PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

https://www.youtube.com/watch?v=zF6MKSbKHTE&list=PLuBRb5B7fa_eLlhgRt2DFNKetmQ5nDLZJ

Basics of sport medicine

Supervisor : Dr.Al-muthanna Al-yamani

Submitted by : Dr.Moutasem Al-zou’bi

- HISTOPHYSIOLOGY
- INJURY
- BASICS OF REHABILITAION
- BASIC SETUP OF ATHROSCOPY OR
- BASIC RADIOLOGY

Sport physiology:

Tendon

Ligament

Meniscus

Articular cartilage

Osteochondral Fractures and Osteochondral Defects

Muscle

tendon

- dense, regularly arranged connective tissues,

- but the collagen fibers in a tendon are parallel to the longitudinal axis than is the case in a ligament

- ***epitenon**, which is* continuous on its inner surface with the ***endotenon**, a thin layer* of connective tissue that binds collagen fibers and contains lymphatics, blood vessels, and nerves.

- In some tendons, the epitenon is surrounded by a loose areolar tissue called the ***paratenon** that functions as an elastic sheath through which* the tendon can slide.

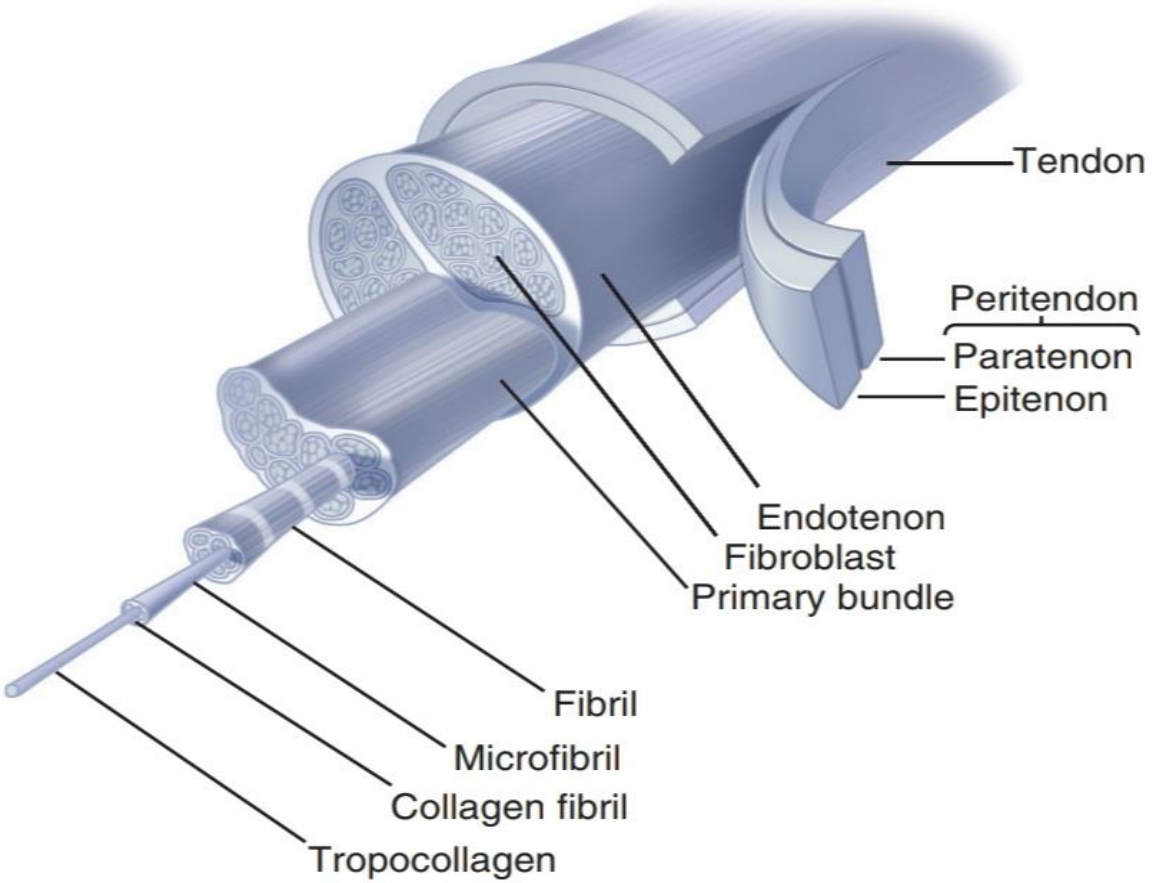


FIGURE 1-1 Structural organization of tendon.

- The blood supply to tendon has several sources, including the perimysium, periosteal attachments, and surrounding tissues.

- The muscle-tendon and tendon-bone junctions, along with the mesotenon, are the three types of vascular supply to the tendon inside the sheath.

- The proprioceptive information supplied to the central nervous system by these nerves usually is picked up through mechanoreceptors located near the musculotendinous junction.

Two types of tendon insertion into bone

- The simpler type, termed *direct insertion, occurs when the tendon* fibrils pass directly into bone through zones of fibrocartilage with little interdigitation into the surrounding periosteum.

- The second type of insertion is more complex; the superficial fibrils insertinto the periosteum, whereas the deeper fibrils fan out into bone directly

- When the mechanical forces on the tendon exceed the maximum strain or stress that the tissue can accept, either by acute trauma or repetitive loading (overuse)

2 theories of repair

- **first** suggests that healing depends on the surrounding tissues and that the tendon itself plays no significant role ,this theory holds that the tendon is an inert, almost avascular structure.
- **second ,**showed that the tendon is invaded by fibrovascular tissue at the location of suture placement. At 28 days, the collagen produced by these fibroblasts is immature, but by 128 days, it is indistinguishable from that of normal tendon

Phases of healing :

- **Inflammatory**
- **Collagen-Producing**
- **Remodiling**

factors affect healing:

- **Application of Load**
- **Effect of Corticosteroids and Nonsteroidal antiinflammatory Drugs on the Injured Tendon**

ligament

- firm, white fibrous bands, sheets,or thickened strips of joint capsule securely anchored to bone
- Some ligaments consist of more than one band of collagen fibril bundles like ACL

- The alignment of collagen fiber bundles within the ligament substance generally follows the lines of tension applied to the ligament

- **wave or crimp pattern OR rows pattern**

Ligament injury+repair

- Ligament strains and tears disrupt the matrix, damage blood vessels, and injure or kill cells.
- Damage to cells, matrices, and blood vessels and the resulting hemorrhage
- start a response that includes **inflammation, repair,** and **remodeling**

- Within 2 to 3 days of the injury, fibroblasts within the wound begin to proliferate rapidly and synthesize new matrix.
- Within 3 to 4 days, vascular buds from the surrounding tissue grow into the repair tissue and then canalize to allow blood flow to the injured .

