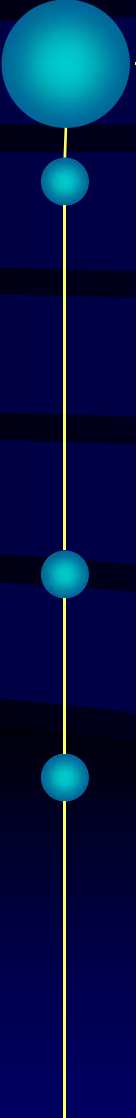


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*Rehabilitation of Traumatic
Injuries to Knee/Ankle/Foot*

Mechanism of Injury

- 
- Overuse or poor training parameters
 - Collision with another athlete / object
 - Dangerous technique
 - Force overload
 - Environmental factors
 - Equipment factors
 - Accidents
 - Unsafe manipulation of physiology / drug abuse
 - Existing pathology
 - Complications of treatment

Traumatic vs overuse

- What are the common traumatic knee injuries in sports?
- Are there any rehabilitation principles for traumatic sports injuries?

Common traumatic knee injuries in sports

- *Sprain*
- *Strain*
- *Fracture/ dislocation*

Common traumatic knee injuries in sports

- *Sprain*
 - *ACL > PCL > MCL > LCL*
 - *combined*
- *Strain*
 - *Quad. /Ham*
- *Fracture/ dislocation*
 - *patellar*

Rehabilitation Principles

- *Monitor/ control of inflammation*
- *Maintain/restore joint ROM, muscle strength, neuromuscular control*
- *Reinforcing the missing structure*
- *Co-ordination /functional training*
- *Safe return to sports*

Factors that influence rehabilitation approach

- *Type of sport*
- *Time remaining in the season*
- *Other sports*
- *Sports rules*
- *Outside sporting influence*
- *Psyche of athlete*
- *Type of injury*
- *Severity of the injury*
- *Type of treatment and rehabilitation*

AND

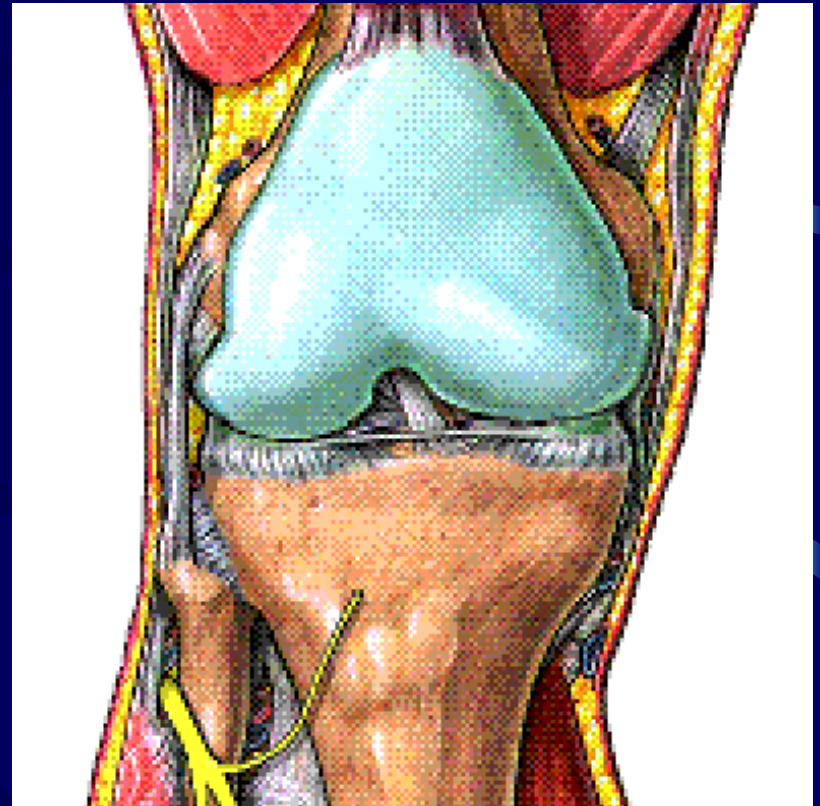
Function of the injured
structure(s)

&

its role in the functional
kinetic chain

What's special about the knee?

- *Function :*
 - *Load bearing*
 - *Shock absorption*
- *Kinematics :*
 - *6 degree of motion*
 - *Ligaments are the prime restrainers*
 - *Muscles/ligaments act as dynamic restrainers*



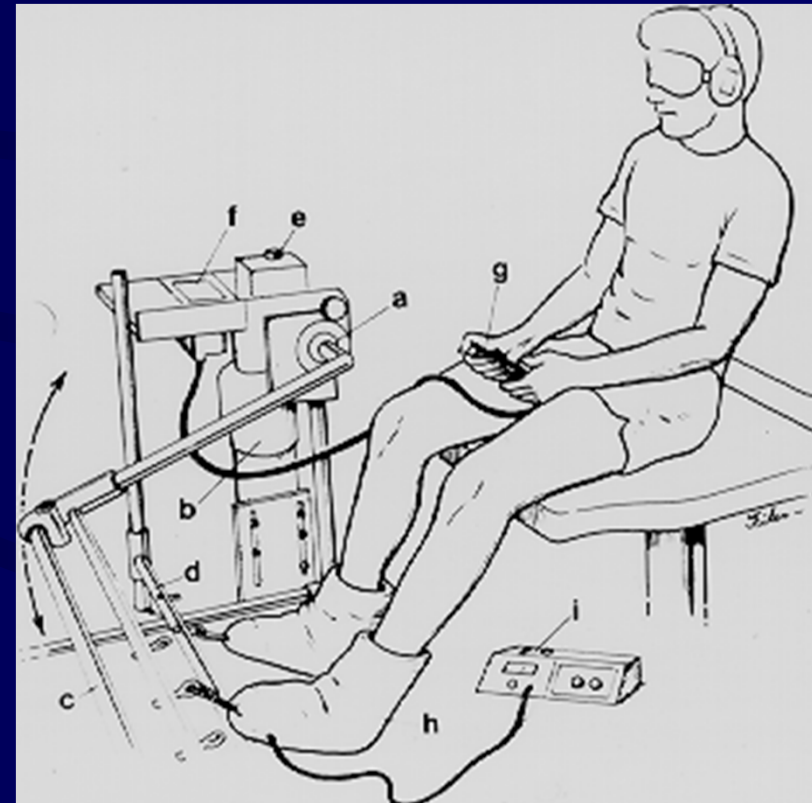
Relationship between ligament and muscle

