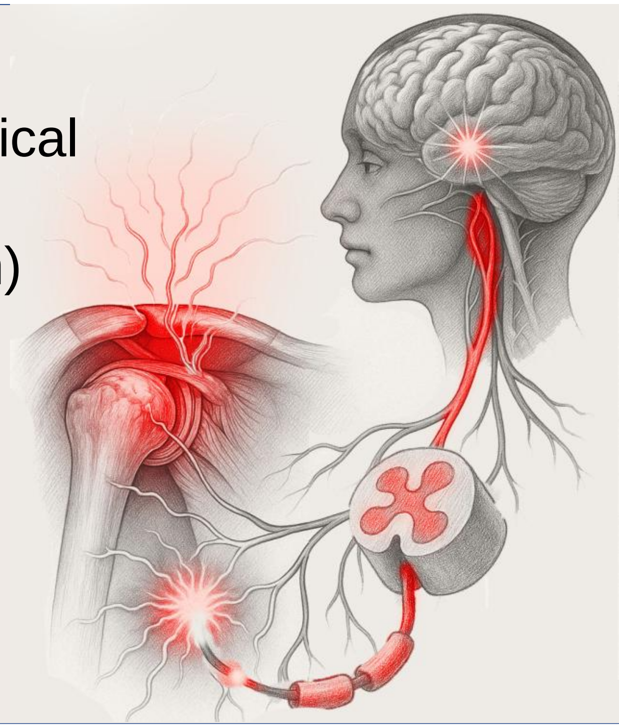
Deconstructing the Neuropsychophysiological Nature of Joint Pain (Nociception)



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Disclosure Statements

I have Online Courses, Posters and a Book I have created based on research

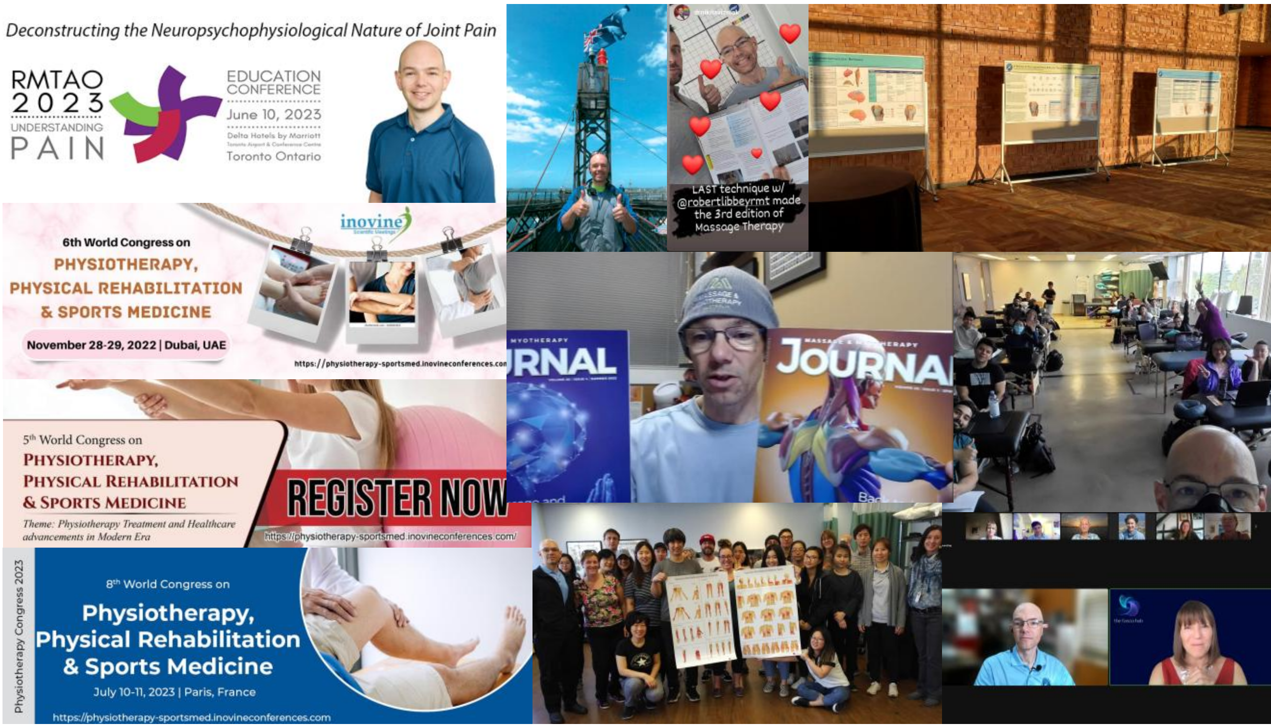
I have run a private practice for over 30 years that treats people in pain/discomfort/dysfunction

I am biased towards evidence-based and science-based practice, as well as biologically plausible explanations.

I treat structure from a Neuropsychophysiological Perspective

I live with chronic discomfort – I'm a Clinician and a Patient

2


Deconstructing the Neuropsychophysiological Nature of Joint Pain
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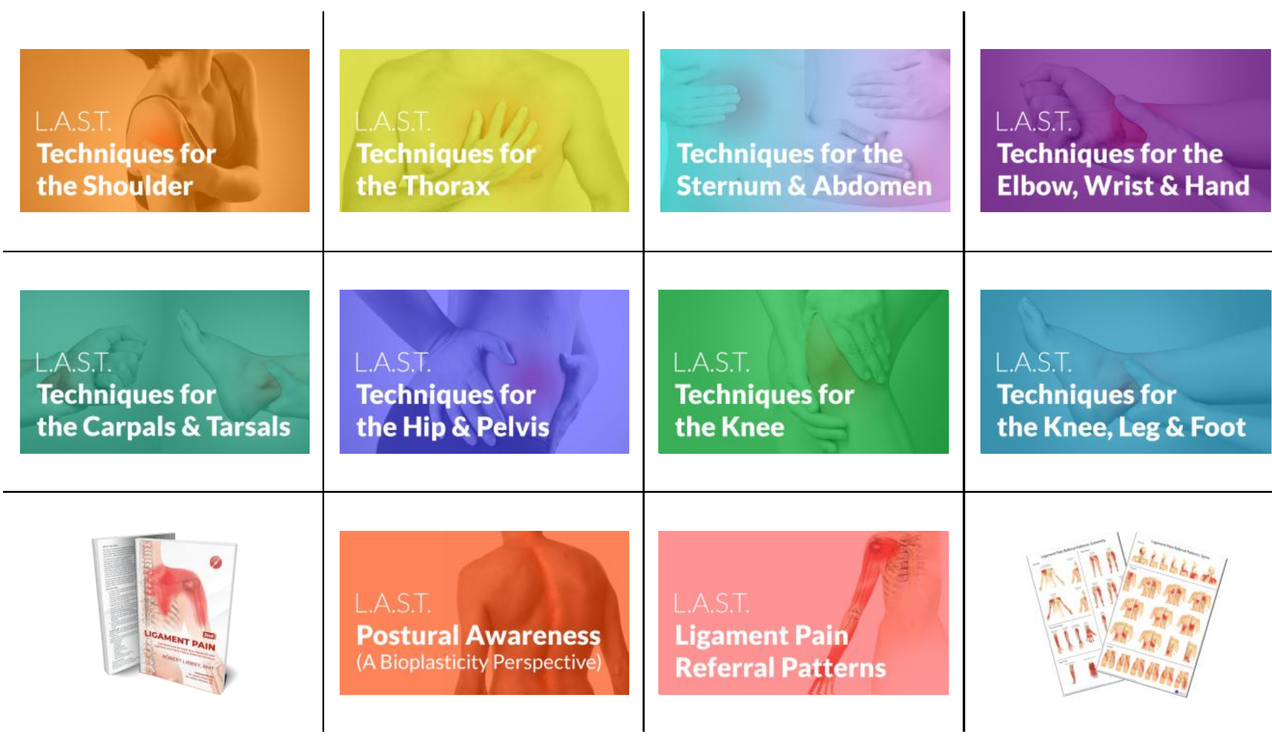
L.A.S.T.
Techniques for the Shoulder
L.A.S.T.
Techniques for the Thorax
Techniques for the Sternum & Abdomen
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Techniques for the Elbow, Wrist & Hand
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Techniques for the Knee
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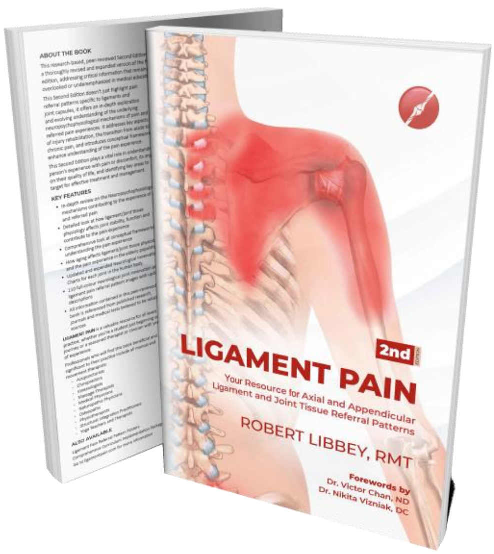
Techniques for the Knee, Leg & Foot
LIGAMENT PAIN
L.A.S.T.
Postural Awareness
(A Bioplasticity Perspective)
L.A.S.T.
Ligament Pain Referral Patterns

4

Ligamentpain.com



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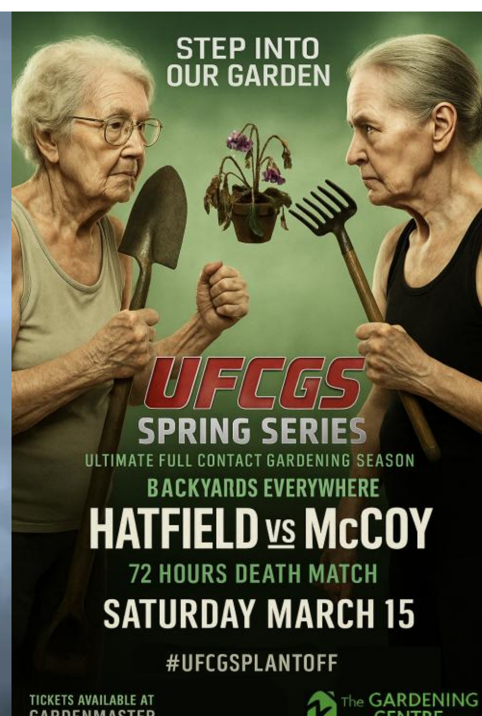
"Half of what we are going to teach you is wrong, and half of it is right. Our problem is that we don't know which half is which."

-Charles Sidney Burwell, Cardiologist, Dean, Harvard Medical School 1935-1949

9

FULL CONTACT GARDENING



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Competence

Confidence

24

25

26

I hope to transform how you approach and treat your patients with injuries/conditions/concerns

Provide information to immediately apply in your Practice with your Patients

Think differently about pain and rehab management

27

28

29


Wild Birds Unlimited
GLOBAL
Domino's
Domino's Pizza
DO NOT DOUBLE STACK

30

31

32


Everything

33


powerless
panic
shocked
burden
sadness
scared
change
nervous
limited
expectation
calm
bad
helpless
normal
frustration
isolated

34

35

36

37

Different Densities with Specific Functions

Ligaments & joint capsules are now seen not as completely separate structures but they are embedded, local densifications, local specifications of a body wide collagenous, fibrous mostly tension driven interconnected system.

- Robert Schleip, Ph.D

38

39

40

How Ligamentous Injuries Happen

41

How Ligamentous Injuries Happen

HIGH FREQUENCY REPETITIVE MOTION OR SPORTS ACTIVITIES

result in high incidents of ligamentous damage or rupture

- Creep
- Stress/Relaxation
- Hysteresis

FAST STRETCH

may exceed the physiological load yet it may still be well within the physiological length range

42


STEP INTO
OUR GARDEN
UFCGS
SPRING SERIES
ULTIMATE FULL CONTACT GARDENING SEASON
BACKYARDS EVERYWHERE
HATFIELD vs McCOY
72 HOURS DEATH MATCH
SATURDAY MARCH 15
#UFCGSPLANTOFF
TICKETS AVAILABLE AT
GARDENMASTER
The GARDENING
CENTRE
CYTOKINE NEEDLES OF FIRE
UFCKC
ULTIMATE FULL CONTACT
KNITTING COMPETITION
SPRING SERIES
LIVING ROOMS EVERYWHERE
48 HOUR SEW DOWN
LAWSON vs MOFFATT
SATURDAY MARCH 15
#UFCKCSEWOFF
TICKETS AVAILABLE AT
KNITMASTER
HOME
KNITTING
CENTRE

43


FULL CONTACT
KNITTING!

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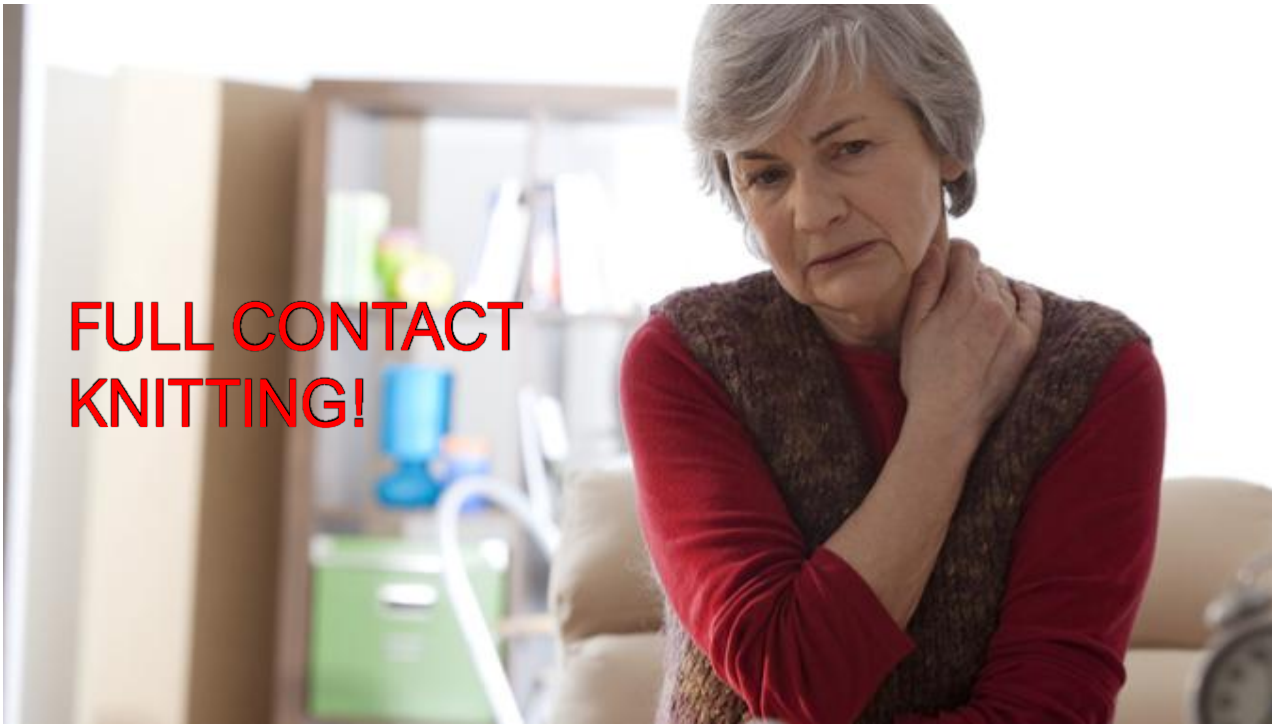

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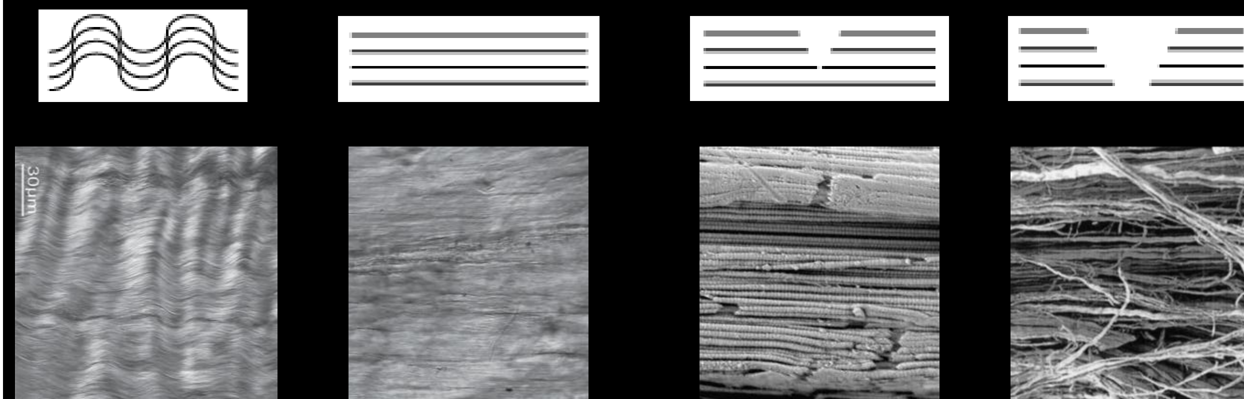
Mechanical Properties