- During the next several weeks, as repair progresses, the composition of the granulation tissue changes. Water, glycosaminoglycan, and type III collagen concentrations decline, the inflammatory cells disappear, and the concentration of type I collagen increases.

- The most apparent signs of remodeling disappear within 4 to 6 months of injury.
- **Factors Affecting Healing:**

  Size, Location of Defect, and Ligament Type

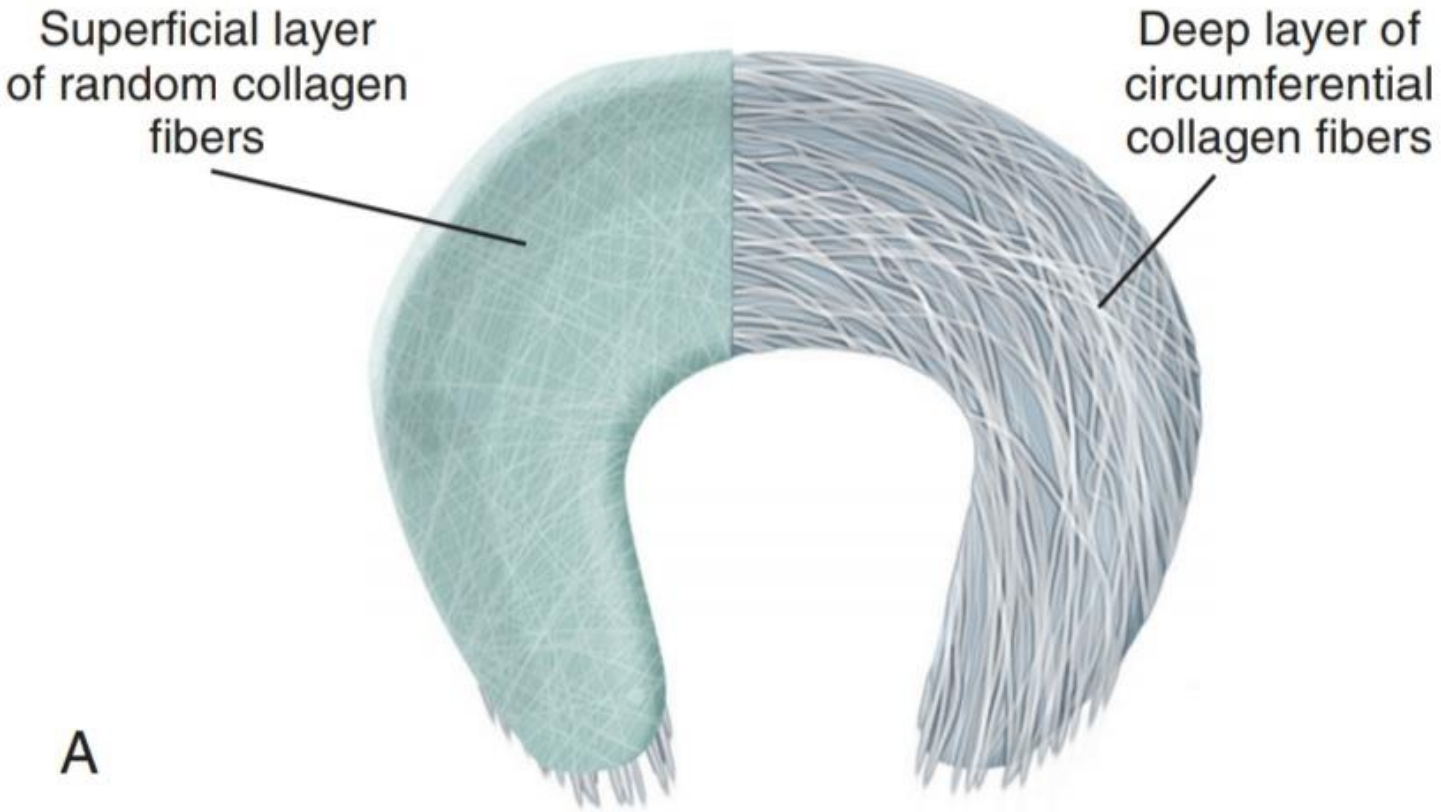
AMERICAN MEDICAL ASSOCIATION LIGAMENT INJURY CLASSIFICATION

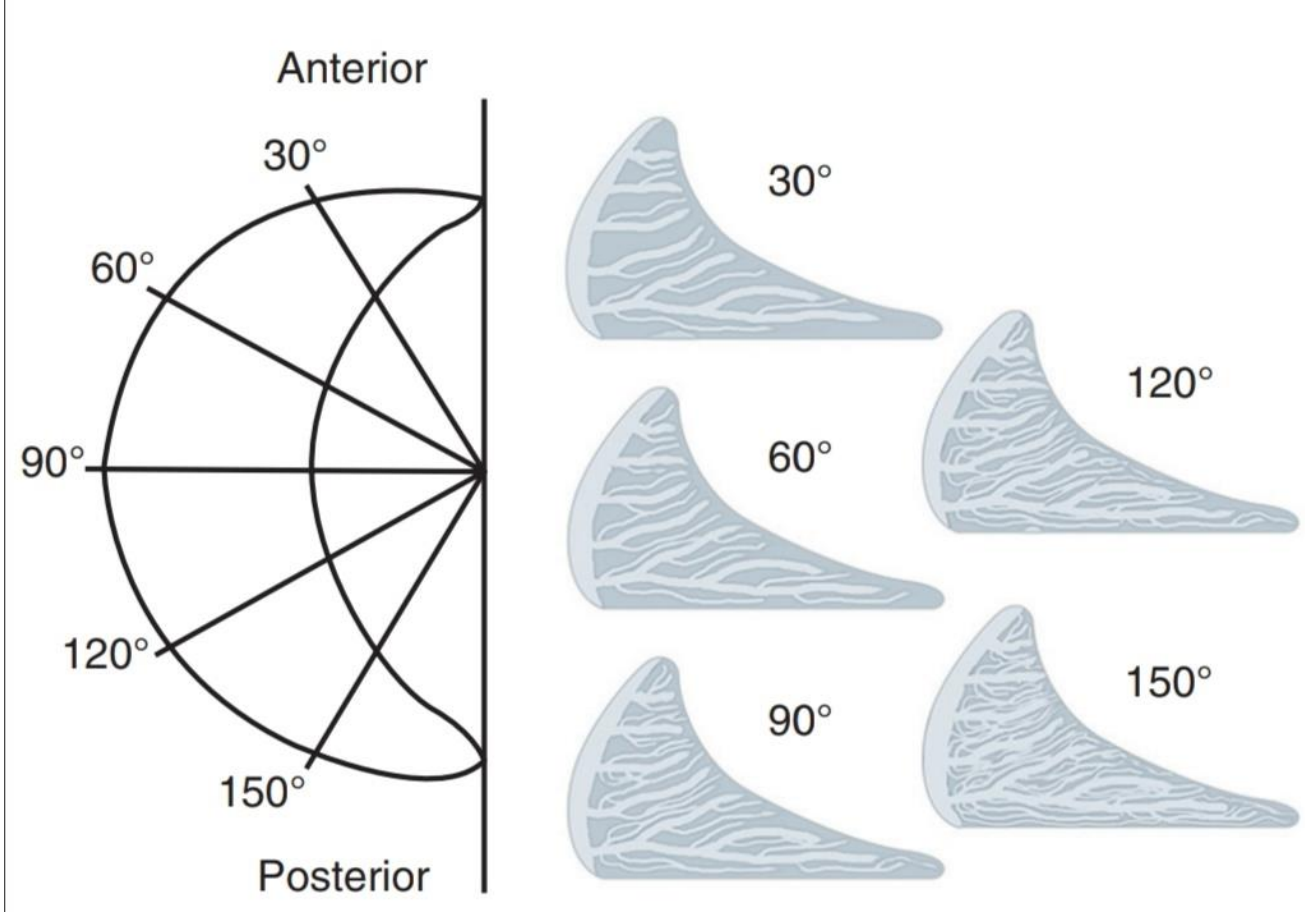
Grade	Description
I	Mild, minor tearing of ligament fibers and no demonstrable increase in translation on examination
II	Moderate, partial tear of the ligament without complete disruption, with a slight to moderate increased translation upon examination
III	Severe, complete tear of the ligament, with a marked increase in translation upon examination

meniscus

- semilunar in shape and consist of a sparse distribution of cells surrounded by an abundant extracellular matrix.
- The meniscal surface consists of a randomly woven mesh of fine collagen type II fibrils that lie parallel to the surface. Below this surface layer, large, circumferentially arranged collagen fiber bundles (mostly type I)

- The collagen bundles insert into the anterior and the posterior meniscal attachment sites on the tibial plateau, providing for stiff and strong attachment sites


Superficial layer of random collagen fibers
Deep layer of circumferential collagen fibers
A