- *Ligament provides mechanical and sensory support to the joint*

Effects of ligamentous injury on proprioception

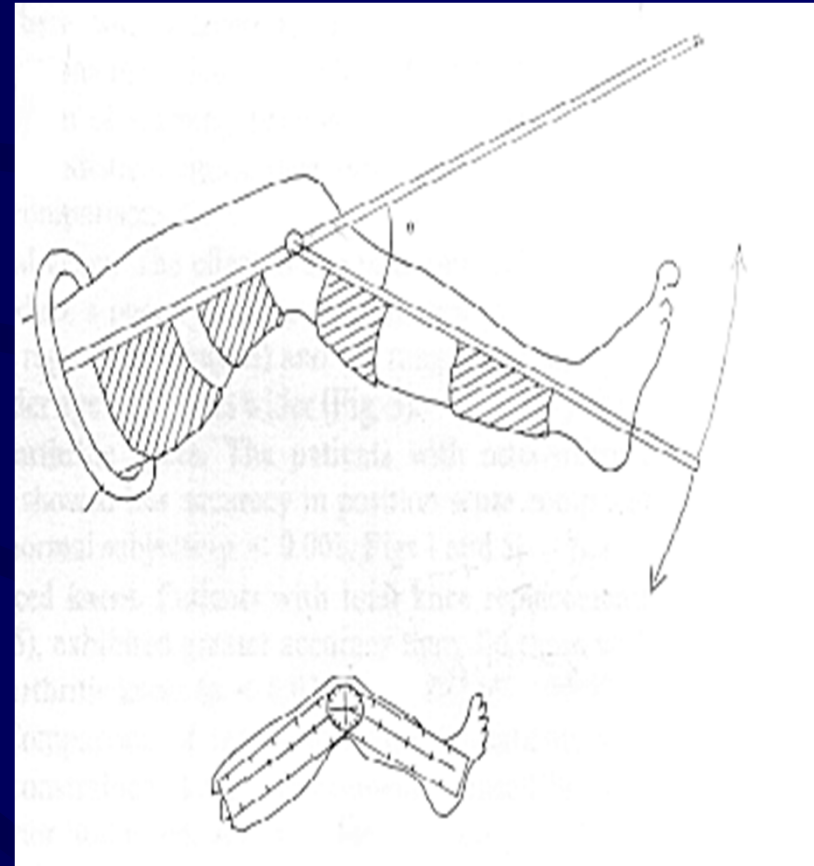
There is an increase in threshold detection of passive knee movement with torn ACL

(Barrack et al 1989, Lephart et al 1992, Corrigan et al 1992, Lephart et al 1995, MacDonald et al 1996, Borsa et al 1997)



Effects of ligamentous injury on proprioception

Significant increased in the error of repositioning on the affected leg



Relationship between proprioception, neuromuscular control and joint stability

Mechanoreceptors

```
graph TD; A[Mechanoreceptors] --> B[Inf. on joint position and movement]; A --> C[Reflex muscular activities]; C --> D[regulation of muscle stiffness]; D --> E[Functional joint stability];
```

