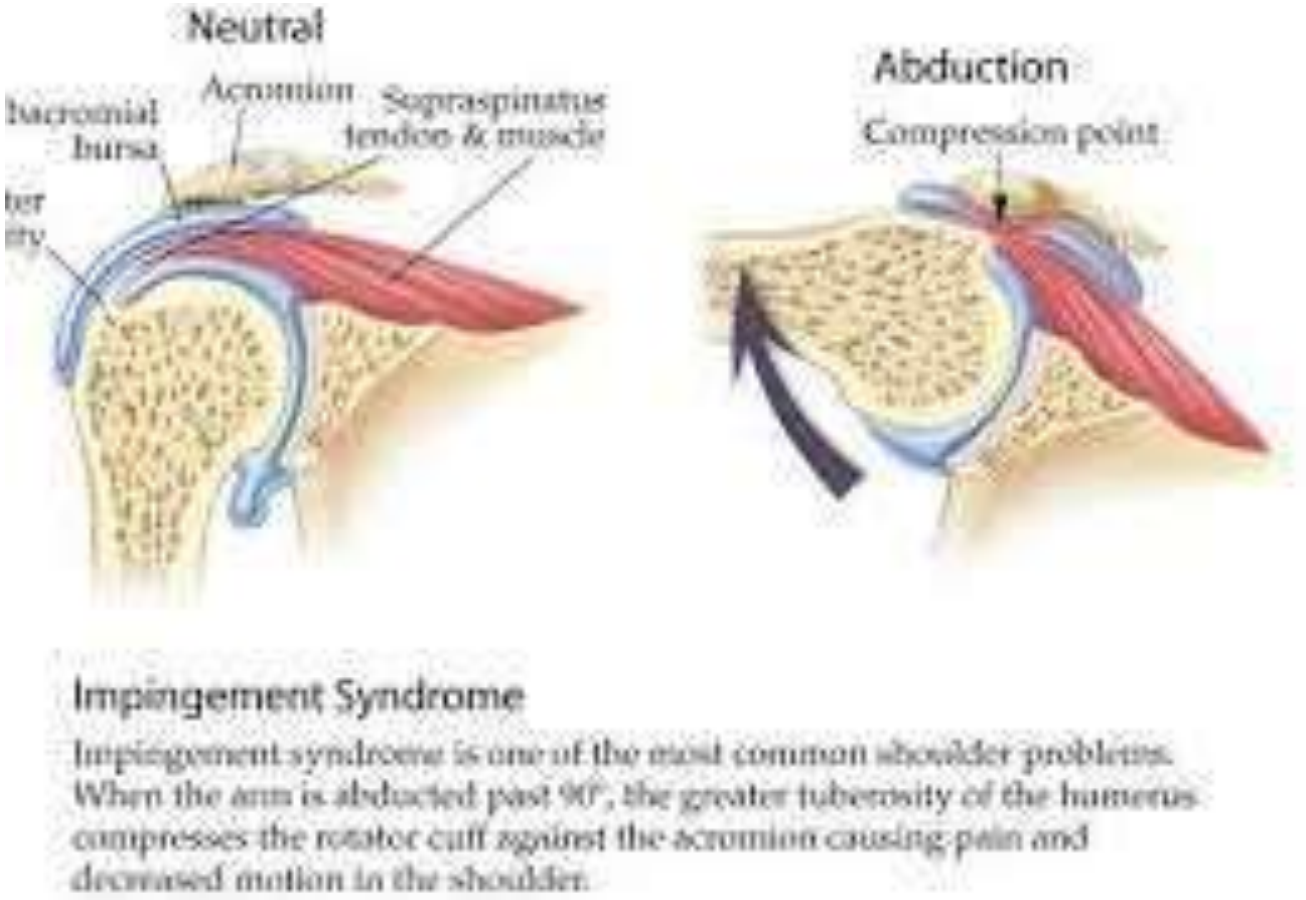
Understanding Common Swimming Injuries

Swimmer's Shoulder

- What is this?
  - 35-91% of competitive swimmers reported shoulder pain.
    - High level swimmers practice 20-30 hrs per week and have over 500,000 strokes per year.
    - Causes of a combination of :
      - Impingement Syndrome
      - Anterior Instability
      - Scapular Dyskinesis

