



SPORTS PHYSICAL THERAPY

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PATHOPHYSIOLOGY OF TENDONS INJURIES



OVERVIEW

This chapter will outline:

- The tendon physiology from a molecular level to gross tissue level
- Relation to its function
- Subsequent mechanical properties.
- Injury mechanisms
- Tendon injury management



Role of tendons in Locomotion

- The tendon is designed to be both rigid enough to enable efficient transfer of forces from muscle to bone
- But also compliant enough to allow storage of energy for later use.
- It is because of diversified requirements in the form of fine motor and gross motor skills



Structure

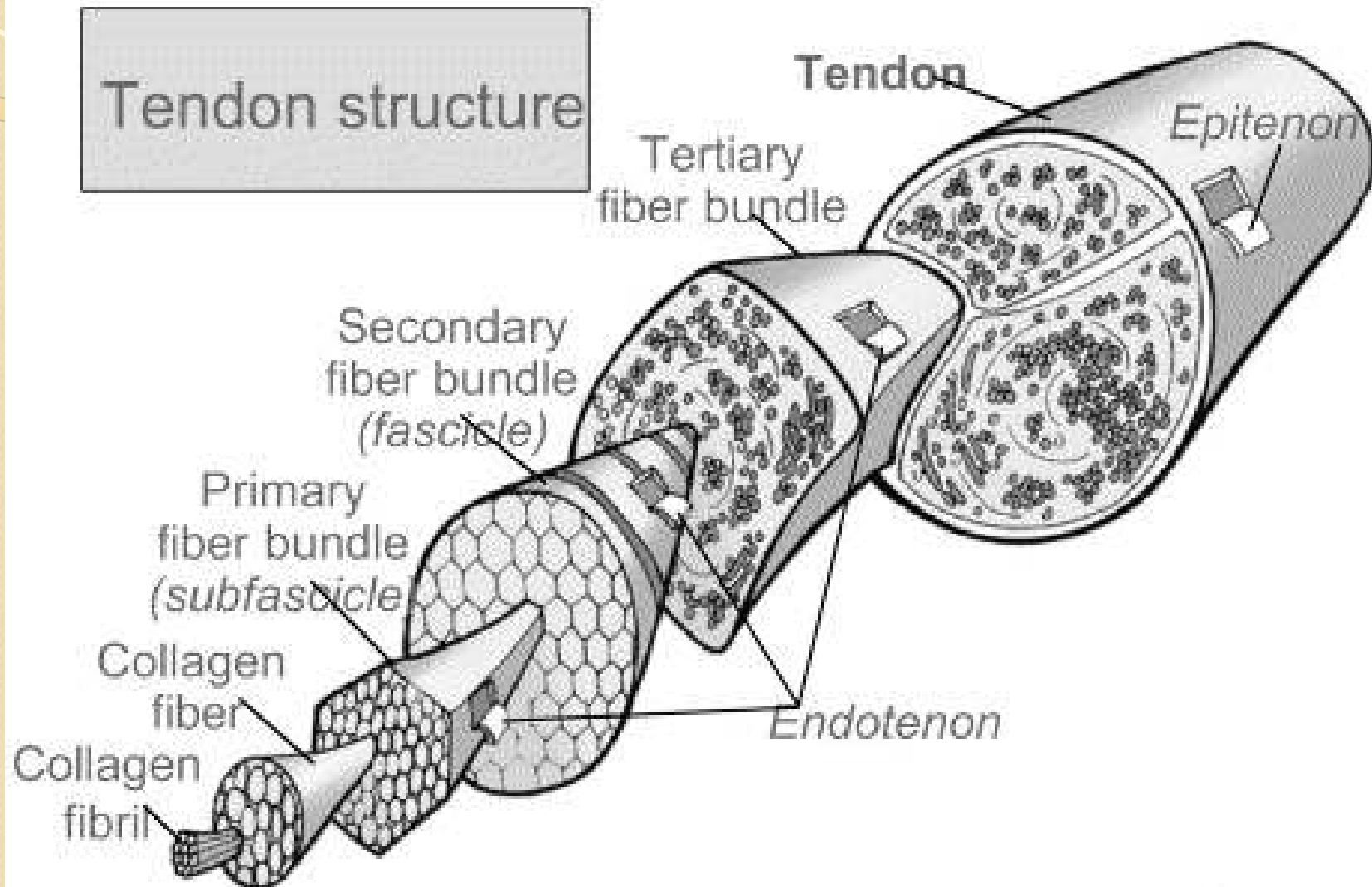
- Rounded in the middle
- Sheet like at attachment in the form of Apponeurosis



