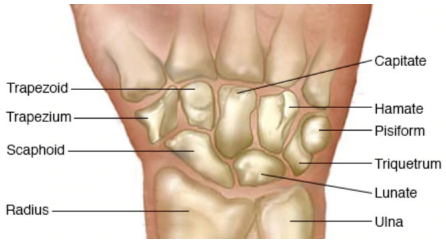
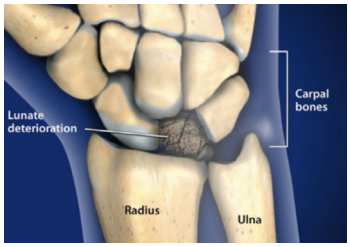
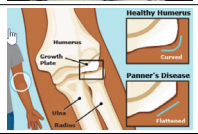
Carpal bones	Kienbock's disease
	
Kienbock's disease, also known as avascular necrosis of the lunate, is a condition in which the lunate bone, one of eight small bones in the wrist, loses its blood supply, leading to death of the bone.	

A 40-year-old male presents to your office with reduced grip strength and pain over the ulnar side of his wrist. The patient gives a history of being a professional cyclist with multiple falls in the past. X-rays show sclerosis and fragmentation of the lunate. This patient most likely has which disease?

A. Kienbock's
B. Panner's
C. Iselin's
D. Sever's

Kienbock's disease		• a disease that is associated with the fragmentation and collapse of the _____ bone. This is seen mostly in men ages 20-40. On physical exam there will be tenderness to palpation of the lunate. Initial treatment is with a cast or splint but if there is poor healing and pain then one may consider surgery for bone grafting, osteotomy, excision or fusion.
Panner's disease		• a disease of the elbow seen in children under the age of 10 who are involved in throwing activities and gymnastics. There is lateral elbow pain and the disease is self- limited and thus conservative management is warranted.
Iselin's disease		• a disease seen in adolescents in the foot at the base of the fifth metatarsal. Treatment involves rest from activity until pain free.
Sever's disease		• a disease of the foot seen in school aged children. There is tenderness at the posterior calcaneus at the insertion of the Achilles tendon. Treatment is rest until pain free.

Which disease is the most common cause of heel pain in growing children and adolescents due to an inflammation on the growth plate in the calcaneous (heel)?

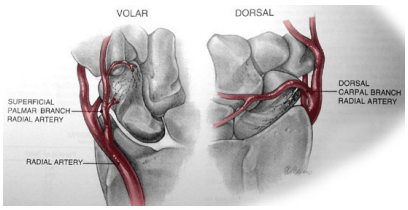
A. Gout
B. L4-S2 lumbar radiculopathy
C. Iselin's disease
D. Sever's disease

	=	Calcaneal apophysitis

Which disease is an overuse injury to the growth plate (apophysis) of the fifth metatarsal in children aged 9 to 14, particularly those who are physically active?

A. Jones fracture
B. L4-S2 lumbar radiculopathy
C. Iselin's disease
D. Sever's disease

Jones fracture	
history of prior trauma	lack of history of prior trauma
	

Blood supply to the Scaphoid	Scaphoid fracture
	

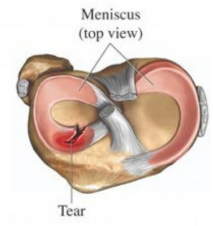
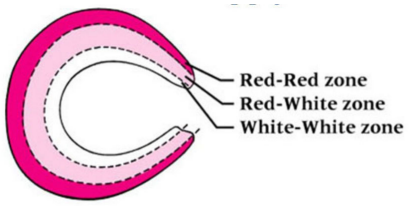
- Scaphoid fractures are the most commonly injured carpal bone and usually occurs due to a fall on an outstretched hand which causes hyperextension of the wrist. It is most prevalent in those 15-30 years old.
- Loss of motion, swelling and pain over the dorsal-radial and radial-volar aspects of the wrist with tenderness in the anatomic snuff box are presenting symptoms.
- Initial x-rays may be negative but if suspicion for fracture is high you must immobilize the joint in a thumb spica splint and reimage the patient in 2 weeks.
- The scaphoid receives the majority of its blood supply via dorsal vessels, 70-80% of which is presented by branches from the radial artery in a retrograde fashion. Due to the retrograde flow to the proximal pole of the scaphoid, a fracture in this part of the bone can adversely affect blood flow and increase the chance of a vascular necrosis. Therefore, the proximal pole fractures have the worst prognosis for healing than more distal injuries.