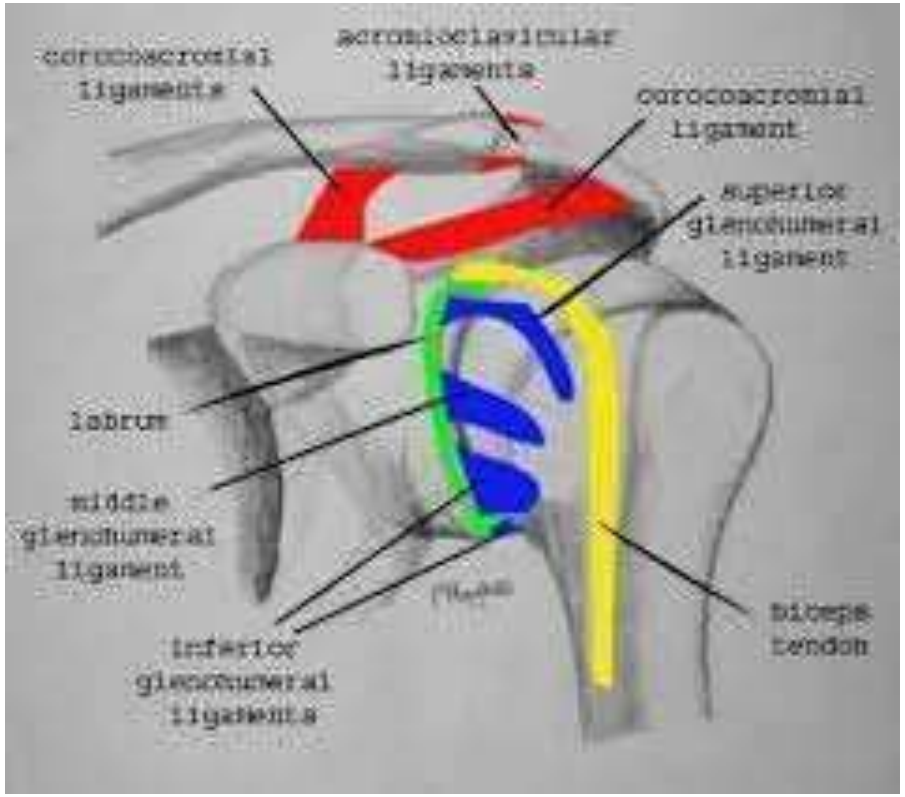
Swimmer's Shoulder

- **<u>Impingement Syndrome</u>**
  - Pinching of shoulder on undersurface of the bony shoulder called the acromion.
  - Caused by repetitive overhead movements.
  - 65% of high level competitive swimmers have this condition



Swimmer's Shoulder

- **<u>Anterior Instability</u>**
  - Occurs in 61% of swimmers with shoulder pain but in only 1.7% of the normal population.
  - Caused by pressure with arm ABDucted and Externally rotated.
  - Pressure on Inferior Glenohumeral Ligament.
  - Shoulder slips forward in the joint causing pain.