Radial collagen fiber bundles of the meniscus. Radial tie fibers consisting of branching bundles of collagen fibrils extend from the periphery of the meniscus to the inner rim in every radial section throughout the meniscus. They are more abundant in the posterior sections and gradually diminish in number as the sections progress toward the anterior region of the meniscus

- the peripheral 25% to 30% of the lateral meniscus and the peripheral 30% of the medial meniscus have a blood supply.

- the peripheral regions of the meniscus, especially the meniscal horns have a nerve supply.

Injury and repair

- **Traumatic**:young / Tension, compression, or shear forces
- Many shapes

- **Degenerative** : age related /complex shape and horizontal clefts/ shear failure

- ***Site of injury is important in response for healing*** (vascular or avascular area)

Articular Cartilage

- cartilage distributes the loads of articulation, thereby minimizing peak stresses acting on the subchondral bone.
- cartilage lacks nerves……cartilage injuries do not cause pain
- Cartilage from skeletally immature joints (open growth plates) is much stiffer than cartilage from skeletally mature joints (closed growth plates)

- Participation in sports often subjects the articular cartilage to intense repetitive, compressive high energy impact forces that can cause tissue injury.
- These abnormally large forces generate high shear stresses at the cartilage-subchondral bone junction, causing matrix lesions and death of the articular chondrocytes that may lead to early osteoarthritis

chondrocyte

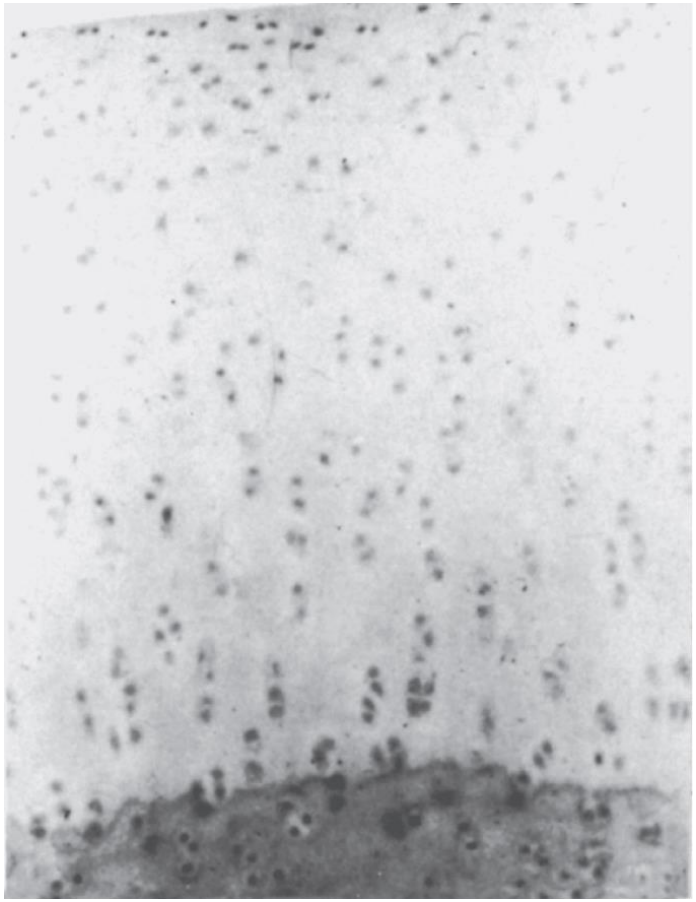
- the only type of cell in cartilage ….isoltaed..surrounded by extracellular matrix…lacks blood vessels