Which portion of the scaphoid bone has the majority of the blood supply and therefore the best chance of fracture healing?

A. Proximal one-third of the scaphoid bone
B. Middle one-third of the scaphoid bone
C. Distal one-third of the scaphoid bone
D. All portions receive equal amounts

A 24-year-old male presents with pain and swelling over the right thumb side of the wrist after falling on an outstretched hand. Physical exam reveals noticeable tenderness to the touch over the "anatomical snuff box." You are suspecting a scaphoid fracture, however, Initial x-ray shows negative for fracture. What is the best course of action?

A. Sedate left LI5 and Tonify left LI2
B. Sedate right LU10 and Sedate SP2
C. Apply Da Huang and Zhi Zi powders with eggwhite mixture
D. Acupuncture and Herbal treatment + Recommends a thumb spica splint and repeat an x-ray in 14 days

Torn meniscus		Meniscal blood supply
• A common injury in which forceful twisting causes certain tissue in the knee to tear. • A meniscus tear occurs in the rubbery knee cartilage that cushions the tibia (shinbone) from the femur (thighbone). The meniscus can tear with forceful twisting or rotation of the knee.		

- The injury is localized within the 2/3 inner portion of the meniscus, which has poor vascularity and is less likely to heal in case of repair. The best option taking in consideration the area of injury is resection of the area in view of poor chances of healing due to poor vascularity.

A 30-year-old female reports right knee pain after a near fall twisted her knee. She reports swelling and an inability to extend the knee. MRI shows a meniscal tear involving the inner 1/3 of the right anterior horn medial meniscus. Which is the best surgical option for her?

A. Repair of the injured portion
B. Resection of the injured portion
C. Total knee replacement
D. Partial knee replacement

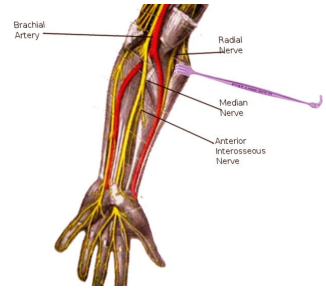
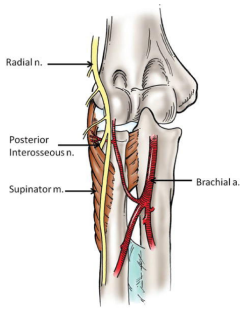
- Total and partial knee replacements would be too aggressive for a 30-year-old patient without problem in the bony joint.

Lateral epicondylitis	Medial epicondylitis
_____ elbow	_____ elbow
an inflammation of the tendons that join the forearm muscles on the outside of the elbow	an inflammation of the tendons that attach the forearm muscles to the inside of the bone at the elbow

Which disorders is the most common overuse tendinopathy injury in the lateral elbow involving the extensor muscles of the forarm?

A. Golfer's elbow
B. Tennis elbow
C. Supinator syndrome
D. Radial tunnel syndrome

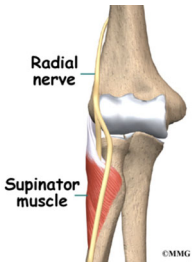
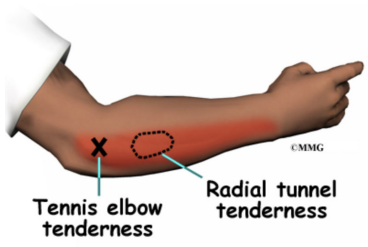
Cozens sign	Mills sign
Active	Passive

Anterior interosseous nerve (AIN)	Posterior interosseous nerve (PIN)
a branch of the _____ nerve	a branch of the _____ nerve
	

45-year-old concert violinist presents to your clinic for evaluation of 8 months of left elbow pain and impaired function. She has been diagnosed with "lateral epicondylitis". She has treated her symptoms with relative rest, occupational therapy and alternative therapies, such as acupuncture and massage, without improvement in her symptoms. What other diagnosis should you consider in this patient?

