

TENDONS & LIGAMENTS

Optimising Health
and Recovery

INFLAMMATION SERIES



Tendon and ligament (T/L) injuries are prevalent in New Zealand and Australia, with poor outcomes often resulting from non-integrative management. This resource explores how healthcare professionals can support and improve outcomes for T/L injury by using functional medicine strategies and patient education.



LEADERS IN NUTRITIONAL MEDICINE

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Introduction

Tendon and ligament (T/L) injuries affect approximately 32,000 people annually across New Zealand and Australia, with over 40% of patients experiencing complications and limited functionality post-surgery without nutritional support. Due to the hypocellularity and hypovascularity of T/Ls, healing is slow and outcomes are often poor when managed solely by surgery, pharmaceuticals and standard rehab.

The anatomy and physiology of T/Ls are discussed in this Practitioner Guide, along with the three overlapping healing stages: inflammatory, proliferative and remodelling. We also review functional medicine interventions, including anti-inflammatory nutraceuticals (curcumin, palmitoylethanolamide and boswellia), omega-3 fatty acids, proteolytic enzymes and targeted nutritional support (vitamin C, taurine, glycine, vitamins A and E, magnesium and hydrolysed collagen). Research supports significantly improved outcomes and reduced recurrence when functional medicine interventions are included.

Anatomy of Ligaments & Tendons

While both ligaments and tendons are composed of dense connective tissue rich in collagen fibres, their structures are specialised for their distinct functions: providing joint stability (ligaments) and facilitating movement (tendons). The differences in their cellular composition, vascularisation and elasticity reflect these functional specialisations.

Ligaments are fibrous connective tissues that connect bones to other bones, providing stability to joints. They are composed mainly of dense, regular connective tissue, which consists of closely packed collagen fibres arranged in parallel bundles.

The key components and characteristics of ligaments include:

Collagen Fibres: These are the primary structural components, providing tensile strength. The collagen in ligaments is primarily Type I collagen, which is strong and resistant to stretching.

Ligament Fibroblasts (fibrocytes): These cells are responsible for producing and maintaining the extracellular matrix, including collagen and elastin.

Elastin Fibres: Present in smaller amounts, elastin fibres contribute to the elasticity and flexibility of ligaments.

Tendons are similar to ligaments but serve a different function. They connect muscles to bones, transmitting the force generated by muscle contraction to the skeleton to produce movement.

The key components and characteristics of tendons include:

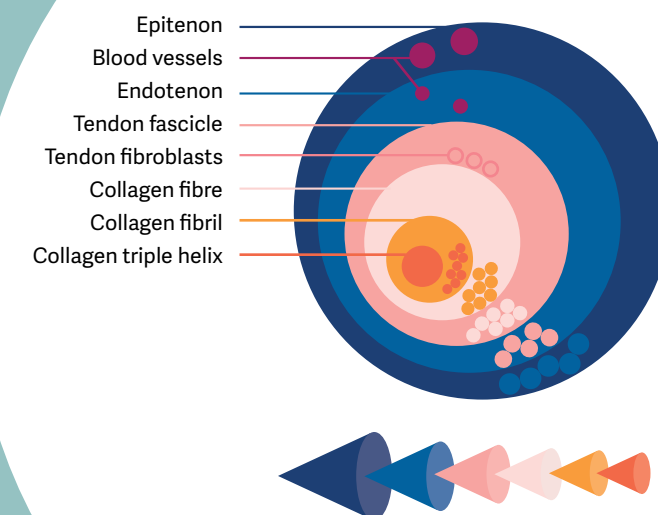
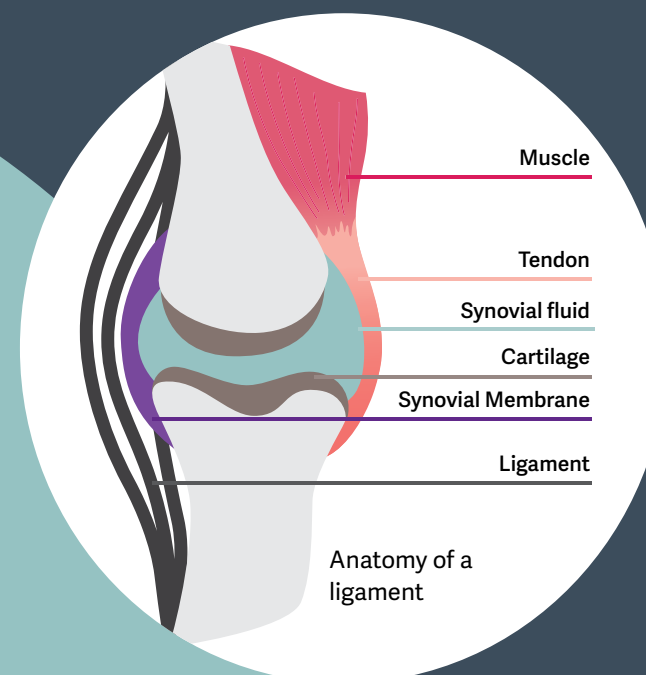
Collagen Fibres: Tendons are also composed mainly of Type I collagen, arranged in parallel bundles to provide high tensile strength. Tendons typically have a higher collagen content than ligaments, which contributes to their strength and resistance to tension. Collagen triple helix forms collagen fibrils which combine into collagen fibres.