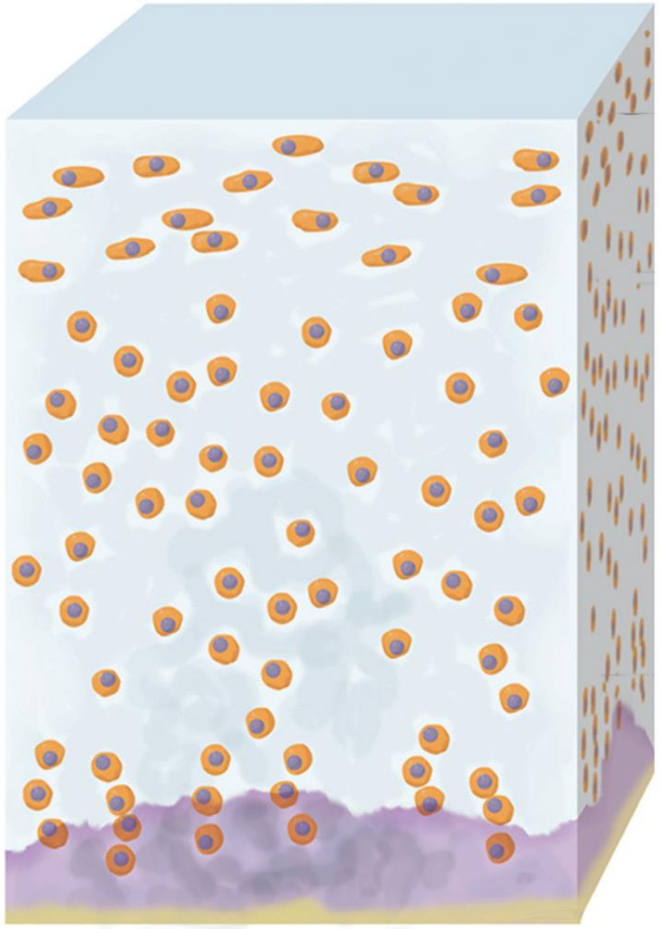
- 3 zones:

  The superficial tangential zone

  The middle zone

  The deep zone





repair

- depend to a large extent on the type of injury sustained and whether the injury involves the subchondral bone

- Unlike ligament repair, the tissue that repairs cartilage defects differentiates toward a fibrocartilaginous phenotype

ACUTE SPORTS-RELATED ARTICULAR CARTILAGE INJURIES

Injury Type	Clinical Presentation	Tissue Response	Potential for Healing
Damage to matrix or cells without visible disruption of articular surface	No known symptoms; direct inspection of the articular surface and current clinical imaging methods cannot detect this type of injury	Synthesis of new matrix macromolecules; cell proliferation(?)	If basic matrix structure remains intact and a sufficient number of viable cells remain, the cells can restore the normal tissue composition; if the matrix or the cell population sustains significant damage or if the tissue sustains further damage, the lesion may progress
Cartilage disruption (cartilage fractures or ruptures)	May cause mechanical symptoms, synovitis, and joint effusions	No fibrin clot formation or inflammation; synthesis of new matrix macromolecules and cell proliferation, but new tissue does not fill cartilage defect	Depending on the location and the size of the lesion and the structural integrity, stability, and alignment of the joint
Cartilage and bone disruption (osteochondral fractures)	May cause mechanical symptoms, synovitis, and joint effusions	Formation of a fibrin clot, inflammation, invasion of new cells, and production of new tissue	Depending on the location and size of the lesion and the structural integrity, stability, and alignment of the joint, the lesion may or may not progress

Osteochondral Fractures and Osteochondral Defects

- Unlike injuries limited to cartilage, fractures that extend into the subchondral bone cause pain, hemorrhage….. Fibrocartilaginous material

- Depends on size and age

Muscle:

CLASSIFICATION OF MUSCLE STRAIN INJURIES		
Injury Type	**Swelling/ Ecchymosis**	**Defect**
Interstitial strain	Absent	Absent
Intramuscular strain	Present	Absent
Partial rupture	Present	Present, incomplete
Complete rupture	Present	Present, complete loss of continuity

Principles of Rehabilitation

- ***Kinetic Chain……*** open and closed kinetic chain

- the open-chain state as a peripheral extremity that is able to move freely

- The closed kinetic chain state was described as when the distal segment meets considerable resistance

- Confusion sometimes exists when determining what is a true closed kinetic chain state.
- A more simple and precise description may be weight-bearing and non–weight-bearing exercises and the relationship to the anatomic structure.

Neuromuscular activation

- designed to activate weak and/or inhibited muscles.

Therapeutic modalities

- cryotherapy, forms of electric stimulation, moist heat, whirlpool, ultrasound, iontophoresis, and phonophoresis
- available to the rehabilitation specialist, particularly during the acute phases of rehabilitation.

- Modalities may aid in controlling or eliminating the inflammatory process, lessening pain, and enhancing the healing environment

Neuromuscular control

- as a person's ability to physically respond to a given stimulus correctly

- Sufficient neuromuscular control is coordinated by one's proprioceptive and kinesthetic awareness

- *Dynamic stability :*ability to control and stabilize a joint during a functional activity.

