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WELCOME

Cleveland University
Chiropractic and Health Sciences

Modern Management of Tendinopathy

Evidence-Based Rehabilitation and High-Intensity Laser Therapy

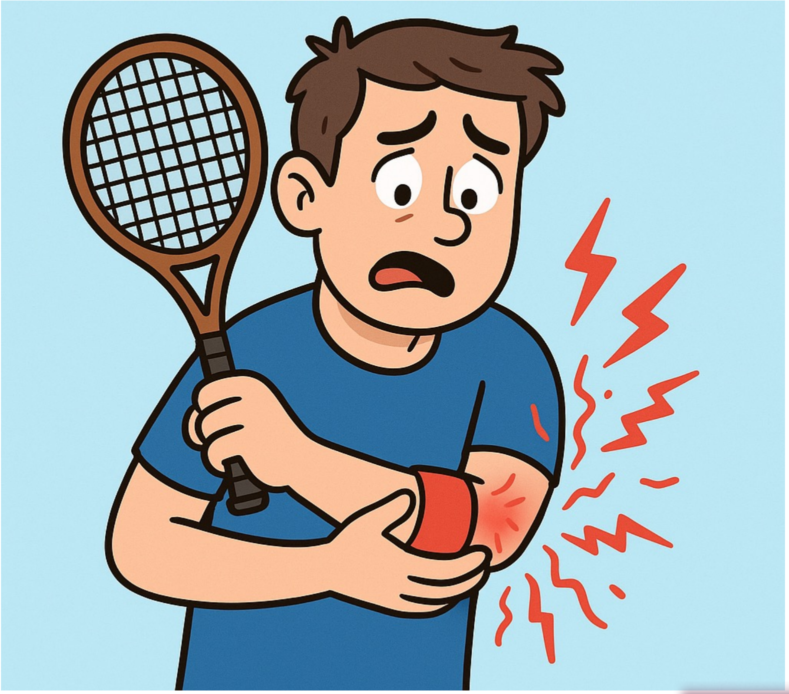
Stuart McIntosh, DC, MS, DACRB

Disclosure

I am a Professor at Cleveland University-Kansas City and an instructor for Functional Movement Systems, teaching FMS/SFMA courses at CUKC. I also serve as Secretary of the ACA Rehab Council and consult for Enovis, the parent company of Chattanooga therapy equipment. While I am a paid consultant for this presentation, the ideas presented are my own. Content has been compiled from various sources, but the views expressed do not necessarily reflect those of CUKC, Functional Movement Systems, Enovis, or the ACA Rehab Council.

Case Presentation – John D.

Chief Complaint: "Pain on the outside of my right elbow that's been bothering me for 18 months. It's not getting better."



Case Presentation – John D.

- Subjective Findings
  - Patient: 48-year-old right-hand dominant male (accountant, recreational tennis player).
  - Chief Complaint: 18-month history of worsening right lateral elbow pain.

- History
  - Insidious onset, no specific trauma.
  - Pain is a dull ache at rest (2/10), becoming sharp with activity (7/10).
  - Aggravated by gripping (shaking hands), lifting, typing, and tennis.

Case Presentation – John D.

- Failed Prior Treatments
  - Minimal relief with NSAIDs.
  - Corticosteroid injection provided ~6 weeks of relief before symptoms returned and worsened.

- Functional Impact
  - Has ceased playing tennis and reports difficulty with daily activities.

Case Presentation – John D.

- Objective Findings
  - Inspection: Unremarkable; no swelling, redness, or atrophy.
  - Palpation: Focal tenderness directly over the right lateral epicondyle.
  - Range of Motion: Full elbow and wrist ROM; however, pain is reproduced with passive wrist flexion while the elbow is extended.
  - Strength:
    - Markedly reduced grip strength on the right (75 lbs) compared to the left (110 lbs), with associated pain.
  - Provocative Special Tests: All positive for right lateral epicondylopathy.
    - + Cozen's Test (resisted wrist extension)
    - + Mill's Test (passive wrist flexion)
    - + Maudsley's Test (resisted 3rd finger extension)

Tendinopathy

Tendinopathy

- Tendons, particularly long tendons of the foot and ankle, are strong enough to tolerate up to 12x's body weight without failure, yet flexible enough to store and return more than 90% of the energy used to store them.

- Despite their impressive strength and resilience, tendon pain accounts for approximately 30% of all overuse injuries.

Michaud T. Exercise Interventions for the Management of Tendinopathy: An Overview. JCC. 2025;8(1):39-49.

Risk Factors for Tendinopathy

<u>Intrinsic risk factors</u>

- Metabolic disorders such as diabetes mellitus, obesity and hyperlipidaemia
- Inflammatory conditions
- Family history
- Age
- Limited or excessive joint mobility
- Muscle weaknesses
- Deficits in neuromuscular control

<u>Extrinsic risk factors</u>

- Overuse
- Sudden increase in activity or intensity of activity
- Initiation of new activities
- Lack of adequate recovery
- Highly repetitive movement
- Poor workplace ergonomics
- Medications
  - Fluoroquinolones
  - Hormone replacement therapy
- Statins

Millar NL, Silbernagel KG, Thorborg K, Kirwan PD, Galatz LM, Abrams GD, Murrell GA, McInnes IB, Rodeo SA. Tendinopathy. Nature reviews Disease primers. 2021 Jan 7;7(1):1.

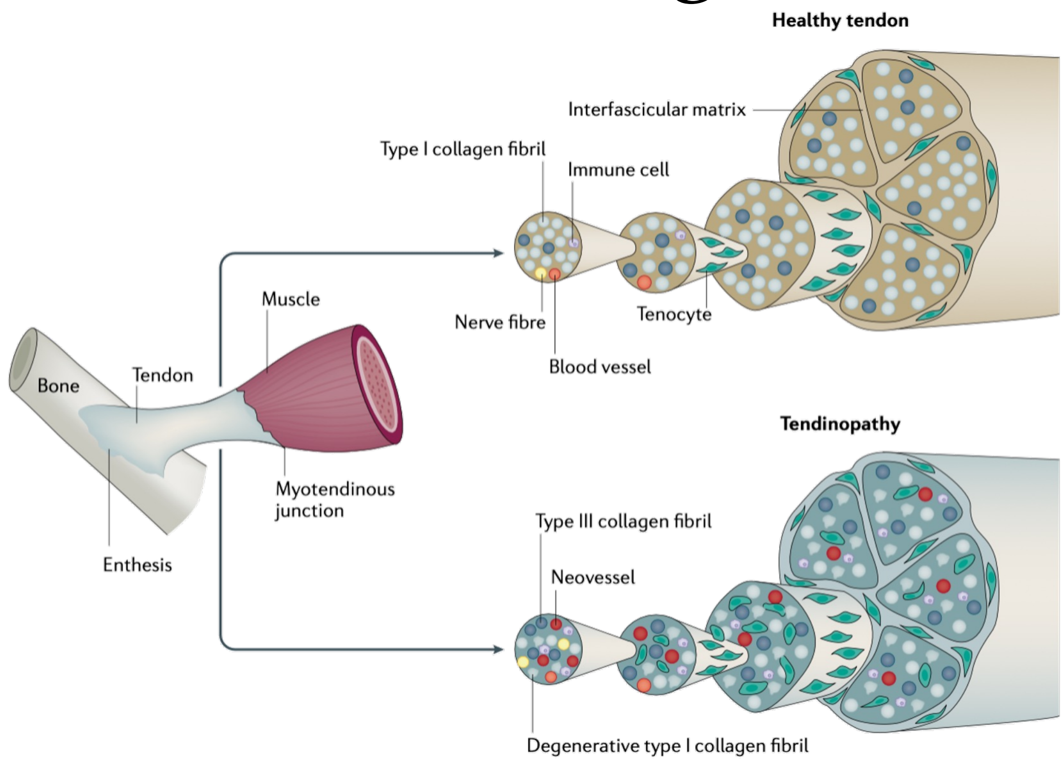
Traditional vs. Modern View

- Traditional View (Tendinitis)
  - Tendon pain viewed as inflammatory.
  - Treated primarily with rest, ice, NSAIDs, corticosteroids.
  - "-itis" implies acute inflammation as the primary pathology.
- Modern Understanding (Tendinopathy)
  - Chronic tendon pain involves non-inflammatory degenerative changes.
  - Histology shows little to no inflammatory cells.
  - Emphasis on load management, exercise-based rehab.
  - "-opathy" reflects the spectrum of tendon pathology (reactive → degenerative).

Traditional Treatment Approach

- Activity Modification
  - Avoid aggravating activities (e.g., repetitive wrist extension or gripping).
  - Temporary cessation of racquet sports or manual labor tasks.
- Rest and Ice
  - Relative rest to reduce inflammation.
  - Ice application (15–20 min several times daily).
- NSAIDs
  - Short-term use for pain and inflammation control.
- Bracing or Counterforce Strap
  - Reduces strain on the extensor tendon origin.
  - Worn during activity.
- Physical Therapy
  - Passive therapeutic modalities (e.g., RICE, therapeutic US, hot packs, electrical stimulation).
  - Stretching and light exercises of the wrist extensors.
- Corticosteroid Injections
  - Often used for short-term relief, though recurrence rates may be high.
- Gradual Return to Activity
  - Progressive loading and return-to-sport/work protocols.
- Surgical Intervention (if persistent > 6–12 months)
  - Considered if conservative management fails.