Tendon fibroblasts (tenocytes): These specialised fibroblasts are responsible for synthesising and maintaining the collagen and extracellular matrix in tendons.

Endotenon: This is a connective tissue sheath that surrounds the bundles of tendon fascicles (bundles of collagen fibres) within a tendon, providing structural support and housing blood vessels and nerves.

Epitenon: This outer layer of connective tissue surrounds the entire tendon, providing additional protection and facilitating the movement of the tendon within surrounding tissues.

Paratenon (not pictured below) surrounds epitenon to create elastic sleeves, permitting free movement



Physiology of Ligaments vs Tendons

Function

Ligaments: Provide joint stability, limiting the range of joint motion

Tendons: Transmit the force of muscle contractions to bones, enabling movement

Vascularisation

Ligaments: Lower blood supply compared to tendons, which can slow healing

Tendons: Slightly better vascularised than ligaments, particularly at the junctions (where muscle meets tendon or tendon meets bone) aiding in their repair

Elasticity

Ligaments: Contain more elastin fibres, for greater elasticity and return to their original length after being stretched

Tendons: Have less elastin and are less elastic, designed to withstand high tensile forces without stretching excessively

Injury and Healing

Ligaments: Injuries to ligaments often take longer to heal (11–13 months) due to their lower blood supply and complex structure. Healing often requires immobilisation and gradual rehabilitation to restore function and prevent re-injury.

Tendons: Tendon injuries (tendinitis or tendon tears) can heal relatively faster (9–12 months) due to better vascularisation but require careful management to prevent chronic issues. Rehabilitation typically involves controlled exercises to strengthen the tendon and restore its function.

In summary, both ligaments and tendons are slow to heal compared to other tissues due to their low, relative, vascularity. Since both tissues are comprised of the same substances, chronic degeneration can occur simultaneously in both types of tissue, even if only one is presenting as injured.

The 12-month protocol provides sufficient support for both tissues when considering treatment length, but requires practitioner insight, as not all cases or people are the same.

Related Pathologies

Several factors contribute to the development and exacerbation of chronic joint pain. Poor mechanics and ergonomics, along with certain comorbidities, increase the risk of joint pain, damage and degeneration. As these comorbidities become more prevalent, so do joint issues.

Genetic influences

Genetic influences (e.g., Ehlers-Danlos syndrome) and autoimmune conditions (e.g., rheumatoid arthritis) can adversely impact T/L structure and integrity.

Systemic inflammation

Systemic inflammation can exacerbate chronic joint inflammation. Factors like food sensitivities, compromised gut health and environmental toxins (e.g., mould, heavy metals, glyphosate) can increase overall inflammation and are linked to rotator cuff damage. Untreated chronic rotator cuff inflammation can lead to bursitis, tears, biceps tendon inflammation and frozen shoulder, prolonging healing and reducing quality of life.

Poor mechanics, ergonomics

Repetitive motion with poor mechanics, often seen in factory workers, computer users ('mouse-arm') and those with full-on workout plans, can lead to chronic shoulder pain. Patients should be informed that this pain is abnormal, treatable and best sorted early. Certain comorbidities also increase the risk of joint pain, damage and degeneration, and as these comorbidities become more common, so do joint issues.

Nutritional deficiencies

Nutritional deficiencies directly affect T/L health. The most common deficiencies affecting collagen structure and repair are:

- Copper deficiency/zinc excess
- Magnesium/calcium deficiencies
- Protein deficiency
- Sulphate deficiencies/sulphide excess
- Vitamin C deficiency
- Vitamin D/K deficiencies

Functional Medicine Interventions

Anti-inflammatory approaches

Nutraceuticals like curcumin, palmitoylethanolamide (PEA), and boswellia can support tendon health and repair, pain and inflammation, and improved patient outcomes. Numerous studies involving millions of patients show that curcumin (500mg) and PEA (350mg) taken three times daily are as effective as ibuprofen (400mg) in reducing pain and inflammation at days 7, 14, and 28 for all causes, without the side effects of ibuprofen.