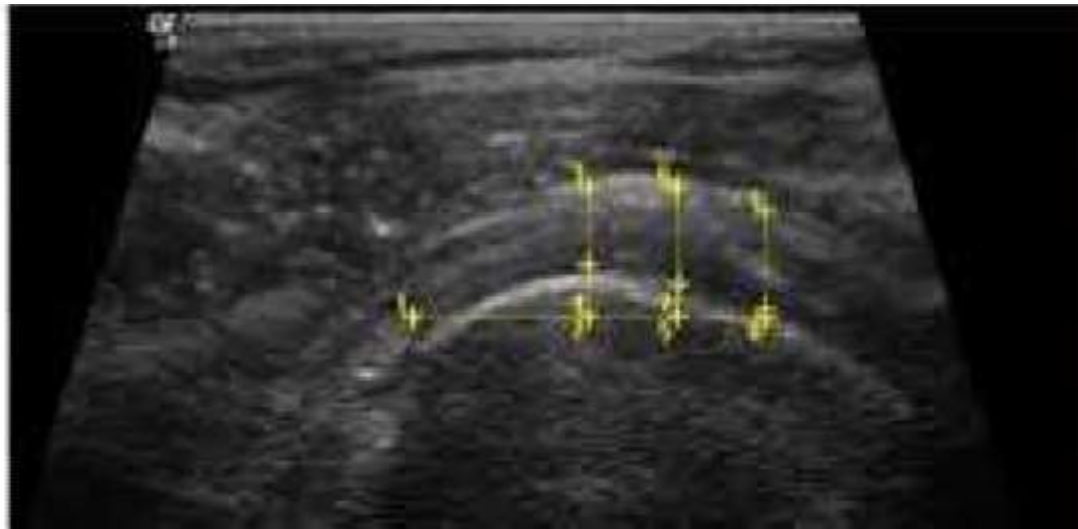
Swimmer's Shoulder

- **<u>Scapular Dyskinesis</u>**
  - Abnormal movement of Scapula (shoulder blade) to the thorax .
  - This is due to an abnormal syncing of the Trapezius, Rhomboid and Serratus Anterior muscles to rotate the scapula around the thorax.
  - Sometimes known as SICK Scapula

Swimmers Shoulder- Causes of Tendonitis

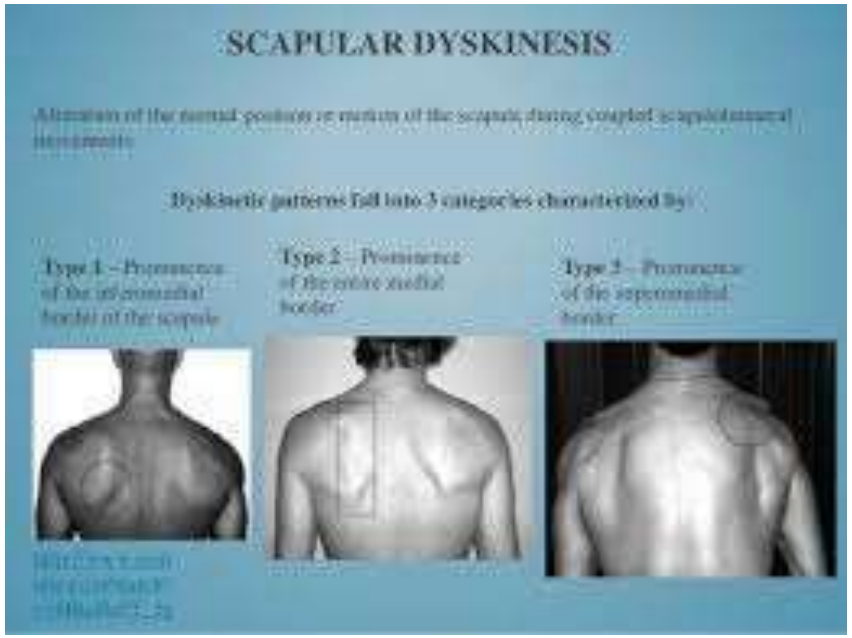
- **Related to hours of training:**
  - Competitive swimmers who trained for more than 15 h/week were twice as likely to have tendinopathy as those who trained less.
- **Related to tendon thickness:**
  - swimmers with increased tendon thickness had impingement pain and supraspinatus tendinopathy.
- **Sein et al [19] proposed a new model :**
  - Repetitive movement causes tendinopathy with an associated increase in tendon thickness.
  - Tendinopathy leads to pain when the thickened tendon and associated bursa are repeatedly squashed under the bony arch of the acromion during swimming as in impingement testing.

- [19] Sein ML, Walton J, Linklater J, Appleyard R, Kirkbride B, Kuah D, Murrell G (2010) Shoulder pain in elite swimmers: primarily due to swim-volume-induced supraspinatus tendinopathy. Br J Sports Med 44:105–113



Swimmer's Shoulder- Causes of Dyskinesis

- **Moving the scapula lateral:**
  - The lateral displacement of the scapula from the thoracic midline has been considered as a marker of scapular dyskinesis [21].
- **Breathing from one side:**
  - The one-sided movement of the head overuses the elevator muscles of scapula upper trapezius, rhomboid and sternocleidomastoid, raising the risk to develop muscular unbalance.
  - [21] Kibler WB (1998) The role of the scapula in athletic shoulder function. Am J Sports Med. 26:325–337.