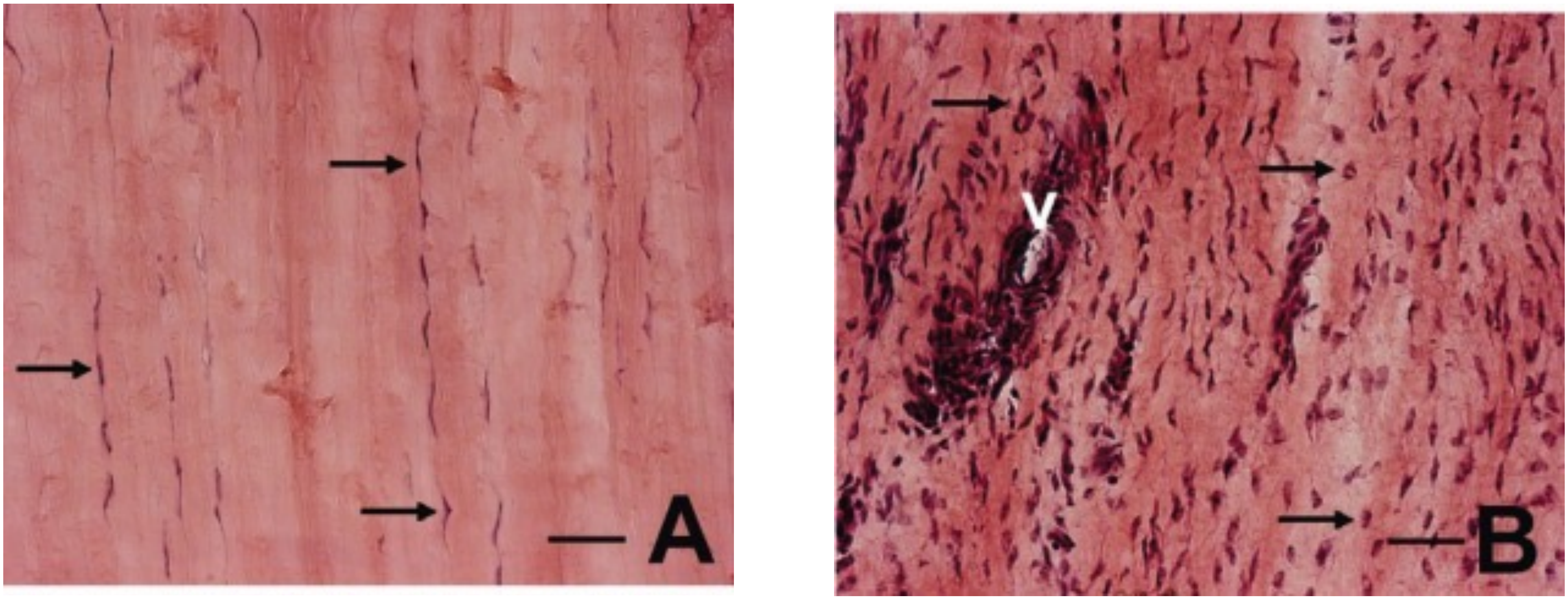
Current Understanding of Tendinopathy



Millar NL, Silbernagel KG, Thorborg K, Kirwan PD, Galatz LM, Abrams GD, Murrell GA, McInnes IB, Rodeo SA. Tendinopathy. Nature reviews Disease primers. 2021 Jan 7;7(1):1.

Current Understanding of Tendinopathy

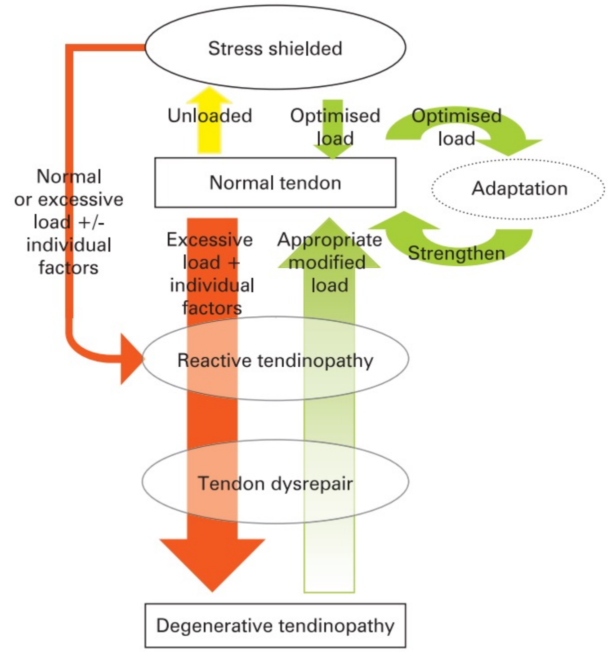
- Cellular changes: Hypercellularity with enlarged, increased nuclei; scattered apoptosis.
- Phenotypic shift: Tenocytes take on a chondroid (pseudocartilage) appearance.
- Hypoxia: Cartilaginous environment reduces local oxygen supply.
- Collagen shift: Increased Type III collagen production; bundles become disorganized.
- Ground substance accumulation: Large proteoglycans (aggrecan, versican) replace normally dominant small proteoglycans (e.g., decorin).
- Functional consequence: Increased water binding → reduced matrix permeability → impaired mechanotransduction.


A
V
B

Continuum of Tendon Pathology

(Cook & Purdam model)

- Reactive Tendinopathy
  - Acute, non-inflammatory response to increased or new load.
  - Short-term thickening of tendon due to proteoglycan influx.
  - Common in younger individuals or after sudden load increase.
  - Potentially reversible with load management.

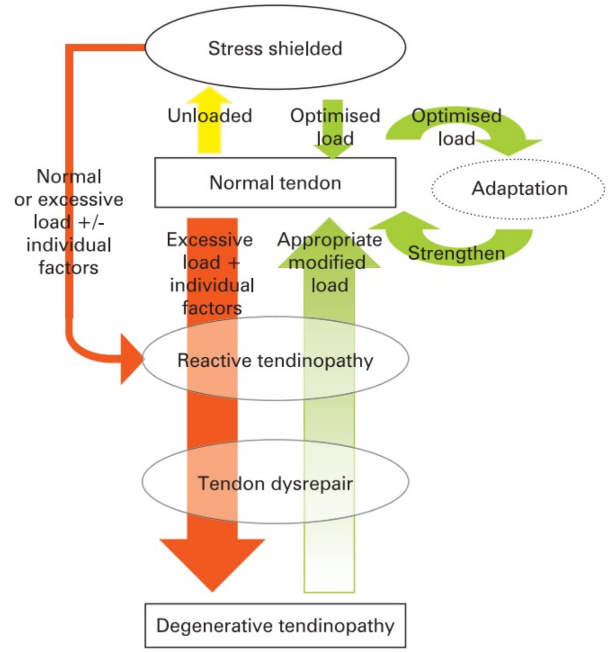


Cook JL, Purdam CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. British journal of sports medicine. 2009 Jun 1;43(6):409-16.

Continuum of Tendon Pathology

(Cook & Purdam model)

- Tendon Dysrepair (Failed Healing)
  - Attempted tendon healing with matrix disorganization.
  - Increased cellular activity, neovascularization, collagen disruption.
  - Often seen with repeated loading and inadequate recovery.
  - Partial reversibility possible with intervention.



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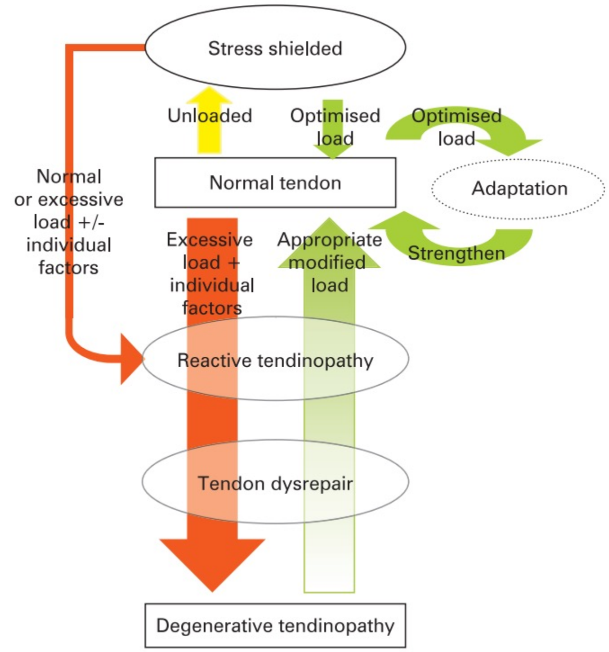
Continuum of Tendon Pathology

(Cook & Purdam model)

- Degenerative Tendinopathy
  - Chronic stage with cell death, collagen breakdown, and neovascularization.
  - Poor tendon structure with risk of rupture.
  - Often seen in older individuals or long-standing cases.
  - Largely irreversible** – focus on managing load and improving function.



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  - Largely irreversible** – focus on managing load and improving function.

** Current best evidence pushes back against treating a degenerative-stage diagnosis as prognostically hopeless, since pain and function outcomes are not tightly bound to whether the structural pathology resolves.

Cook JL, Purdam CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. British journal of sports medicine. 2009 Jun 1;43(6):409-16.

Myofascial Trigger Points

A Modern Clinical Model

- Tendon pain rarely exists in isolation.
- The painful tendon, the involved muscle, the nervous system, and movement patterns all influence one another.