Boswellia is often used to support healing in tendinopathies due to its ability to inhibit 5-lipoxygenase and leukotriene biosynthesis and downregulate several proinflammatory cytokines (TNF- α , IL-1, IL-2, IL-4, IL-6 and IFN- γ).

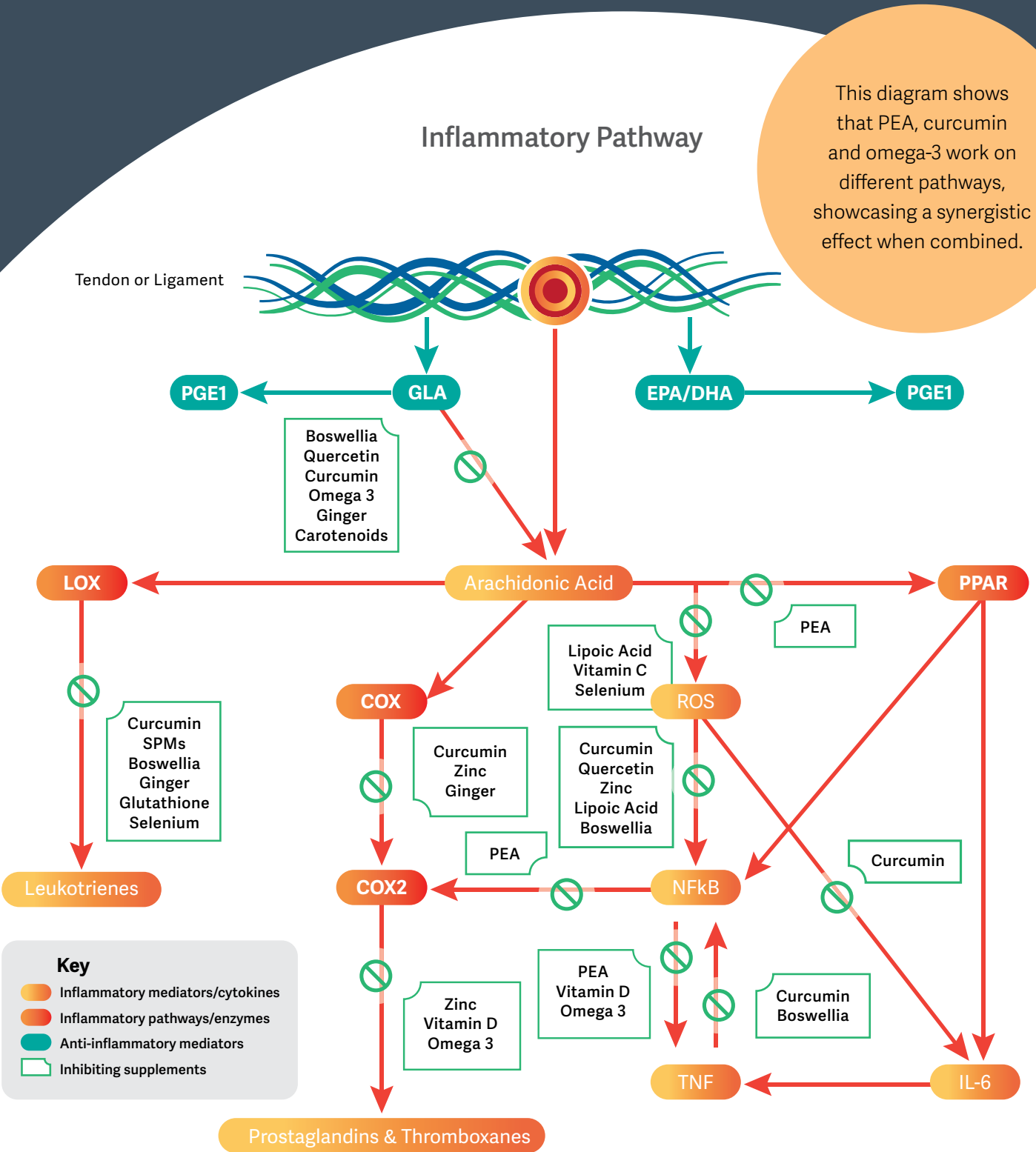
Curcumin is well-known in research to support tendon health and repair, aiding recovery both histologically and biochemically, with or without surgery. Curcumin is shown to relieve pain and inflammation as effectively as NSAIDs at similar doses, as NSAIDs can significantly worsen outcomes when used within the first week after surgery, tear, or rupture.

Omega-3 fatty acids (EPA and DHA), found in fish oils, reduce localised inflammation and decrease adhesion rates during the repair phase of tendons and ligaments. Those with chronic rotator cuff damage were correlated with low omega-3 index, though causality was not determined.