A. Intersection syndrome
B. Musculocutaneous neuropathy
C. Posterior interosseous neuropathy
D. Rotator cuff tendinopathy

- Patients whose symptoms are consistent with lateral epicondylitis/epicondylosis or "tennis elbow" but who do not respond to conservative treatments should be considered to have a posterior interosseous neuropathy.
- Mild neural compression of the posterior interosseous nerve may present with proximal and dorsal forearm pain without obvious muscle weakness, wasting, or sensory deficits.

Supinator syndrome	Radial tunnel syndrome
associated with motor weakness	motor dysfunction is not a feature
pain followed by progressive weakness of the extensors of the digits	pain without weakness
	

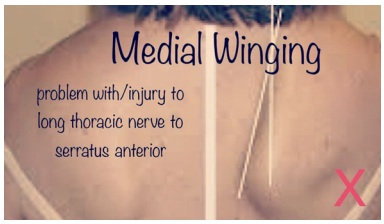
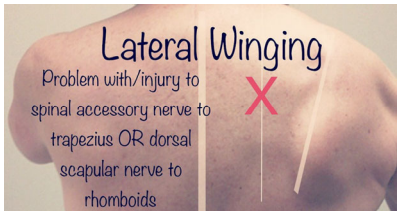
A 34-year-old male tennis player is referred to your office for recalcitrant right lateral elbow pain without weakness for 18 months. Based on these findings, you would anticipate which of the following on physical examination?

A. Weakness of wrist extension
B. Numbness at the dorsum of the hand
C. Weakness in finger flexion
D. Pain with resisted extension of the 3rd digit

Lateral elbow pain

Tendinopathy	PIN entrapment	
Lateral epicondylitis	Supinator syndrome	Radial tunnel syndrome

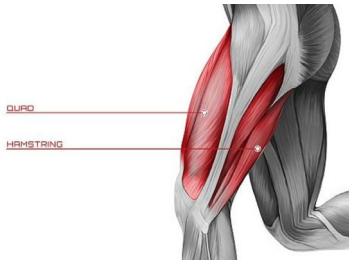
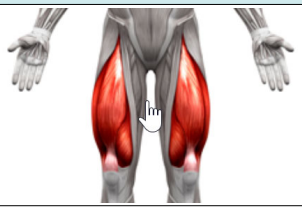
Tendinopathy	• Lateral epicondylitis, also known as "Tennis Elbow", is the most common overuse syndrome in the elbow. It is a tendinopathy injury involving the extensor muscles of the forearm. These muscles originate on the lateral epicondylar region of the distal humerus.
PIN entrapment	• **Supinator syndrome** and **radial tunnel syndrome** are both entrapments of the posterior interosseous nerve that can be mistaken for lateral epicondylitis, but differ in presentation and electrodiagnostic studies. • **Supinator syndrome** results in weakness of muscles innervated by the posterior interosseous nerve, whereas **radial tunnel syndrome** features pain without weakness. **Supinator syndrome**: pain with weakness of muscle **Radial tunnel syndrome**: pain without weakness • A common physical exam finding in **radial tunnel syndrome** is pain at the lateral elbow with resisted extension of the 3rd digit. Although there is controversy as to what exact structure causes radial tunnel syndrome, surgical decompression of the radial tunnel has been shown to relieve symptoms.

Medial winging	Lateral winging
Muscle: Serratus anterior / Nerve: Long thoracic	Muscle: Trapezius / Nerve: Accessory
	
Scapular winging, sometimes called a winged scapula, is a condition that affects the shoulder blades. The shoulder blades usually rest flat against the back of the chest wall. Scapular winging occurs when a shoulder blade sticks out.	

A 23-year-old right hand dominant soccer goalie presents to your clinic with a 4-week history of posterior right shoulder pain after landing on his right side with his arm outstretched while diving for a ball. A thorough physical examination reveals medial scapular winging. Which muscle would be most likely to have abnormalities on electrodiagnostic testing?

A. Serratus anterior
B. Supraspinatus
C. Infraspinatus
D. Trapezius

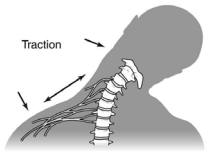
- The serratus anterior is innervated by the long thoracic nerve. Disruption to this nerve will create **medial scapular winging**.
- The trapezius is innervated by the spinal accessory nerve and injury results in **lateral scapular winging**.
- The supraspinatus and infraspinatus muscles are innervated by the suprascapular nerve and their functions to do not pertain to scapular stability.