A Modern Clinical Model

Tendon overload

↓

Pain and altered motor control

↓

Muscle guarding and increased tone

↓

Myofascial trigger point development

↓

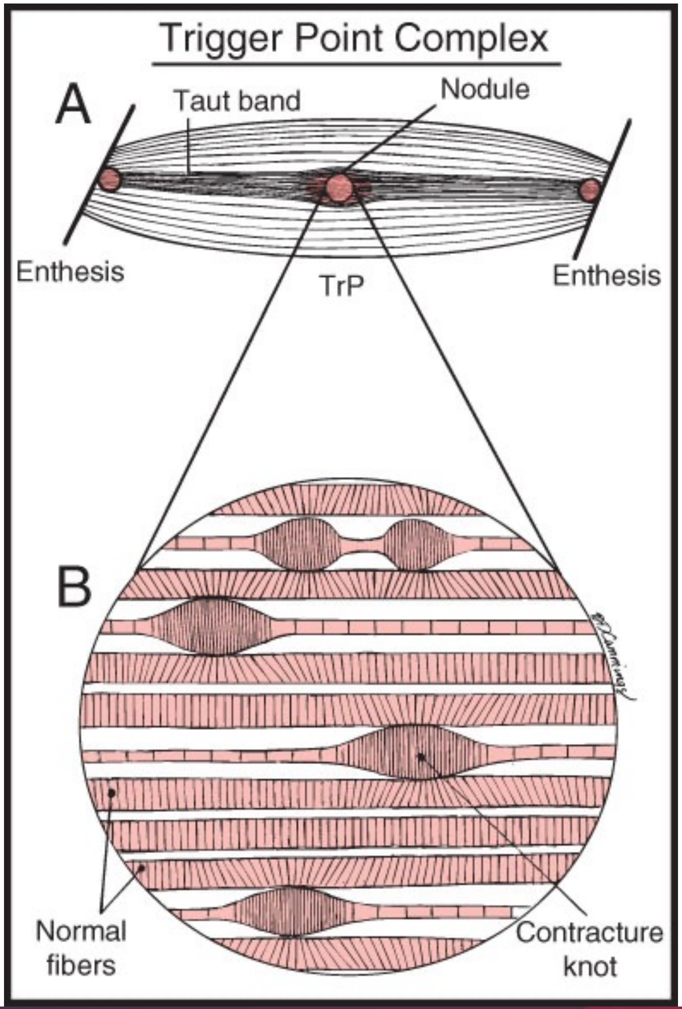
Altered force transmission

↓

Continued tendon overload

↓

Persistent tendinopathy



Donnelly J. Travell, Simons & Simons' Myofascial pain and Dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 2018 Jul 10.

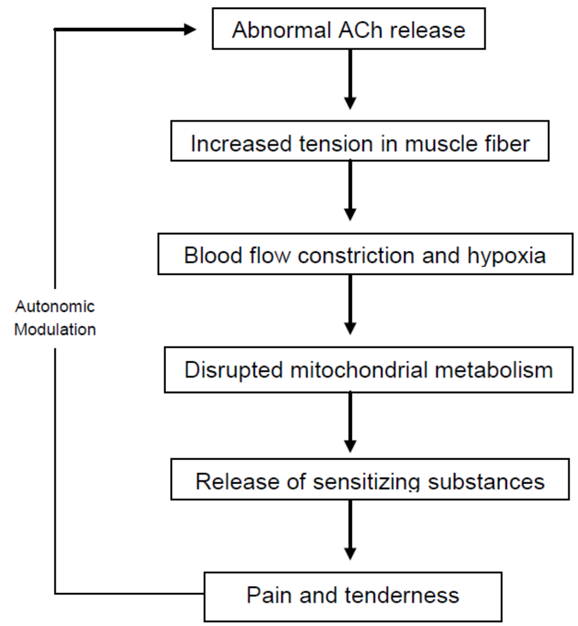
Clinical Characteristics

Box 1-1 Clinical characteristics of trigger points

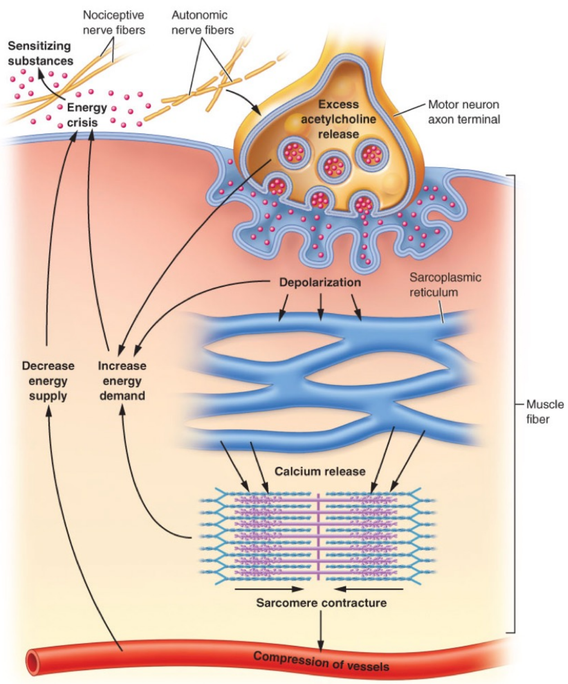
	Common Findings of TrPs	
Simons, Simons and Travell[49]	▪ Palpable taut band with cross-fiber flat or pincer palpation ▪ Hypersensitive spot within the taut band ▪ Local twitch response when adequately stimulated ▪ May produce motor and autonomic phenomena ▪ May prevent full lengthening of the muscle (restricts range of motion) ▪ May cause inhibition weakness of the muscle	
	Active TrPs	**Latent TrPs**
	▪ Refers or produces a patient's recognized pain ▪ Spontaneous local or referred pain	▪ Local or referred unrecognized pain ▪ Painful only when palpated or needled
Expert opinion Delphi study[52]	▪ Reproduce any symptom(s), not just pain, experienced by the patient ▪ Patient recognizes the symptom as familiar ▪ The symptom(s) may be absent at the moment of the examination, but will appear during manual palpation	▪ Do not reproduce symptoms experienced by the patient ▪ Patient does not recognize symptoms caused by cross-fiber flat or pincer palpation

Donnelly J. Travell, Simons & Simons' Myofascial pain and Dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 2018 Jul 10.

Integrated Trigger Point Hypothesis



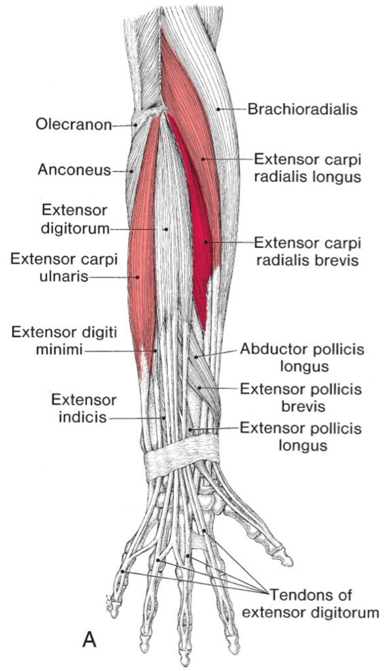
Integrated Trigger Point Hypothesis



Integrated Trigger Point Hypothesis: The primary dysfunction hypothesized here is an abnormal increase (by several orders of magnitude) in the production and release of acetylcholine packets from the motor nerve terminal under resting conditions. The greatly increased number of miniature endplate potentials produces endplate noise and sustained depolarization of the postjunctional membrane of the muscle fiber. This sustained depolarization could cause a continuous release and uptake of calcium ions from local sarcoplasmic reticulum and produce sustained shortening (contracture) of sarcomeres. Each of these four highlighted changes would increase energy demand. The sustained muscle fiber shortening compresses local blood vessels, thereby reducing the nutrient and oxygen supplies that normally meet the energy demands of this region. The increased energy demand in the face of an impaired energy supply would produce a local energy crisis, which leads to the release of sensitizing substances that could interact with autonomic and sensory (some nociceptive) nerves traversing that region. Subsequent release of neuroactive substances could in turn contribute to excessive acetylcholine release from the nerve terminal, completing what then becomes a self-sustaining vicious cycle.

Donnelly J. Travell, Simons & Simons' Myofascial pain and Dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 2018 Jul 10.

Trigger Points – Brachioradialis



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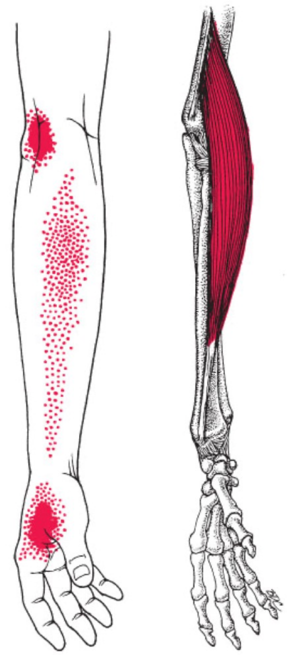
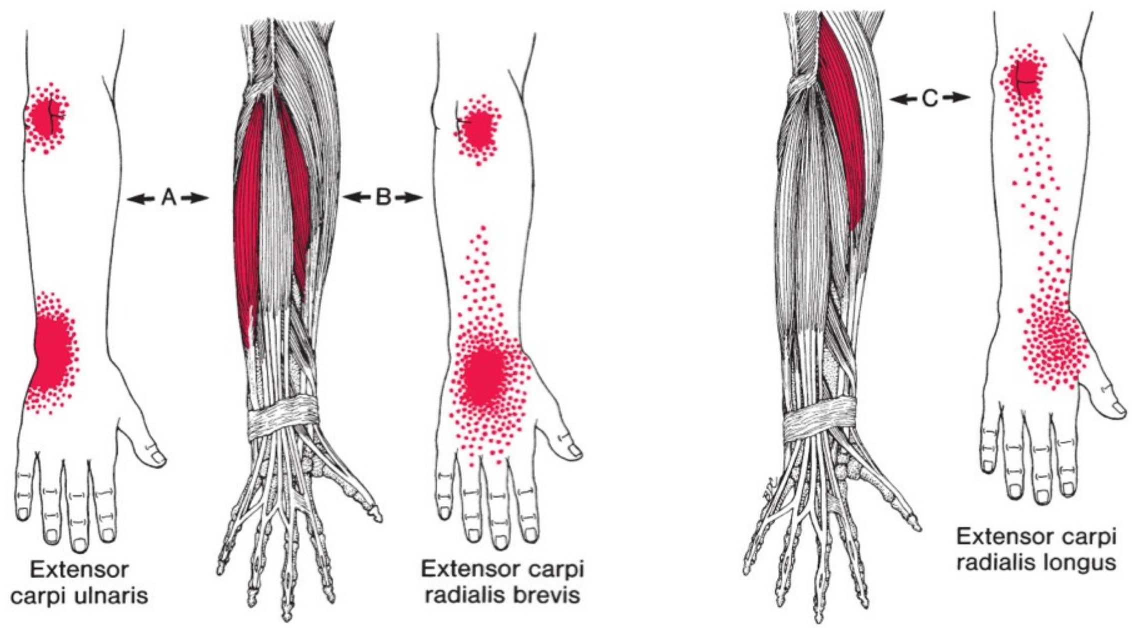