**Inf. on joint position
and movement**

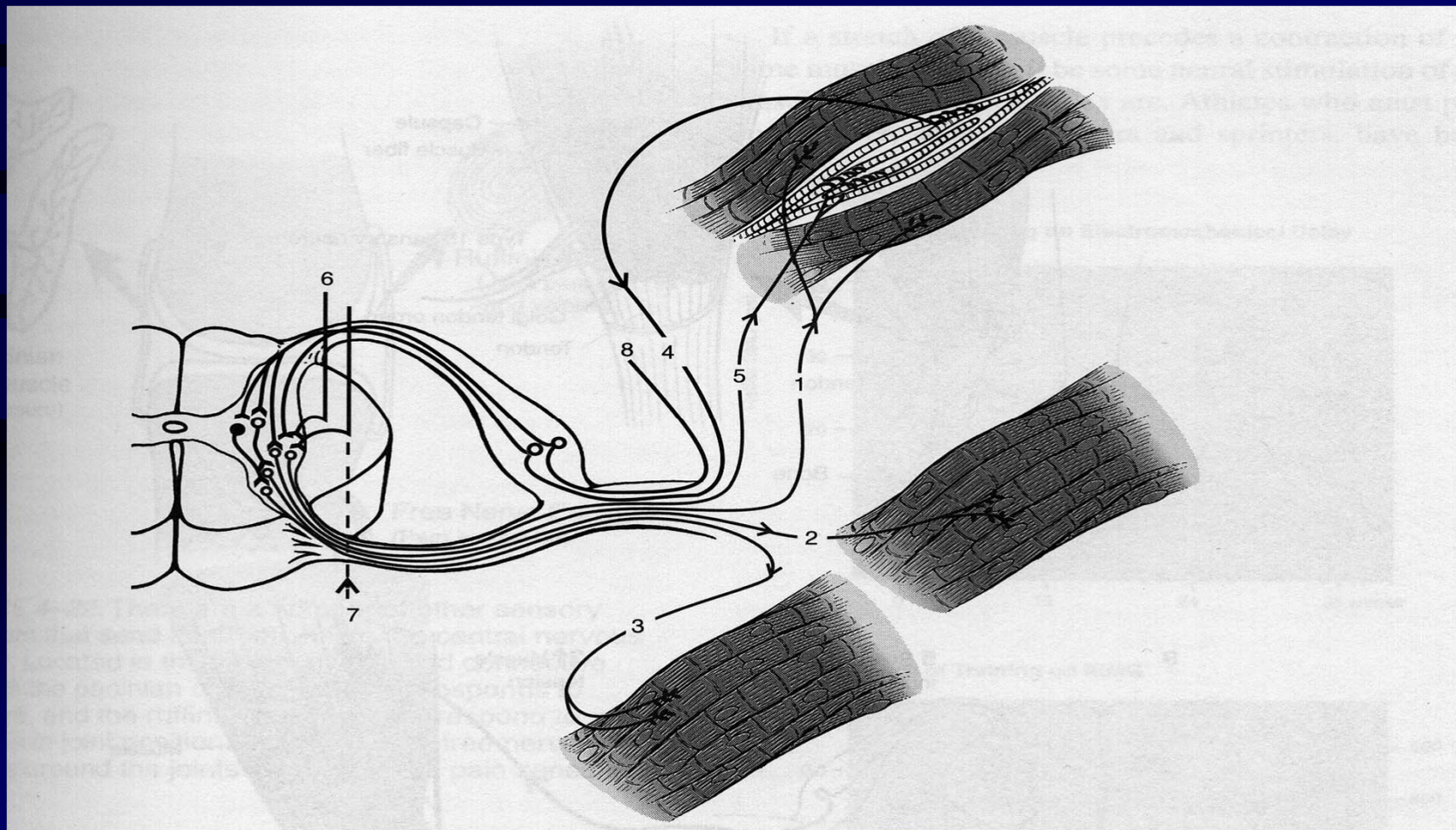
Reflex muscular activities

regulation of muscle stiffness

Functional joint stability

Proposed mechanism on "Ligament -thigh reflex arc"

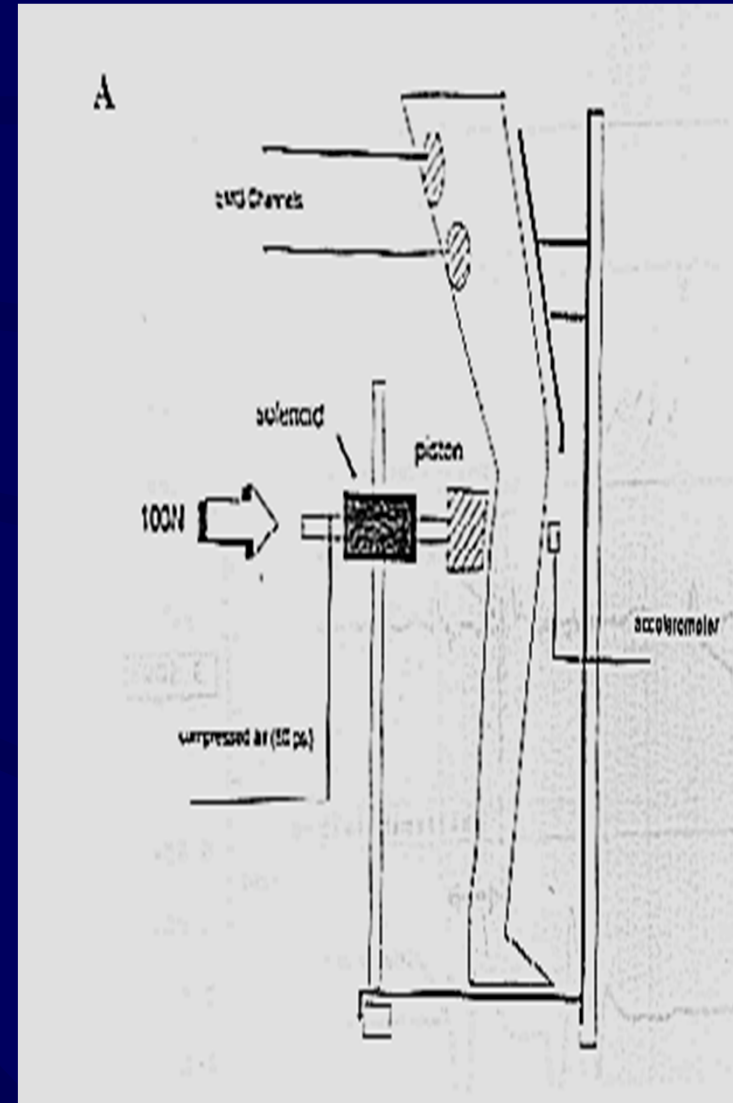
(Johansson et al 1989, 1990, 1990, Sojka et al 1989)