PEA operates on pain and inflammatory pathways akin to CBD precursors, diminishing pain perception and lowering IL-6, TNF- α and COX2 levels on pathways broader than those impacted by curcumin and boswellia alone. Research indicates that combinations of PEA, curcumin and boswellia expedited improvements in inflammation, pain markers and patient-reported pain more effectively, comprehensively and with lower dosages compared to individual ingredients.

Proteolytic enzymes like bromelain, proteases, lumbrokinase, serrapeptase and nattokinase identify and break down damaged proteins, help repair injured tissues and improve blood flow to affected areas. They reduce bruising and pain while improving access for repair mechanisms and cellular response in areas with poor blood supply, which can be impacted by conditions like diabetes, endothelial issues, post-viral illnesses and heart/lung disease.

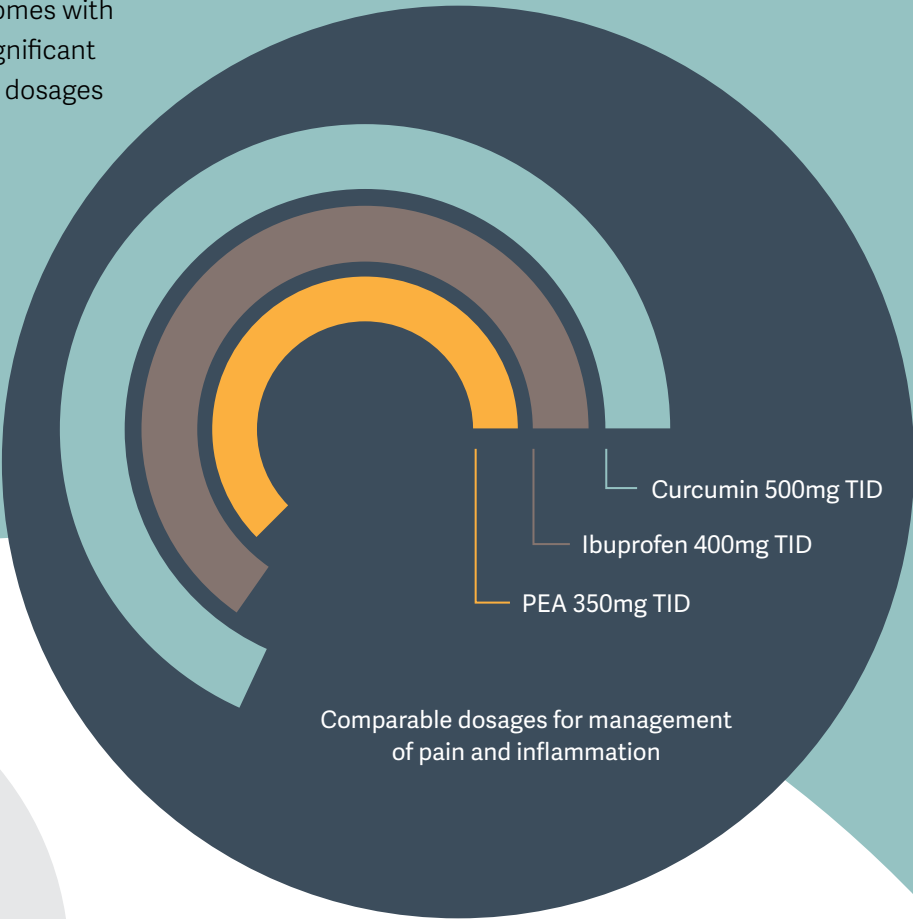
Full-thickness tears often follow partial tears and degeneration, highlighting the importance of early intervention. This may include addressing joint instability as a critical early intervention. Over the past few decades, our focus has been on investigating optimal strategies for addressing bone health. However, we've come to recognise that nurturing ligament and tendon health is just as crucial. Ensuring strength and flexibility can significantly enhance mobility and diminish discomfort across one's lifespan.



New pain management options

NSAIDs for ongoing pain management comes with health risks. PEA and curcumin have a significant number of studies delineating equivalent dosages and expected outcomes.

In dozens of studies involving millions of patients, curcumin and PEA were found to be equally effective as ibuprofen in reducing pain and inflammation when taken three times a day at the doses in the graph on the right, for all-cause pathology, at days 7, 14 and 28.



Additional nutritional support



Vitamin C holds clinical significance in both chronic and acute T/L repair. It stimulates hydroxyproline, improves collagen I and III maturation, supports cross-linking continuity, reduces adhesion to tendon sleeves for better gliding and supports circulation. Research shows Vitamin C supports full-thickness healing in the Achilles (the biggest, thickest and slowest-healing tendon). As a key cofactor in collagen synthesis, even mild vitamin C deficiencies after trauma or surgery can have a dramatic and clinically significant impact.



Magnesium showed further reduction in perception of pain. Magnesium deficiency is correlated with increased perception of pain and even a slight deficiency can increase perceived pain from injury.