Quads + Hamstrings	Quadriceps	Hamstrings
		
Flex hip + Extend knee		Extend hip + Flex knee
4 muscles		3 muscles
• Rectus femoris • Vastus medialis • Vastus intermedius • Vasts lateralis		• Biceps femoris • Semitendinosus • Semimembranosus

An 18-year-old female presents with a sudden onset of posterior thigh pain that occurred while water skiing over a week ago. She reports a "pop" may have been perceived at the onset of the pain. Ecchymosis is noted in the posterior thigh. Pain is noted with straight leg raise. X-ray of the thigh is negative for fracture. What is the most likely diagnosis?

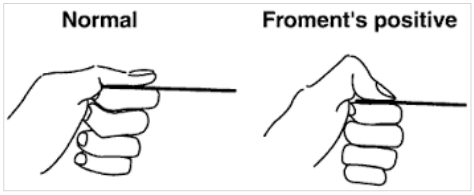
A. An avulsion fracture
B. Acute hamstring strain
C. ACL tear
D. Hip dislocation

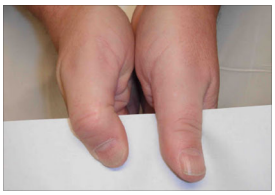
• The patient has an acute hamstring strain. Unless an avulsion fracture with bony fragment or apophyseal fracture is suspected, plain x-rays are of little use in the work up of an acute hamstring injury. • Ultrasonography (US) and MR imaging technologies are utilized instead. US is extremely accurate in the acute phase. However, MRI is most commonly used. • Treatment: take a break, use a cane or crutches, apply ice packs, wrap the injured area, rest with the leg elevated, take a over-the-counter pain medication	

Stingers	
	• It occurs from a direct blow causing depression of the shoulder and the neck is forced into lateral flexion causing the neck to bend forward the opposite side. • Stingers are a transient episode of unilateral pain and/or paresthesias in an upper extremity. There is a preponderance of C5 or C6 and upper trunk symptoms. • All athletes require further diagnostic evaluation, with the exception of a first stinger (or second stinger in a separate season) with rapid resolution of symptoms prior to return to play. • Athletes must have resolution of all symptoms with full, pain-free cervical ROM and full strength, along with an absence of any underlying risk factors for further injury, before they are allowed to return to play. • Cervical imaging would be indicated in the evaluation of this athlete. Nerve conduction studies will not be useful since alteration in nerve conduction takes about 3 weeks for signs of denervation to be seen.

A football player complains of left neck pain and left shoulder burning and tingling after making a tackle. Sideline examination reveals decreased sensation over the lateral deltoid and weakness with abduction and elbow flexion. Spurling's maneuver is negative. After 15 minutes the symptoms abate. Of note, the player had one previous episode with similar symptoms 2 weeks prior. The next best step in management of this player is:

A. Obtain imaging work-up prior to return to play
B. Return to play as symptoms have resolved
C. Obtain nerve conduction study prior to return to play
D. Withhold from play for the remainder of the season

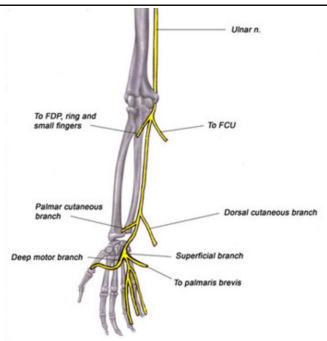




A 65-year-old patient complains of numbness and tingling in her 4th and 5th digits for the past 2 months. She denies any trauma. On physical examination, she has atrophy of her first dorsal interosseous (FDI) muscle, 4/5 strength of her abductor digiti minimi (ADM), and positive Froment sign. Sensation is decreased to light touch and pin prick in the 4th and 5th digits and along the dorsal aspect of the medial hand. Which is the most likely location of the nerve lesion?