Donnelly J. Travell, Simons & Simons' Myofascial pain and Dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 2018 Jul 10.

Trigger Points – Extensor Carpi Ulnaris (A), Extensor Carpi Radialis Brevis (B), Extensor Carpi Radialis Longus (C)



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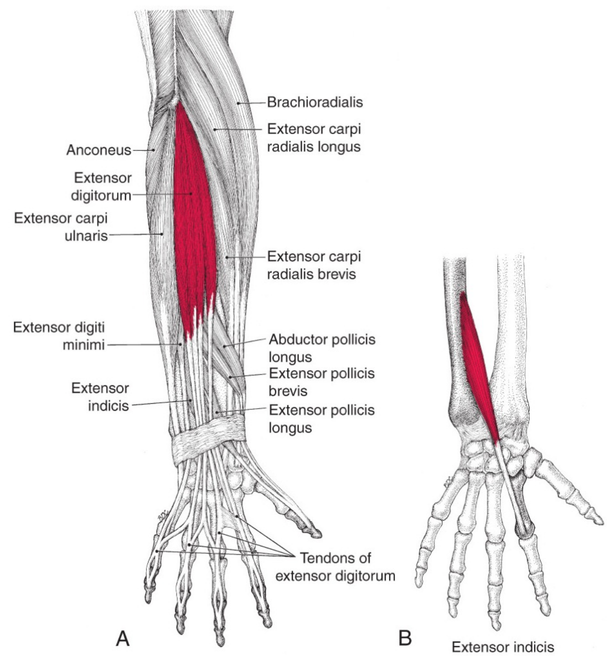
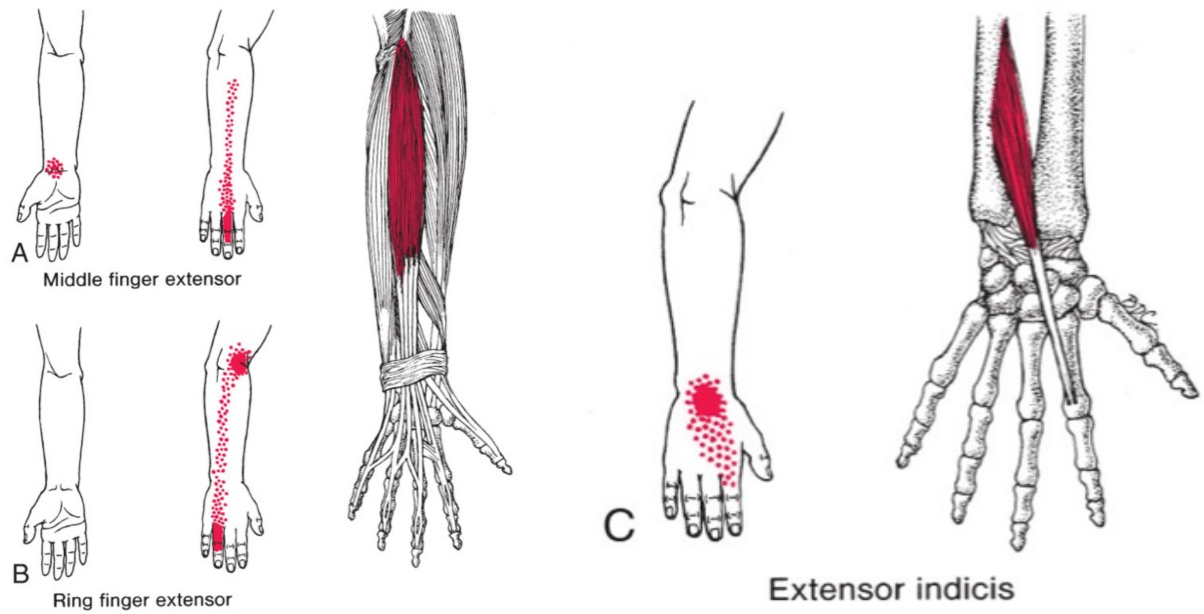
Trigger Points – Finger Extensor Muscles



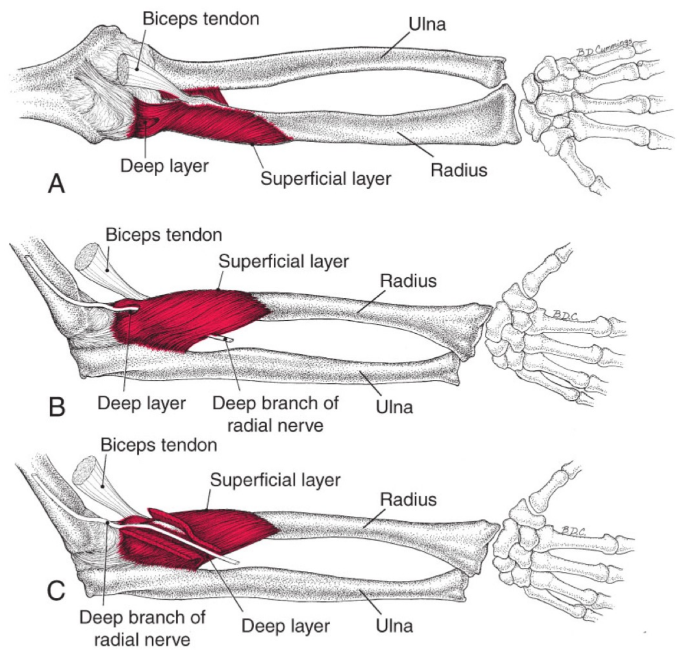
Donnelly J. Travell, Simons & Simons' Myofascial pain and Dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 2018 Jul 10.

Trigger Points – Finger Extensor Muscles



Donnelly J. Travell, Simons & Simons' Myofascial pain and Dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 2018 Jul 10.

Trigger Points – Supinator



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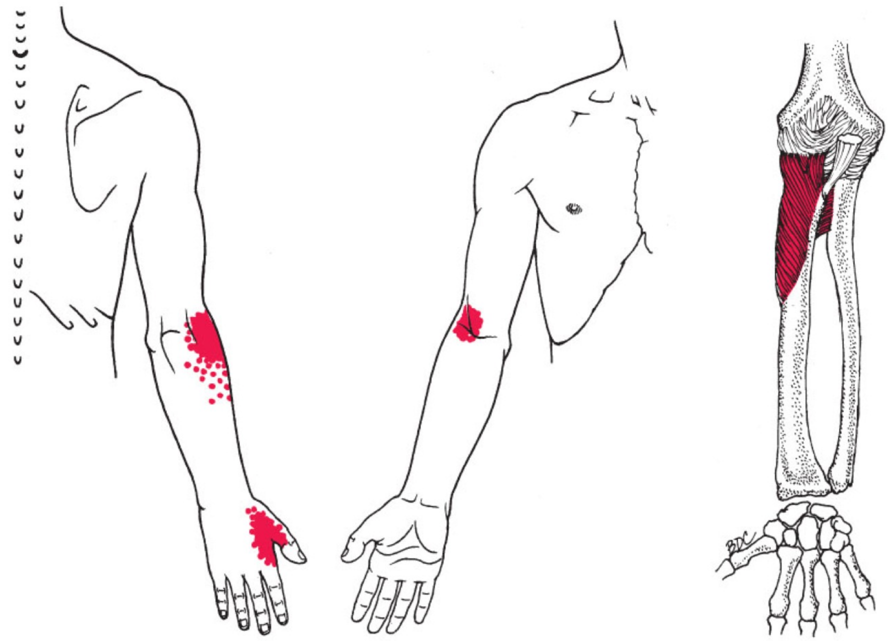
Trigger Points – Supinator



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High Intensity Laser Therapy

Photobiomodulation

- Photobiomodulation (PBM) is the mechanism by which nonionizing optical radiation from lasers and noncoherent sources in the visible and near-infrared spectral range are absorbed by endogenous chromophores to elicit photophysical and photochemical events at various biological scales, leading to physiological changes and therapeutic effects.
- Accepted term for laser therapy since 2015.

Anders JJ, Lanzafame RJ, Arany PR. Low-level light/laser therapy versus photobiomodulation therapy. Photomed Laser Surg 2015;33:183–184.