Nitric oxide (NO) levels within the first two weeks of T/L repair are crucial for repair due to the low vascularity of these tissues. Supplements like alpha-lipoic acid (ALA), l-citrulline, glycine, taurine, and vitamin C drive NO production, while deficiencies in EPA/DHA, iron, magnesium, vitamins A, E, and K, zinc, and copper inhibit NO production.



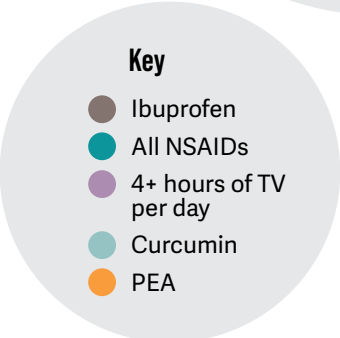
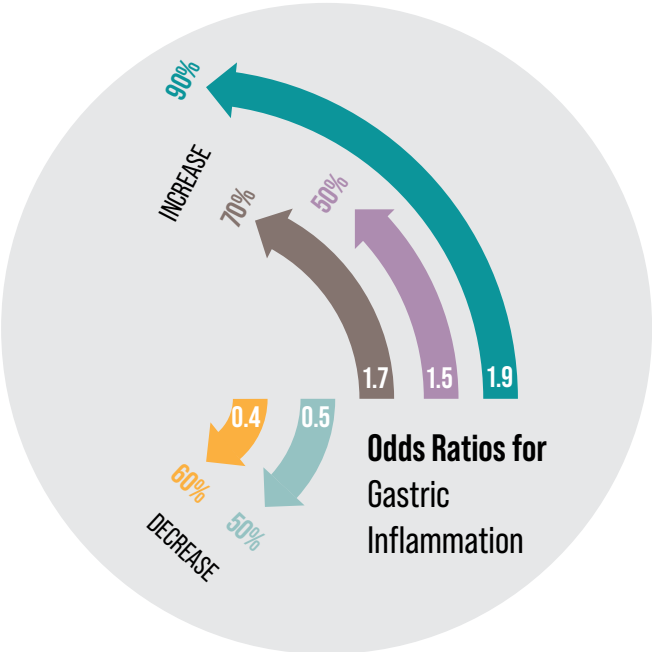
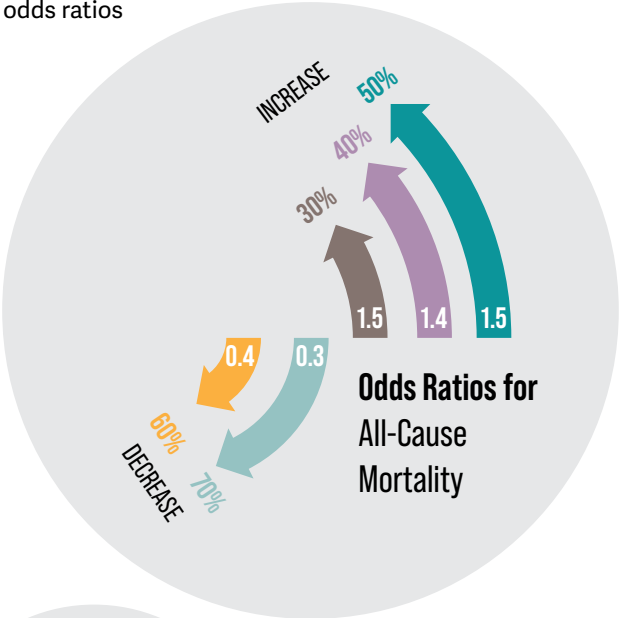
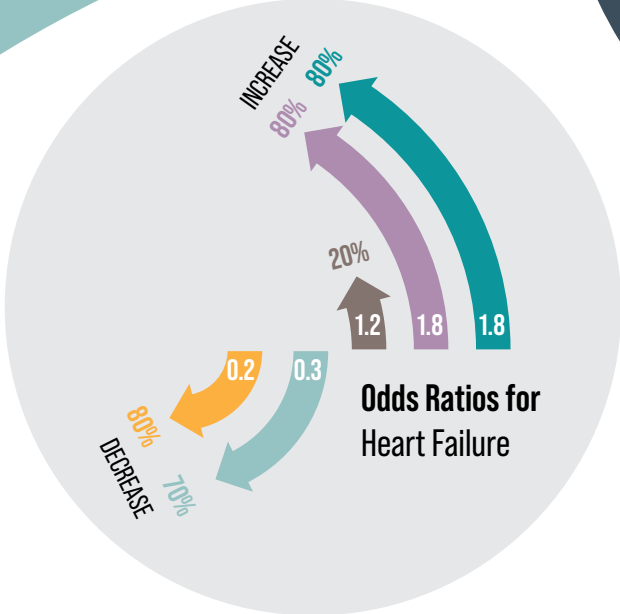
Taurine, glycine, vitamins A and E have demonstrated favourable clinical results through both direct and indirect mechanisms. They contributed to enhanced full-thickness repair, restoring tendons to their pre-injury or surgical levels of strength, flexibility and fibre alignment. Notably, when administered for a duration of 12 months following a rupture, these nutrients showed a reduction in frayed fibres and decreased adhesions.