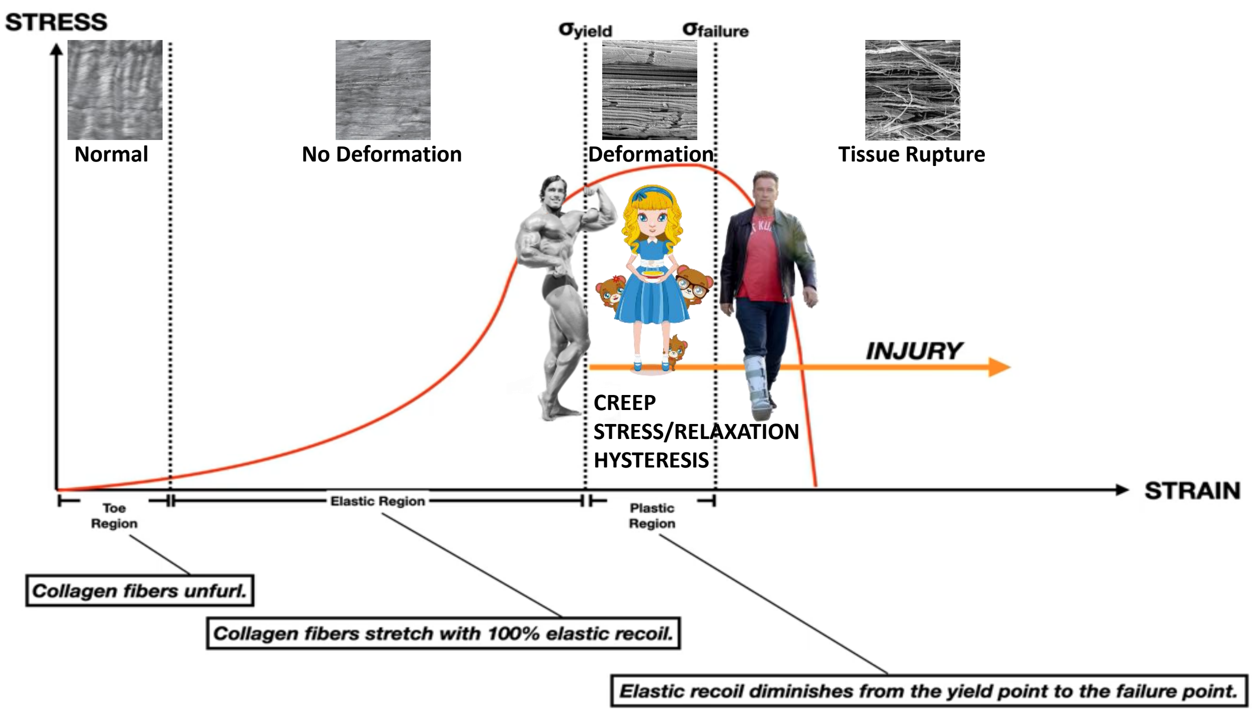
48

How Ligamentous Injuries Happen



Normal Crimped Fibers	No Deformation Straighten fibers	Deformation Microscopic Failure	Tissue Rupture Macroscopic Failure

49



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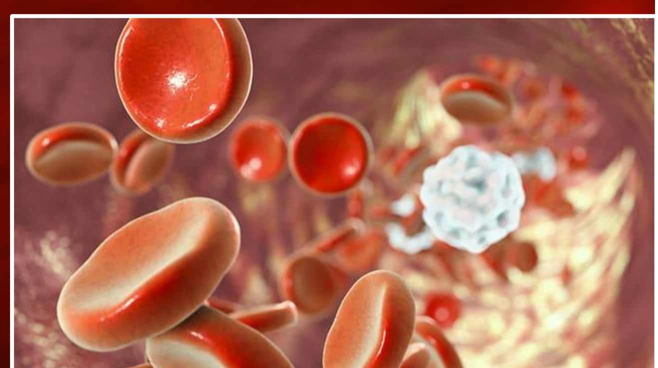
51

Normal Wound-Healing Process

Bleeding and Inflammation Phase
occur within hours, can last for weeks

2 weeks to 6 weeks
Hemorrhage, blood flow and vascular volume increase
Nerve fibers and clot formation

Neovascularization (nerve fibers infiltration)
Formation of granulation tissue (scar)



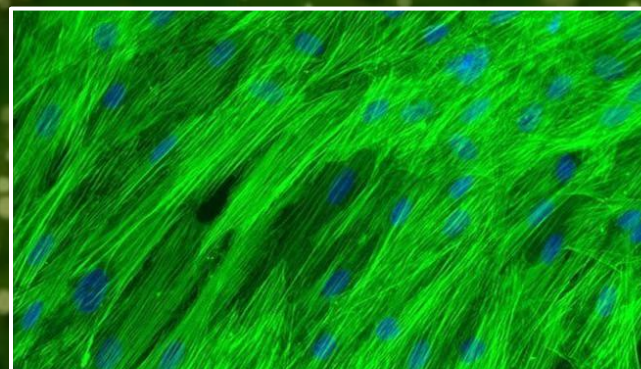
52

Normal Wound-Healing Process

Cell Proliferation with Matrix Production Phase
lasts weeks to months

Neovascularization (nerve fibers infiltration)
Formation of granulation tissue (scar)

Fibroblasts are recruited and begin to produce matrix and form new tissues



53

Normal Wound-Healing Process

Matrix Remodeling Phase
continues for months to years

Blood flow and vascular volume still elevated

Realignment of collagen fibers

Increased collagen matrix maturation

54

Understanding And Approach To Treatment Of Scars And Adhesions
Susan L. Chapelle

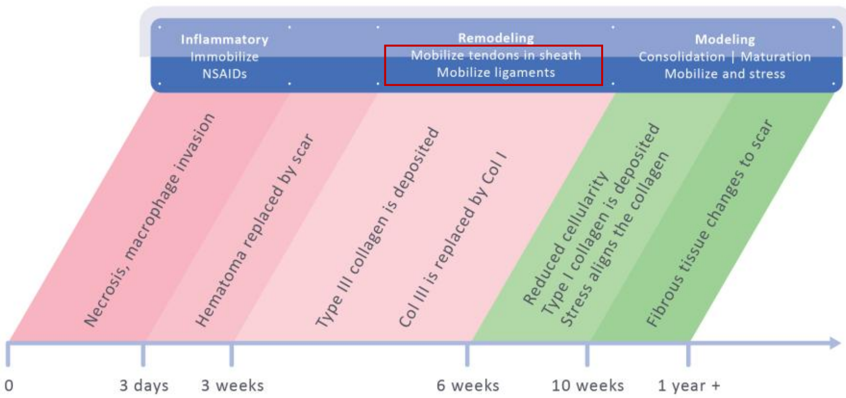


Figure 51.7
Tendon and ligament injury and healing time with potential therapeutic opportunities. Courtesy of Dr Geoffrey Bove

55

How Pro Athletes Heal Tendon Injuries 25% Faster

Dr. Keith Baar is a Professor at the University of California Department of Physiology and Membrane Biology.

56

Understanding And Approach To Treatment Of Scars And Adhesions
Susan L. Chapelle

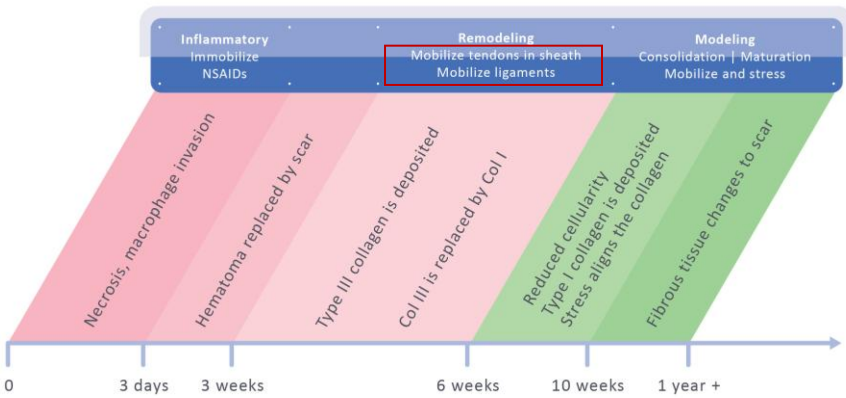


Figure 51.7
Tendon and ligament injury and healing time with potential therapeutic opportunities. Courtesy of Dr Geoffrey Bove

57

How Pro Athletes Heal Tendon Injuries 25% Faster

Dr. Keith Baar is a Professor at the University of California Department of Physiology and Membrane Biology.

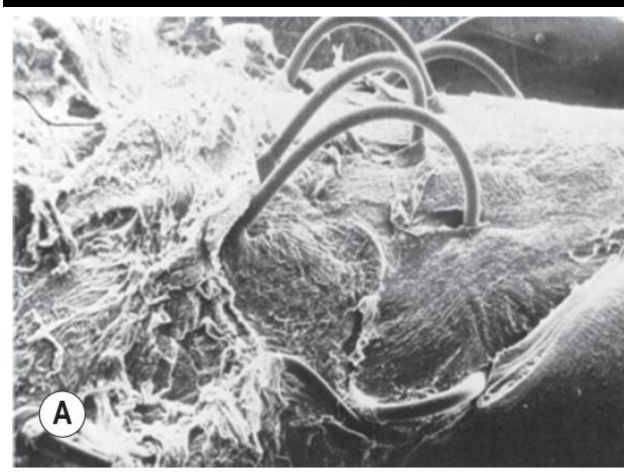
58

Normal

Adhesions

59

No Mobilization (A)



Mobilization (B)

60

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Journal of Electromyography and Kinesiology 14 (2004) 49–60

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Ligaments: a source of work-related musculoskeletal disorders

M. Solomonow *

Occupational Medicine Research Center, Bioengineering Laboratory, Department of Orthopaedic Surgery, Louisiana State University Health Sciences Center, New Orleans, LA 70112, USA

61

TIMELINES FOR ACUTE-CHRONIC

Acute inflammation
sets in within 2 hours, may last several weeks and up to 12 months

represents the healing or upgrading of the ligament’s properties

undergoing changes in cellular, metabolic and vascular condition to improve the mechanical properties

only 70% of original structural and functional characteristics are attained

62

TIMELINES FOR ACUTE-CHRONIC

Chronic inflammation
builds up silently over many weeks, months or years

when the tissue is not allowed to rest, recover and heal

atrophy and degeneration of the collagen matrix
permanently damaged
permanent disability associated with pain, limited motion, weakness

Full recovery was never reported

63

RECOVERY

loading or stretching a ligament over relatively short periods induces changes in its length–tension behavior that may last **20 – 40 times longer** than the duration of the loading/stretching

10 – **60 min** of creep and tension–relaxation
40 – 60% recovery in the first hour of rest
24 – 48H REQUIRED FOR RECOVERY

64

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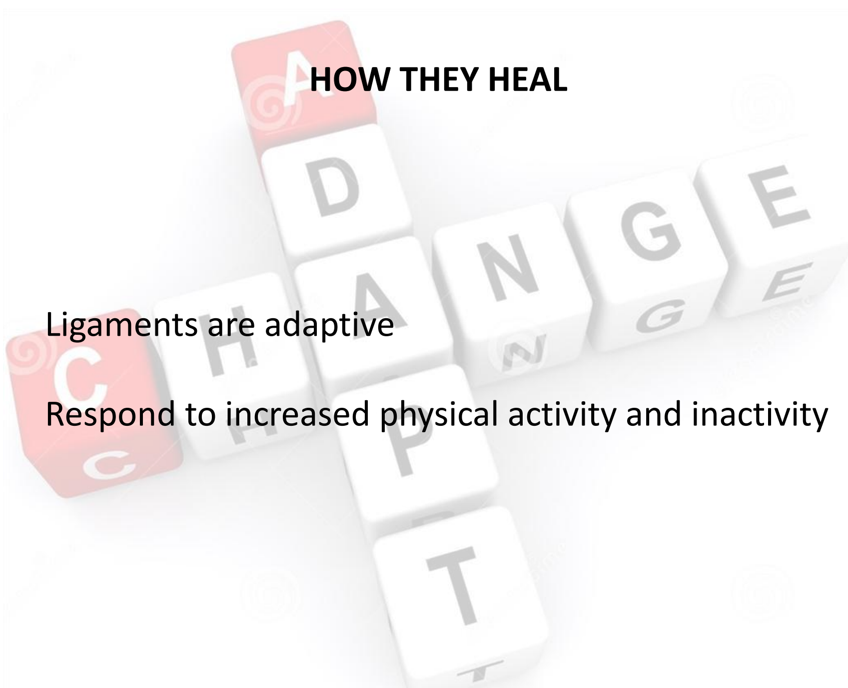
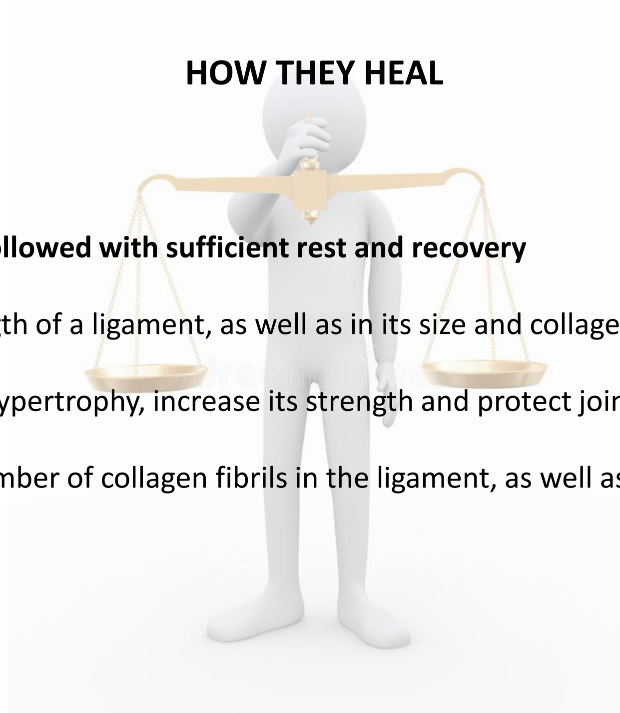


HOW THEY HEAL

Ligaments are adaptive

Respond to increased physical activity and inactivity

66



HOW THEY HEAL

Moderate exercise followed with sufficient rest and recovery

increase in the strength of a ligament, as well as in its size and collagen content

allows the tissue to hypertrophy, increase its strength and protect joint stability

Increase the total number of collagen fibrils in the ligament, as well as in the fibril diameter

67

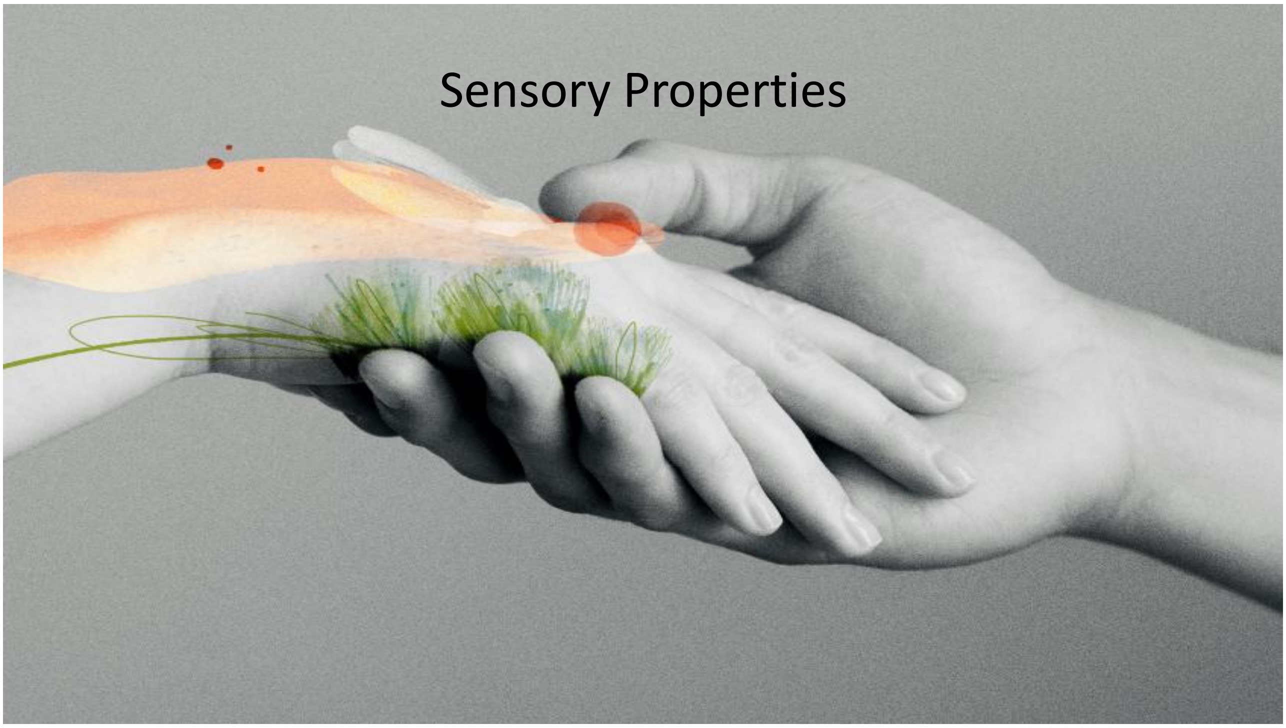
HOW THEY HEAL

Immobilization or reduced physical activity

- degenerative changes
- decreased collagen fiber diameter
- decreased fibril density
- decreased fibril number
- decreased overall collagen mass and metabolism

- weaker and thinner ligaments
- weaker attachment to the bones
- increasing the risk for potential injury

68



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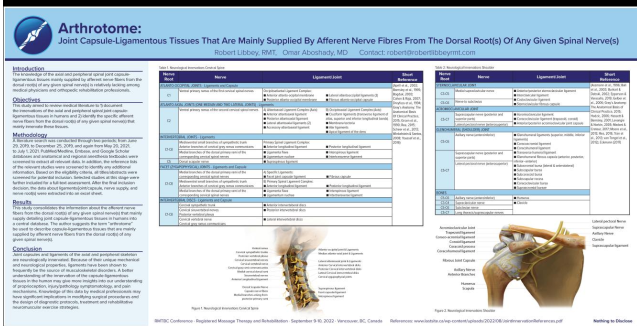
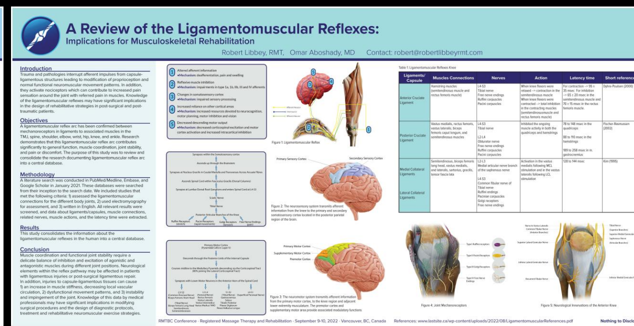
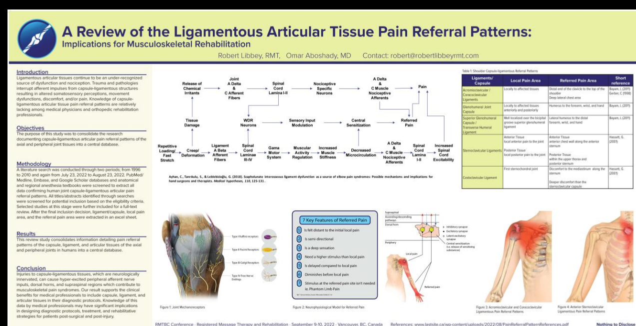






71

Do the Dermatome/Myotome Dance

72

Arthrotome:

Joint Capsule-Ligamentous Tissues That Are Mainly Supplied By Afferent Nerve Fibres From The Dorsal Root(s) Of Any Given Spinal Nerve(s)

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com

Introduction

The knowledge of the axial and peripheral spinal joint capsule-ligamentous tissues mainly supplied by afferent nerve fibers from the dorsal root(s) of any given spinal nerve(s) is relatively lacking among medical physicians and orthopedic rehabilitation professionals.