BASIC TENDON ANATOMY AND PHYSIOLOGY

- Tendon consists of tendon cells **(fibroblasts)**
 - Longitudinal rows and are elongated cells extending within the tendon structure and
 - Communicate via gap junctions within the three-dimensional space of the tendon.
- Also there is the extracellular matrix (ECM) that forms the
 - Scaffold for the tendon
 - Range of collagens (I, II, III, V, VI, IX and XI), proteoglycans and water.

BASIC TENDON ANATOMY AND PHYSIOLOGY



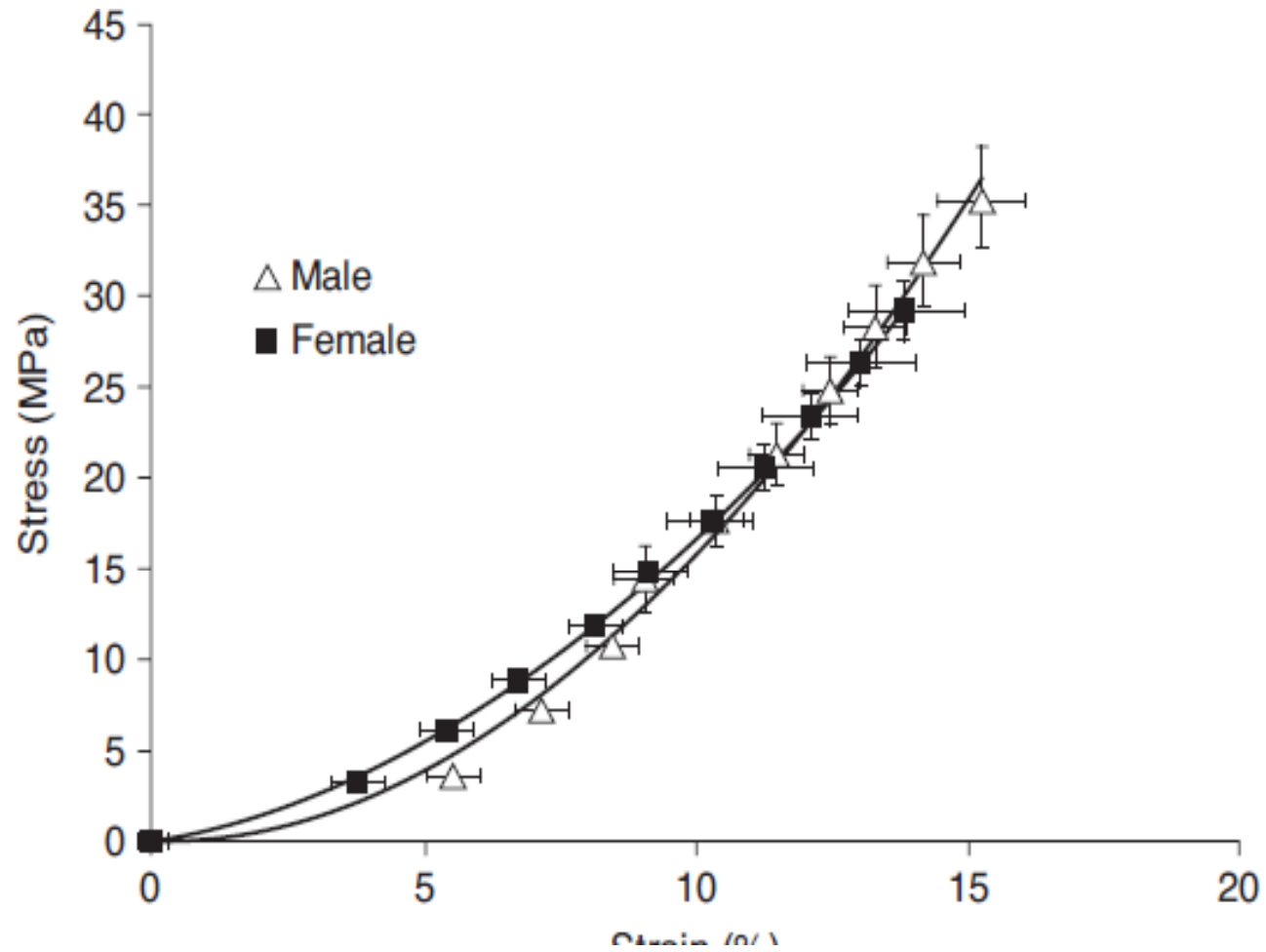


Functional aspects of tendon

- The tensile properties of tendon allow for its capacity to resist rupture under normal loading conditions.
- The tendon response to loading in terms of strain (percentage change of length from rest) and stress (force per unit area).

Functional aspects of tendon

- As tendons are also elastic they tend to stretch when muscle contraction takes place.
- The external load is very heavy, then as the muscle contracts the tendon may stretch initially
- The action of the tendon here could be thought of as similar to a **spring** being stretched and energy **stored**.



Stress–strain curve for elderly males and females (mean age 72 yrs) (Burgess et al. 2009b).