Effect of disruption of ACL on neuromuscular control

Beard et al 1994

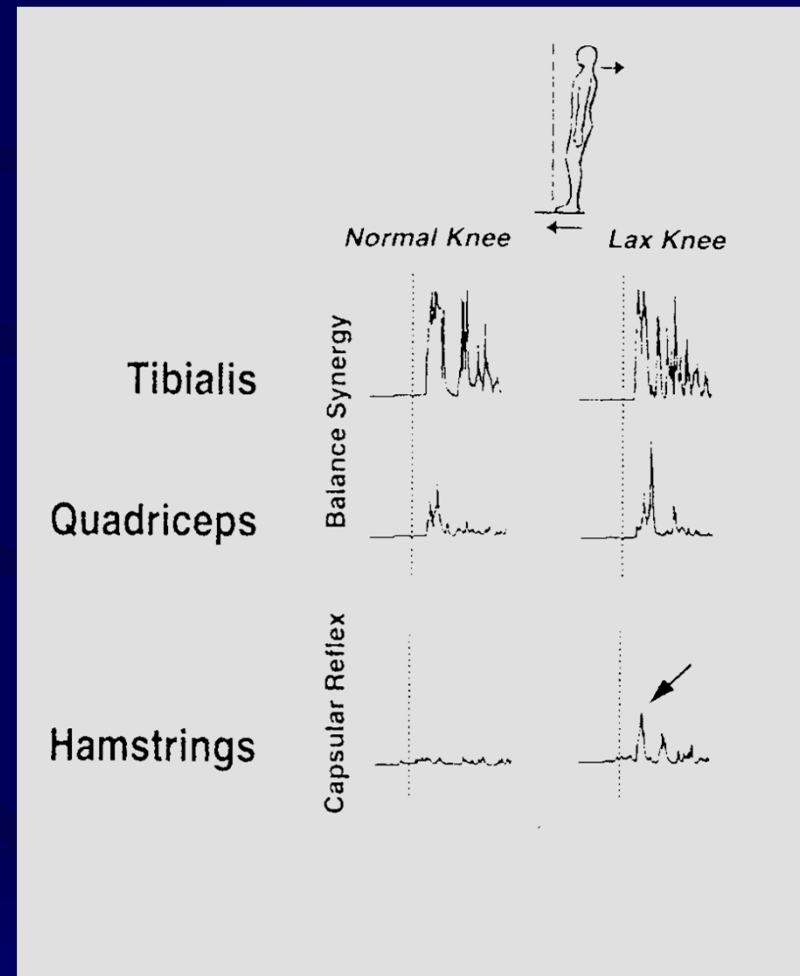
- *ACL D have an increased reflex contraction latency of the hamstring muscles (90.4ms vs 49.1ms)*
- *Reflex contraction latency of the hamstrings co-related with reported instability ($r=0.78$)*



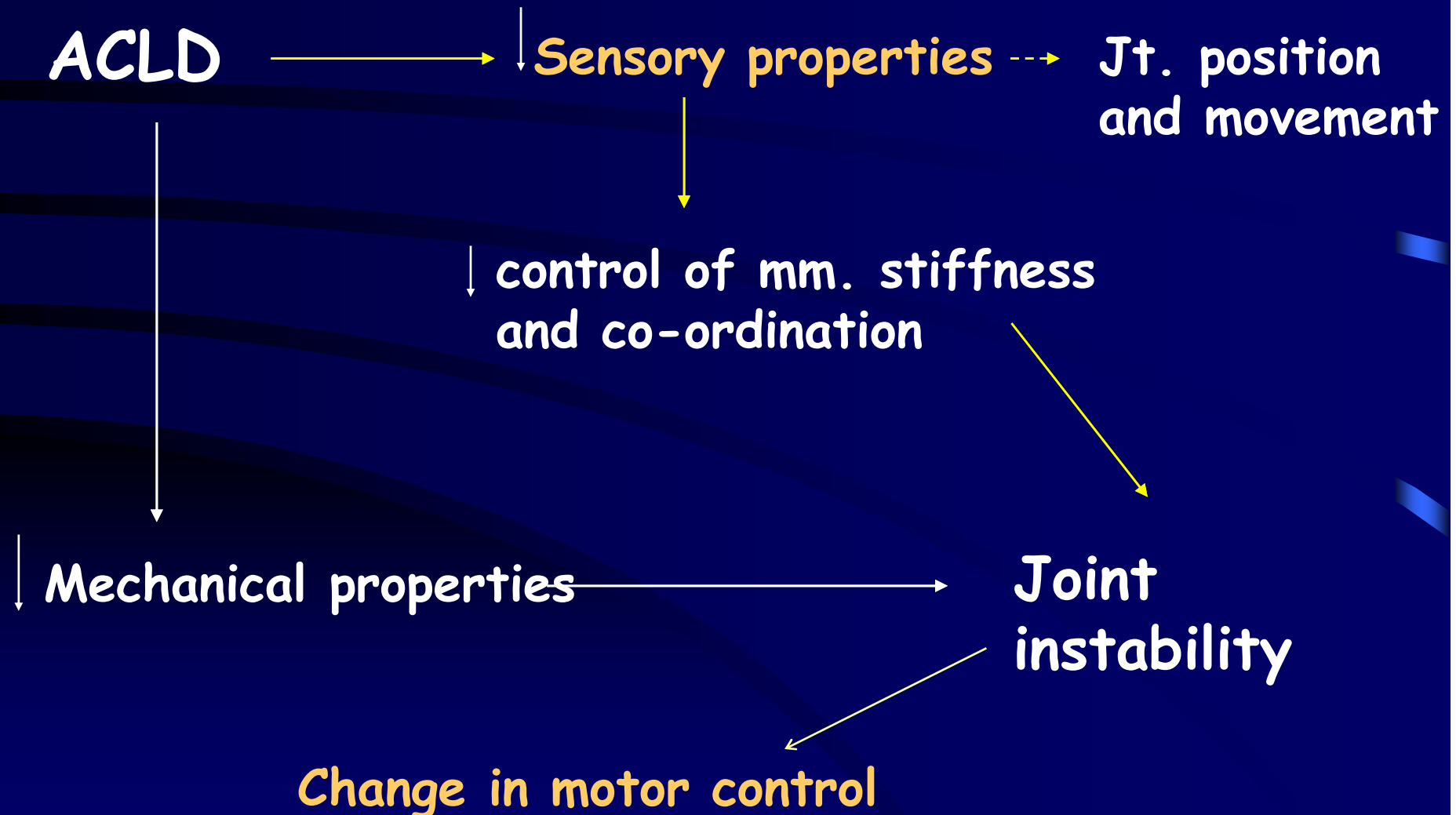
Effect of disruption of ACL on neuromuscular control