Hydrolysed collagen types I and III are shown to reach damaged joint capsules, tendons and cartilage when supplemented, providing superior benefits compared to other collagen forms as supported by radiographic studies. Rectifying collagen deficiencies at therapeutic doses proved safe and emerged as the sole predictor for the complete histological restoration of T/L health to its pre-injury state. Even young athletes with ankle instability reported improved ankle stability with ingestion of hydrolysed collagen.

Why pain management matters

Pain management odds ratios



The 3-R Approach to Health and Recovery

The 3-R approach creates three primary treatment phases: Relieve, Restore and Reinforce. Although the phases can overlap, they still need to be addressed in order, for example, we cannot focus on reinforcing the stability of an acutely injured joint without first relieving the patient's pain and then creating an environment for the joint to heal.

By following the 3-R approach, we aim to provide comprehensive care that not only alleviates immediate symptoms but also restores function and reinforces long-term health to help patients live their healthiest lives.

Relieve

This first phase focuses on alleviating the patient's immediate pain, fear, discomfort, or risk. For instance, with pain management, the focus is on reducing pain.

Restore

Once the patient's pain or underlying conditions are addressed, we move to the Restore phase. The goal here is to restore the patient's functional capabilities to a healthy and stable state.

Reinforce

The final stage, is where functional medicine really excels. It focuses on reducing the risk of recurrence by addressing underlying causes and promoting long-term health and a sustainable, healthy lifestyle.

Three healing stages

(1) Inflammatory phase (Days 1-7)

- Blood clot forms immediately upon tear, triggers chemoattractants
- Preliminary scaffolding begins
- Inflammatory cells arrive
- Necrotic debris is digested by phagocytosis
- Nitric oxide synthase (NOS) levels peak at 7 days
- NOS levels return to baseline at day 14
- Activation of tenocytes begins

(2) Proliferative or reparative phase (Days 3-30)

- Fibroblasts proliferate, particularly in the epitenon
- Intrinsic tenocytes (in endotenon and epitenon) migrate and proliferate
- Tenocytes establishing an internal neovascular network
- Neutrophil levels decline while macrophages continue to recruit repair cells
- Matrix synthesised by tenocytes
- Higher proportion of collagen type III is utilised

(3) Remodelling phase (Months 2-12)

- Begins 1-2 months after injury
- Tenocytes and collagen fibres align
- A higher proportion of collagen type I is utilised