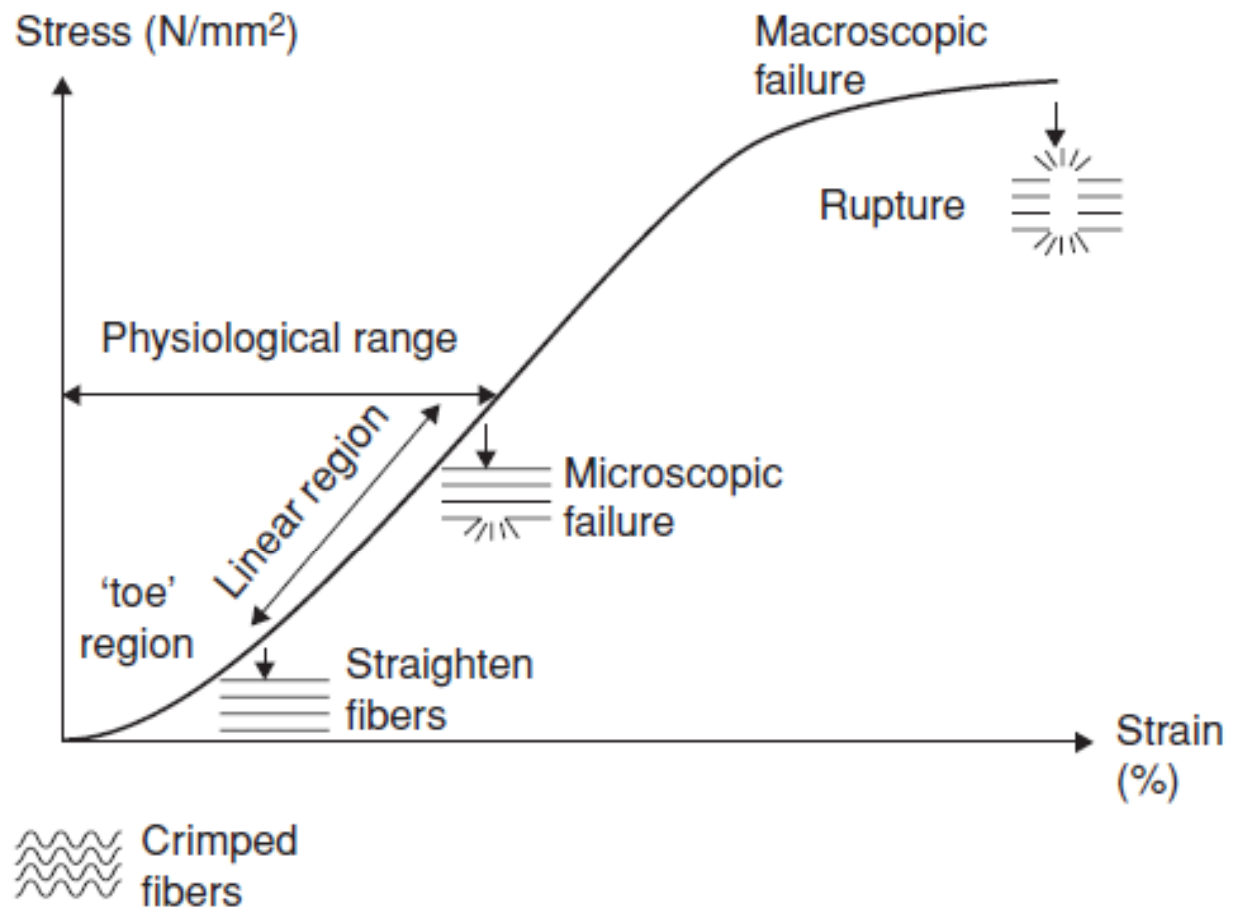


Figure 5.4 Diagram showing elongation properties of tendon with progressive loading. Low load region (toe) shows characteristic greater strain than linear region, with subsequent plastic region leading to rupture.



Tendon injury and its management

- A damaged tendon will likely reduce the capacity for transfer of forces via the muscle to the bone.
- Injury to the tendon can be characterized as acute resulting in either a catastrophic rupture or a less major tear of the tendon tissue.

	TERM	DESCRIPTION
1	Tendinitis or tendonitis	Inflammation of the tendon
2	Tendinosis	Asymptomatic tendon degeneration
3	Tendinopathy	Generic description for tendon disorders
4	Paratenonitis	Inflammation of the paratenon
5	Peritendinitis	Inflammation of the peritendon
6	Spontaneous tendon rupture	Tendon rupture without any predisposing factors
7	Partial rupture	Incomplete tendon tear
8	Enthesopathy	Tendon-bone junction disorders



Tendon injury and its management

Acute tendon injury

- This can be perhaps best described as either complete rupture of the tendinous structure or partial rupture.
- The tendons mostly seen to be suffering rupture are those bearing higher functional loads, such as the **Achilles and Patellar tendons**