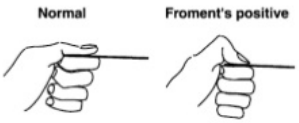
- **A. Median nerve compression at the pronator teres muscle**
- **B. Radial nerve compression in the forearm**
- **C. Ulnar nerve compression at the Guyon canal**
- **D. Ulnar nerve compression at the elbow**

- Both FDI and ADM are innervated by the deep branch of the ulnar nerve. This patient most likely has an ulnar nerve injury at the elbow.
- Sensory loss in the 4th-5th digits and along the dorsum of the hand implies an ulnar nerve injury with involvement of the dorsal ulnar cutaneous nerve (DUC).
- Lesions involving the DUC must be proximal to the wrist and Guyon canal because the DUC branches from the main trunk of the ulnar nerve 5-10 cm proximal to the wrist.



Testing Motor Function

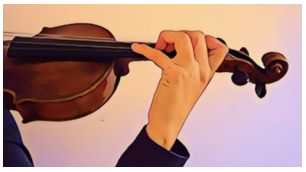
- "Thumbs up!" = Thumb Extension = Radial Nerve
- "Okay sign" = Flexor Pollicus Longus + Flexor Digitorum Profundus = Median Nerve
  - Normal = Flex both  Abnormal = Unable to 
- Thumb Opposition = Opponens Pollicus = Median Nerve
- "Fingers crossed" (Index + Middle) = Ulnar Nerve
- Froment's Sign = Ulnar Nerve Palsy
  = weak Adductor Pollicus
  = Flex Flexor Pollicus Longus to compensate to pinch rather than grip



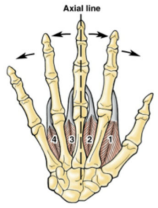
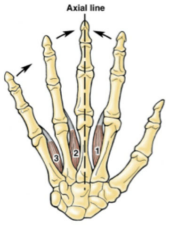
Entrapment neuropathies are a group of disorders of the peripheral nerves that are characterized by pain and/or loss of function (motor and/or sensory) of the nerves as a result of chronic compression.		
Ulnar nerve	**Median nerve**	**Radial nerve**
Cubital tunnel (elbow) / Guyon's canal (wrist)	Carpal tunnel syndrome	Posterior interosseous nerve entrapment

Risk factors for entrapment neuropathies in musicians include:

- **A. Improper hand position**
- **B. Large hand size**
- **C. Joint capsular tightness**
- **D. Routine practice schedules**

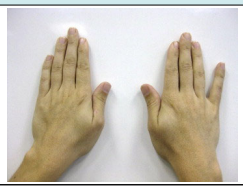


Risk factors for entrapment neuropathy include improper hand position, small hand size, joint laxity, and changes in the performer's practice schedule.

DAB	PAD
Dorsal Interossei	Palmar Interossei
___duct the fingers	___duct the fingers
	

The interossei muscles are intrinsic muscles of the hand located between the metacarpals. Which muscles are responsible for finger abduction?

A. Palmar interossei **B. Dorsal interossei**

Wartenbergs' sign	
	• Wartenberg's Sign refers to the slightly greater abduction of the fifth digit, due to paralysis of the abducting palmar interosseous muscle and unopposed action of the radial innervated extensor muscles (digiti minimi, digitorum communis).

A 67-year-old male with a 12-month history of gradual onset right arm and finger numbness and tingling. He states he has significantly increased his time using his computer since he retired. He denies weakness. During examination, you notice his right fifth digit sticks out when he tries to put his hands in his pockets. Based on your observation, you would expect to find weakness in which of the following muscles?

A. Abductor pollicis brevis
B. Pronator teres
C. Extensor pollicis brevis
D. Palmar interosseous

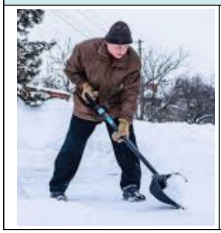
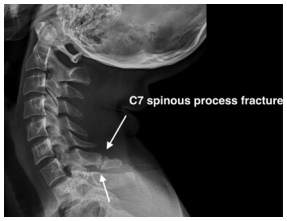
- This patient has **ulnar neuropathy at the elbow (UNE)**. UNE may be caused by external compression such as repetitively leaning elbows, compression by normal or anomalous anatomic structures, repetitive/prolonged elbow flexion, chronic subluxation, or elbow trauma.
- Wartenberg's sign occurs when placing the affected hand in a pocket, the small finger remains abducted and does not enter the pocket. This is caused by weakness of ulnar-innervated palmar interossei, which are responsible for finger adduction.
- The abductor pollicis brevis and pronator teres are innervated by the median nerve. The extensor pollicis brevis is innervated by the radial nerve.