- *Power:* how fast one is able to perform work

- *Plyometrics:* such as jumping and throwing, use a prestretch movement in a quick and powerful manner.

GENERAL GOALS FOR EACH PHASE IN A REHABILITATION SETTING

Phase	Goals	Focus of Training
Acute phase	Diminish pain and inflammation If the patient has had surgery, minimize the negative effects of immobilization Advance/normalize motion without overstressing repaired or healing tissues Address postural/flexibility limitations Activity modification Activate, isolate, and strengthen weak muscles (protocol dependent)	Patient education Modalities as needed Flexibility, stretching Strength and neuromuscular training
Intermediate phase	Progress strength and neuromuscular training Begin to integrate strength into functional movements Advance/normalize motion Address postural/flexibility limitations Promote dynamic stability	Continue training focus as indicated in the acute phase as necessary Initiate kinetic chain flexibility, stretching Initiate core training
Advanced strengthening phase	Reinforce therapeutic exercises Include more aggressive strength training Advance dynamic stability training Improve strength, power, and muscular endurance	Continue training focus as indicated in the intermediate phase as necessary Initiate plyometric training Initiate interval return to activity program
Return-to-activity phase	Move forward with an activity/sport-specific strength and conditioning program Return to activity or sport	Continue training focus as indicated in the advanced phase as necessary Strength and conditioning Move forward with plyometric training Move forward with an interval return-to-activity program

Basic Arthroscopic Principles

- Arthroscopy typically has low morbidity and high diagnostic yield, but the results are dependent on the surgeon's experience

- benefits of arthroscopic surgery include reduced morbidity, less postoperative inflammation, smaller incisions, improved diagnostic accuracy, lower complication rates, reduced hospital stay, and reduced cost

- Disadvantages of arthroscopy include risk of damage to articular structures, increased operating times, a steep learning curve for the surgeon, and expensive equipment

- **Absolute contraindications** to arthroscopy are skin infection over the operative site or at a remote site with risk of seeding

- **Relative contraindications** are ankylosis of the joint and major capsular disruptions that risk excessive extravasation of fluid and make joint distension difficult.

- The operating room must be large enough to accommodate the required equipment

- operating room personnel experienced with arthroscopy.

- Because arthroscopic cables and equipment are damaged by standard autoclaving techniques, alternate methods of sterilization must be used

- These methods include gas sterilization with ethylene oxide, low-temperature sterilization using peracetic acid (Steris, Mentor, OH), and cold disinfection using activated glutaraldehyde (Civco, Kalona, IA).

Arthroscope

- designed to fit inside a **cannula**, which is inserted into the joint with use of a **blunt trocar**.

- Modern cannulas allow the flow of **irrigation** fluid into the joint.

- **The camera** is housed within the arthroscope and connected to the digital monitor for direct visualization of the joint, whereas the **light source is coupled using fiber-optic cable.**

Arthroscopic Setup

D4000 Shaver Console

24k® Pump

IM8000 3MOS Camera Controller

LS8000 Direct LED Light Source

DRSHD 1080p Image Management

Sony Medical Grade Printer

- Arthroscopes are differentiated on the basis of optical characteristics, which include the lens diameter, field of view, and angle of inclination

- **Fluid Pump**
- **Motorized Shavers**
- **Arthroscopic Probe**
- **Basket Forceps**
- **Grasping forceps**
- **Scissors**
- **Cannulas and Switching Sticks**
- **Electrocautery and Radiofrequency Instruments**