Tendon injury and its management

Acute tendon injury

Causes

- Acute tendon injuries may be predominantly caused by extrinsic factors
- A sudden, large force or torque applied through the tendon, perhaps at an oblique angle could result in a partial or complete tear.

(Incorrect or accidental placement of the limbs, abnormal surface conditions, neural control mechanism failure, inappropriate muscle balance.)

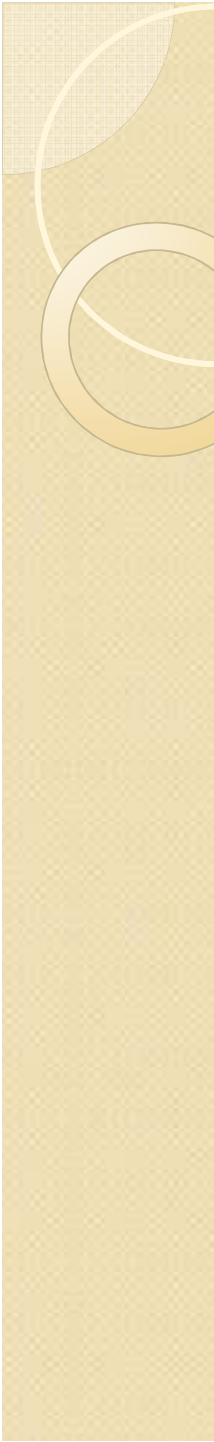
Tendon injury and its management

Acute tendon injury

Causes

- It has been reported that males present with tendon injuries more often than females.
- Certain classes of drugs, including **antibiotics (flouoroquinolines) and corticosteroids**, can affect the collagen tissue directly. (Sode et al. 2007).

(Increased activation of metalloproteinase, a regulator of collagen degradation)



Tendon injury and its management

Chronic Tendon Injury

CAUSES

- Overuse injuries can be described as chronic tendon injuries and fall into the description for tendinopathies.
- Tensile overload, Tenocyte related collagen synthesis disruption, Tendon load induced ischemia, Neural sprouting, and Histological adaptive compressive responses.