Indications for HILT

- 810 nm and 980 nm wavelengths:
  - The laser system emits energy in the visible and near-infrared spectrum to provide topical heating for the purpose of elevating tissue temperature for a temporary relief of minor muscle and joint pain and stiffness, minor arthritis pain, or muscle spasm; the temporary increase in local blood circulation; the temporary relaxation of muscle.

Chattanooga. *LightForce® XLi Instructions for Use*. New Castle (DE): Enovis; 2024.

Contraindications for HILT

- Do not apply infrared light to abdominal or lumbosacral points in pregnant females.
- Do not apply infrared light to the epiphyseal lines in children.
- Do not apply infrared light to the thoracic region or over the pacemaker itself in patients with pacemakers.
- Do not apply infrared light over the thyroid gland, ovaries or testicles.
- Do not apply infrared light to patients who are taking drugs that have heat or light sensitive contraindications, such as but not limited to certain types of steroids.
- Do not treat over known cancerous lesions.

Chattanooga. *LightForce® XLi Instructions for Use*. New Castle (DE): Enovis; 2024.

Cellular Mechanisms of PBM

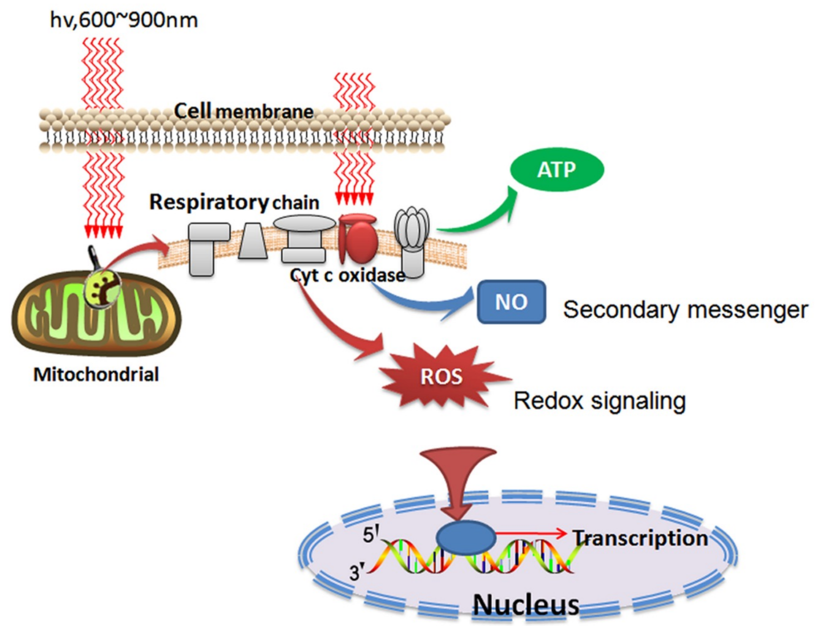


FIG. 1. Schematic depiction of the cellular signaling pathways triggered by LLLT. After photons are absorbed by chromophores in the mitochondria, respiration and ATP is increased but in addition signaling molecules such as reactive oxygen species (ROS) and nitric oxide (NO) are also produced.

Huang YY, Sharma SK, Carroll J, Hamblin MR. Biphasic dose response in low level light therapy–an update. Dose-response. 2011 Oct 1;9(4):dose-response.

PBM Basic Mechanism of Action

↑ Increased activity Cytochrome C Oxidase

↓

↑ Increased mitochondrial function

↓

↑ Increased oxygen consumption

↓

↑ Increased ATP production

↓

Restoration of energy balance and mitochondrial signaling

Huang YY, Sharma SK, Carroll J, Hamblin MR. Biphasic dose response in low level light therapy–an update. Dose-response. 2011 Oct 1;9(4):dose-response.

Effects of PBM on Pain

- Increases cellular energy
  - Laser stimulates mitochondria, the "powerhouses" of cells, to produce more ATP (energy), which impacts the inflammatory cascade.
- Reduces inflammation
  - The light reduces the production of inflammatory markers (like prostaglandins and cytokines), helping to decrease swelling and pain in the tissues.
- Improves blood flow
  - Laser promotes vasodilation, increasing oxygen and nutrient delivery to damaged tissues, which accelerates healing.
- Reduces nerve sensitivity
  - Laser can modulate pain signals in the nervous system by lowering the excitability of pain-sensitive nerves, leading to reduced perception of pain.

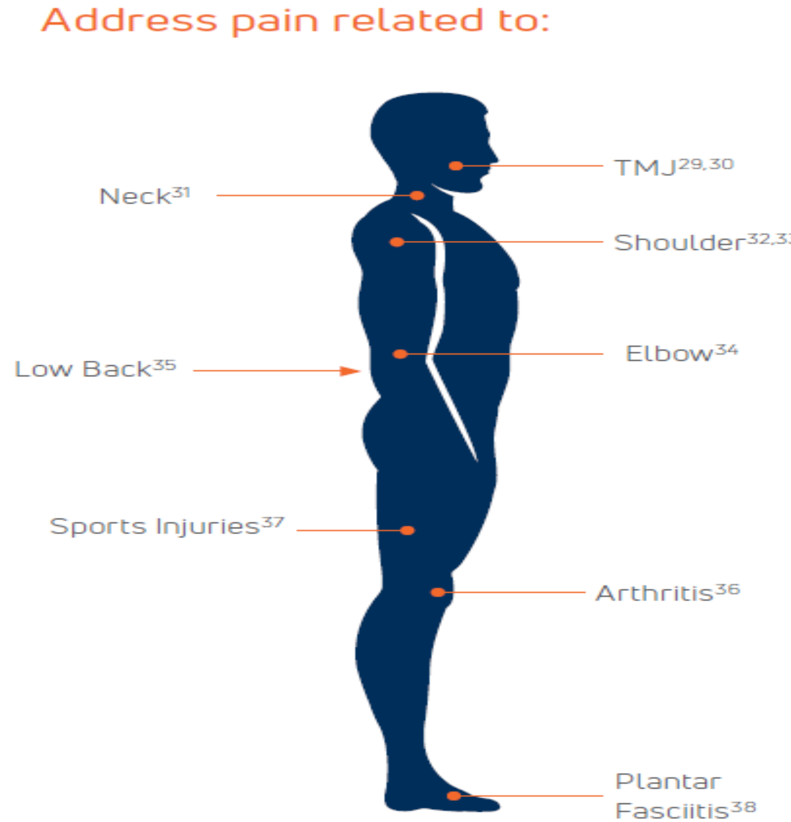
Applications for PBM

Use photobiomodulation therapy in conjunction with other modalities and treatment techniques with a low risk of side effects.

- Acute Conditions
- Chronic Conditions

Multiple Tissues:

- Tendons
- Ligaments
- Joint Capsules
- Muscles
- And More



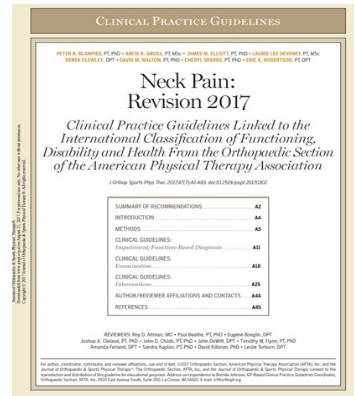
Shockwave and Laser Therapy Lower Leg Injuries 101 [Internet]. Carlsbad, CA: DJO Chattanooga; 2024 [cited 2025 Feb 26]. Available from: https://learn.chattanoogarehab.com/lower-leg-ebook

Research Supporting Laser

- **APTA CPG**
  - Acute ankle swelling (2021)
  - Acute nerve pain (neck) (2017)
  - Chronic neck pain (OA) (2017)
  - Heel pain / plantar fasciitis (2014 / 2023 – upgraded to level B evidence)

- **AAOS recommends LLLT for knee OA (2021)**
- **American College of Physicians (ACP)**
  - Conservative care for chronic low back pain (2017)

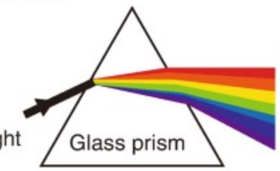
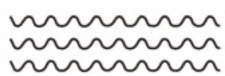
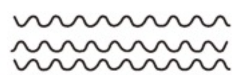
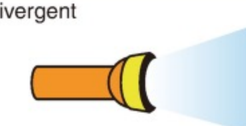
- **PEDro/ Cochrane Reviews**
  - Carpal tunnel (high power, low dose) (2020)
  - Plantar fasciitis (high power better than low power laser) (2018)
  - Cochrane reviews – shoulder: frozen shoulder (2014) and rotator cuff disease (2016)
    - Short term benefits managing pain