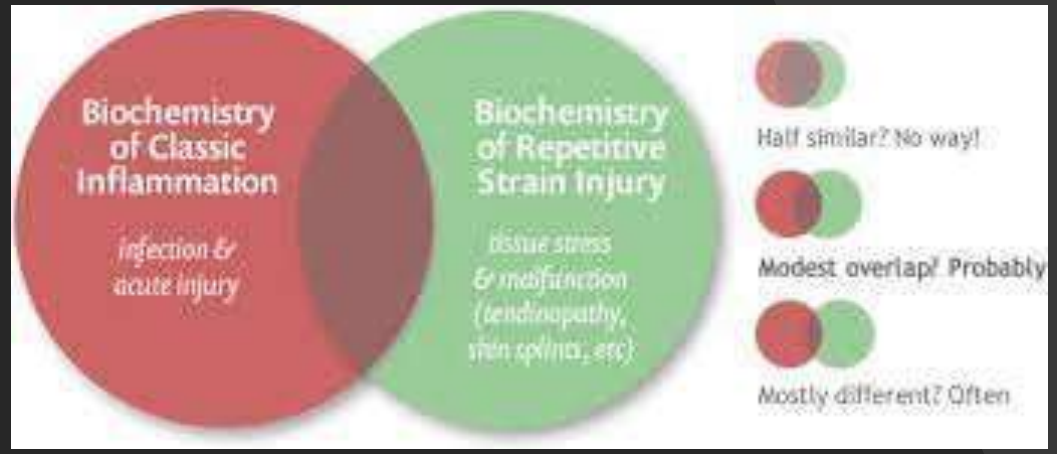
Swimmer's Shoulder- Causes of Impingement

- **Comparison of Swimmers with and without shoulder pain:**
  - 15 swimmers in each group.
  - Group 1- Shoulder pain
  - Group 2 – no shoulder pain
  - Swimmers with pain had less internal rotation of the shoulder.
- **GIRD (Glenohumeral Internal Rotation Deficit)**
  - Found in dominant shoulder
  - average loss was 12.6 degrees.

- [31] Bak K, Magnusson P (1997) Shoulder Strength and Range of Motion in Symptomatic and Pain-Free Elite Swimmers. Am. J. Sports Med. 25(4):454- 9.
- [34] Torres RR, Gomes JL (2009) Measurement of glenohumeral internal rotation in asymptomatic tennis players and swimmers. Am J Sports Med. 37(5):1017-23.

Biochemical Changes

- **The Tendon Cell (Tenocyte) is exposed to**:
  - MMP – Matrix Metalloproteinases
  - TIMP- Tissue inhibitors of MMP. (39)
  - N0- Nitric oxide (40)
- Tendon harmful chemical response seems to be related to magnitude related stress rather than frequency related stress.(50)
- May be sudden change in stress rather than gradual increase (ie military press of 250 lbs once rather than 50 lbs 5 times)
- [39] GP Riley (2005) Gene expression and matrix turnover in overused and damaged tendons. Scand J Med Sci Sports 15: 241–251.
- [44] Szomor ZL, Appleyard RC, Murrell GAC (2006) Overexpression of Nitric Oxide Synthases in Tendon Overuse. J Orthop Res 24:80–86
- [50] Arnoczky SP, Tian T, Lavagnino M, Gardner K, Schuler P, Morse P (2002) Activation of stress-activated protein kinases (SAPK) in tendon cells following cyclic strain: the effects of strain frequency, strain magnitude, and cytosolic calcium. J Orthop Res 20:947–52



Consensus on Training

- more than five sessions per week should perform dry-land exercise in order to prevent lesions.
- exposure reduction to repetitive motions
- cross-training
- posterior shoulder stretching & avoid anterior stretch
- strengthening, and core endurance training [52].