Di Fabio et al 1992

Automatic postural response in the ACLD was restructures to include hamstrings activation



ACLD



Change in motor control

Rehabilitation principles in proprioception and neuromuscular control

- *maximization of sensory receptors*
- *functional motor pattern*
- *specialization*
- *adaptability*

Selected example of rehabilitation of traumatic knee injuries

- *ACL injuries*



What's special about ACLD knee?

- Pain is not a persisting problem
- Instability is a major impairment
- Dysfunction due to instability

Non-copers with ACL deficient knee

- *Reconstruction*
 - *Graft*
 - *New considerations ?*



Rehabilitation principles

- *Control of inflammation*
- *Early mobilization with min. stress on the graft tissue*
- *Strengthening ex. with min. stress on the graft*
- *Training of proprioception and functional motor pattern*
- *Early but safe return to ADL /sports*

Strength of graft

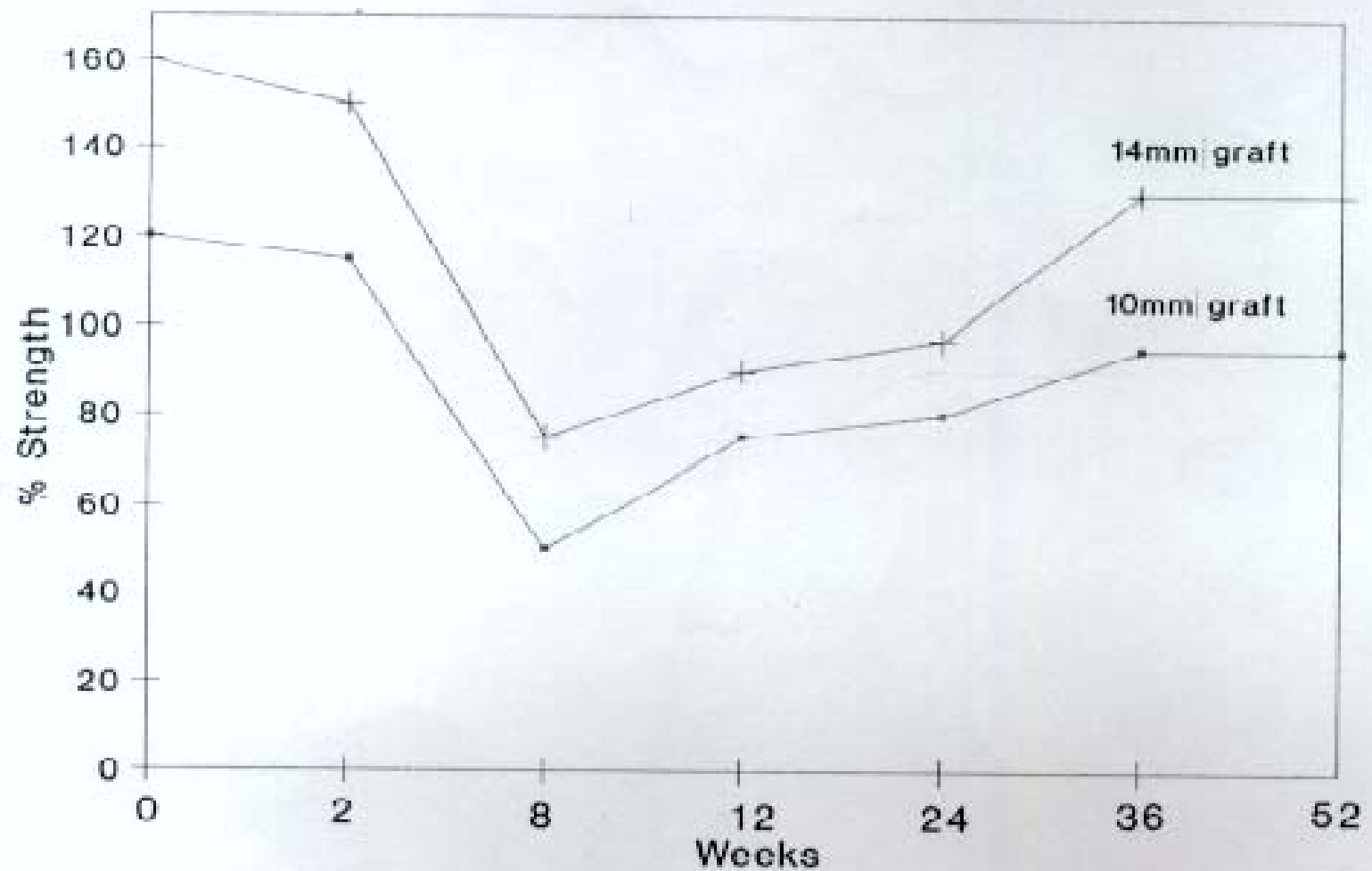


FIGURE 2. Theoretical graft strength curve of a patellar tendon autograft (Based on collective work of Clancy (27), Noyes (94), Warren).