Tendon injury and its management

- Clinical diagnosis of tendinopathies involves manual and visual elements. Pain may or may not be present, but changes to the tendon may include swelling, crepitus, tenderness.

Tendon injury and its management

- Tendon healing is slow due to
 - lower metabolic rate
 - The limited blood supply to the tendon tissue

TREATMENT

- Surgery may be advantageous, providing better functional capacity over non-operative options (Schepesis et al. 2002);
- The use of a “cascade membrane” to knit the tendon and accelerate healing. (thin layer of autologous fibre saturated in platelets)

Tendon injury and its management

TREATMENT

- After surgery the patient is immobilized for a period of four weeks.
- Conservative and non-surgical, treatment options include: Rest, ice, massage therapy, eccentric exercise, NSAIDS, ultrasound therapy, electrotherapy, taping, sclerosing injections (Polidocanol) , blood injection, and glyceryl trinitrate patches.

Tendon injury and its management

Achilles Tendon Disorders





Tendon injury and its management

Achilles Tendon Disorders

Anatomy ???



Tendon injury and its management

Achilles Tendon Disorders

Physiology ???



Tendon injury and its management

Achilles Tendon Disorders

Biomechanics ???



Tendon injury and its management

Achilles Tendon Disorders

Biomechanics

- Gastrocnemius-soleus-Achilles complex
 - Spans 3 joints
 - Flex knee
 - Plantar flex tibiotalar joint
 - Supinate subtalar joint
- Up to 10 times body weight through tendon when running

Tendon injury and its management

Achilles Tendon Disorders

- Pathophysiology
 - Repetitive microtrauma in a relatively hypovascular area.
 - Reparative process unable to keep up
 - May be on the background of a degenerative tendon



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Tendon injury and its management

Achilles Tendon Disorders

- 75% of sports-related ruptures happen in patients between 30-40 years of age.
- Most ruptures occur in watershed area 4cm proximal to the calcaneal insertion.
- Mechanism
 - Eccentric loading (running backwards in tennis)
 - Sudden unexpected dorsiflexion of ankle
 - Direct blow or laceration