Objectives

This study aimed to review medical literature to 1) document the innervations of the axial and peripheral spinal joint capsule-ligamentous tissues in humans and 2) identify the specific afferent nerve fibers from the dorsal root(s) of any given spinal nerve(s) that mainly innervate these tissues.

Methodology

A literature search was conducted through two periods; from June 29, 2019, to December 25, 2019, and again from May 20, 2021, to July 1, 2021. PubMed/Medline, Embase, and Google Scholar databases and anatomical and regional anesthesia textbooks were screened to extract all relevant data. In addition, the reference lists of the relevant studies were screened to identify any additional information. Based on the eligibility criteria, all titles/abstracts were screened for potential inclusion. Selected studies at this stage were further included for a full-text assessment. After the final inclusion decision, the data about ligaments/joint/capsule, nerve supply, and nerve root(s) were extracted into an excel sheet.

Results

This study consolidates the information about the afferent nerve fibers from the dorsal root(s) of any given spinal nerve(s) that mainly supply detailing joint capsule-ligamentous tissues in humans into a central database. The author suggests the term "arthrotome" be used to describe capsule-ligamentous tissues that are mainly supplied by afferent nerve fibers from the dorsal root(s) of any given spinal nerve(s).

Conclusion

Joint capsules and ligaments of the axial and peripheral skeleton are neurologically innervated. Because of their unique mechanical and neurological properties, ligaments have been shown to frequently be the source of musculoskeletal disorders. A better understanding of the innervation of the capsule-ligamentous tissues in the human may give more insights into our understanding of proprioception, injury/pathology symptomatology, and pain mechanisms. Knowledge of this data by medical professionals may have significant implications in modifying surgical procedures and the design of diagnostic protocols, treatment and rehabilitative neuromuscular exercise strategies.

Table 1. Neurological Innervations Cervical Spine

Nerve Root	Nerve	Ligament/Joint	Short Reference
ATLANTO-OCCIPITAL JOINTS - Ligaments and Capsule			(April et al., 2002; Barnsley et al., 1995; Bogduk, 2003; Cohen & Raja, 2007; Dreyfuss et al., 1994; Gray's Anatomy: The Anatomical Basis Of Clinical Practice, 2015; Groen et al., 1990; Rea, 2015; Scheer et al., 2013; Winkelstein & Santos, 2008; Youssef et al., 2016)
C1	Ventral primary ramus of the first cervical spinal nerves	Occipitoatlantal Ligament Complex: ■ Anterior atlanto-ocipital membrane ■ Posterior atlanto-occipital membrane ■ Lateral atlantooccipital ligaments (2) ■ Fibrous atlanto-occipital capsule	
ATLANTO-AXIAL JOINTS (ONE MEDIAN AND TWO LATERAL JOINTS) - Ligaments			
C2	Ventral primary ramus of the second cervical spinal nerves	A) Atlantoaxial Ligament Complex (Axis): ■ Anterior atlantoaxial ligament ■ Posterior atlantoaxial ligament ■ Lateral atlantoaxial ligaments (2) ■ Accessory atlantoaxial ligament B) Occipitoaxial Ligament Complex (Axis): ■ Cruciform ligaments (transverse ligament of atlas, superior and inferior longitudinal bands) ■ Membrana tectoria ■ Alar ligaments ■ Apical ligament of the dens	
INTERVERTEBRAL JOINTS - Ligaments			
C1-C8	Medioventral small branches of sympathetic trunk Anterior branches of cervical grey ramus communicans	Primary Spinal Ligament Complex: ■ Anterior longitudinal ligament ■ Posterior longitudinal ligament	
	Medial branches of the dorsal primary rami of the corresponding cervical spinal nerves	■ Ligamenta flava ■ Ligamentum nuchae ■ Interspinous ligament ■ Intertransverse ligament	
C5	Dorsal scapular nerve	■ Supraspinous ligament	
FACET (ZYGAPOPHYSICAL) JOINTS - Ligaments and Capsule			
C1-C8	Medial branches of the dorsal primary rami of the corresponding cervical spinal nerves	A) Specific Ligaments: ■ Facet joint capsular ligament ■ Fibrous capsule	
	Medioventral small branches of sympathetic trunk Anterior branches of cervical grey ramus communicans	B) Primary Spinal Ligament Complex: ■ Anterior longitudinal ligament ■ Posterior longitudinal ligament	
	Medial branches of the dorsal primary rami of the corresponding cervical spinal nerves	■ Ligamenta flava ■ Ligamentum nuchae ■ Interspinous ligament ■ Intertransverse ligament	
INTERVERTEBRAL DISCS - Ligaments and Capsule			
C1-C8	Cercival sympathetic trunk	■ Anterior intervertebral discs	
	Cervical sinuvertebral nerves Posterior vertebral plexus	■ Posterior intervertebral discs	
	Cervical vertebral nerve Cervical grey ramus communicans	■ Lateral intervertebral discs	

Figure 1. Neurological Innervations Cervical Spine

Table 2: Neurological Innervations Shoulder

Nerve Root	Nerve	Ligament/Joint	Short Reference
STERNOCLAVICULAR JOINT			(Aszmann et al., 1996; Ball et al., 2003; Burkart & Debski, 2002; Epperson & Varacallo, 2019; Gelber et al., 2006; Gray's Anatomy: The Anatomical Basis of Clinical Practice, 2015; Hadzic, 2006; Hassett & Barnsley, 2001; Levangie & Norkin, 2005; Madani & Croteur, 2017; Moore et al., 2013; Rea, 2015; Tran et al., 2013; van Tongel et al., 2012); Eckmann (2017)
C3-C5	Medial supraclavicular nerve	■ Anterior/posterior sternoclavicular ligament ■ Interclavicular ligament ■ Costoclavicular ligament ■ Sternoclavicular fibrous capsule	
C5-C6	Nerve to subclavius		
ACROMIOCLAVICULAR JOINT			
C5-C7	Suprascapular nerve (posterior and superior parts) Lateral pectoral nerve (anterosuperior)	■ Acromioclavicular ligament ■ Coracoclavicular ligament (trapezoid, conoid) ■ Anterior/posterior acromioclavicular joint capsule	
GLENOHUMERAL (SHOULDER) JOINT			
C5-C6	Axillary nerve (anteroinferior)	■ Glenohumeral ligaments (superior, middle, inferior ligaments) ■ Coracoacromial ligament ■ Coracohumeral ligament ■ Transverse humeral ligament ■ Glenohumeral fibrous capsule (anterior, posterior, inferior–anterior) ■ Subacromial bursa (lateral & anterolateral) ■ Subscapular bursa ■ Subcoracoid bursa ■ Subscapular recess ■ Coracoclavicular bursa ■ Supraacromial bursae	
C5-C7	Suprascapular nerve (posterior and superior parts) Lateral pectoral nerve (anterosuperior)		
BONES			
C5-C6	Axillary nerve (anteroinferior)	■ Humerus	
C3-C4	Supraclavicular nerve	■ Clavicle	
C5-C6	Subclavian nerve		
C5-C7	Long thoracic/suprascapular nerves		

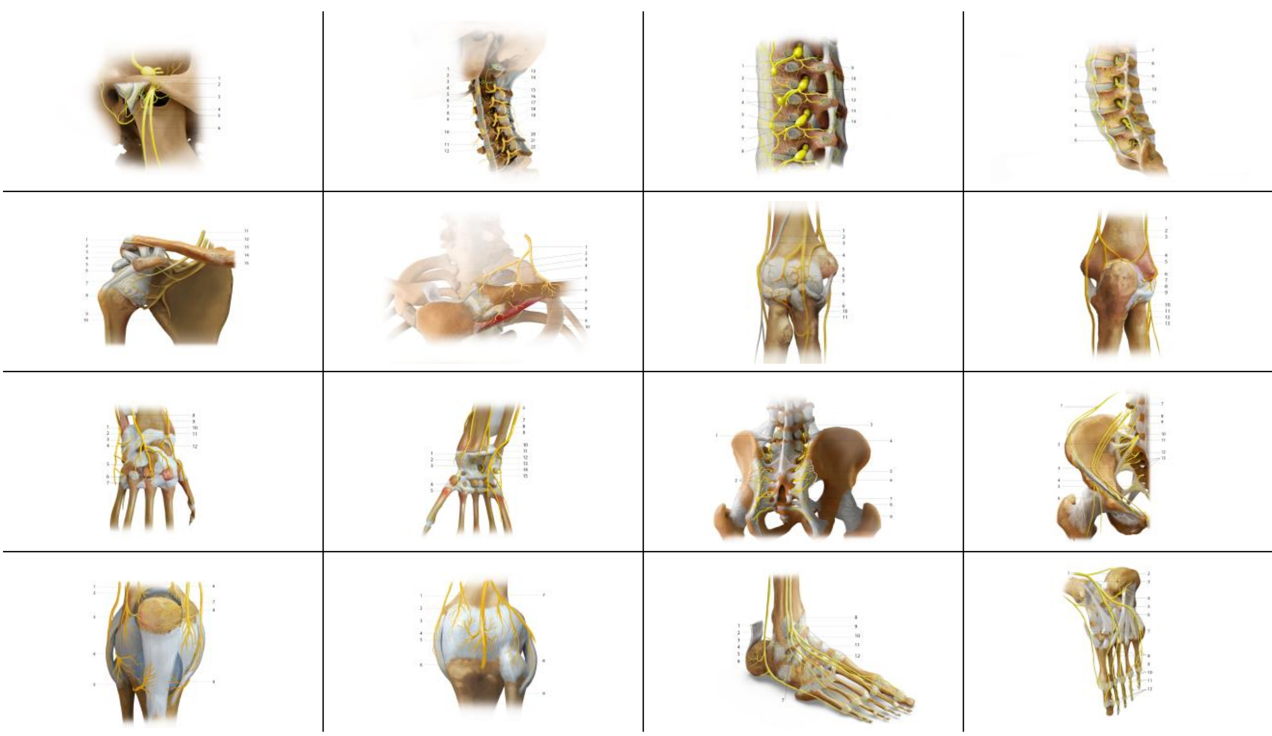
Figure 2. Neurological Innervations Shoulder

RMTBC Conference · Registered Massage Therapy and Rehabilitation · September 9-10, 2022 · Vancouver, BC, Canada

References: www.lastsite.ca/wp-content/uploads/2022/08/JointInnervationReferences.pdf

Nothing to Disclose

73



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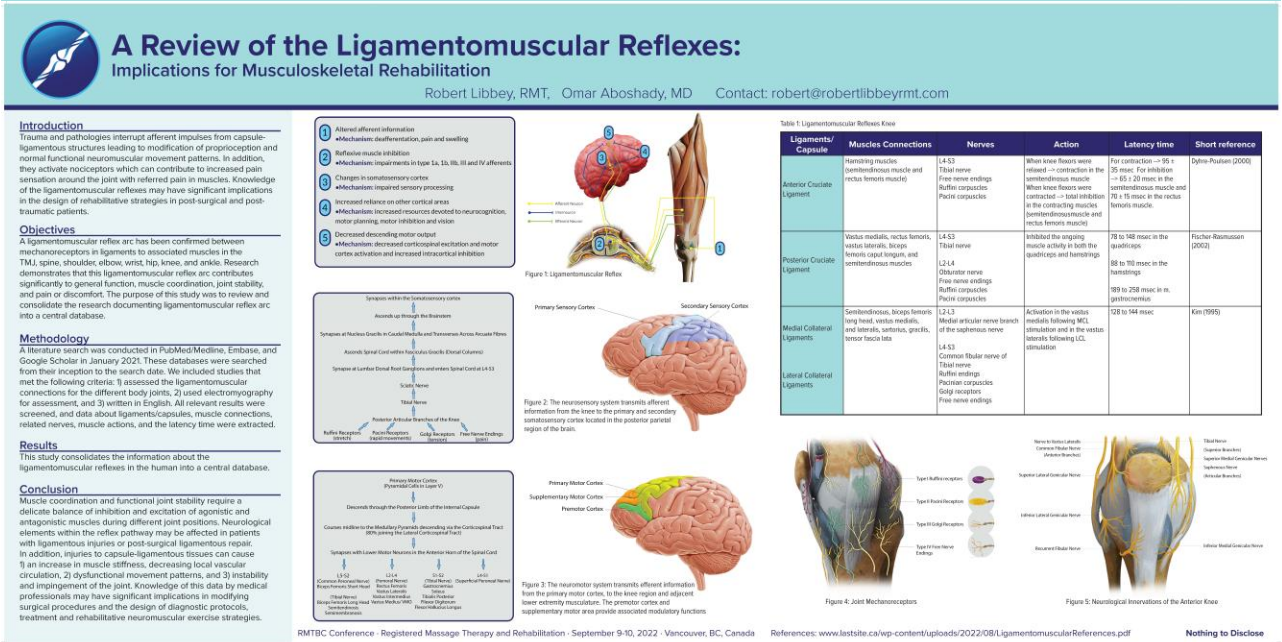
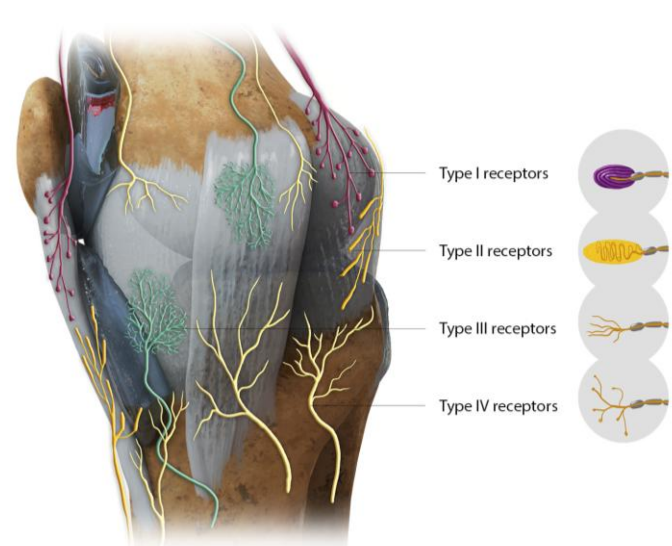


75

A Review of the Ligamentomuscular Reflexes:
Implications for Musculoskeletal Rehabilitation

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com



References: www.lastsite.ca/wp-content/uploads/2022/08/LigamentomuscularReferences.pdf

The four types of mechanoreceptors, their location and the effects manual treatment has on them	
Receptor:	**Ruffini - Type I**
Location:	• superficial layer of joint capsules • dura mater • peripheral joints' ligaments • muscle fasciae • the deep dorsal fascia of the hand
Responds to:	constant, slow and deep pressure slow shear forces
Results in:	a lowering of sympathetic nervous system activity
Receptor:	**Pacini – Type II**
Location:	• deep layers of joint capsules • deeper spinal ligaments • investing muscular fasciae (antebrachial, crural) • abdominal fasciae, masseter, lateral thigh, plantar and palmar tissues, & peritoneum
Responds to:	• rapid changes in pressure • vibratory/oscillatory techniques • HVLA's
Results in:	an increase local proprioceptive attention and self-regulation

76

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Implications for Musculoskeletal Rehabilitation

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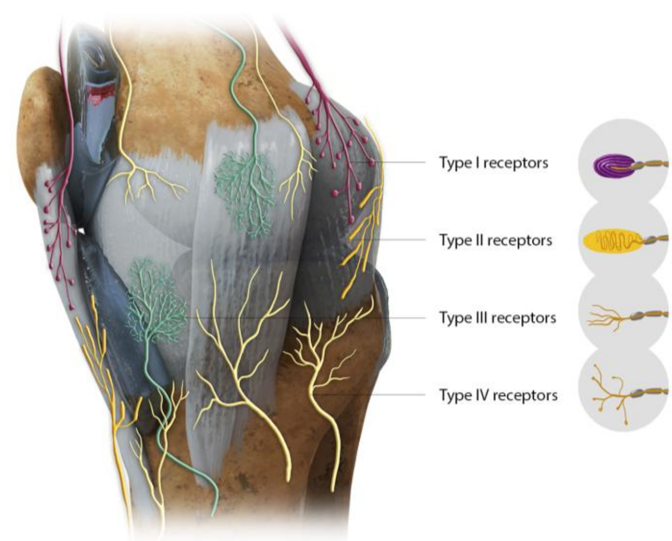

The four types of mechanoreceptors, their location and the effects manual treatment has on them	
Receptor:	**Golgi – Type III**
Location:	• all dense connective tissues • intrinsic and extrinsic ligaments • joint capsules • myotendinous junctions • attachment areas of aponeurosis
Responds to:	slow stretch techniques
Results in:	a decrease in active muscle tone
Receptor:	**Free/Interstitial Nerve Endings – Type IV**
Location:	• fibrous joint capsule • articular fat pads • intrinsic and extrinsic ligaments • all fascial tissue • periosteum • interosseous membranes • tendons • fascial connections to bones
Responds to:	• deep, slow or steady manual pressure • Treatment to periosteum, interosseous membranes, and fasciae connected to bones
Results in:	• autonomic functions: changes in heart rate, blood pressure, respiration, increase or decrease blood pressure, sensation of position and movement, increased vagal activity, global muscle relaxation, alterations in local fluid dynamics and tissue metabolism • plasma extravasation

References: www.lastsite.ca/wp-content/uploads/2022/08/LigamentomuscularReferences.pdf

77

A Review of the Ligamentomuscular Reflexes:
Implications for Musculoskeletal Rehabilitation