Range of movement

- *early restoration of full extension symmetric to the uninvolved knee*
- *full flexion within 5/52 post.op*
- *mobility of patellofemoral joint*

Exercises

- *Type of exercise :*
without strain on the graft
- *Closed kinetic vs Open kinetic*

Closed / open kinetic chain exercises

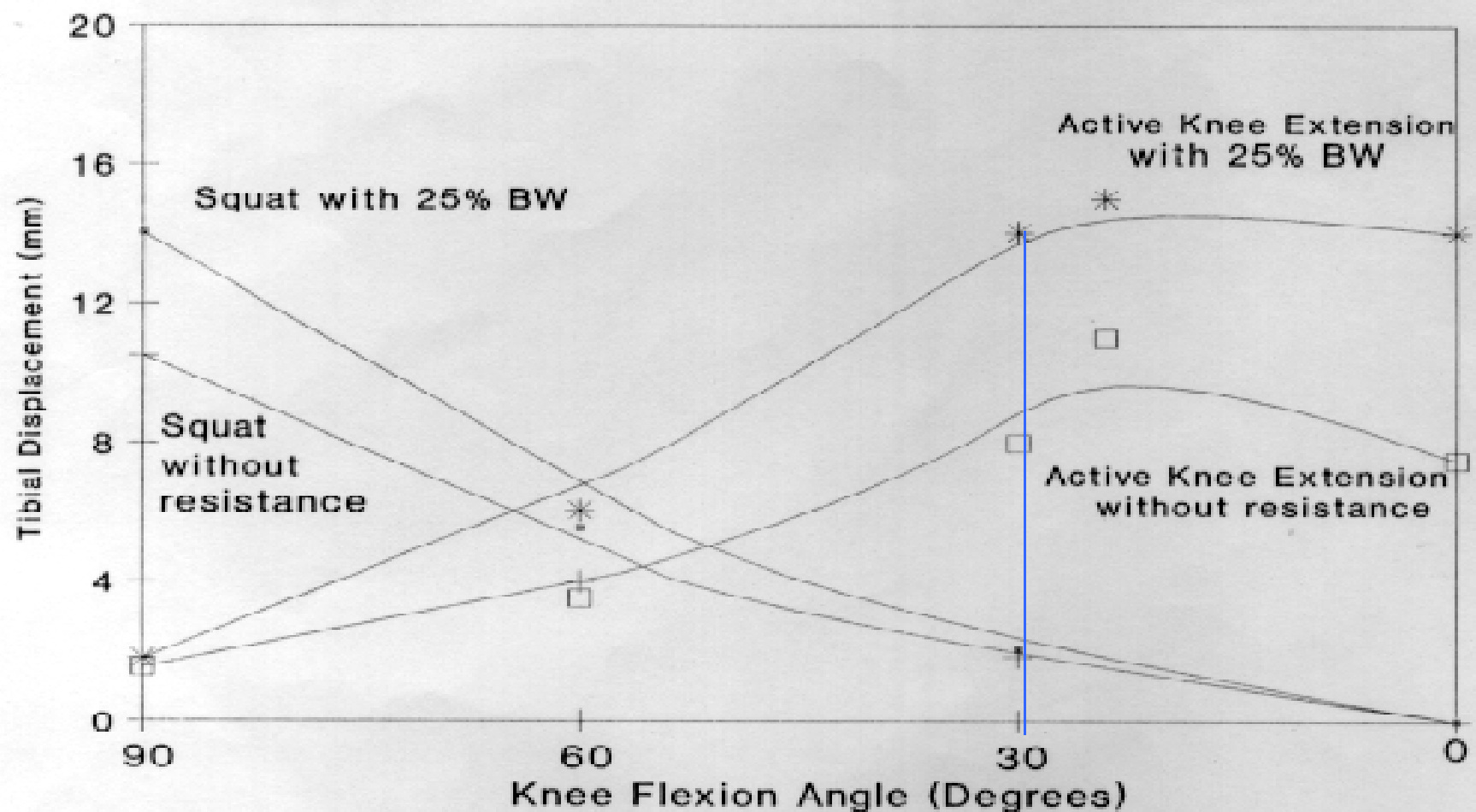


FIGURE 13. Tibial displacement during active knee extension (with and without resistance) compared to a
(Adapted from Wilk & Andrews JOSPT 15(6) 1992)

Weight bearing

- *as tolerated*
- *braced in full extension and use of crutch initially*
- *brace unlocked with good knee range and control*

Proprioception enhancement

- *Inc. in proprioceptive sensation with Neoprene sleeve*
- *Inc. in knee control with training on thigh muscles*
- *Perturbation training?*

Functional training

Phases of perioperative rehabilitation

- *Phase 1 - preoperative rehabilitation*
- *Phase 2 - 0-2 weeks post-operation*
- *Phase 3 - 2-5 weeks post-operation*
- *Phase 4 - 5 weeks to return to full function*

Phase 1 - preoperative rehabilitation

- *Aims*
 - *regain full painless range of motion equal to the non-injured knee*
 - *resolve hemoarthrosis and swelling*
 - *regain good leg control and a normal gait*
 - *mental preparation for the surgery*

Phase II - 0-2 weeks post-op.