CLINICAL PRACTICE GUIDELINES

Neck Pain:
Revision 2017

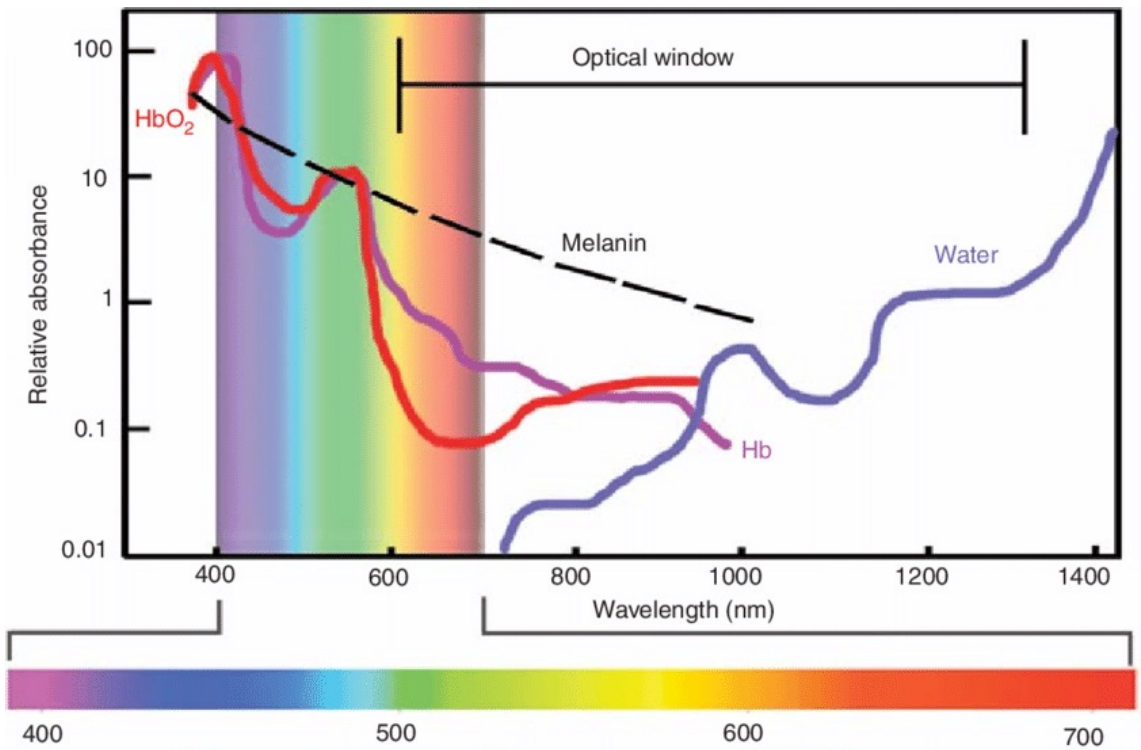
Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association

Wavelength

	Laser light	Non-laser light(e.g., flashlight)
①	Monochromatic 	Polychromatic 
②	Coherent 	Incoherent 
③	Collimated 	Divergent 
④	High intensity	Low intensity

Lee JD, Lee JK, Oh MJ. Principles and choice of laser treatment in dermatology. Springer Singapore; 2020.

Wavelength



Optical window
100
10
1
0.1
0.01
Relative absorbance
HbO2
Melanin
Water
Hb
400
600
800
1000
1200
1400
Wavelength (nm)
400
500
600
700

Power Output

TABLE 3

Laser pointer classification according to the European standard DIN EN 60825-1 (28)

Laser class	Hazard or potential for injury	Typical ouptput power P (continuous wave laser)	Typical use
1	Safe under reasonably foreseeable conditions	P <0.4 mW	Scanner checkouts, DVD players
1M	Hazardous to the eye when using telescopic optical instruments (otherwise as in class 1)	P <0.4 mW; but the beam diameter is greater than 7 mm	
2	Direct intrabeam viewing must be avoided—retinal injury is possible at intra-beam viewing times exceeding 0.25 s	P <1 mW	Laser pointers, laser spirit levels
2M	Hazardous to the eye when using telescopic optical instruments (otherwise as in class 2)	P <1 mW; but the beam diameter is greater than 7 mm	
3A	Hazardous to the eye only when using telescopic optical instruments	P <5 mW; but the beam diameter is greater than 7 mm and the power density is related to the same pupil diameter as in class 2 lasers	
3R	Hazardous to the eye	P <5 mW	Show and projection lasers, material pro-cessing lasers
3B	Always hazardous to the eye	P <500 mW	
4	Always hazardous to the eye and skin	P >500 mW	

https://www.aerzteblatt.de/int/archive/article/195090

Effect of PBM on Pain

PEDro Score: 8/10

- A comparative study of the dose-dependent effects of low level and high intensity photobiomodulation (laser) therapy on pain and electrophysiological parameters in patients with carpal tunnel syndrome.

- Inclusion criteria:
  - Patients aged 20 – 60 years
  - Confirmed moderate CTS based on EMG-NCV study
    - Electrodiagnostic studies were performed twice; once before the study and once 3-weeks after therapy

Ezzati K, Laakso E, Saberi A, Yousefzadeh Chabok S, Nasiri E, Bakhshayesh Eghbali B. A comparative study of the dose-dependent effects of low level and hi
intensity photobiomodulation (laser) therapy on pain and electrophysiological parameters in patients with carpal tunnel syndrome: a randomized controlled trial
European journal of physical and rehabilitation medicine. 2020 Dec 1;56(6):733-40.

Effect of PBM on Pain

- 5 groups studied:
  - Group A (20) – exercise + LLLT with low dose
    - 50 mW, 8 J/cm^2
  - Group B (19) – exercise + LLLT with high dose
    - 50 mW, 20 J/cm^2
  - Group C (20) – exercise + HILT with low dose
    - 1.6 W, 8 J/cm^2
  - Group D (19) – exercise + HILT with high dose
    - 1.6 W, 20 J/cm^2
  - Group E (20) – control, exercise only

Ezzati K, Laakso E, Saberi A, Yousefzadeh Chabok S, Nasiri E, Bakhshayesh Eghbali B. A comparative study of the dose-dependent effects of low level and hi
intensity photobiomodulation (laser) therapy on pain and electrophysiological parameters in patients with carpal tunnel syndrome: a randomized controlled trial
European journal of physical and rehabilitation medicine. 2020 Dec 1;56(6):733-40.

Effect of PBM on Pain

- Treatment outcomes:
  - Pain intensity
    - Group A: VAS decreased from **6.77** +/- 1.47 to **4.77** +/- 1.15
    - Group B: VAS decreased from **6.78** +/- 1.31 to **4.89** +/- 1.03
    - Group C: VAS decreased from **6.8** +/- 1.6 to **2.17** +/- 1.48
    - Group D: VAS decreased from **6.94** +/- 1.71 to **4.02** +/- 1.2
    - Group E: VAS decreased from **7.05** +/- 1.7 to **6.55** +/- 1.16

Ezzati K, Laakso E, Saberi A, Yousefzadeh Chabok S, Nasiri E, Bakhshayesh Eghbali B. A comparative study of the dose-dependent effects of low level and hig
intensity photobiomodulation (laser) therapy on pain and electrophysiological parameters in patients with carpal tunnel syndrome: a randomized controlled trial
European journal of physical and rehabilitation medicine. 2020 Dec 1;56(6):733-40.

Effect of PBM on Pain

The study found that exercise therapy plus HILT (808 nm) with a power of 1.6 W and low dose (fluence) of 8 J/cm^2 was superior in reducing pain and improving median motor nerve electrophysiological studies compared to LLLT and exercise-only control groups.

Ezzati K, Laakso E, Saberi A, Yousefzadeh Chabok S, Nasiri E, Bakhshayesh Eghbali B. A comparative study of the dose-dependent effects of low level and hi intensity photobiomodulation (laser) therapy on pain and electrophysiological parameters in patients with carpal tunnel syndrome: a randomized controlled trial European journal of physical and rehabilitation medicine. 2020 Dec 1;56(6):733-40.

PBM and Tendon Microcirculation

- Findings suggest laser therapy transiently enhances microvascular perfusion and oxygen delivery to tendon tissue, effects still measurable 10 minutes post-treatment.
  - 21 healthy volunteers, patellar tendon microcirculation measured via laser Doppler + white light spectroscopy (O2C device)
  - Measured pre-intervention, immediately post, and 10 min post
  - Blood flow: +86.38 AU immediately post ($p<0.001$), +25.76 AU at 10-min follow-up ($p<0.001$)
  - Oxygen saturation (SO_2): +20.14% immediately post, +13.48% at 10-min follow-up (both $p<0.001$)

Brandl A, Egner C, Reisser U, Lingenfelder C, Schleip R. Influence of high-energy laser therapy to the patellar tendon on its ligamentous microcirculation: an experimental intervention study. PLoS One. 2023;18(3):e0275883.

PBM and Tendon Microcirculation

- Mechanism proposed by authors: acceleration of blood flow via improved flow properties of erythrocytes/platelets, not simply local vasodilation (since hemoglobin concentration decreased rather than increased).
- Clinical relevance: supports HILT as a potential adjunct for tendinopathies with impaired microcirculation.
- Limitation: healthy volunteers only (not a tendinopathy population) — authors note further high-quality studies are needed before drawing treatment conclusions for pathological tendons.

Brandl A, Egner C, Reisser U, Lingenfelder C, Schleip R. Influence of high-energy laser therapy to the patellar tendon on its ligamentous microcirculation: an experimental intervention study. PLoS One. 2023;18(3):e0275883.