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com

1. Altered afferent information
   - **Mechanism:** deafferentation, pain and swelling
2. Reflexive muscle inhibition/stimulation
   - **Mechanism:** changes in type 1a, 1b, IIb, III and IV afferents
3. Changes in somatosensory cortex
   - **Mechanism:** impaired sensory processing
4. Increased reliance on other cortical areas
   - **Mechanism:** increased resources devoted to neurocognition, motor planning, motor inhibition and vision
5. Decreased descending motor output
   - **Mechanism:** decreased corticospinal excitation and motor cortex activation and increased intracortical inhibition

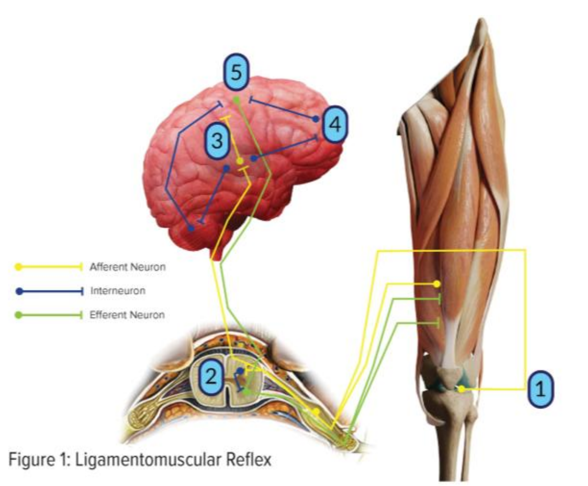

Figure 1: Ligamentomuscular Reflex

References: www.lastsite.ca/wp-content/uploads/2022/08/LigamentomuscularReferences.pdf

78

A Review of the Ligamentomuscular Reflexes:
Implications for Musculoskeletal Rehabilitation

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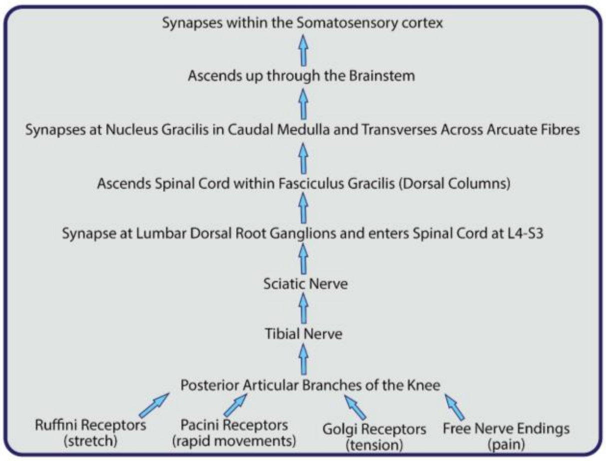

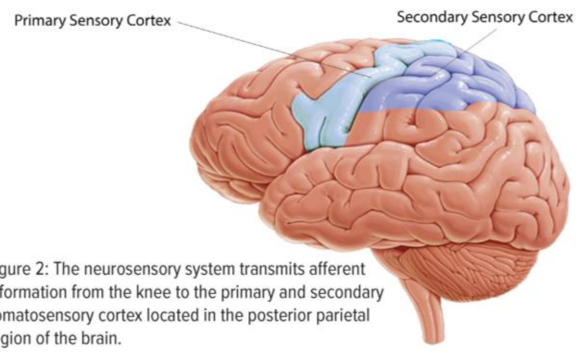

Figure 2: The neurosensory system transmits afferent information from the knee to the primary and secondary somatosensory cortex located in the posterior parietal region of the brain.

References: www.lastsite.ca/wp-content/uploads/2022/08/LigamentomuscularReferences.pdf

79

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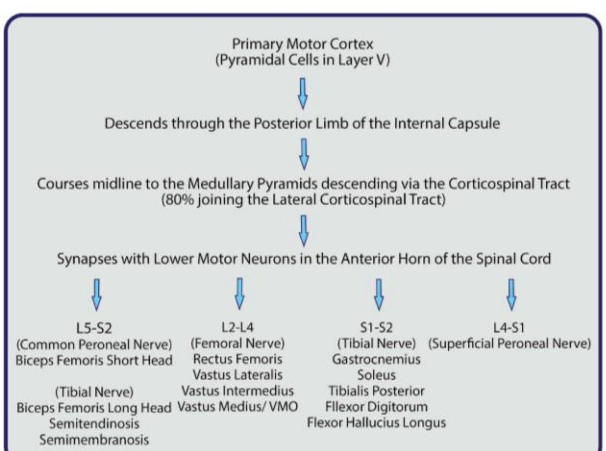
Implications for Musculoskeletal Rehabilitation

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com



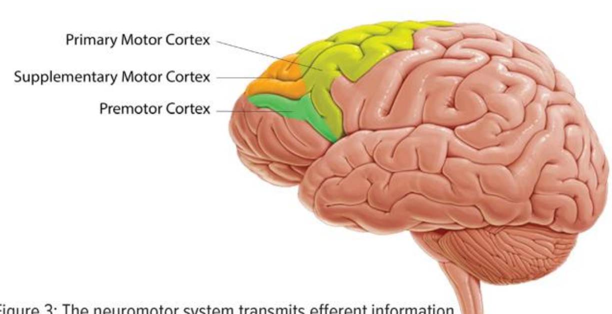


Figure 3: The neuromotor system transmits efferent information from the primary motor cortex, to the knee region and adjacent lower extremity musculature. The premotor cortex and supplementary motor area provide associated modulatory functions

References: www.lastsite.ca/wp-content/uploads/2022/08/LigamentomuscularReferences.pdf

80

A Review of the Ligamentomuscular Reflexes:
Implications for Musculoskeletal Rehabilitation

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com

Table 1: Ligamentomuscular Reflexes Knee

Ligaments/ Capsule	Muscles Connections	Nerves	Action	Latency time	Short reference
Anterior Cruciate Ligament	Hamstring muscles (semitendinosus muscle and rectus femoris muscle)	L4-S3 Tibial nerve Free nerve endings Ruffini corpuscles Pacini corpuscles	When knee flexors were relaxed --> contraction in the semitendinosus muscle When knee flexors were contracted --> total inhibition in the contracting muscles (semitendinosusmuscle and rectus femoris muscle)	For contraction --> 95 ± 35 msec For inhibition --> 65 ± 20 msec in the semitendinosus muscle and 70 ± 15 msec in the rectus femoris muscle.	Dyhre-Poulsen (2000)
Posterior Cruciate Ligament	Vastus medialis, rectus femoris, vastus lateralis, biceps femoris caput longum, and semitendinosus muscles	L4-S3 Tibial nerve L2-L4 Obturator nerve Free nerve endings Ruffini corpuscles Pacini corpuscles	Inhibited the ongoing muscle activity in both the quadriceps and hamstrings	78 to 148 msec in the quadriceps 88 to 110 msec in the hamstrings 189 to 258 msec in m. gastrocnemius	Fischer-Rasmussen (2002)
Medial Collateral Ligaments Lateral Collateral Ligaments	Semitendinosus, biceps femoris long head, vastus medialis, and lateralis, sartorius, gracilis, tensor fascia lata	L2-L3 Medial articular nerve branch of the saphenous nerve L4-S3 Common fibular nerve of Tibial nerve Ruffini endings Pacinian corpuscles Golgi receptors Free nerve endings	Activation in the vastus medialis following MCL stimulation and in the vastus lateralis following LCL stimulation	128 to 144 msec	Kim (1995)

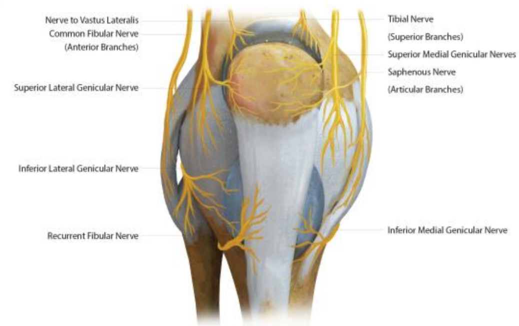


Figure 5: Neurological Innervations of the Anterior Knee

References: www.lastsite.ca/wp-content/uploads/2022/08/LigamentomuscularReferences.pdf

81

A Review of the Ligamentomuscular Reflexes:
Implications for Musculoskeletal Rehabilitation
Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com

Automatic, dynamic involuntary responses work in harmony with conscious muscle control to maintain balance, stability, and coordination, enabling seamless adaptation to uneven terrain. While voluntary control allows for precise and intentional movements, the ligamentomuscular reflex provides rapid, automatic stabilization to minimize mechanical stress or strain being applied to the joint.

Together, these mechanisms are essential for maintaining joint stability, preventing injuries, and supporting both everyday movements and more demanding physical activity (Hauser, 2013; Johansson et al., 1991; Solomonow, 2009; Van der Wal, 2009).

For example, running cross-country or walking in high heels on a cobblestone surface requires an instinctive and seamless blending of conscious balance and automatic reflexive stabilization to navigate and adjust to uneven terrain.

82

A Review of the Ligamentous Articular Tissue Pain Referral Patterns:
Implications for Musculoskeletal Rehabilitation

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com

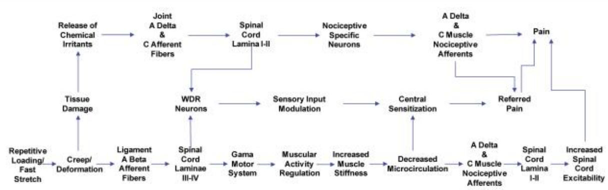
Introduction
Ligamentous articular tissues continue to be an under-recognized source of dysfunction and nociception. Trauma and pathologies interrupt afferent impulses from capsule-ligamentous structures resulting in altered somatosensory perceptions, movement dysfunctions, discomfort, and/or pain. Knowledge of capsule-ligamentous articular tissue pain referral patterns are relatively lacking among medical physicians and orthopedic rehabilitation professionals.

Objectives
The purpose of this study was to consolidate the research documenting capsule-ligamentous articular pain referral patterns of the axial and peripheral joint tissues into a central database.

Methodology
A literature search was conducted through two periods; from 1996 to 2010 and again from July 23, 2022 to August 23, 2022. PubMed/Medline, Embase, and Google Scholar databases and anatomical and regional anesthesia textbooks were screened to extract all data confirming human joint capsule-ligamentous articular pain referral patterns. All titles/abstracts identified through searches were screened for potential inclusion based on the eligibility criteria. Selected studies at this stage were further included for a full-text review. After the final inclusion decision, ligament/capsule, local pain area, and the referral pain area were extracted in an excel sheet.

Results
This review study consolidates information detailing pain referral patterns of the capsule, ligament, and articular tissues of the axial and peripheral joints in humans into a central database.

Conclusion
Injuries to capsule-ligamentous tissues, which are neurologically innervated, can cause hyper-excited peripheral afferent nerve inputs, dorsal horns, and supraspinal regions which contribute to musculoskeletal pain syndromes. Our result supports the clinical benefits for medical professionals to include capsule, ligament, and articular tissues in their diagnostic protocols. Knowledge of this data by medical professionals may have significant implications in designing diagnostic protocols, treatment, and rehabilitative strategies for patients post-surgical and post-injury.



Ayhan, C., Tanrıkulu, S., & Leblebicioğlu, G. (2018). Scapholunate interosseous ligament dysfunction as a source of elbow pain syndromes: Possible mechanisms and implications for hand surgeons and therapists. *Medical hypotheses, 110*, 125-131.

Table 1: Shoulder Capsule-ligamentous Referral Patterns

Ligaments/ Capsule	Local Pain Area	Referred Pain Area	Short reference
Acromioclavicular / Coracoclavicular Ligaments	Locally to affected tissues	Distal end of the clavicle to the top of the shoulder Deep lateral chest area	Bayam, L (2011) Gerber, C (1998)
Glenohumeral Joint Capsule	Locally to affected tissues anteriorly and posteriorly	Humerus to the forearm, wrist, and hand	Bayam, L (2011)
Superior Glenohumeral Capsule / Transverse Humeral Ligament	Well localized over the bicipital groove superior glenohumeral ligament	Lateral humerus to the distal forearm, wrist, and hand	Bayam, L (2011)
Sternoclavicular Ligaments	Anterior Tissue local anterior pain to the joint Posterior Tissue local posterior pain to the joint	Anterior Tissue anterior chest wall along the anterior sternum Posterior Tissue within the upper thorax and posterior sternum	Hassett, G. (2001)
Costoclavicular Ligament	First sternochondral joint	Discomfort to the mediastinum along the sternum Deeper discomfort than the sternoclavicular capsule	Hassett, G. (2001)

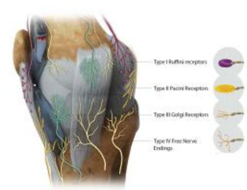


Figure 1: Joint Mechanoreceptors

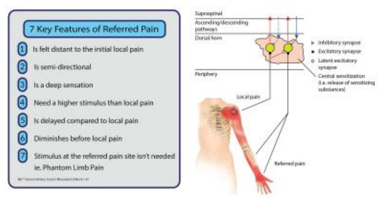


Figure 2: Neurophysiological Model for Referred Pain

Figure 3: Acromioclavicular and Coracoclavicular Ligamentous Pain Referral Patterns

Figure 4: Anterior Sternoclavicular Ligamentous Pain Referral Patterns

RMTBC Conference · Registered Massage Therapy and Rehabilitation · September 9-10, 2022 · Vancouver, BC, Canada

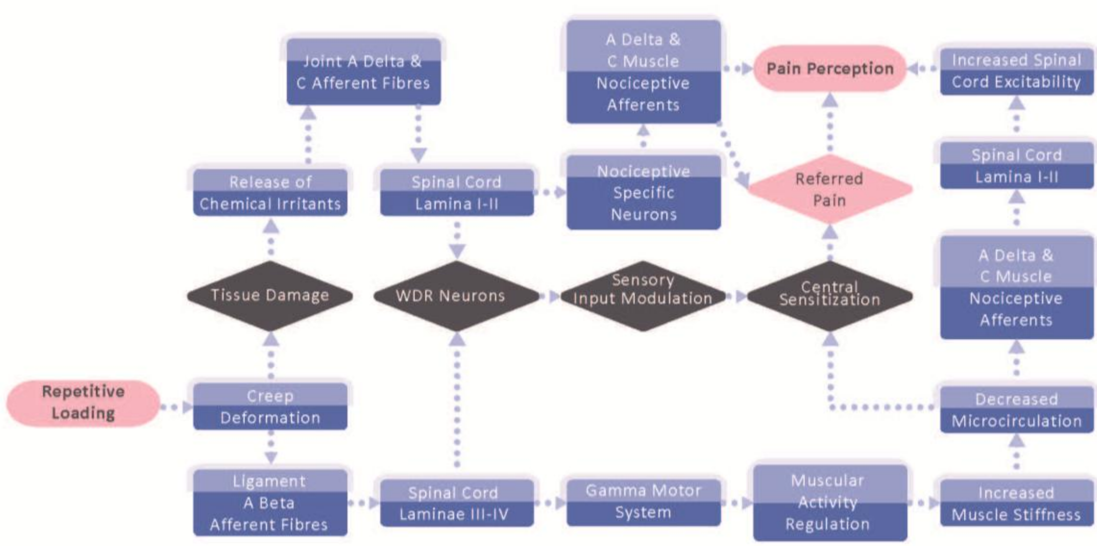
References: www.lastsite.ca/wp-content/uploads/2022/08/PainReferralPatternReferences.pdf

Nothing to Disclose

83

A Review of the Ligamentous Articular Tissue Pain Referral Patterns:
Implications for Musculoskeletal Rehabilitation

Robert Libbey, RMT, Omar Aboshady, MD Contact: robert@robertlibbeyrmt.com



References: www.lastsite.ca/wp-content/uploads/2022/08/PainReferralPatternReferences.pdf

84

A Review of the Ligamentous Articular Tissue Pain Referral Patterns:
Implications for Musculoskeletal Rehabilitation

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85

A Review of the Ligamentous Articular Tissue Pain Referral Patterns:
Implications for Musculoskeletal Rehabilitation
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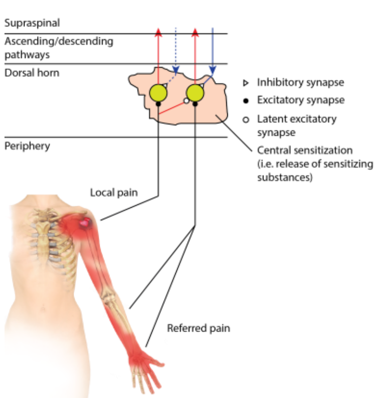
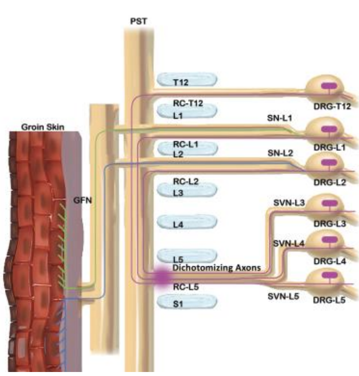
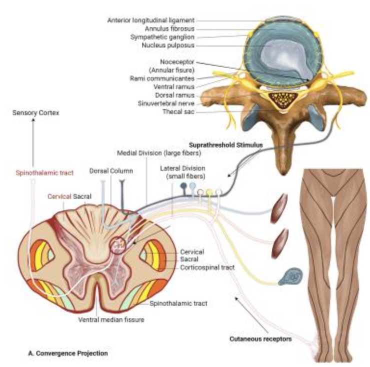