Pump On
Synergy
35
100

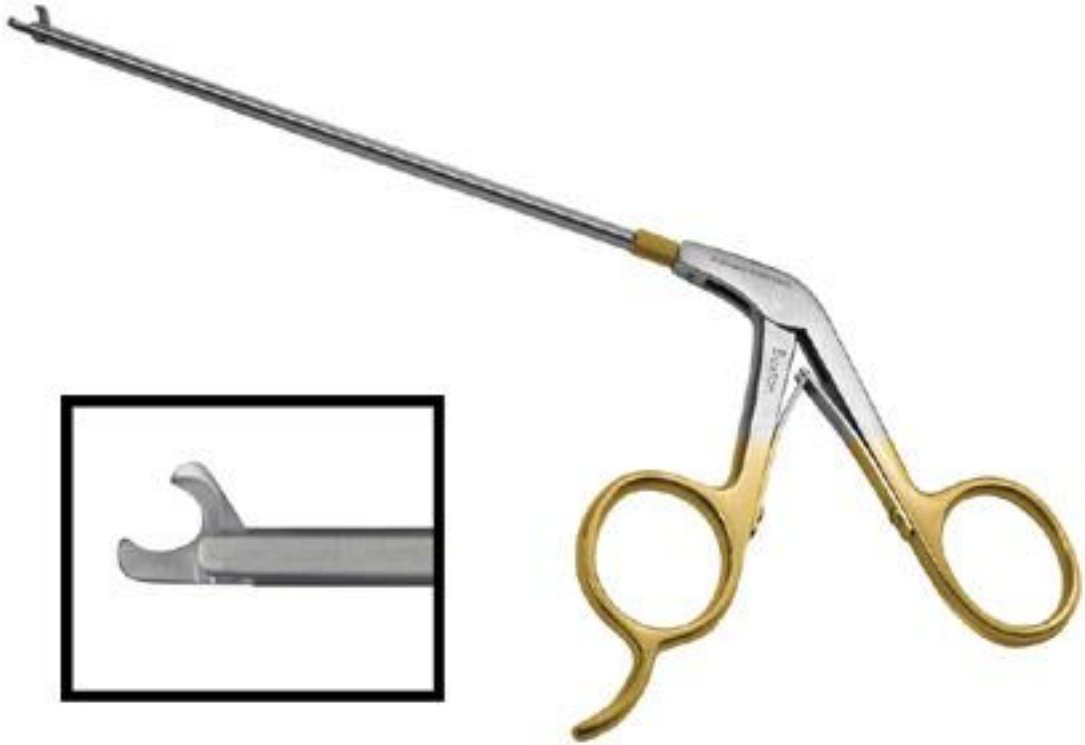
Cuda
Most Aggressive

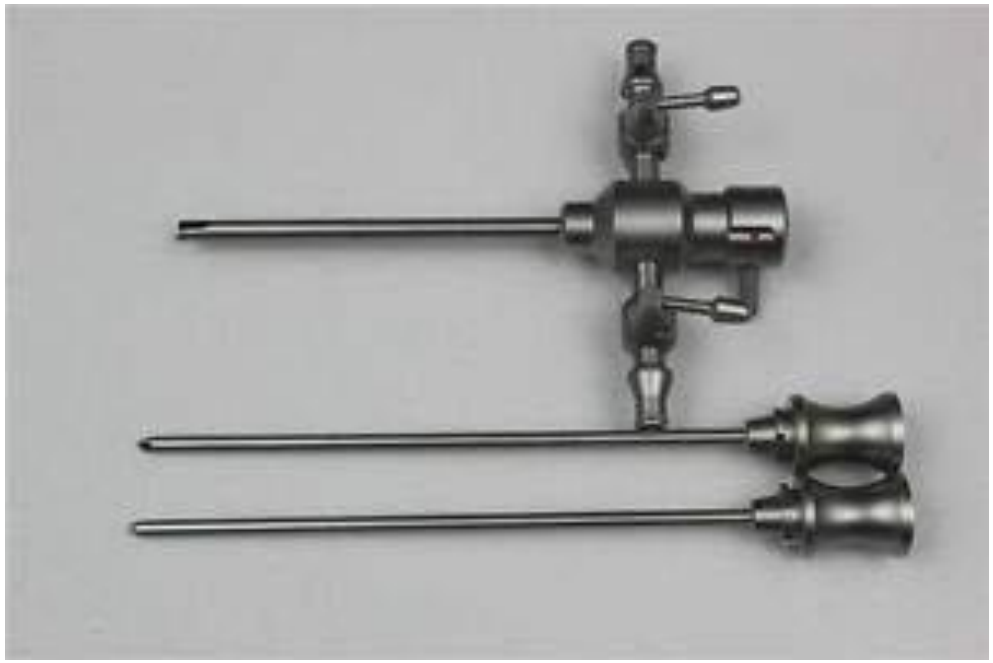
Gator
Aggressive

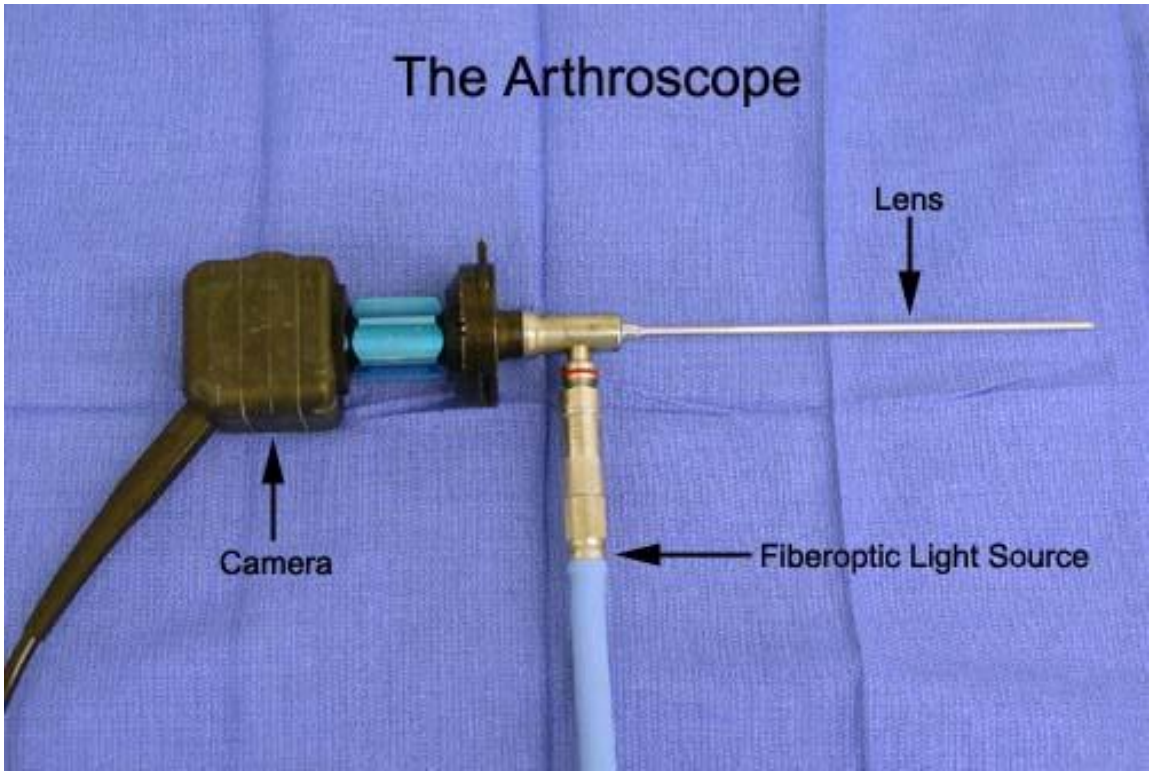
FRR
Least Aggressive

Spherical


SMALL JOINT
GRASPER






The Arthroscope
Lens
Camera