Hypertrophic cardiomyopathy (HCM)	
obstructive (HOCM)	non-obstructive
Idiopathic hypertrophic subaortic stenosis (IHSS), asymmetric septal hypertrophy (ASH)	Yamaguchi hypertrophy, first described in individduals of Japanese descent

What is the leading cause of cardiac-related death in younger athletes?

A. Dysrhythmia
B. Coronary artery disease
C. hypertrophic cardiomyopathy
D. Valvular disease

- Dysrhythmia, coronary artery disease, idiopathic hypertrophic subaortic stenosis and valvular disease all can lead to cardiac-related collapse.
- Coronary artery disease is the most common cause in the older athlete, and idiopathic hypertrophic subaortic stenosis is the most common cause in younger athletes.

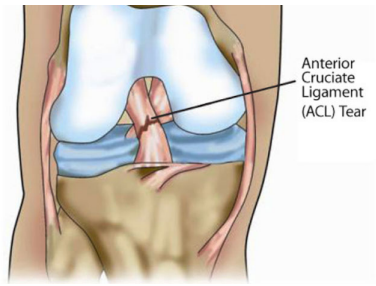
Clay shoveler's fracture		
	• Clay shoveler's fracture gets its name from the injury suffered by men digging deep ditches in Australia during the 1930s. • Powerful hyperflexion of the neck combined with contraction of the paraspinous muscles during shoveling is the typical mechanism of injury. • The tremendous force pulls on the spinous process producing an avulsion fracture.	

In Clay shoveler's fracture, what anatomic region of lower cervical and upper thoracic spine is affected?

A. Transverse process
B. Semispinalis
C. Spinous process
D. Occipitalis

- Clay shoveler's fracture is a repetitive stress injury that affects the spinous process of the lower cervical and upper thoracic spine.
- In sports, deceleration forces caused by the pull of the trapezius, rhomboids, and the ligamentum nuchae on the neck probably exert repetitive traction on their attachment sites to the narrow spinous processes.
- The condition is known in manual laborers, but is rare in athletes.
- It is treated conservatively.

Avulsion fracture	Segon fracture
An avulsion fracture is an injury to the bone in a location where a tendon or ligament attaches to the bone. When an avulsion fracture occurs, the tendon or ligament pulls off a piece of the bone.	The Segond fracture is a type of avulsion fracture (soft tissue structures pulling off fragments of their bony attachment) from the lateral tibial plateau of the knee, immediately below the articular surface of the tibia.

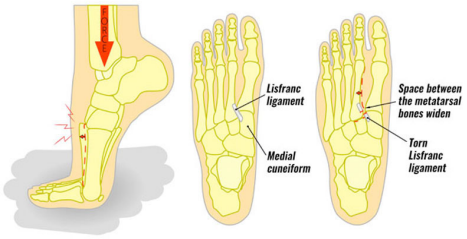
Segon Fracture	
	

- The above case is describing a Segond fracture, which is considered pathognomonic for the presence of an ACL tear.
- Contrary to the more common causes of an ACL tear, which typically involve a valgus stress, a Segond fracture usually occurs as a result of internal rotation and varus stress. Typically these injuries are seen in two settings: falls, sports (especially skiing, basketball and baseball).

What structure is associated with an avulsion fracture off the lateral tibial plateau after a knee twisting injury following a deceleration and change of direction?

A. Lateral collateral ligament
B. Posterior meniscofemoral ligament
C. Posterior cruciate ligament
D. Anterior cruciate ligament

Low-energy fracture	High-energy fracture
less energy imparted into the fracture environement → less destructive process	more energy imparted into the fracture environement → very destructive process
example: sudden muscular contraction, osteoporotic bone	example: motor vehicle accidents, fall from heights