Neurophysiological Mechanism

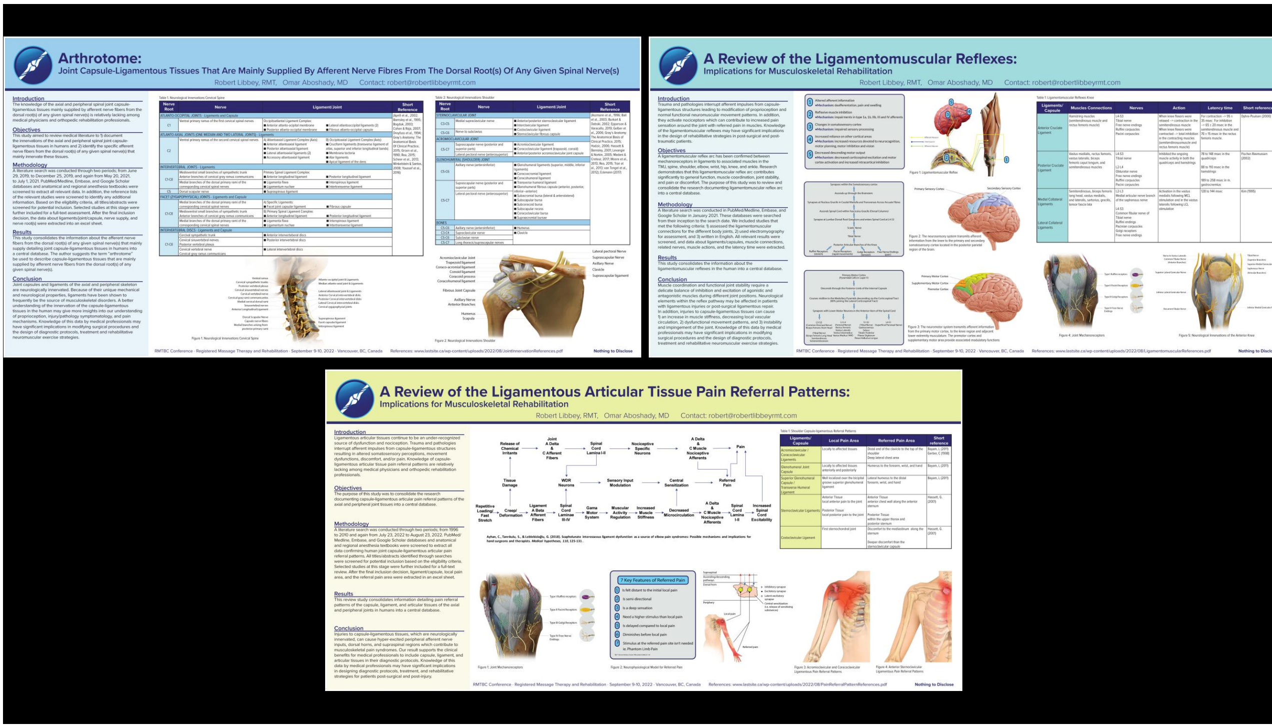


Neurophysiological Schematic Model of Dichotomizing Axons



Convergence-Projection Pattern

86



87

Factors Affecting Wound Healing

88

Thoughts & Beliefs & Expectations

89

CRITICAL REVIEWS IN ORAL BIOLOGY & MEDICINE

S. Guo and L.A. DiPietro*

Center for Wound Healing and Tissue Regeneration, Department of Periodontics, College of Dentistry (MC 859), University of Illinois at Chicago, 801 S. Paulina Ave., Chicago, IL 60612, USA; *corresponding author, ldipiet@uic.edu

J Dent Res 89(3):219-229, 2010

Factors Affecting Wound Healing

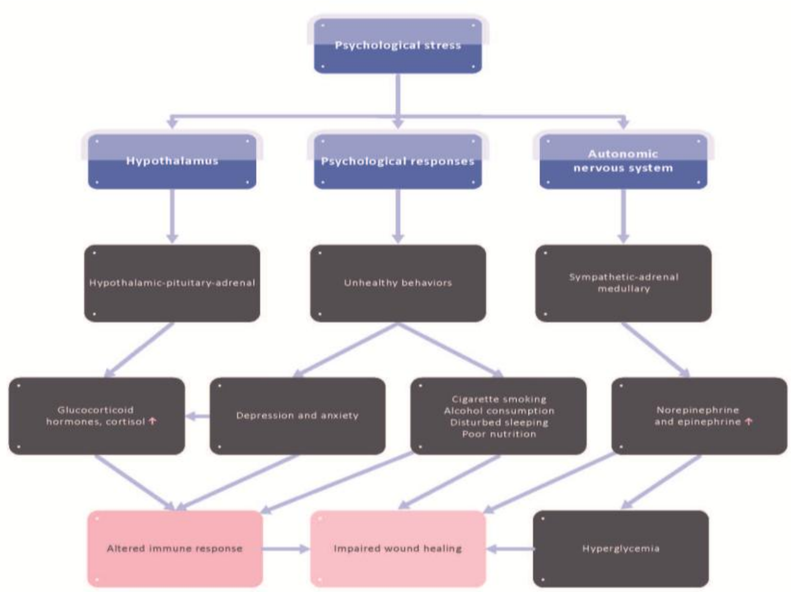
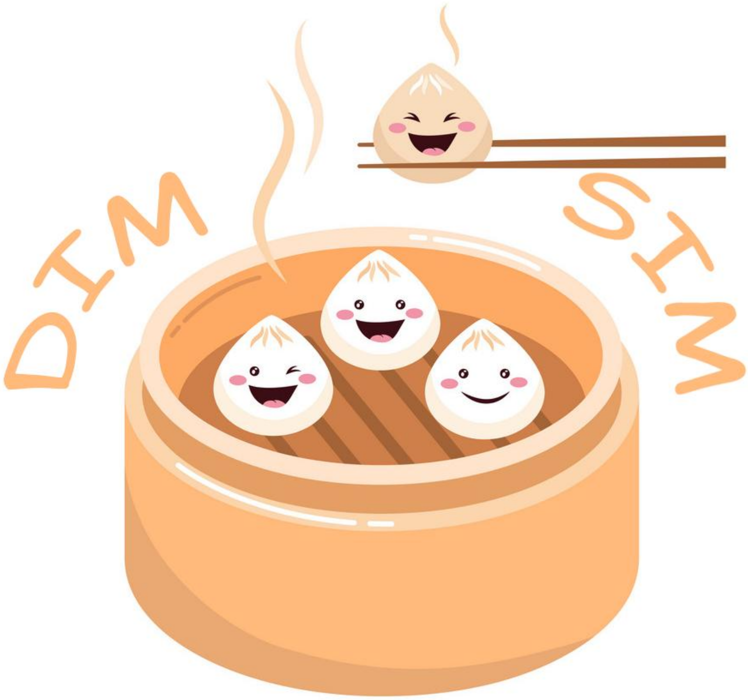


Figure 1: The effects of stress on wound healing. Stress-impaired wound healing is mediated primarily through the hypothalamic-pituitary-adrenal, sympathetic-adrenal medullary axes, and psychological- response-induced unhealthy behaviors.

90



91

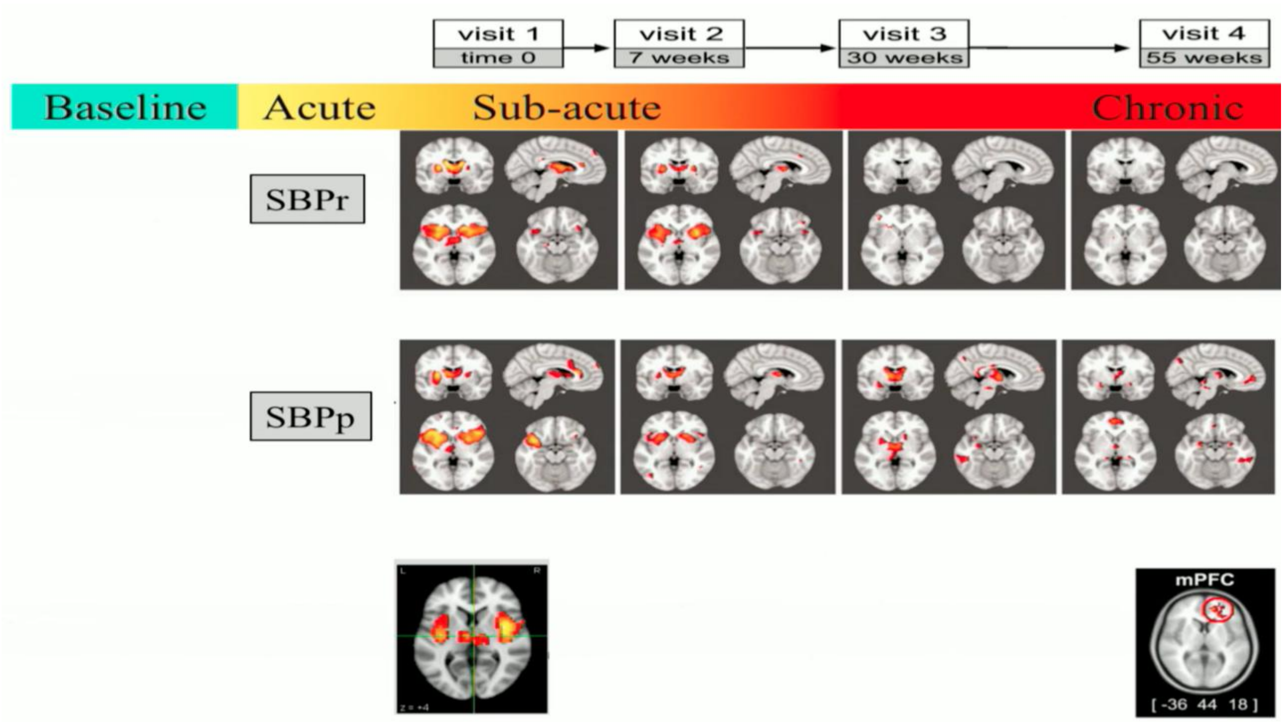
Brain mechanisms of Chronic Pain

A. Vania Apkarian, PhD

San Diego Pain Summit

February , 2018
San Diego

92


visit 1
time 0
visit 2
7 weeks
visit 3
30 weeks
visit 4
55 weeks
Baseline
Acute
Sub-acute
Chronic
SBPr
SBPp
mPFC
[-36 44 18]

93


POLICE
PROTECT & SERVE

94

95

Armouring / Protecting

- Ligamentomuscular Reflex
- Chronic Fascial Stiffness
- Vascular Compression/Insufficiency
- Neuroplastic Changes

96

Neuroplastic Changes

Explains the transition from acute to chronic conditions

Nociceptive to **Nociplastic** Pain

Explains why some patients continue to experience pain when no structural cause can be determined

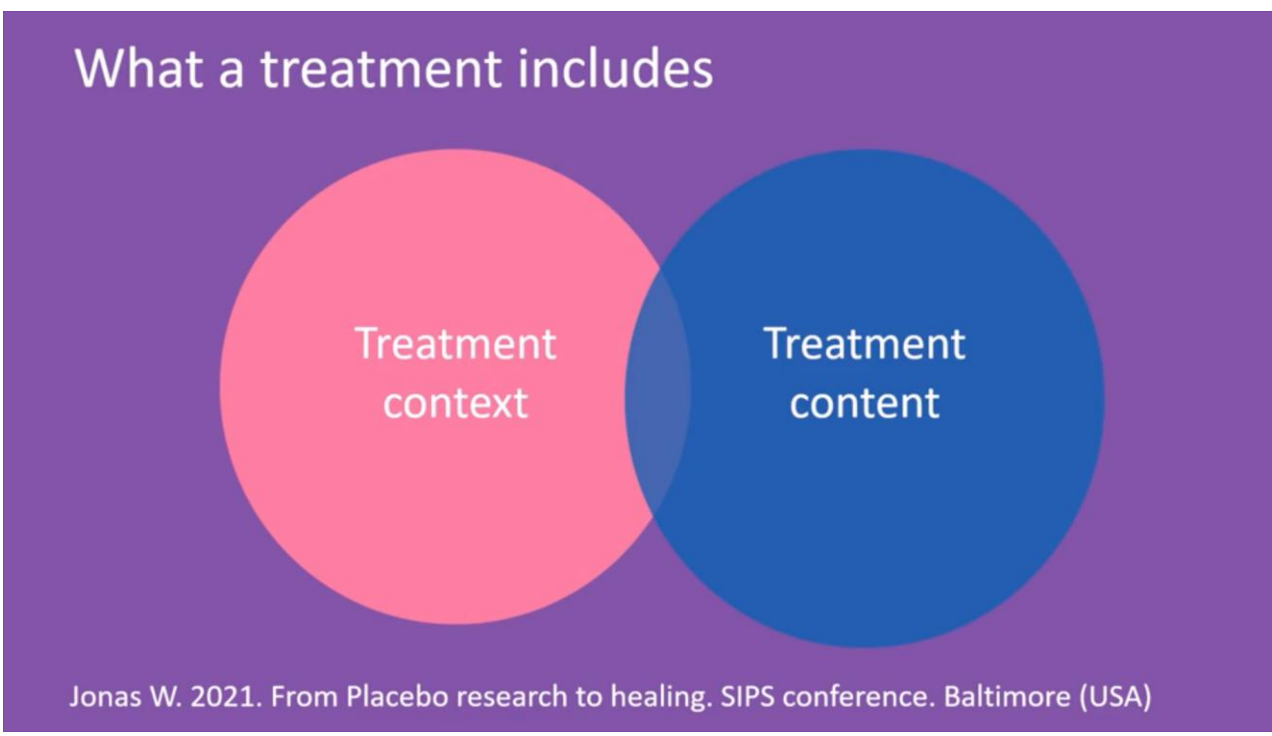
Explains why some patients fail to respond to conservative interventions.

97

98


Treatment

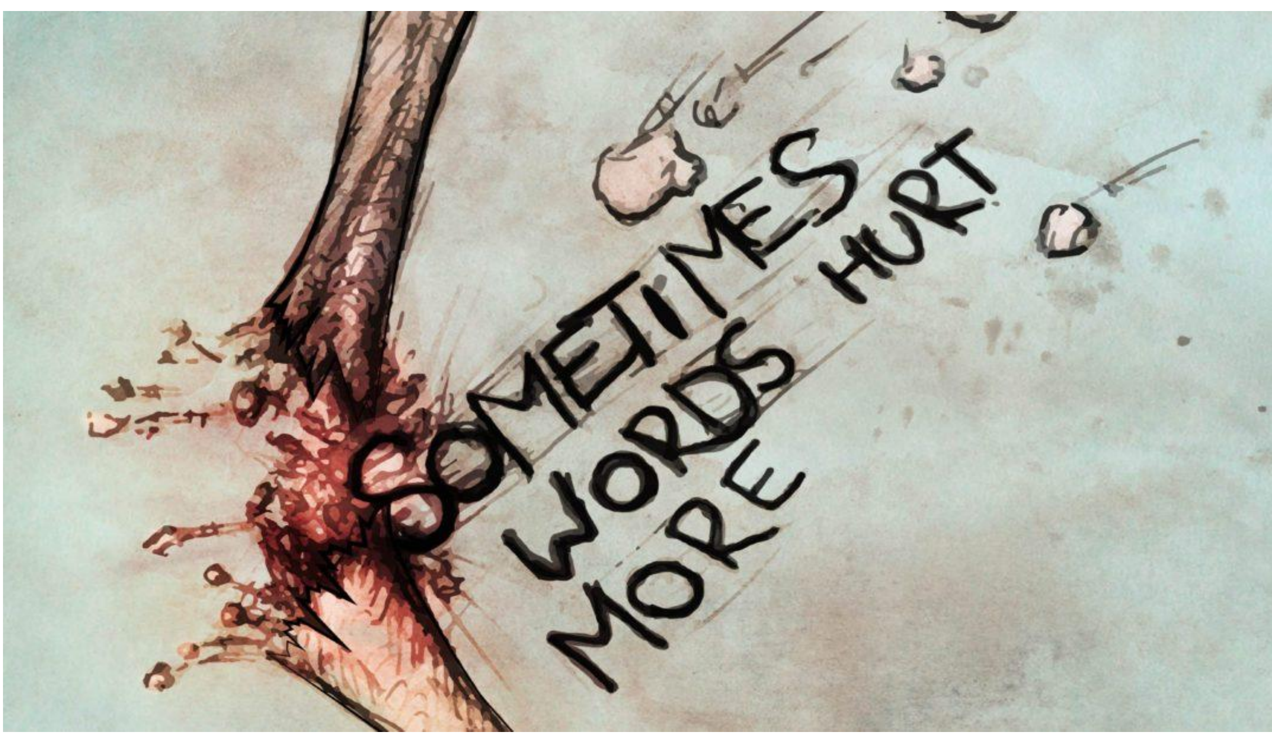
99


What a treatment includes
Treatment context
Treatment content
Jonas W. 2021. From Placebo research to healing. SIPS conference. Baltimore (USA)

100

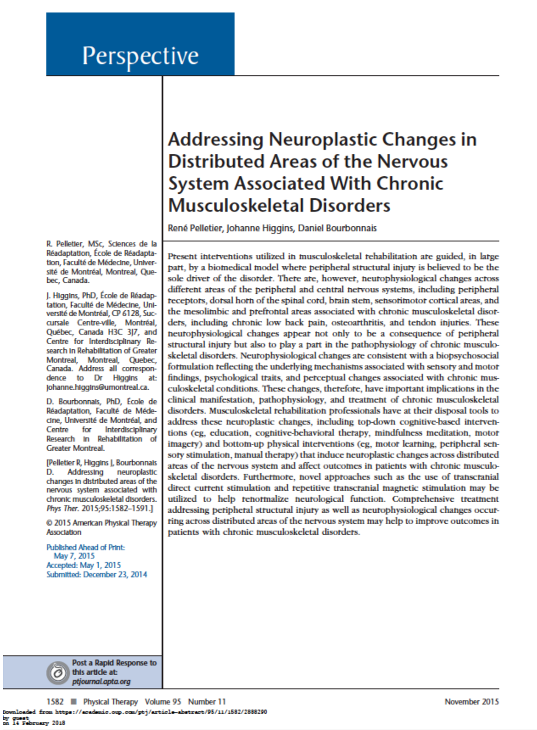

"There's been more damage done from the word than the scalpel"
- Dr. Steve Kamper
RIP
REST IN PAIN

101


SOMETIMES WORDS HURT MORE

102

103



Perspective

Addressing Neuroplastic Changes in Distributed Areas of the Nervous System Associated With Chronic Musculoskeletal Disorders

René Pelletier, Johanne Higgins, Daniel Bourbonnais

R. Pelletier, MSc, Sciences de la Réadaptation, École de Réadaptation, Faculté de Médecine, Université de Montréal, Montreal, Quebec, Canada.