Fiberoptic Light Source

Overview of imaging

- X ray
- Ultrasoun
- CT
- MRI

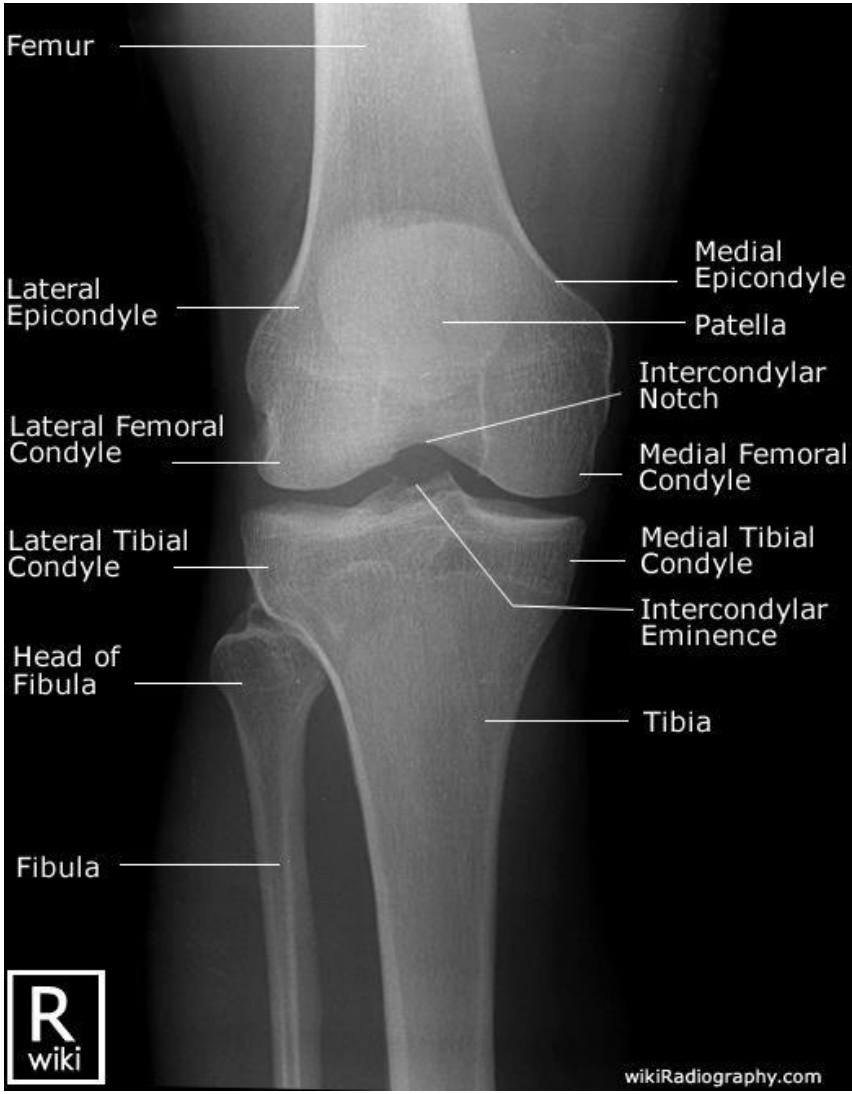
- X ray:

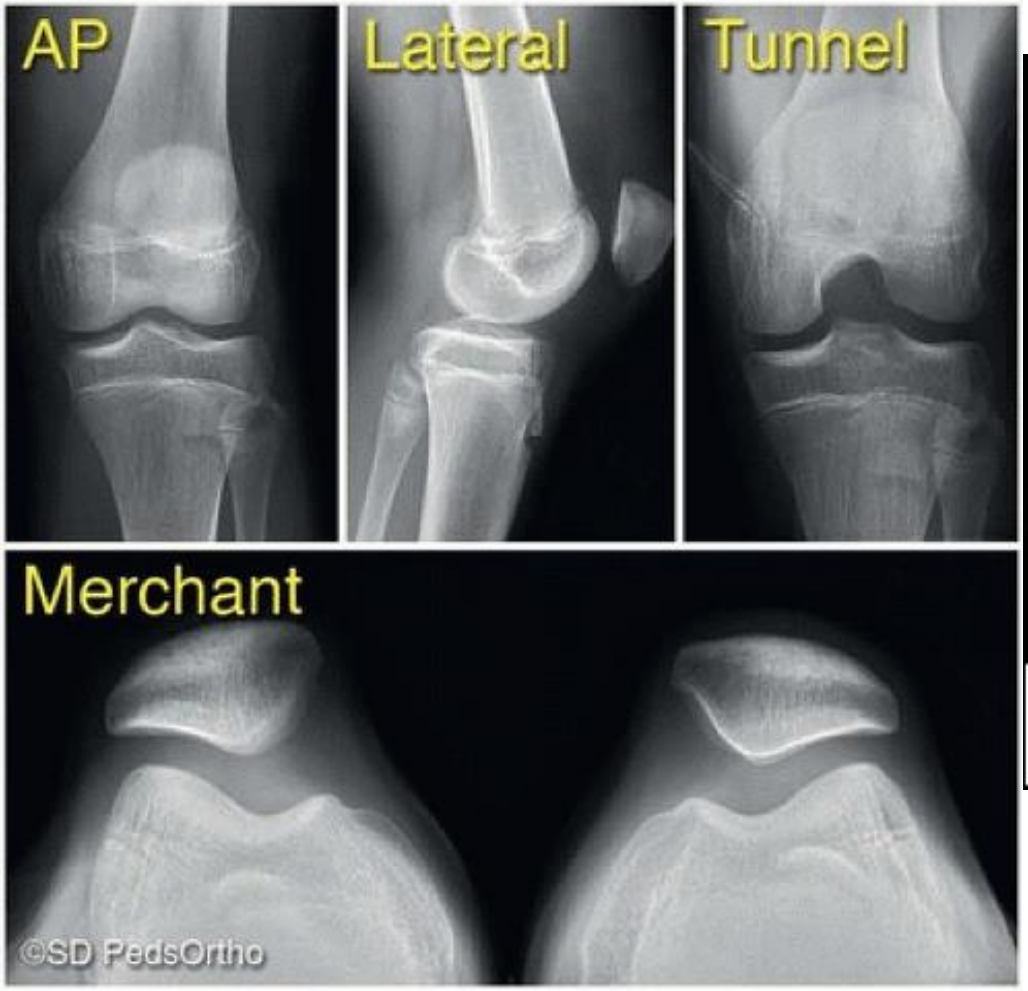
  Radiographs provide the basis for the initial evaluation of virtually all bone and joint pathology.