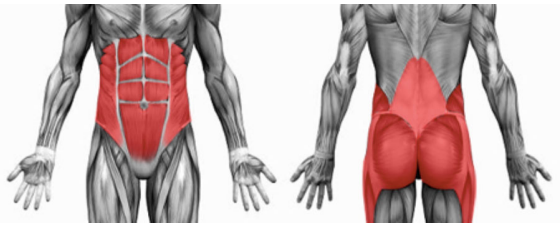


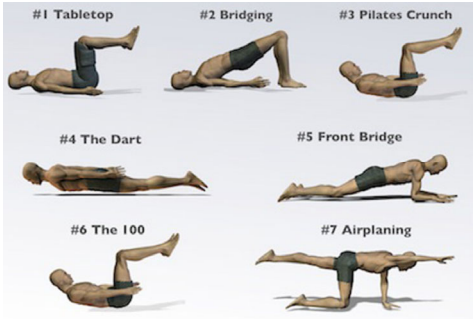
- Injuries to the LisFranc complex range from sprains of the tarsal-metatarsal joint to injuries of the LisFranc ligament to severe fracture dislocations of the entire LisFranc complex.
- Fracture-dislocations result from high-energy trauma (motor vehicle accidents), low-energy injuries such as with sports typically involve a sprain or rupture of the LisFranc ligament with resulting diastasis, and although radiographs can be equivocal or negative in up to 20% of cases, diastasis is commonly observed.

A 16-year-old male presents to your clinic with a low energy LisFranc Injury. The most likely findings you would anticipate seeing would be:

A. Fracture-dislocation of 2nd through 5th metatarsal bones
B. Avulsion fracture of the base of the 4th metatarsal
C. Diastasis of the medial cuneiform and 2nd metatarsal bones
D. Normal radiographs without evidence of fracture or dislocation

- Concomitant injury to the base of the 2nd metatarsal is possible and avulsion injuries or other fracture of the base of the 2nd metatarsal may be seen in such cases; however, isolated avulsion injuries of the 4th metatarsal would be rare in any case.

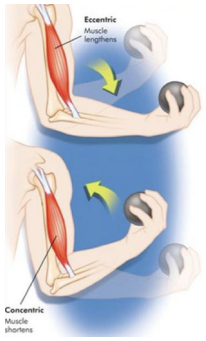
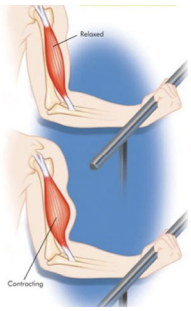




- **'Core stability'** is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities.
- Core muscle activity is best understood as the pre-programmed integration of local, single-joint muscles and multi-joint muscles to provide stability and produce motion.
- This results in proximal stability for distal mobility, a proximal to distal patterning of generation of force, and the creation of interactive moments that move and protect distal joints.
- Evaluation of core should be dynamic, and include evaluation of the specific functions (trunk control over the planted leg) and directions of motions (three-planar activity).

Which of the following statements is true regarding core stability?

A. Control the position and motion of the trunk over the pelvis
B. Force generation patterns from distal to proximal
C. Proximal flexibility is needed for distal mobility
D. Core evaluation is best achieved in a static testing position

Isotonic contraction	Isometric contracton
same tension + changing length	same length + changing tension
• Concentric: muscle shortens and does work • Eccentric: muscle generates force as it lengthens	• Tension builds but muscle enighter shortens or lengthens • Maintain paosture
	

A 70-year-old athletic man presents with painful osteoarthritis of the knee. Initial exercise recommendations at this stage should include:

A. Isometric quadriceps strengthening
B. Leg press and squat training
C. Eccentric, closed kinetic-chain exercises
D. Seated knee extension exercises

Phase 1	• should focus on controlling pain and swelling, with protected mobilization consisting of range of motion (ROM) exercises, with isometric quadriceps exercises progressing to the addition of ankle weights. Once the individual has attained full range of motion, treatment progresses to phase 2.
Phase 2	• includes activities that are open kinetic chain and non-weight bearing, such as seated knee extension.
Phase 3	• advances to closed kinetic chain exercises, such as leg press or squats.
Phase 4	• includes return to low-impact, sport-specific exercises, specifically closed kinetic chain exercises of both the concentric and eccentric type.
Phase 5	• consists of maintaining strength, flexibility, balance, and injury prevention.

Open Kinetic Chain	Closed Kinetic Chain
• Exercise that uses of a combination of successively arranged joints, which terminal joint is FREE to move • Allows for greater concentration on isolated joint/muscle movement • Ex: seated knee extension	• Exercise, which the terminal joint meets considerable resistance that prohibits or restrains free ROM as the distal joint is STATIONARY • Ex: squat/push-up