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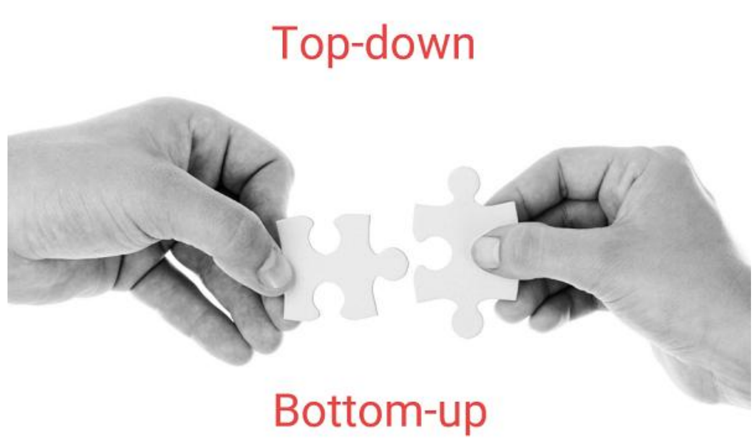
D. Bourbonnais, PhD, École de Réadaptation, Faculté de Médecine, Université de Montréal, and Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal.

[Pelletier R, Higgins J, Bourbonnais D. Addressing neuroplastic changes in distributed areas of the nervous system associated with chronic musculoskeletal disorders. *Phys Ther*. 2015;95:1582–1591.]

Published Ahead of Print: May 7, 2015
Accepted: May 1, 2015
Submitted: December 23, 2014

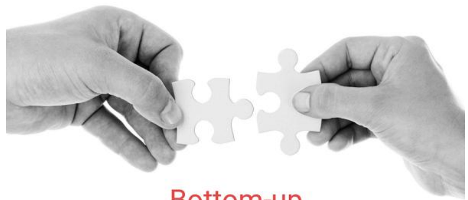
Present interventions utilized in musculoskeletal rehabilitation are guided, in large part, by a biomedical model where peripheral structural injury is believed to be the sole driver of the disorder. There are, however, neurophysiological changes across different areas of the peripheral and central nervous systems, including peripheral receptors, dorsal horn of the spinal cord, brain stem, sensorimotor cortical areas, and the mesolimbic and prefrontal areas associated with chronic musculoskeletal disorders, including chronic low back pain, osteoarthritis, and tendon injuries. These neurophysiological changes appear not only to be a consequence of peripheral structural injury but also to play a part in the pathophysiology of chronic musculoskeletal disorders. Neurophysiological changes are consistent with a biopsychosocial formulation reflecting the underlying mechanisms associated with sensory and motor findings, psychological traits, and perceptual changes associated with chronic musculoskeletal conditions. These changes, therefore, have important implications in the clinical manifestation, pathophysiology, and treatment of chronic musculoskeletal disorders. Musculoskeletal rehabilitation professionals have at their disposal tools to address these neuroplastic changes, including top-down cognitive-based interventions (eg, education, cognitive-behavioral therapy, mindfulness meditation, motor imagery) and bottom-up physical interventions (eg, motor learning, peripheral sensory stimulation, manual therapy) that induce neuroplastic changes across distributed areas of the nervous system and affect outcomes in patients with chronic musculoskeletal disorders. Furthermore, novel approaches such as the use of transcranial direct current stimulation and repetitive transcranial magnetic stimulation may be utilized to help renormalize neurological function. Comprehensive treatment addressing peripheral structural injury as well as neurophysiological changes occurring across distributed areas of the nervous system may help to improve outcomes in patients with chronic musculoskeletal disorders.

1582 ■ Physical Therapy Volume 95 Number 11 November 2015



104

Top-down



Bottom-up

Clinicians who utilize:
bottom-up influences (manual therapy, motor learning, peripheral sensory stimulation)

top-down influences (education, cognitive-behavioral therapy, mindfulness meditation, motor imagery)

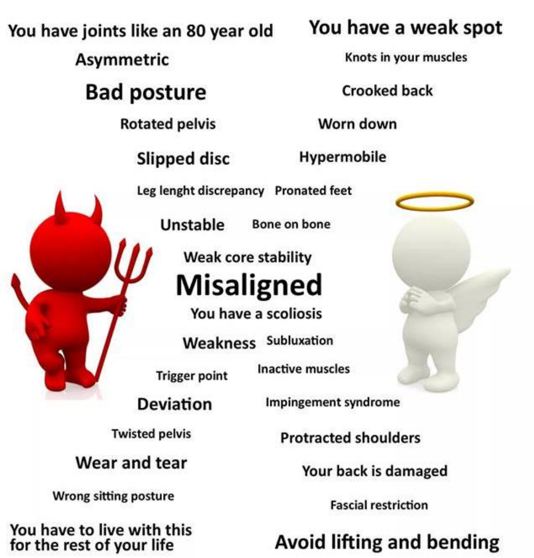
can stimulate CNS neuroplastic changes

105

Nocebic words

nocebo (Latin nocēbō, "I shall harm", from noceō, "I harm")

What did your words do for someone today?



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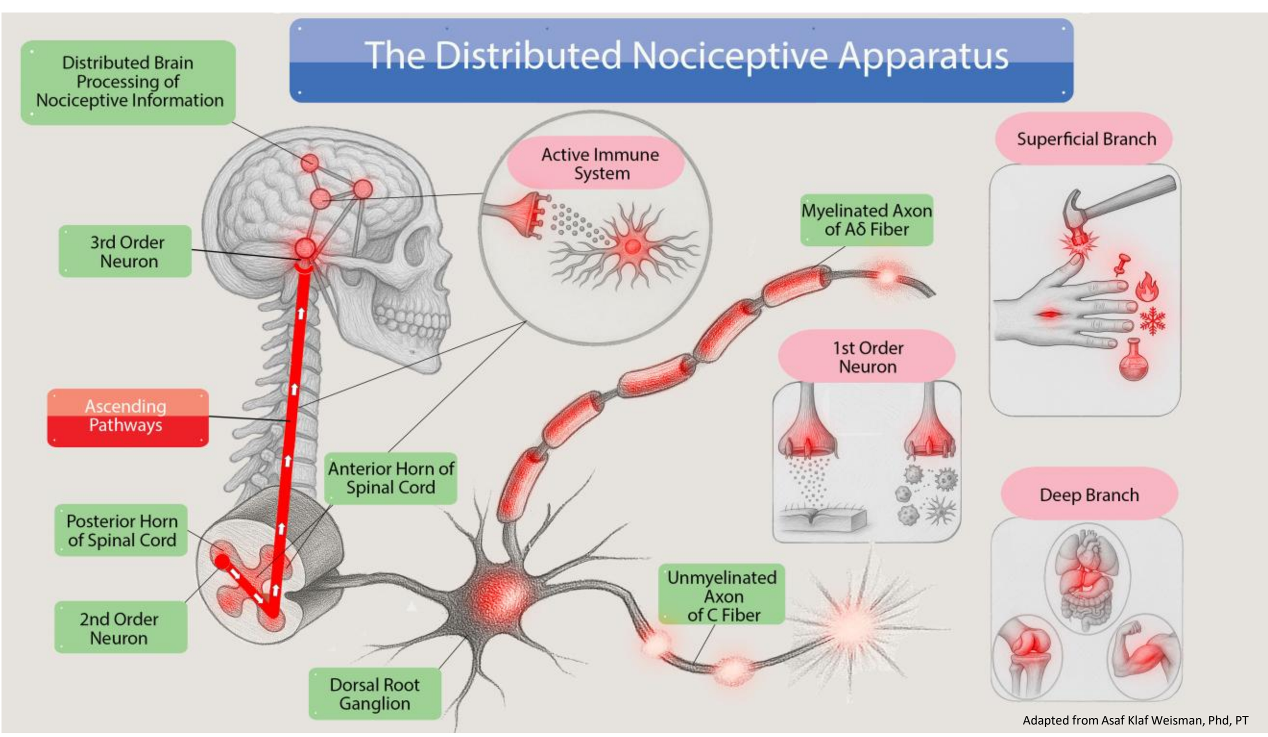
108


Is It Pain?
Or
Something Else?

109


The Distributed Nociceptive Apparatus
Distributed Brain Processing of Nociceptive Information
3rd Order Neuron
Ascending Pathways
Posterior Horn of Spinal Cord
2nd Order Neuron
Anterior Horn of Spinal Cord
Dorsal Root Ganglion
Active Immune System
Myelinated Axon of Aδ Fiber
1st Order Neuron
Unmyelinated Axon of C Fiber
Superficial Branch
Deep Branch
Adapted from Asaf Klaf Weisman, Phd, PT

110


Accept Patients where they are at
Ask them where they would like to go

111


CASE STUDY
RESEARCHER
CIRCUMSTANCES
CASE
ANALYZING
KEY
DATA
CRITERIA
KNOWLEDGE

112

113

114

115

116

117

118

119

Understanding And Approach To Treatment Of Scars And Adhesions
Susan L. Chapelle

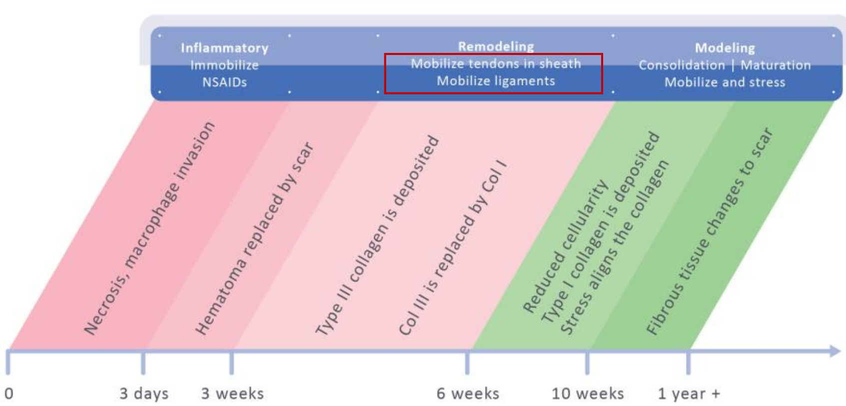
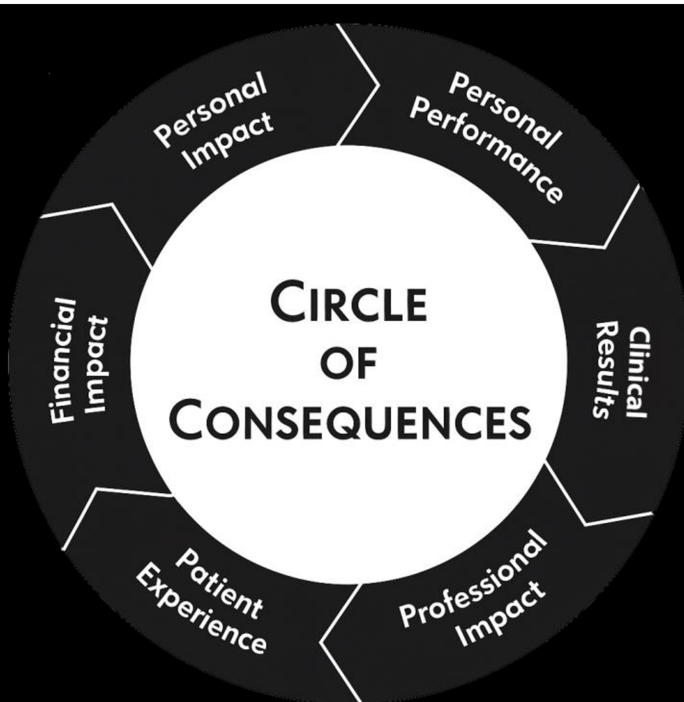


Figure 51.7
Tendon and ligament injury and healing time with potential therapeutic opportunities. Courtesy of Dr Geoffrey Bove

120



121

Thoughts & Beliefs & Expectations

122

123

124

125

P R A C T I C E

Massage Therapy: A Person-Centred Approach to Chronic Pain

Richard Lebert, RMT[1*], Monica Noy, MSc, RMT[2], Eric Purves, MSc, RMT[3], Jacqueline Tibbett, PhD, LMT[4]

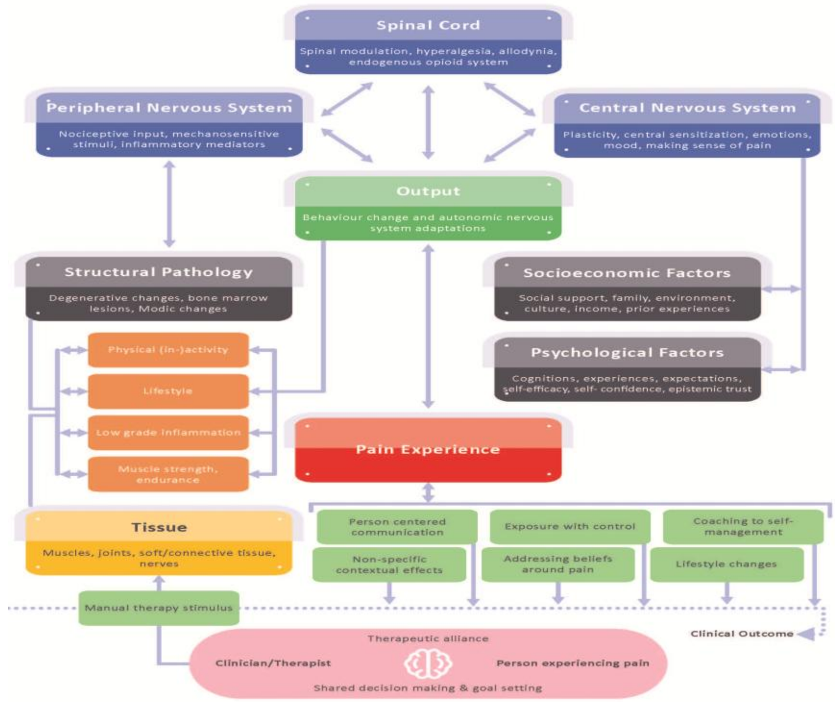
[1]*The School of Health Science, Community Services and Creative Design, Lambton College, Sarnia, ON, Canada,* [2]*Private Practice, Toronto, ON, Canada,* [3]*Private Practice, Victoria, BC, Canada,* [4]*Private Practice, Miami, FL, USA*

https://doi.org10.3822/ijtmb.v15i3.713

126

Person-centred Approach and Shared Decision-making in Low Back and Chronic Pain Patients

Adapted from:
J.-P. Grenier & Rothmund, 2024

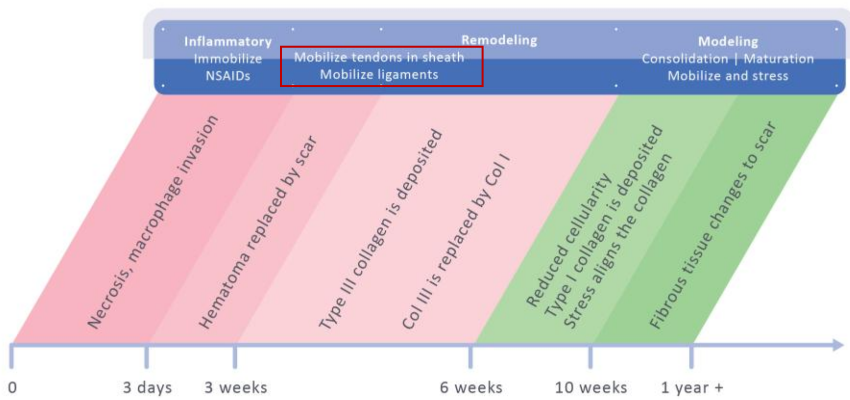


127

128

How Pro Athletes Heal Tendon Injuries 25% Faster

Dr. Keith Baar is a Professor at the University of California Department of Physiology and Membrane Biology.



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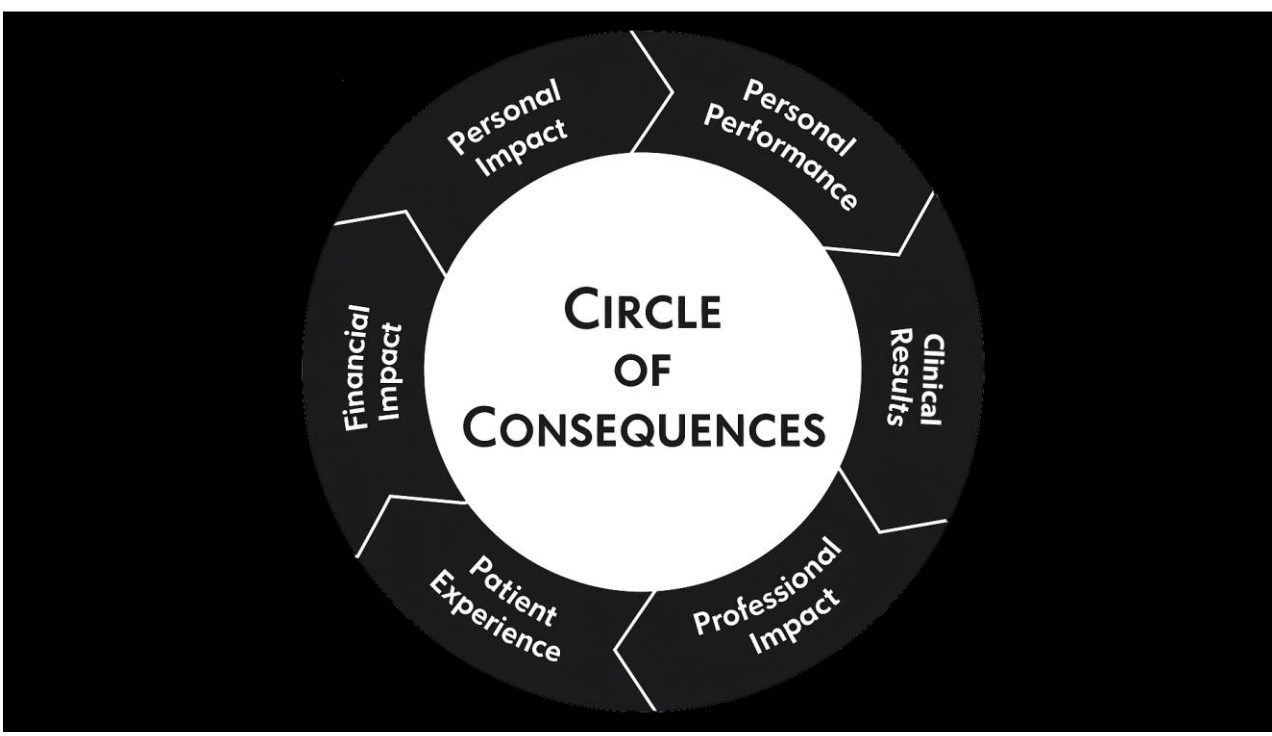