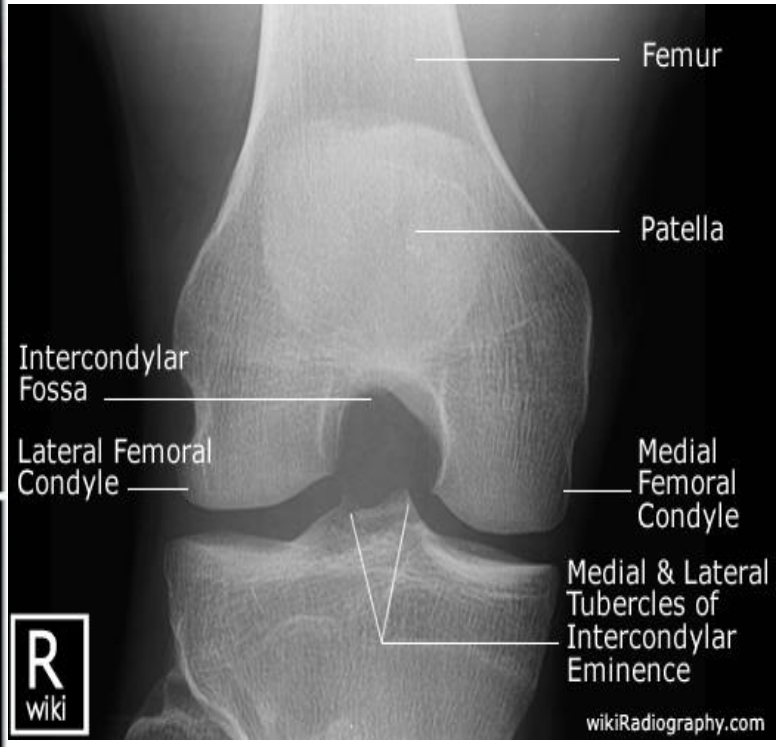
the soft tissues are not well demonstrated

Knee x ray

- AP
- Lateral
- Tunnel view
- Merchant view


Femur
Lateral Epicondyle
Medial Epicondyle
Patella
Intercondylar Notch
Lateral Femoral Condyle
Medial Femoral Condyle
Lateral Tibial Condyle
Medial Tibial Condyle
Intercondylar Eminence
Head of Fibula
Tibia
Fibula
R
wiki
wikiRadiography.com


AP
Lateral
Tunnel
Merchant
©SD PedsOrtho


Femur
Patella
Intercondylar Fossa
Lateral Femoral Condyle
Medial Femoral Condyle
Medial & Lateral Tubercles of Intercondylar Eminence
R
wiki
wikiRadiography.com

Shoulder x ray

Standard projections(AP ..lateral or scapular Y view)

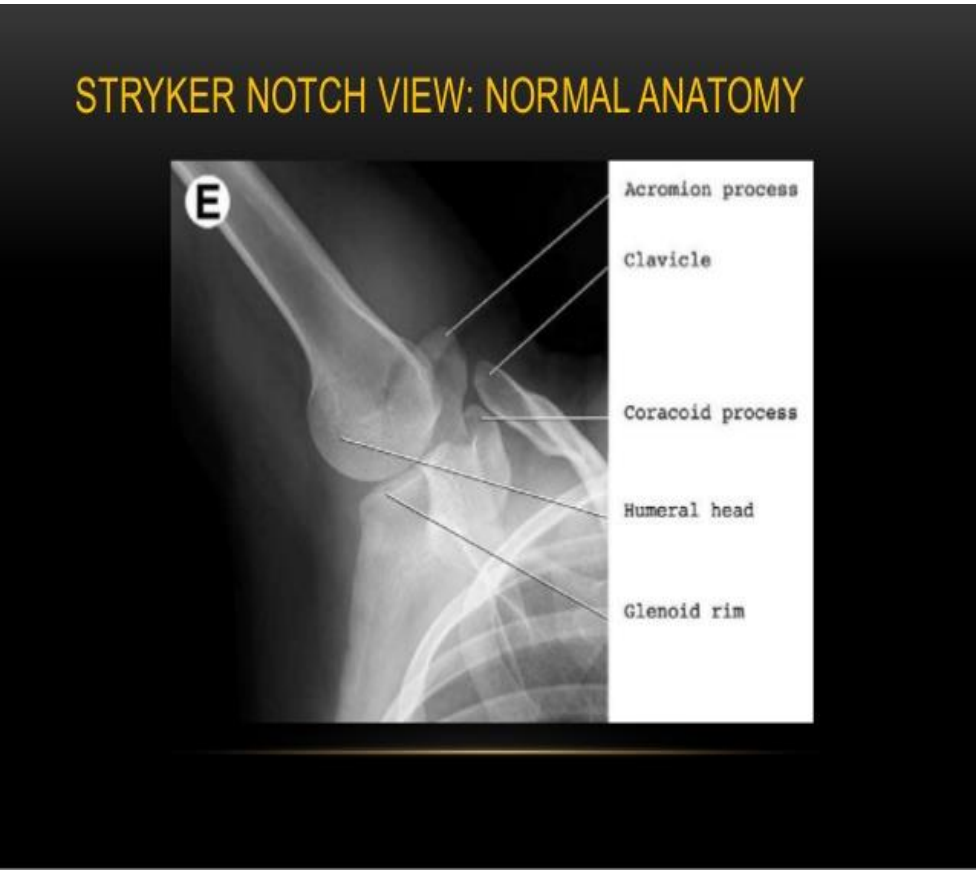
Modified trauma projections(modified trauma axial,garth, supine lateral, supine axial, Neer view**)**

Axial variants (superior-inferior axial, stryker view, west point view, velepeau view**)**


R

Garth view

Stryker view



MRI

- has the highest soft tissue contrast discrimination compared with other modalities

- interpreted by synthesizing data from several image series.
- Each series is composed of a pulse sequence (e.g., spin echo, gradient echo, or inversion recovery),
- typically with T1, proton density, or T2 weighting in the sagittal, coronal, transverse, or oblique plane, resulting in multiple adjacent images

Thanks all