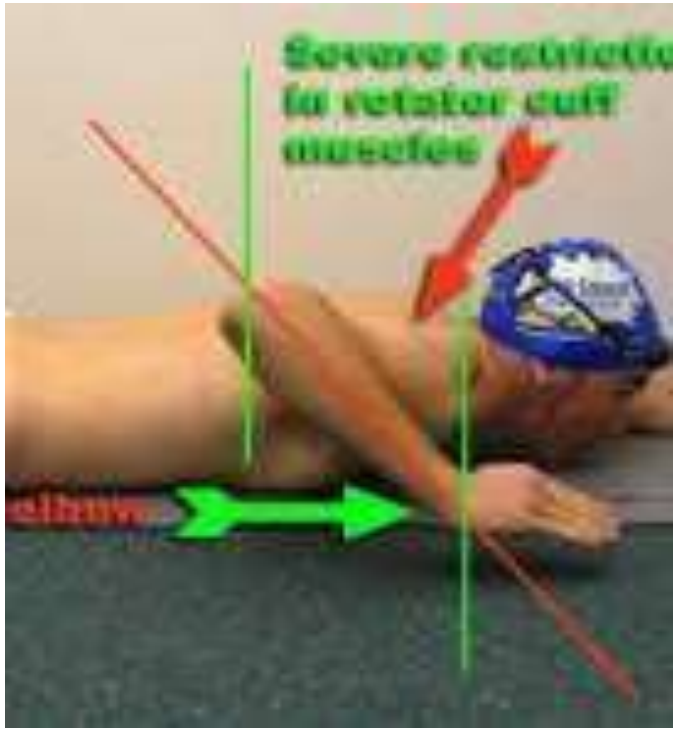
- [52] Tate A, Turner GN, Knab SE, Jorgensen C, Strittmatter A, Michener LA (2012) Risk factors associated with shoulder pain and disability across the lifespan of competitive swimmers. J Athl Train. 47(2):149-58.

Common Training Errors

- Rapid increase in distance
- Excessive use of paddles
- Using the kickboard to rest the shoulder
- The coach should seek for increased body roll with scapular retraction [54].

- [18] TMurphy TC(1994) The athlete's shoulder. New York, NY: Churchill Livingstone Inc. pp. 411-424.

Stroke Training Errors



- **Optimal Body Roll :**
- Excessive body roll led to **cross the mid-line** with the hand during the pull-through phase.
  - Compresses subacromial space.
  - Leads to tendon compression. [18].
- Greater length of the adductors, medial rotator, scapular protractors and abdominal oblique muscles in the beginning of the pull-through phase [55].

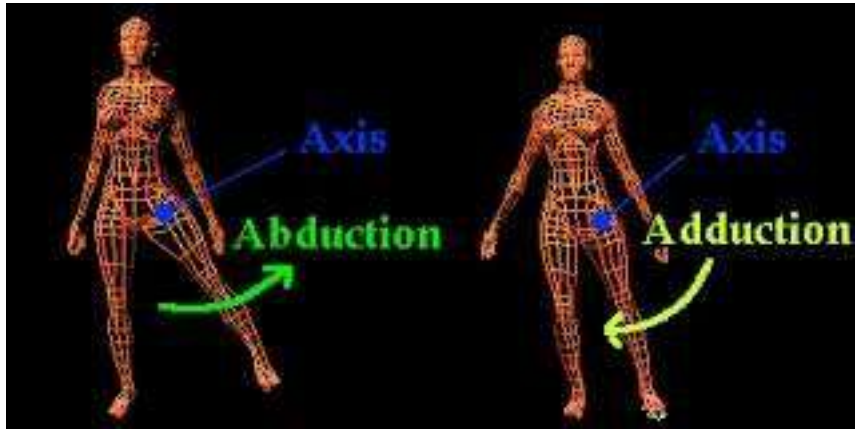
- [54] Weldon EJ III, Richardson AB (2001) Upper extremity overuse injuries in swimming. Clin Sports
  Med. 2001 20:423–438.
- [55] Shapiro C (2001) Swimming. In: Shamus E, Shamus J, editors. Sports injury prevention and rehabilitation. New York: McGraw-Hill. pp. 103-154.

Correcting the Roll

- Head is 12 o'clock
- Right Hand enters – 1 o'clock
- Left Hand enters – 11 o'clock
- Hand does not cross midline during pull
- Exit with bent elbows
- Allows Lattissumus Dorsi to engage first and swimmer pulls under the body= less impingement