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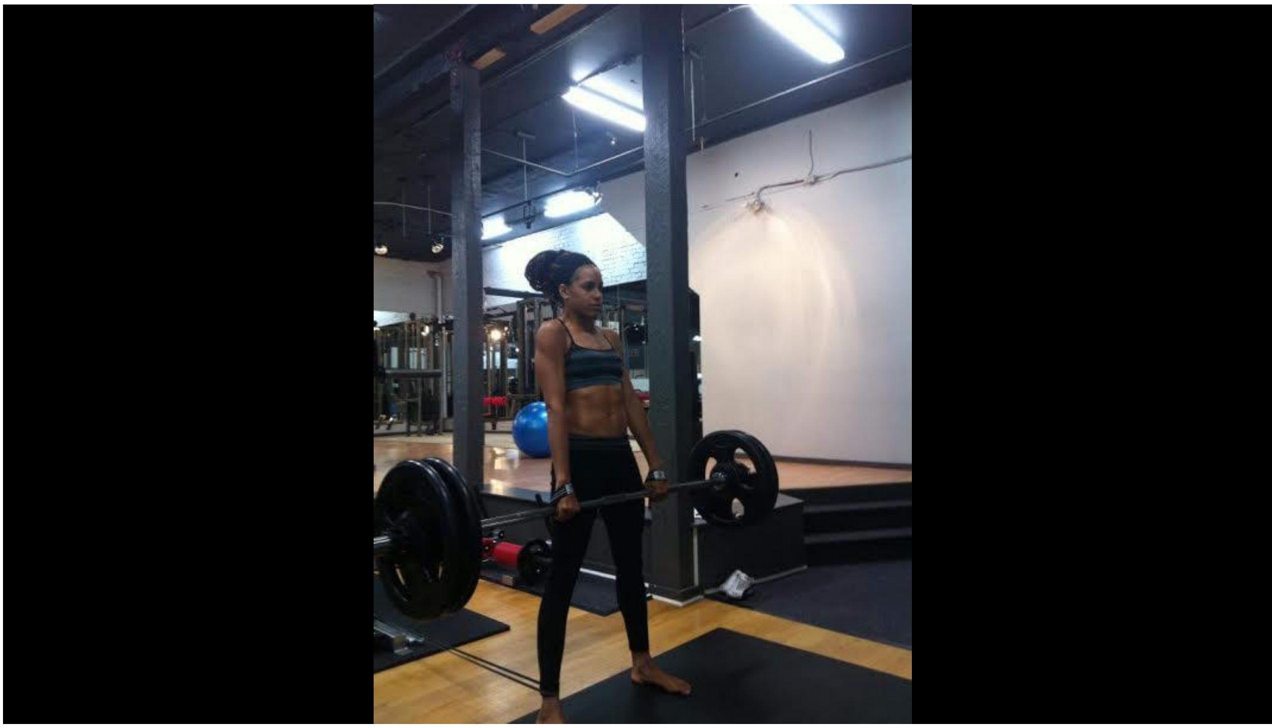

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132

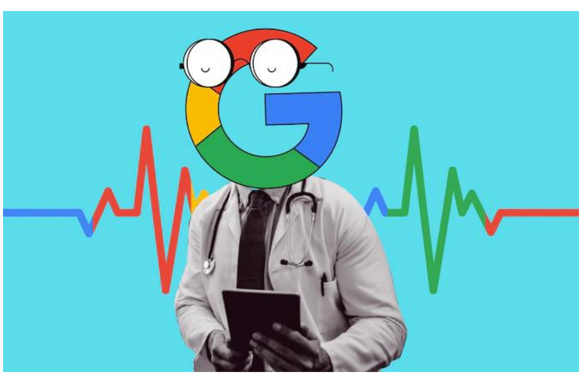
133

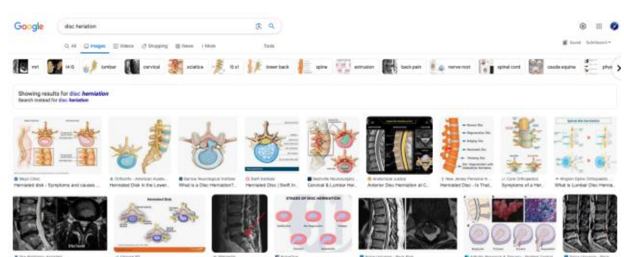

Wild Birds Unlimited
Domino's
Domino's Pizza
DO NOT DOUBLE STACK

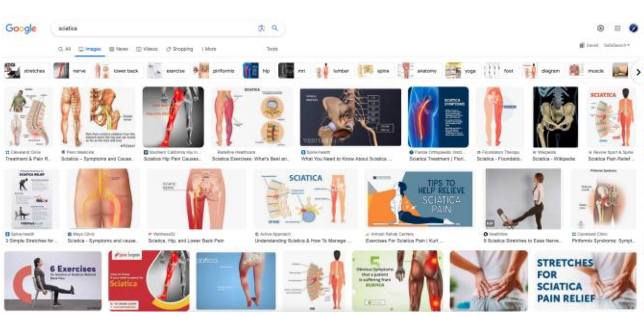
134


Pain

135




Google
disc herniation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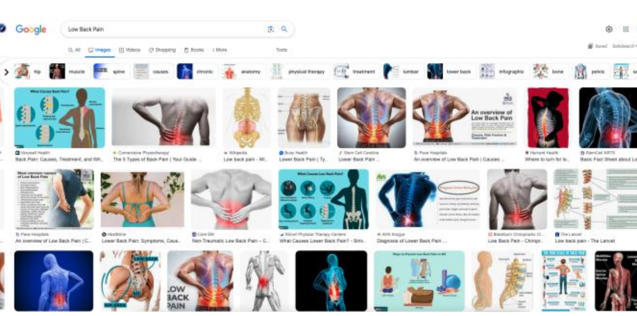
sciatica
6 Exercises
SCIATICA
TIPS TO HELP RELIEVE SCIATICA PAIN
STRETCHES FOR SCIATICA PAIN RELIEF


Google
Low Back Pain
LOW BACK PAIN

136


Everything

137

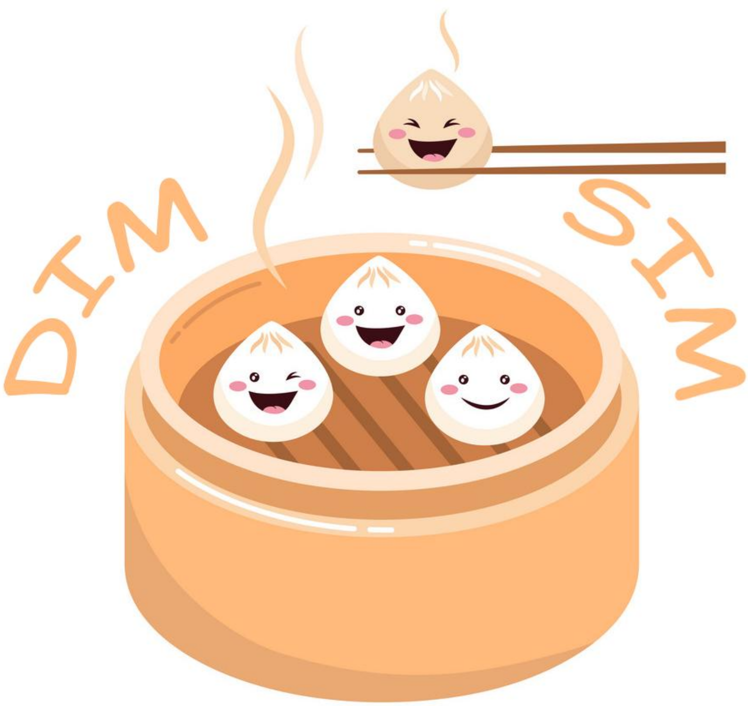

powerless
panic
sadness
burden
scared
change
nervous
bad
limited
expectation
calm
helpless
normal
frustration
isolated

138

139

140

141



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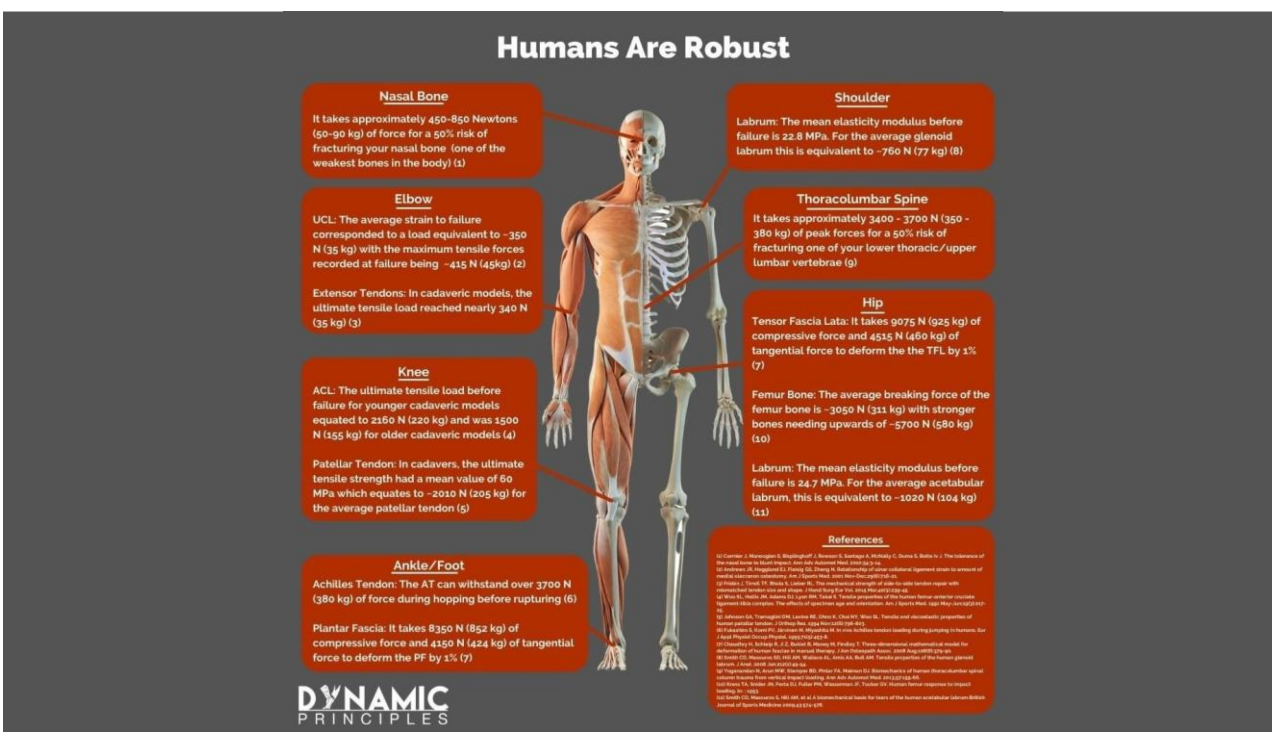
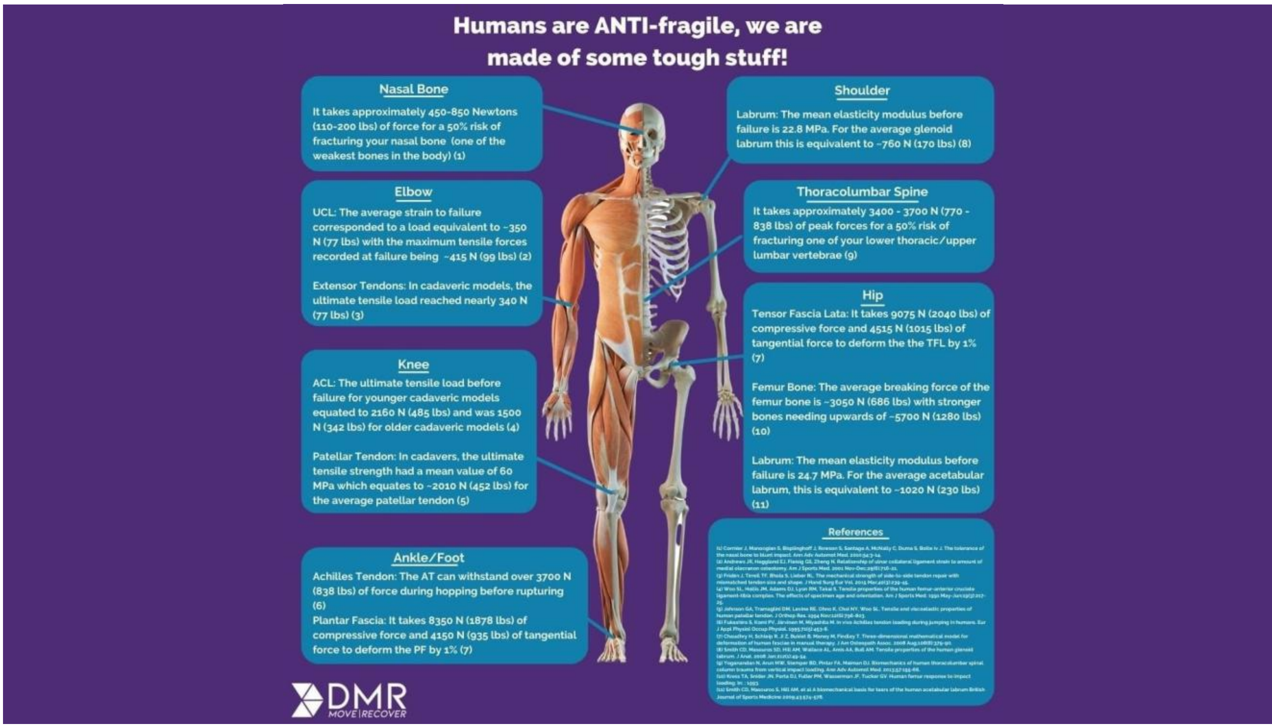

Humans Are Robust
Nasal Bone
It takes approximately 450-850 Newtons (50-90 kg) of force for a 50% risk of fracturing your nasal bone (one of the weakest bones in the body) (1)
Elbow
UCL: The average strain to failure corresponded to a load equivalent to ~350 N (35 kg) with the maximum tensile forces recorded at failure being ~415 N (45kg) (2)
Extensor Tendons: In cadaveric models, the ultimate tensile load reached nearly 340 N (35 kg) (3)
Knee
ACL: The ultimate tensile load before failure for younger cadaveric models equated to 2160 N (220 kg) and was 1500 N (155 kg) for older cadaveric models (4)
Patellar Tendon: In cadavers, the ultimate tensile strength had a mean value of 60 MPa which equates to ~2010 N (205 kg) for the average patellar tendon (5)
Ankle/Foot
Achilles Tendon: The AT can withstand over 3700 N (380 kg) of force during hopping before rupturing (6)
Plantar Fascia: It takes 8350 N (852 kg) of compressive force and 4150 N (424 kg) of tangential force to deform the PF by 1% (7)
Shoulder
Labrum: The mean elasticity modulus before failure is 22.8 MPa. For the average glenoid labrum this is equivalent to ~760 N (77 kg) (8)
Thoracolumbar Spine
It takes approximately 3400 - 3700 N (350 - 380 kg) of peak forces for a 50% risk of fracturing one of your lower thoracic/upper lumbar vertebrae (9)
Hip
Tensor Fascia Lata: It takes 9075 N (925 kg) of compressive force and 4515 N (460 kg) of tangential force to deform the the TFL by 1% (7)
Femur Bone: The average breaking force of the femur bone is ~3050 N (311 kg) with stronger bones needing upwards of ~5700 N (580 kg) (10)
Labrum: The mean elasticity modulus before failure is 24.7 MPa. For the average acetabular labrum, this is equivalent to ~1020 N (104 kg) (11)
References
DYNAMIC
PRINCIPLES

144



145

1hr of creep/tension – relaxation = 2 days Required For Full Recovery

8hrs of tissue challenge = 16 days Required For Recovery

146

Review

OPEN ACCESS

Effectiveness of physical activity interventions for improving depression, anxiety and distress: an overview of systematic reviews

Ben Singh[1], Timothy Olds,[1] Rachel Curtis,[1] Dorothea Dumuid[1], Rosa Virgara,[1] Amanda Watson,[1] Kimberley Szeto,[1] Edward O'Connor,[1] Ty Ferguson,[1] Emily Eglitis,[1] Aaron Miatke,[1] Catherine EM Simpson,[1] Carol Maher[2]

What is already known

- ⇒ Previous research trials suggest that physical activity may have similar effects to psychotherapy and pharmacotherapy for patients with depression, anxiety or psychological distress.
- ⇒ Studies have evaluated different forms of physical activity, in varying dosages, in different population subgroups, and using different comparator groups, making it difficult for clinicians to understand the body of evidence for physical activity in the management of mental health disorders.

What are the new findings

- ⇒ Results showed that physical activity is effective for reducing mild-to-moderate symptoms of depression, anxiety and psychological distress (median effect size range=−0.42 to −0.60), compared with usual care across all populations.
- ⇒ Our findings underscore the important role of physical activity in the management of mild-to-moderate symptoms of depression, anxiety and psychological distress.

Conclusion and relevance Physical activity is highly beneficial for improving symptoms of depression, anxiety and distress across a wide range of adult populations, including the general population, people with diagnosed mental health disorders and people with chronic disease. Physical activity should be a mainstay approach in the management of depression, anxiety and psychological distress.