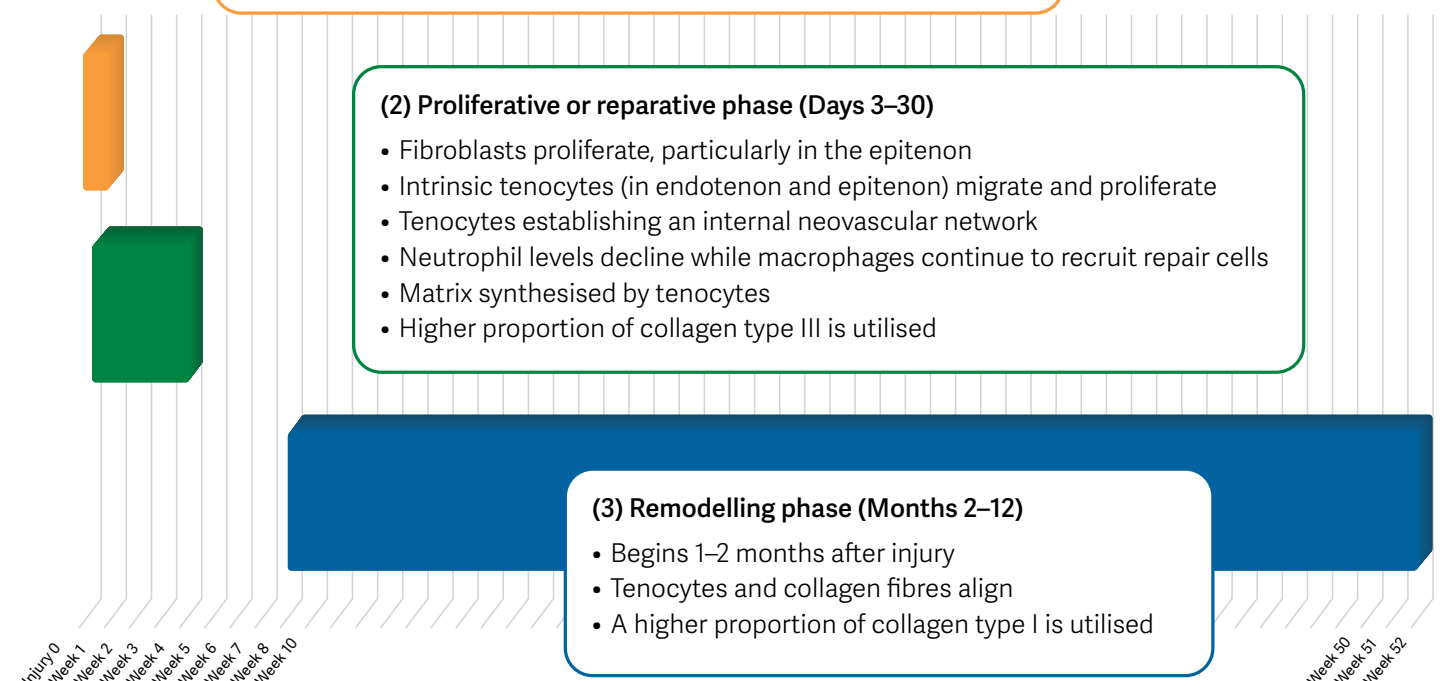
Healing stages

T/Ls have three overlapping healing stages: (1) the inflammatory phase, (2) the proliferative phase and (3) the remodelling phase.

RELIEVE
Inflammatory Phase

RESTORE
Proliferative Phase

REINFORCE
Remodelling Phase



Tendon and Ligament Support Protocol

This practical evidence-based 12-month protocol includes nutritional support and repair ingredients researched to provide potential for full thickness repair of damaged ligaments and tendons when reinforcement is sustained for one year.



InflamaSoothe Trio

60 capsules

Contains Palmidrol (PEA), Casperome® Boswellia Phytosome® and Meriva® Curcumin Phytosome® to support a broad range of painful and inflammatory health conditions.

Days 1-14 — 3 caps twice daily

Days 15-42 — 2 caps twice daily

Days 43-365 — 1 cap twice daily



Core Nutrients with Collagen

448g (28 serves)

A comprehensive blend of essential vitamins, minerals and trace elements with hydrolysed bovine collagen (10g/scoop) and herbs (milk thistle and ginger).

Days 1-365 — 1 scoop daily with or without food



MyoMend

60 capsules

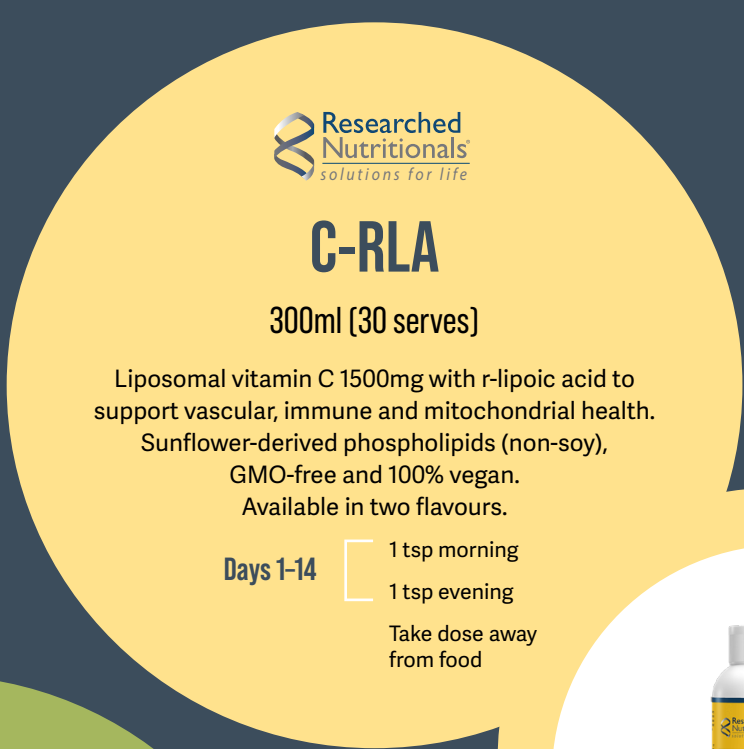
Promotes a healthy inflammatory response, encourages accelerated recovery and tissue repair. Includes tropical plant enzymes bromelain and papain as well as rutin, nattokinase and serrapeptase.