Dosing HILT

Surface Area:
10 cm x 10 cm = 100 cm^2

500 Joules / 100 cm^2 = **5 J/cm^2**
1000 Joules / 100 cm^2 = **10 J/cm^2**

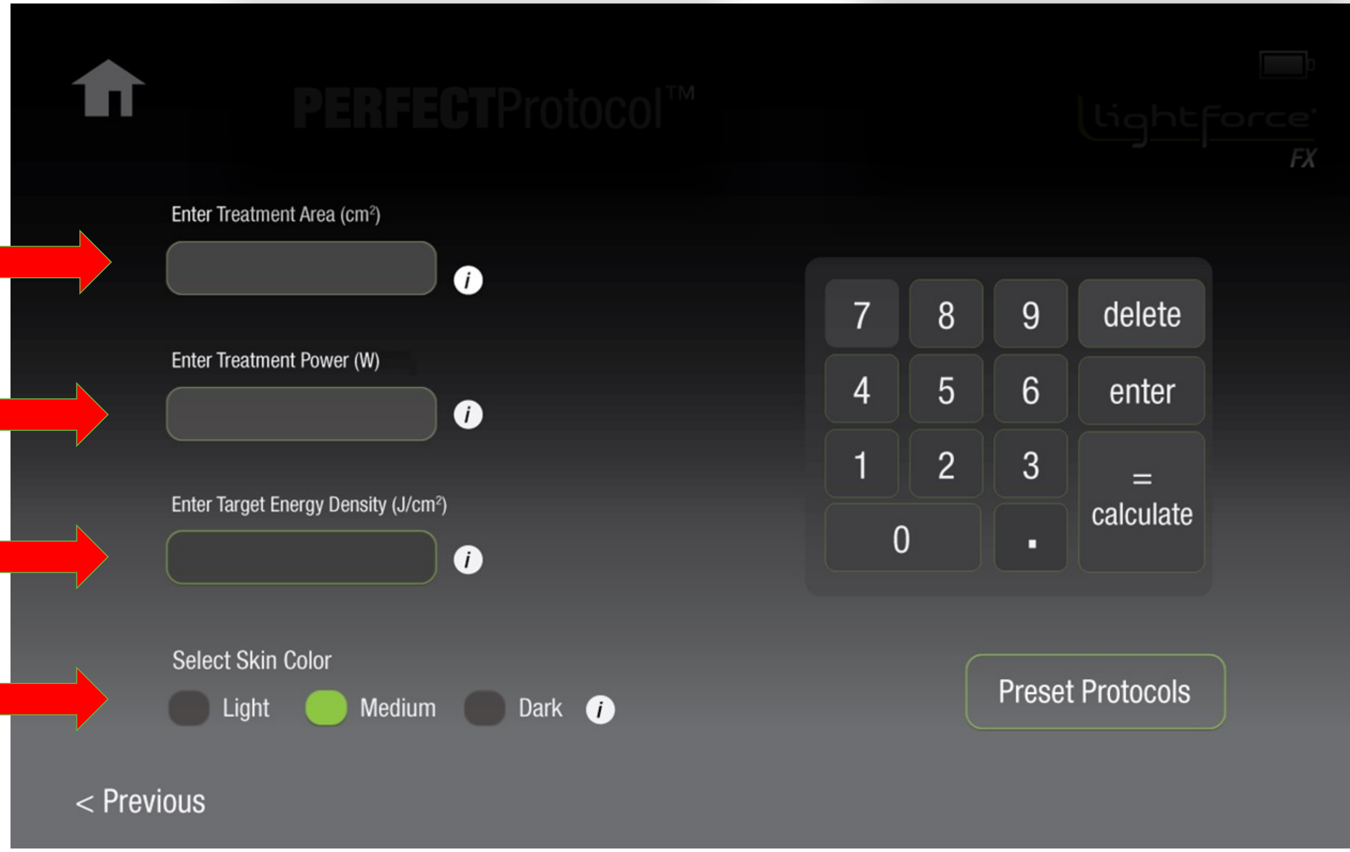
Number of ‘cell phones’ x 100

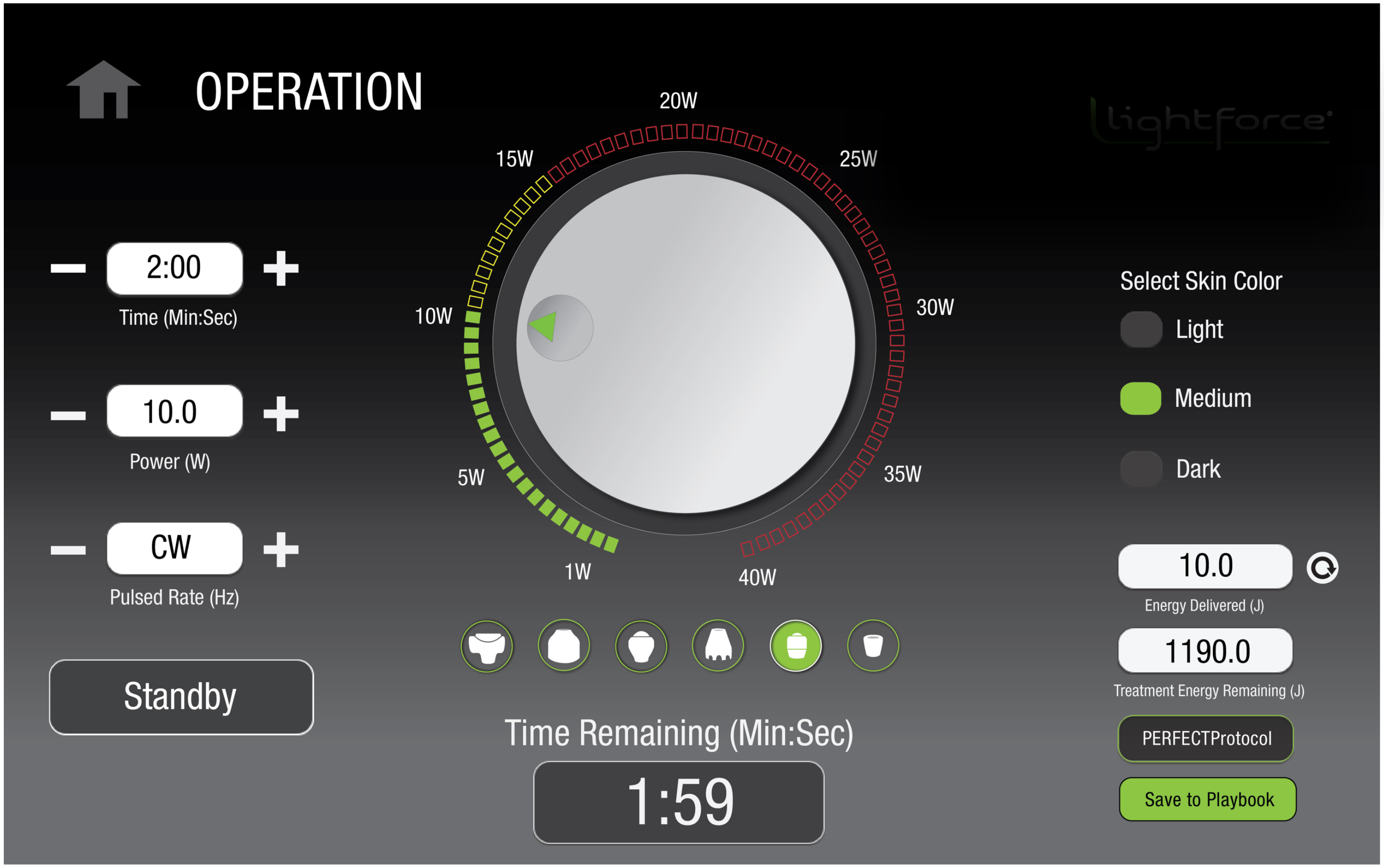
High power, brighter light, better for depth / pain blocking.

Dose (J/cm^2). Higher amount for deep tissue / chronic issues.

Don’t forget skin tone.

Higher power will create more heat on skin.

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Treatment Energy Remaining (J)
PERFECTProtocol
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Exercise and Manual Therapy

Mechanotransduction

- Mechanotransduction = the process by which cells sense and convert mechanical stimuli into biochemical signals.
- Critical for tissue repair, remodeling, and adaptation.

How it Works:

1. Mechanical Load → Applied through manual therapy or exercise.
2. Cellular Detection → Integrins, ion channels, and cytoskeleton sense forces.
3. Signal Transduction → Activation of intracellular pathways.
4. Response → Changes in gene expression, protein synthesis, and tissue remodeling.

Khan KM, Scott A, Mechanotherapy: how physical therapists' prescription of exercise promotes tissue repair British Journal of Sports Medicine 2009;43:247-252.

Isometric Exercise for Tendinopathy

- Overcoming Isometrics
  - Overcoming isometrics, also known as pushing isometrics, involve exerting maximal force against an immovable object. Think of pushing with all your might against a solid wall.
- Yielding Isometrics
  - Yielding isometrics, also referred to as holding isometrics, involve maintaining a specific joint position against a submaximal load for a period of time. The focus is on resisting the force that is trying to move you.

Isometric Exercise for Tendinopathy

- A single bout of isometric contractions can reduce tendon pain for at least 45 minutes, accompanied by a reduction in cortical inhibition.

- Prolonged isometric contractions (30+ seconds) at moderate to high effort may also promote tendon repair by reducing stress shielding, ensuring damaged regions are appropriately loaded.

Rio E, Kidgell D, Purdam C, Gaida J, Moseley GL, Pearce AJ, Cook J. Isometric exercise induces analgesia and reduces inhibition in patellar tendinopa
British journal of sports medicine. 2015 Oct 1;49(19):1277-83.

Eccentric Exercise for Tendinopathy

- Historically, eccentric loading has been the gold standard for tendon rehabilitation.

- The Alfredson Protocol, developed in the late 1990s, is a well-known eccentric program designed for chronic Achilles tendinopathy.
  - Eccentric heel drops: 3 sets of 15 reps, twice daily, 7 days per week, with the knee straight and bent, performed on a step for 12 weeks…

- Because the protocol tends to be uncomfortable, there tends to be low patient compliance due to increased pain.