Table 1 Overview of all populations, conditions and physical activity modes of the included reviews

Population or condition	Number of reviews
Cancer	n=27[45–62 98–106]
Adults with depression	n=11[63 64 66–73 75]
Dementia	n=5[107–111]
Older adults	n=5[33–37]
Chronic obstructive pulmonary disease	n=4[78 112–114]
Multiple sclerosis	n=4[81 115–117]
Pregnant or postnatal or post-partum women	n=4[38–41]
Adults with various chronic diseases	n=3[118–120]
Apparently healthy adults	n=3[42–44]
Anxiety disorders	n=3[84 85 121]
Cardiovascular disease	n=3[80 122 123]
Older adults with depression	n=4[63 65 74 124]
Renal disease	n=3[86 125 126]
Stroke	n=3[21 127 128]
Arthritis and rheumatic diseases	n=2[82 129 130]
Cognitive impairment	n=2[77 131]
HIV/AIDS	n=2[76 132]
Post-traumatic stress disorder	n=2[133 134]
Various mental health disorders	n=2[83 135]
Fatigue	n=1[136]
Knee osteoarthritis	n=1[129]
Neurological disorders	n=1[137]
Schizophrenia	n=1[138]
Substance use disorder	n=1[79]
Physical activity modality	**Number of reviews**
Mixed-mode exercise, not including mind-body exercise (eg, Yoga, Tai Chi or Qigong)	n=37[13 21 38 41 47 50 52–55 58 59 66–70 73–75 81 84 86 100 101 103 106 108–110 112 121 123 125 126 132 133]
Mixed-mode exercise, including mind-body exercises (eg, Yoga, Tai Chi or Qigong)	n=33[33–37 40 42 49 51 56 57 60 61 63 72 76–80 98 99 102 104 107 115–117 124 129 130 134 137]
Yoga	n=7[39 45 46 62 127 135 138]
Aerobic exercise	n=6[43 71 82 83 85 122]
Tai Chi	n=6[65 113 118 128 131 136]
Qigong	n=3[104 114 120]
Resistance exercise	n=3[64 111 119]
Dance	n=2[44 48]

147

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Hurts So Good: Pain as an Emotion Regulation Strategy

Doukas AM[1], D'Andrea WM[1], Gregory WE[1], Joachim B[1], Lee KA[1], Robinson G[1], Freed SJ[1], Khedari-DePierro V[1], Pfeffer KA[1], Todman M[1], Siegle GJ[2].

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2 Department of Psychiatry.

Abstract

In the field of emotion regulation studies, cognitive reappraisal has been established as the preferred strategy for coping with painful negative feelings. For some, however, asking them to think more about an already distressing situation can be quite literally "like pulling teeth." Indeed, many people voluntarily cause themselves physical pain during upsetting situations (e.g., getting a deep tissue massage after a stressful week or hitting a punching bag when angry); however, there is currently little empirical evidence of the relative effectiveness of such behaviors. The present study tested two primary hypotheses: (a) some people will choose to inflict pain to regulate negative emotional states; and (b) pain provides effective short-term relief from negative emotion. The findings from these two studies demonstrate that, given the opportunity, participants will choose to use physical pain in addition to other strategies, like reappraisal or distraction, to cope with various sources of negative emotion. We further show that physical sensation in general, and pain in particular, are equally effective in coping with negative emotion. These results suggest a reconsideration of the dominance of cognitively based emotion regulation. We discuss the implication that benign physical pain may be a broadly effective and underrecognized coping strategy. (PsycINFO Database Record (c) 2019 APA, all rights reserved).

148

> PLoS One. 2023 May 24;18(5):e0285041. doi: 10.1371/journal.pone.0285041. eCollection 2023.

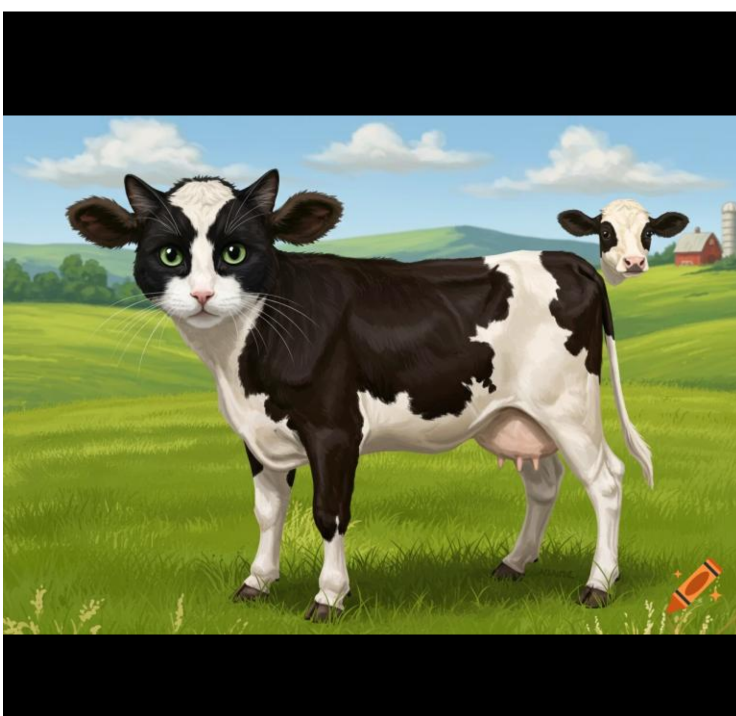
Longitudinal relationships between habitual physical activity and pain tolerance in the general population

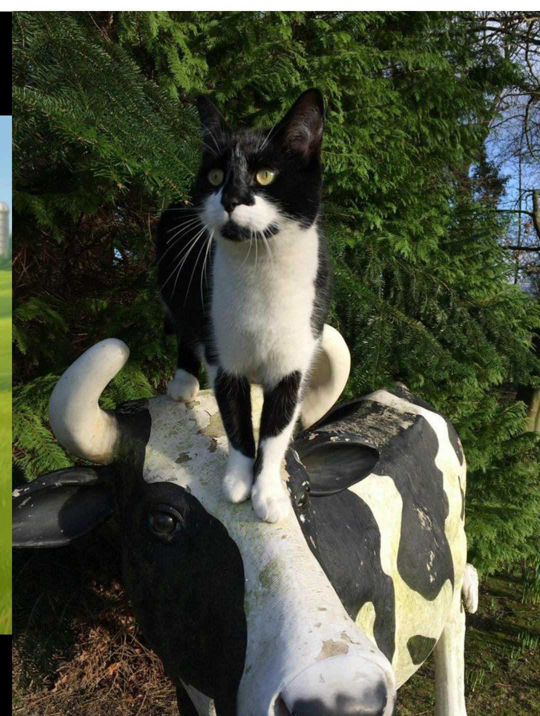
Anders Pedersen Årnes [1], Christopher Sievert Nielsen [2] [3], Audun Stubhaug [3] [4], Mats Kirkeby Fjeld [2], Aslak Johansen [1], Bente Morseth [5], Bjørn Heine Strand [2] [6], Tom Wilsgaard [7], Ólöf Anna Steingrímsdóttir [2]

Abstract

Physical activity (PA) might influence the risk or progression of chronic pain through pain tolerance. Hence, we aimed to assess whether habitual leisure-time PA level and PA change affects pain tolerance longitudinally in the population. Our sample (n = 10,732; 51% women) was gathered from the sixth (Tromsø6, 2007–08) and seventh (Tromsø7, 2015–16) waves of the prospective population-based Tromsø Study, Norway. Level of leisure-time PA (sedentary, light, moderate, or vigorous) was derived from questionnaires; experimental pain tolerance was measured by the cold-pressor test (CPT). We used ordinary, and multiple-adjusted mixed, Tobit regression to assess 1) the effect of longitudinal PA change on CPT tolerance at follow-up, and 2) whether a change in pain tolerance over time varied with level of LTPA. We found that participants with high consistent PA levels over the two surveys (Tromsø6 and Tromsø7) had significantly higher tolerance than those staying sedentary (20.4 s. (95% CI: 13.7, 27.1)). Repeated measurements show that light (6.7 s. (CI 3.4, 10.0)), moderate (CI 14.1 s. (9.9, 18.3)), and vigorous (16.3 s. (CI 6.0, 26.5)) PA groups had higher pain tolerance than sedentary, with non-significant interaction showed slightly falling effects of PA over time. In conclusion, being physically active at either of two time points measured 7–8 years apart was associated with higher pain tolerance compared to being sedentary at both time-points. Pain tolerance increased with higher total activity levels, and more for those who increased their activity level during follow-up. This indicates that not only total PA amount matters but also the direction of change. PA did not significantly moderate pain tolerance change over time, though estimates suggested a slightly falling effect possibly due to ageing. These results support increased PA levels as a possible non-pharmacological pathway towards reducing or preventing chronic pain.

149





150

151


calm
breathing
balance
harmony
gratitude
mindfulness
awareness
relaxation
focus
ease
discipline
meditation
stress relief
lifestyle
yoga
spirit
care
health
positive
spa
concentration

152

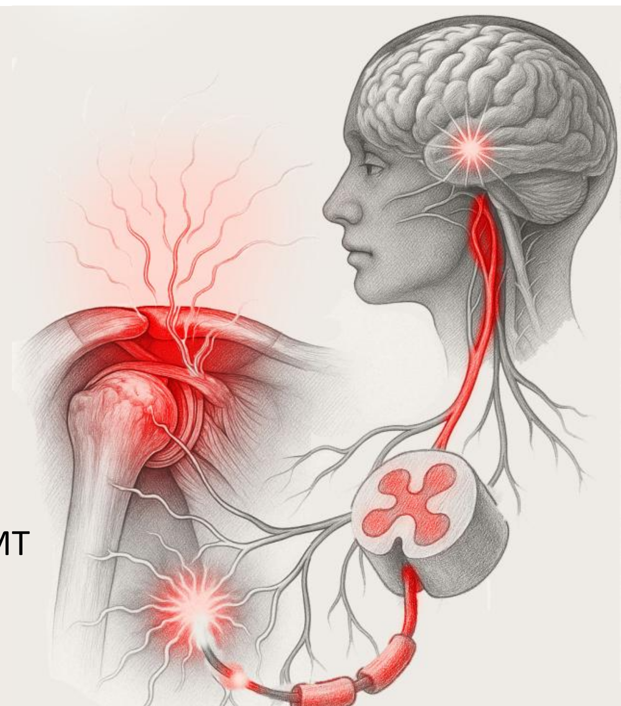
153

154

155

Injuries are both
Connective Tissue
and
Neuropsychophysiological
dysfunctions causing reorganization of the central nervous system affecting neural plasticity.

- Robert Libbey, RMT



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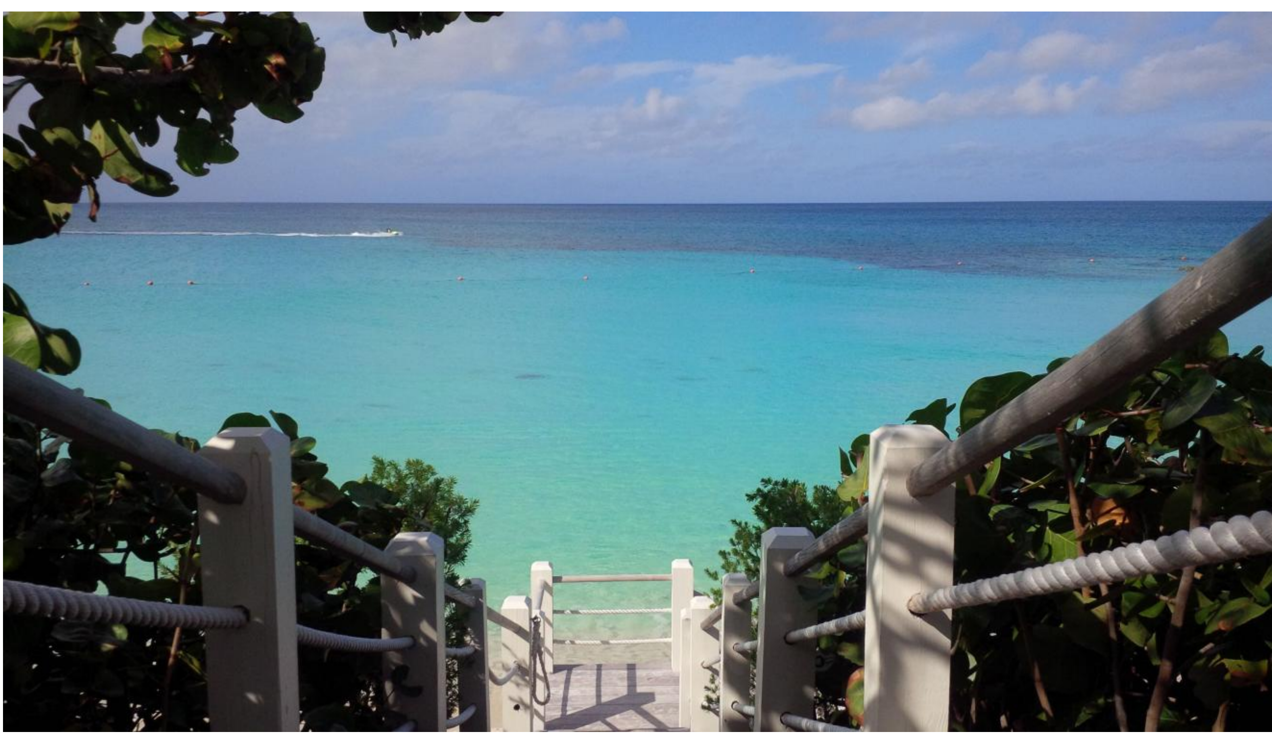

160


7 EFFECTS
OF
TREATMENT

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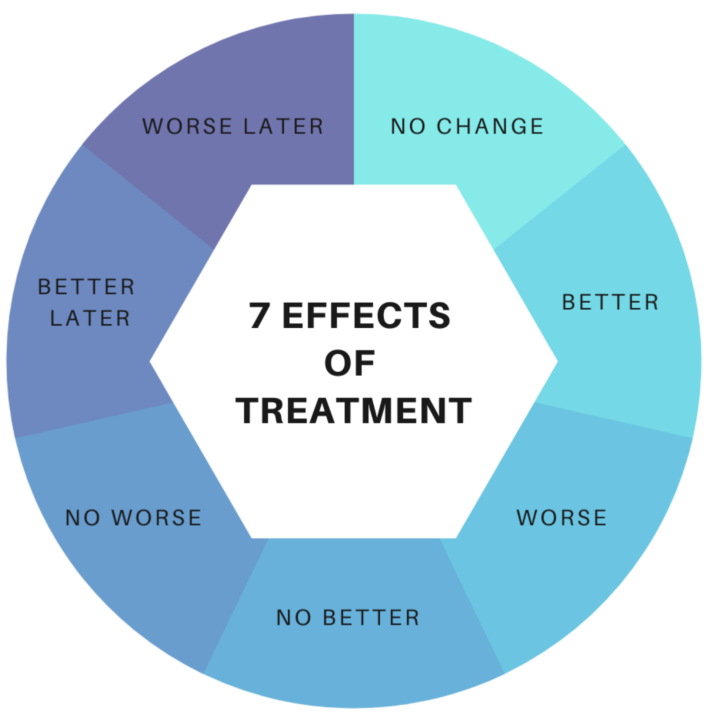

7 EFFECTS
OF
TREATMENT
NO CHANGE
BETTER
WORSE
NO BETTER
NO WORSE
BETTER LATER
WORSE LATER

162

163

Questions

- What’s wrong with me?
- How long will it take to heal?
- What can I (Patient) do about it?
- What you (Clinician) can do to help?
- How much will it cost?

164

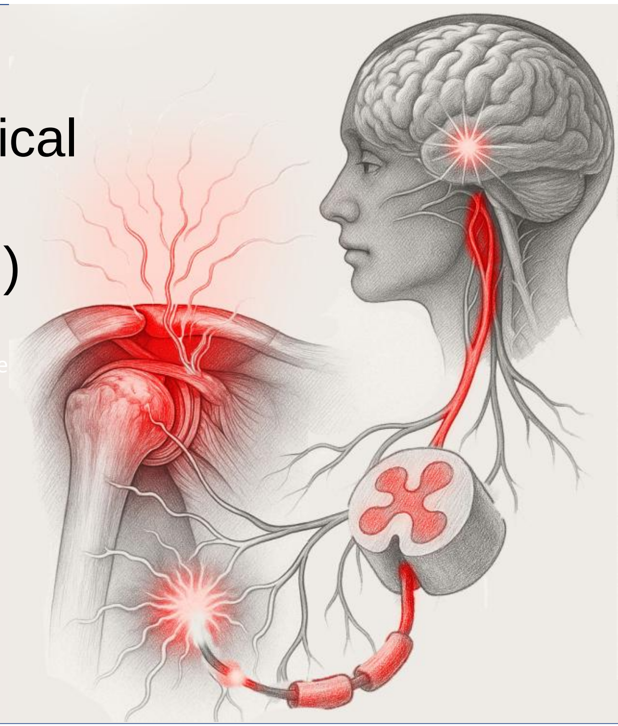

powerless
panic
burden
sadness
scared
change
nervous
bad
limited
expectation
calm
helpless
frustration
normal
isolated

165


discipline
meditation
relaxation
stress relief
ease
focus
lifestyle
yoga
balance
gratitude
awareness
harmony
positive
health
spa
mindfulness
ease
meditation
breathing
care
spirit
breathing
yoga
balance
awareness
concentration

166

Deconstructing the Neuropsychophysiological Nature of Joint Pain (Nociception)



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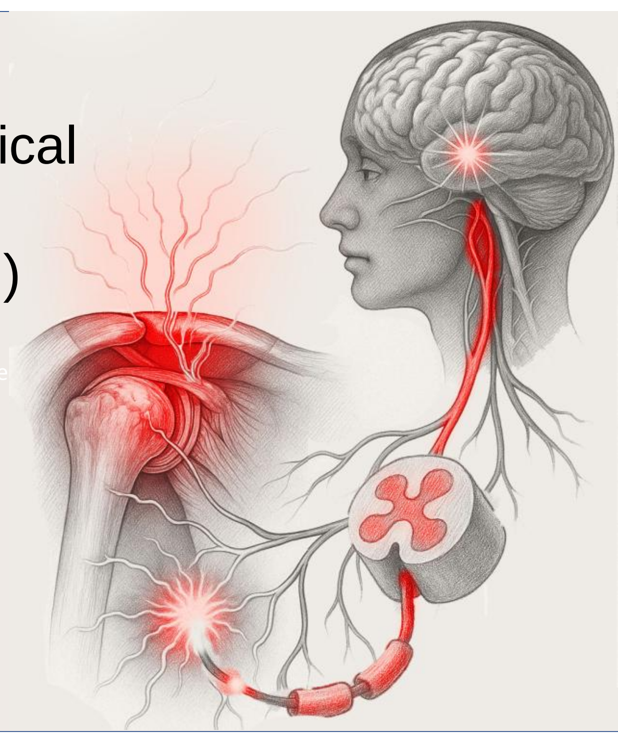
Deconstructing the Neuropsychophysiological Nature of Joint Pain (Nociception)



168

169