Tendon injury and its management

Achilles Tendon Disorders

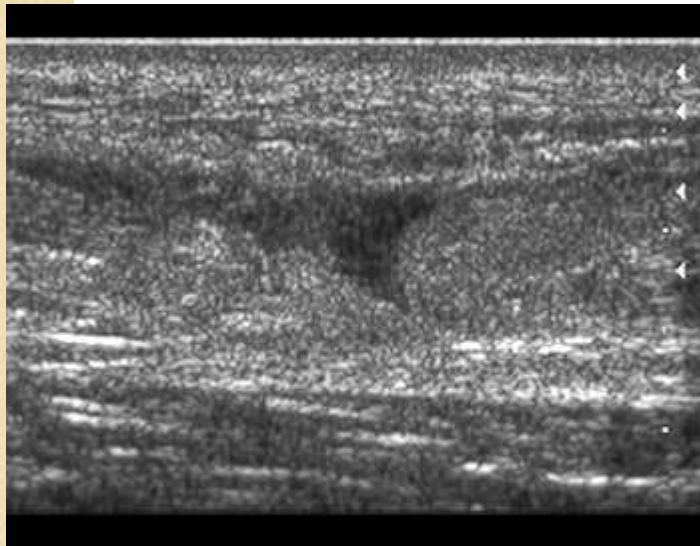
POSITIVE THOMPSON TEST



Tendon injury and its management

Achilles Tendon Disorders

Ultrasound



MRI





Tendon injury and its management

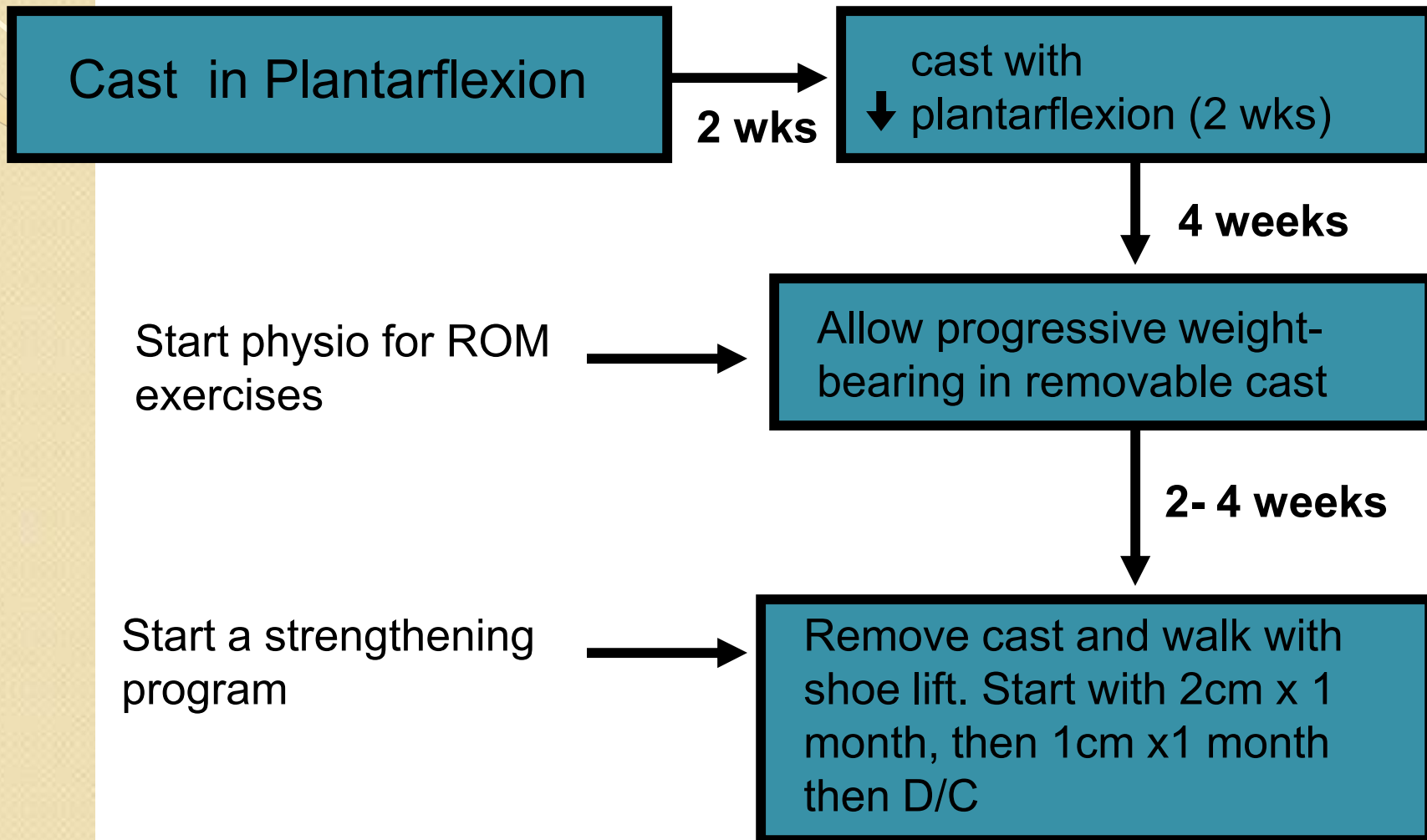
Achilles Tendon Disorders

Management Goals

- Restore musculotendinous length and tension.
- Optimize gastro-soleous strength and function
- Avoid ankle stiffness

Tendon injury and its management

Conservative Management



Tendon injury and its management

Achilles Tendon Disorders



Achilles Tendonitis Rehabilitation Exercises



Towel stretch



Standing calf stretch



Standing soleus stretch



Side-lying leg lift



Step-up



Heel raise



Balance and reach exercise A



Balance and reach exercise B

Achilles Tendon Disorders

Physiotherapy



Achilles Tendon Disorders

Physiotherapy





Thanks