- *Aims*

- *the control of inflammation*
- *early restoration of full extension*
- *early range of motion (knee flex. to 90 deg.)*
- *strengthening ex.*
- *restoration of normal gait*

Phase III (2-5 weeks post-op)

- *Aims*

- *maintain full extension*
- *increase to full flexion by week 5*
- *restore a normal gait pattern*
- *begin rehab. to the donor site*

**** watch for sign of over-training ****

Phase IV - 5 weeks to full function

- *Aims*

- *maintain full range of motion*
- *strengthening of inj. knee*
- *proprioceptive training*
- *agility training*
- *sport specific activities and drill begin*
- *return to competition when knee allows*

Progression of functional/agility training

walking

Jogging

running

sprinting

acceleration / deceleration

Hopping / jumping

cutting/pivoting/twisting

PCL injuries

- *History*
- *Examination*

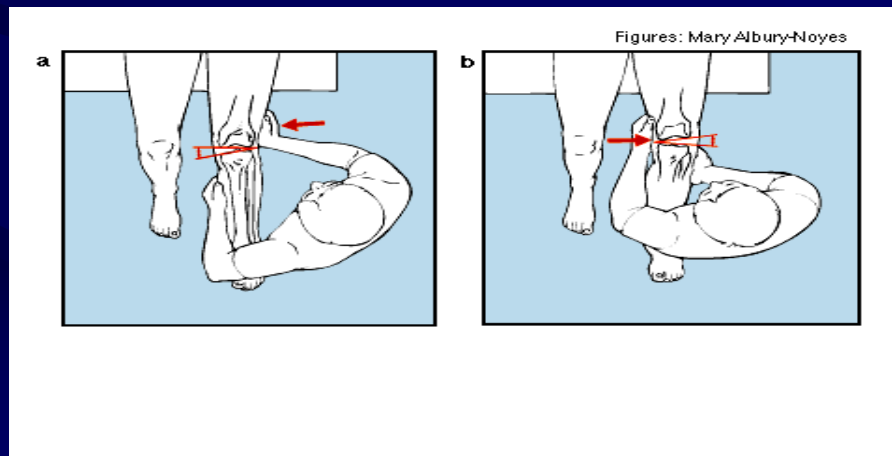
Figure: Courtesy of Randall R. Wroble, MD



- *Rehabilitation (? Diff. From ACLD)*

Collateral ligament injuries

- *Much more promising*
- *History*
- *Examination*
- *Rehabilitation*



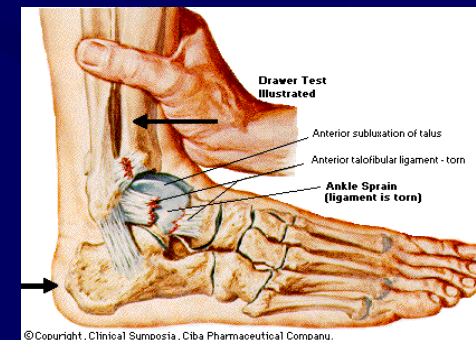
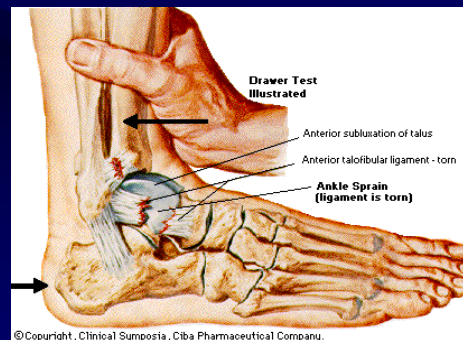
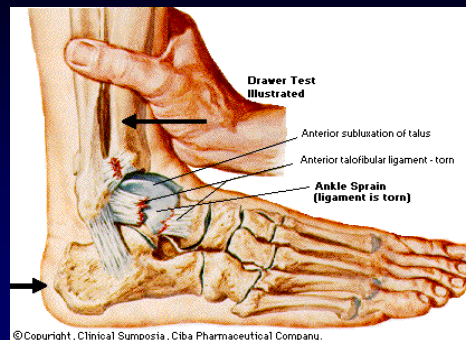
Meniscal injuries

- *History*
- *Examination*
- *Any special consideration ?*

What have we learnt?

- *Common traumatic knee injuries in sports*
- *Rehabilitation principles for sports injuries*
 - *neuromuscular control*
 - *functional motor pattern*
 - *sport specific*

- *What are the common traumatic ankle and foot injuries in sports?*
- *How to apply the rehabilitation principles on ankle injuries?*