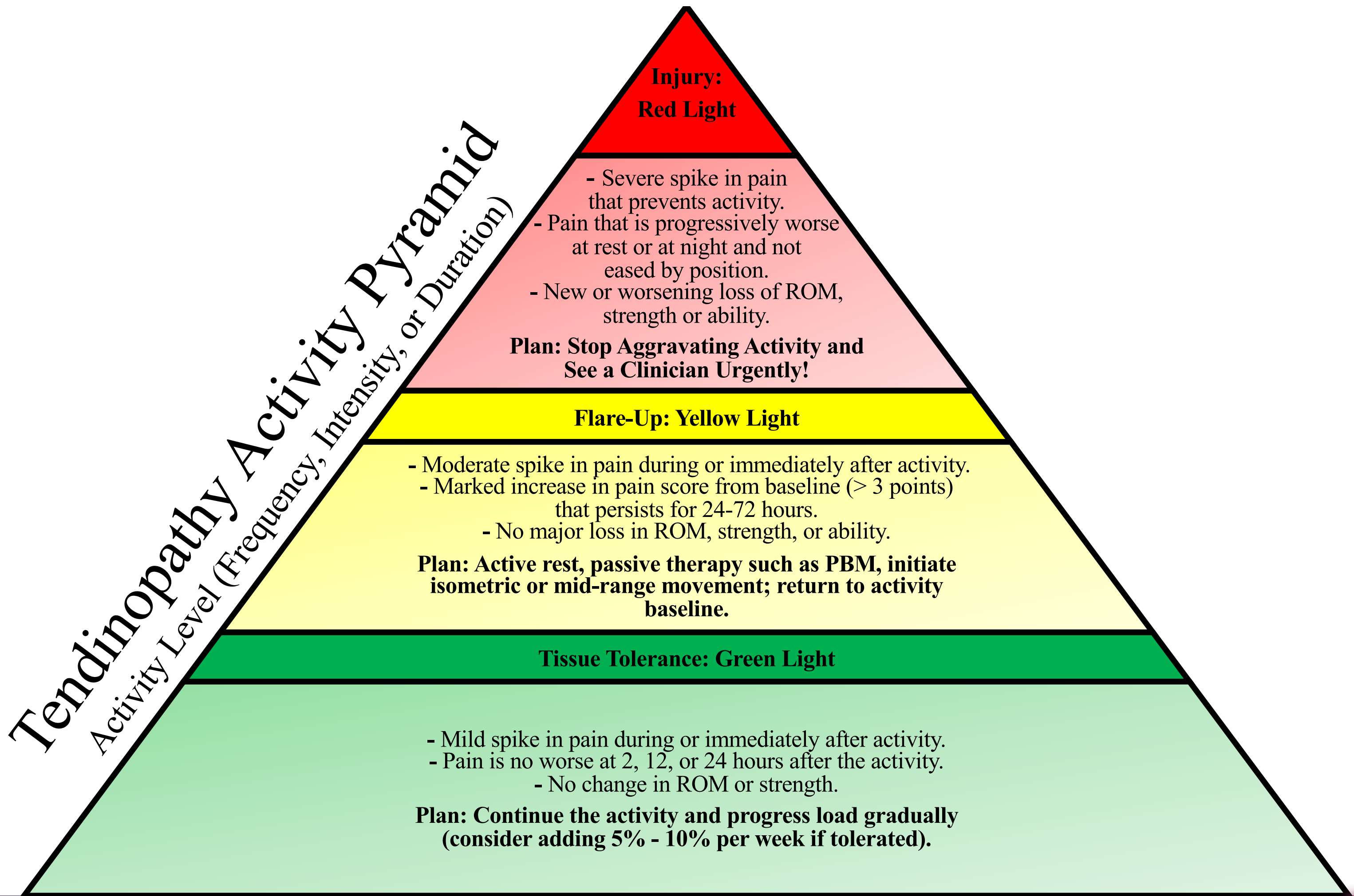
Heavy Slow Resistance Training

- Commonly used exercise approach when managing chronic tendinopathies since tendon strain sufficient for adaptation is generally more likely at a higher percentage (> 70% of 1RM) of maximum.

- Generally, 6-second repetitions (concentric + eccentric).

- HSR has also been shown to have higher patient satisfaction ratings when compared to eccentric exercise.

Morrison, S. and J. Cook, Putting “Heavy” into Heavy Slow Resistance. Sports Med, 2022. 52(6): p.1219-1222.



Modified from: Kolski MC, O'Connor A. A world of hurt: a guide to classifying pain. Thomas Land Publishers Incorporated; 2015.

Sample Lateral Elbow Tendinopathy Treatment Protocol

- Clinical Goals
  - Reduce pain and irritability
  - Improve tendon load tolerance
  - Address myofascial dysfunction
  - Restore upper-quarter biomechanics
  - Progressively increase tendon capacity
  - Return to unrestricted occupational and recreational activity
- Pain Reduction → Movement Restoration → Tendon Loading → Capacity Building → Return to Function

Phase 1: Pain Reduction and Load Management, Weeks 0–2

- Patient Education
  - Tendons respond to progressive loading
  - Complete rest is generally not recommended
  - Pain during rehabilitation is acceptable within tolerable limits
  - Recovery often requires 8–12+ weeks, 6–12 months for complete resolution
- Activity Modification
  - Reduce repetitive gripping
  - Reduce heavy lifting
  - Reduce sustained wrist extension
  - Reduce racquet sports
  - Reduce power tools
  - Avoid complete unloading

Phase 1: Pain Reduction and Load Management, Weeks 0–2

- Radial Pressure Wave Therapy (RPW)
  - Frequency
    - 1 session/week
  - Target
    - Common extensor tendon
    - ECRB tendon insertion
  - Typical Parameters
    - 2000–3000 pulses over elbow
    - Additional 1000–3000 pulses over trigger points
    - 2–4 bar (5–6/10 VNRS)
    - 10–15 Hz
  - Progress intensity as tolerated
  - Evidence suggests shockwave may improve pain and function, particularly in chronic cases.
- High-Intensity Laser Therapy (HILT) / PBM
  - Frequency
    - 2–3 sessions/week at 5–10 J/cm^2
  - Treatment Area
    - Common extensor tendon origin
    - ECRB
    - EDC
    - Supinator region
    - Trigger points
  - Goals
    - Pain reduction
    - Decreased peripheral sensitization
    - Improved local circulation
    - Reduced muscle guarding
  - Laser is being used primarily to facilitate exercise participation.

Phase 1: Pain Reduction and Load Management, Weeks 0–2

- Chiropractic Manipulation (CMT)
  - Cervical Spine
    - Focus on:
      - Address cervical contributions to upper-extremity pain
      - Improve sensorimotor function
  - Shoulder/Thoracic Region
    - Focus on:
      - Upper thoracic segments
      - Costotransverse joints
      - Glenohumeral mobility deficits
    - Particularly assess:
      - Internal rotation deficits
      - Posterior shoulder tightness
- Evidence suggests manipulation may provide short-term pain reduction but should not replace exercise therapy.

- Exercise Progression
  - Isometrics
    - Goal
      - Pain modulation
    - Wrist Extension Isometrics
      - 5 × 45-second holds
      - 60–70% effort
      - 1–2 times daily
      - Progress force before duration
    - Grip Isometrics
      - 5 × 30-second holds
      - Neutral wrist position

Phase 2: Tendon Capacity Restoration, Weeks 2–6

- Continue
  - CMT
  - HILT (1–2x/week)
  - RPW (weekly if indicated)
  - Trigger point management as needed
- Patient Education
  - Gradually increase repetitive gripping
  - Gradually increase heavy lifting
  - Gradually increase sustained wrist extension
  - Gradually increase racquet sports
  - Gradually increase power tools
- Heavy Slow Resistance Training
  - Wrist extension, supination, radial deviation, grip
    - 3–4 sets
    - 8–15 reps
      - 3-second concentric
      - 3-second eccentric
  - Progress load weekly

Phase 2: Tendon Capacity Restoration, Weeks 2–6

- Proximal Strengthening
  - Scapular retraining
  - Rows
  - Lower trap raises
  - Serratus punches
- Rotator Cuff
  - External rotation
  - Scaption
- Evidence increasingly supports proximal strengthening in upper-extremity tendinopathy.

Phase 3: Energy Storage and Functional Loading, Weeks 6–10

- At this stage:
  - Pain ≤3/10
  - Grip strength improving
  - Resisted wrist extension tolerated
- Continue
  - CMT
  - HILT (1x/week)
  - RPW (weekly if indicated)
  - Trigger point management as needed
  - Progress proximal strengthening
- Exercise Progression
  - Faster Resistance / Tempo
    - Wrist extension
    - Increase movement velocity
      - 3 sets
      - 8–10 reps
  - Dynamic Progression
    - Ball Drops
    - Medicine ball
      - 3 sets
      - 20–30 seconds

Phase 4: Return to Normal Activity, Weeks 10–12+

Criteria

- Pain:
  - ≤2/10 during activity
  - No symptom flare next day
- Strength:
  - ≥90% of opposite side
- Grip:
  - ≥90% of opposite side
- Function:
  - Sport/work simulation tolerated

- Occupational/Sport-Specific Loading
  - Manual Workers
    - Progressive hammering
    - Progressive tool use
    - Carrying tasks
  - Racquet Athletes
    - Begin:
      - Mini tennis
      - Half court
      - Full practice
      - Competition

In Summary

- Chiropractors excel in diagnosing and treating tendinopathies throughout the body.
- A comprehensive approach to treatment is essential, incorporating various modalities to improve pain and function sufficiently to allow progression of loading. Gradual progression to heavy exercises is integral to the care plan.
- Patience is key, as tendinopathies may require 6 – 12 months for complete resolution.
- Prioritize non-surgical interventions exhaustively before contemplating surgical options.

Have more questions? Want a demo?

MEET ME AT BOOTH #4
immediately following this session.

Questions?

Contact: stuart.mcintosh@cleveland.edu