Days 1-28

2 caps morning

2 caps evening

Take capsules away from food



C-RLA

300ml (30 serves)

Liposomal vitamin C 1500mg with r-lipoic acid to support vascular, immune and mitochondrial health. Sunflower-derived phospholipids (non-soy), GMO-free and 100% vegan. Available in two flavours.

Days 1-14

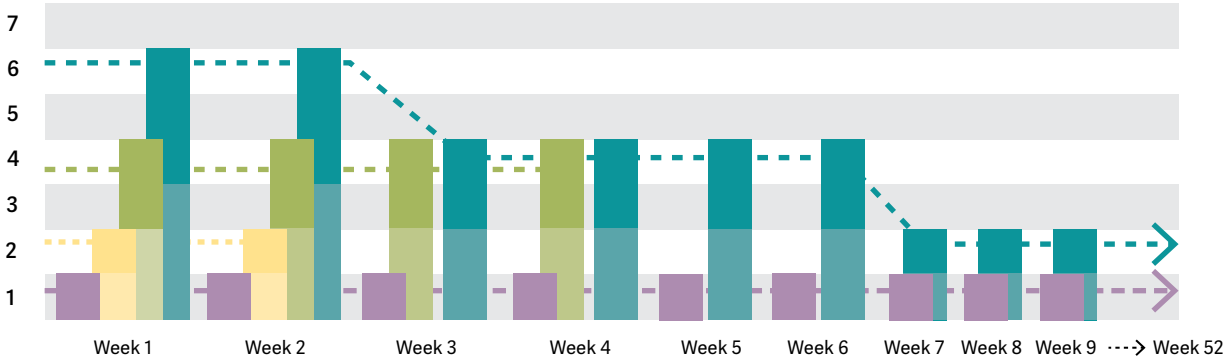
1 tsp morning

1 tsp evening

Take dose away from food



Tendon and Ligament 12 month Support Protocol
Daily dosages per week



Key

- Core Nutrients with Collagen
- C-RLA
- MyoMend
- InflamaSoothe Trio

Conclusion

Without supplemental support, less than half of T/L injuries will return to full, pre-injury health. With an integrative approach, tendons and ligaments involved in sprains and strains have the potential for a complete, full thickness repair.

When solely using pharmaceuticals, T/L repair is often incomplete. NSAIDs and glucocorticoids can reduce tendon repair potential and cause long-term damage. Without nutritional support, over 40 percent of patients experience complications and limited functionality post-surgery.

Relieve

Pain management
PEA
Curcumin
Boswellia
Magnesium

Inflammation management

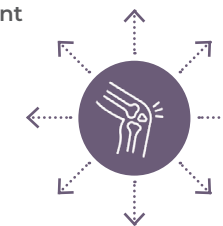
Curcumin
Boswellia
PEA
Vitamin C

Hypovascularisation

Nattokinase
Serrapeptidase
Nitric oxide (NO)
• Vitamin C
• Glycine
• Magnesium
• Lipoic acid

Restore

Repair components
Collagen
Glycine
Taurine



Circulation
Vitamin C
Lipoic acid
Serrapeptidase
Nattokinase

Reinforce

Cross linking/strength
Collagen
Vitamin C
Glycine
Curcumin
Zinc

Flexibility/alignment

Collagen
Vitamin C
Glycine
Curcumin

Decrease adhesions Improve gliding

Collagen
Vitamin C
Glycine
Boswellia



Functional medicine offers a comprehensive approach to support tendon and ligament health by addressing inflammation, nutritional deficiencies, and the unique challenges of various anatomical locations. Targeted nutraceuticals, such as curcumin, PEA, and omega-3 fatty acids, work synergistically with essential nutrients like vitamin C and hydrolysed collagen to support optimal healing environments.

N=O

Enhancing circulation and nitric oxide production ensures that vital nutrients reach hypovascular regions, while proteolytic enzymes and antioxidants break down barriers to healing and protect against oxidative stress. Educating patients on the importance of a nutrient-dense, anti-inflammatory diet, proper sleep hygiene and targeted supplementation empowers them to take an active role in their recovery.



As healthcare professionals, staying at the forefront of scientific research and embracing integrative approaches allows us to transform the lives of those suffering from chronic pain and recurrent injuries. By guiding our patients with functional medicine principles and a commitment to holistic well-being, we can help them achieve optimal tendon and ligament function and improve their overall quality of life.

Resources

Download from the FxMed Practitioner Hub or contact your Practitioner Consultant

Practitioner Resources:

- Tendon & Ligament Quick Reference Guide

Patient Resources:

- Tendon & Ligament Patient Protocol
- Sprains & Strains Patient Brochure
- Mouse-Arm Patient Handout
- Pain Tracker Handout

Watch the Inflammation Lunch and Learn Webinar Series 2024

fxlearn.co.nz/inflammation-lunch-and-learn-webinar-series-2024/



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