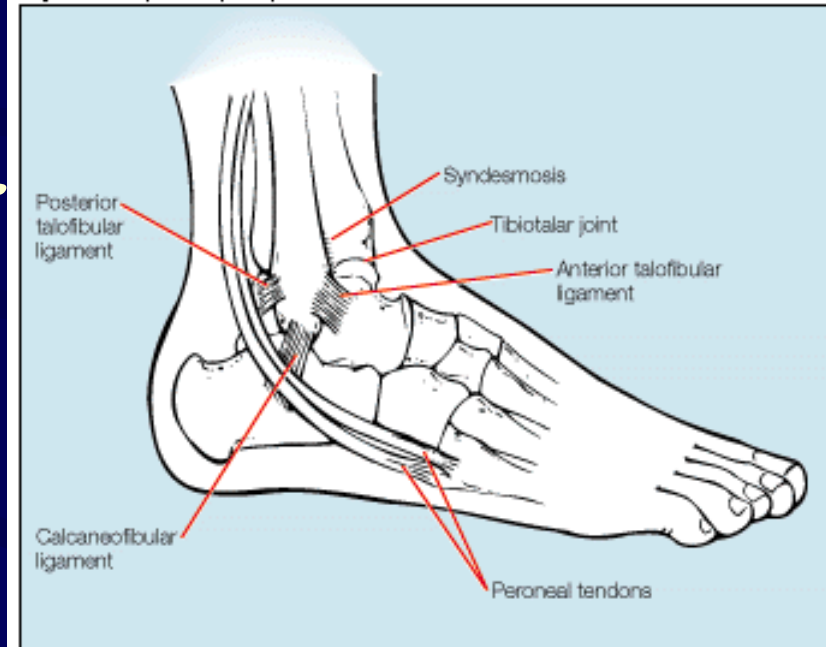
Common sports injuries in the ankle and foot unit

- *Same as the knee*
 - *sprain*
 - *strain*
 - *Fracture*
- *But*

Common sports injuries in the ankle and foot unit

- *Structures*
 - *ligament +++++*
 - *bone*
 - *muscle*

Figure: Mary Albury-Noyes



What's special about the ankle and foot unit ?

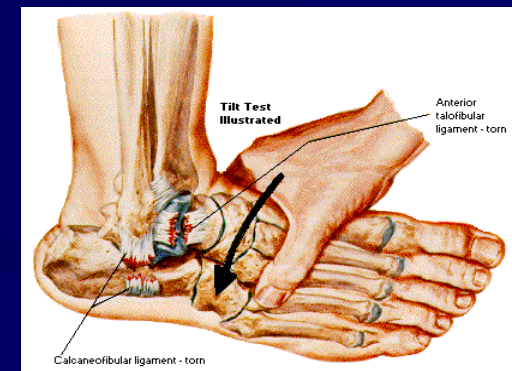
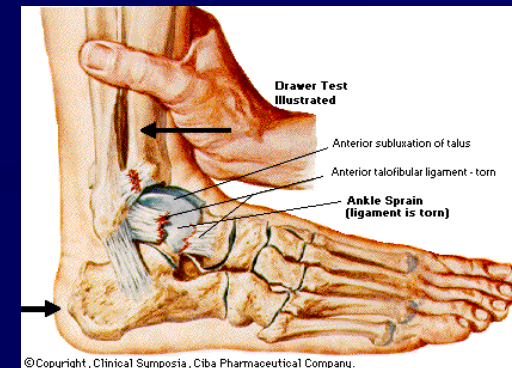
- *Function*
 - *Accepting uneven terrain*
 - *Providing a firm level for push-off*
 - *Absorption shock*
- *Stability depends on articular surface*

Ligamentous injuries at the ankle

- *Cited as the most common injuries at the AF unit*
- *High risk sports - basketball, soccer, volleyball, gymnastic, fencing*
- *85% with inversion injuries*
 - *ATFL > ATFL + CF > PTFL*
- *10% with syndesmotic injuries*
 - *Damaged structures - ITFL, interosseous membrane*

Ligamentous injuries at the ankle

- *History*
- *Examination*
 - *Anterior draw test*
 - *Lateral talar tilt*
 - *Squeeze test*
 - *External rotation test*



What's special about lateral ankle sprain?

- *Majority suffered from complete tears*
- *Majority are able to return to sports*
- *Majority are having repeated sprains*

Rehabilitation of acute ankle sprain

- *Monitor/ control of inflammation*

- *Maintain/restore joint ROM, muscle strength, neuromuscular control*
- *Reinforcing the missing ligament*
- *Co-ordination /functional training*
 - *Common ones are :*

Control of inflammation

- *Very important but not difficult*
- *Follow your RICE principle*

Maintain/restore joint ROM, muscle

- *Watch for substitution*
- *Train for invertors as well as evertors, + DF/PF*

Neuromuscular control

- *PNF*
- *Single leg standing with eyes open then closed*
- *Wobble board training - double/single legs, eyes open and closed, inside /outside parallel bar*
- *Pro-fitters*
- *Perturbation training*

Functional/agility training

- *Are they special enough for the ankle and foot unit?*
- *Do they re-train the function of the ankle/foot unit?*

Impairments due to ankle sprain

- *40% suffered from recurrent ankle sprain*
- *Persisting pain*
- *Possible damage to the osteochondral bone*
- *Performance being affected*
- *Avoidance strategy*
- *<20% ended up with surgery*

Predicting factors for recurrent ankle sprains

- *Muscle*
 - *strength*
 - *ratio*
- *Proprioception*
- *Functional kinetic chain*

External supports

- *Types*
 - *Soft brace*
 - *Tape*
 - *Semi-rigid brace*
- *Effects*
 - *Mechanical support*
 - *Sensory enhancement*
 - *Psychological support*

Turf toe

- *Ligamentous injuries of the 1st MTJ*
 - *May associated with microruptures in the FHB, collateral lit.*
- *History*
- *Examination*
- *Rehab.*

What have we learnt?

- *Common traumatic ankle and foot injuries in sports*
- *Application of the rehabilitation principles on ankle injuries*