Breaststroker's Knee- Causes

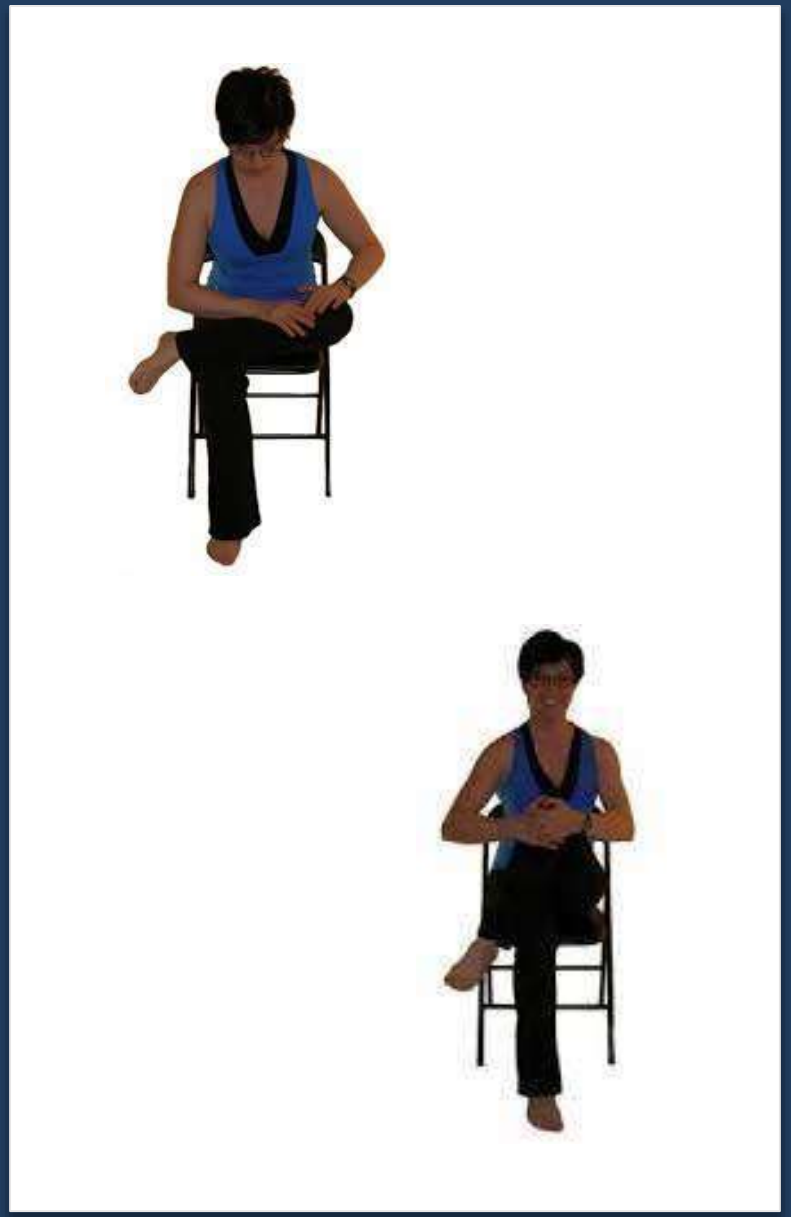
- 391 swimmers- 73% of breast- stroker's reported knee pain compared to 43% of non-breast-stroker's
- Dramatic differences in the injury rate were noted when hip abduction angles at kick initiation were less than 37 degrees or greater than 42 degrees.
- NOT TOO MUCH OUT or IN



- Am J Sports Med. 1987 Jan-Feb;15(1):63-71. **Breaststroker's knee. An analysis of epidemiological and biomechanical factors.** Vizsolyi P, Taunton J, Robertson G, Filsinger L, Shannon HS, Whittingham D, Gleave M

Breastroker's Knee Causes

- **Loss of Internal Rotation of Hip**
  - 36 subjects with frequent knee pain were found to have less internal rotation at the hip joint.
- **Stress on Medial (Inside) Knee Joint:**
  - 47% of subjects with weekly knee pain had tender, thickened medial plicae. (thick band of tissue in knee capsule)
- **Age, Years of Swimming , Breaststroke Distance**:
  - There was a significant relationship between more frequent knee pain and increasing swimmer's age, increasing years of competitive swimming, increasing breaststroke training distance, and decreasing warm-up distance.
- Rovere GD, Nichols AW. **Frequency, associated factors, and treatment of breaststroker's knee in competitive swimmers.** Am J Sports Med. 1985 Mar- Apr;13(2):99-104.



Breaststroker's Knee Treatment Tips

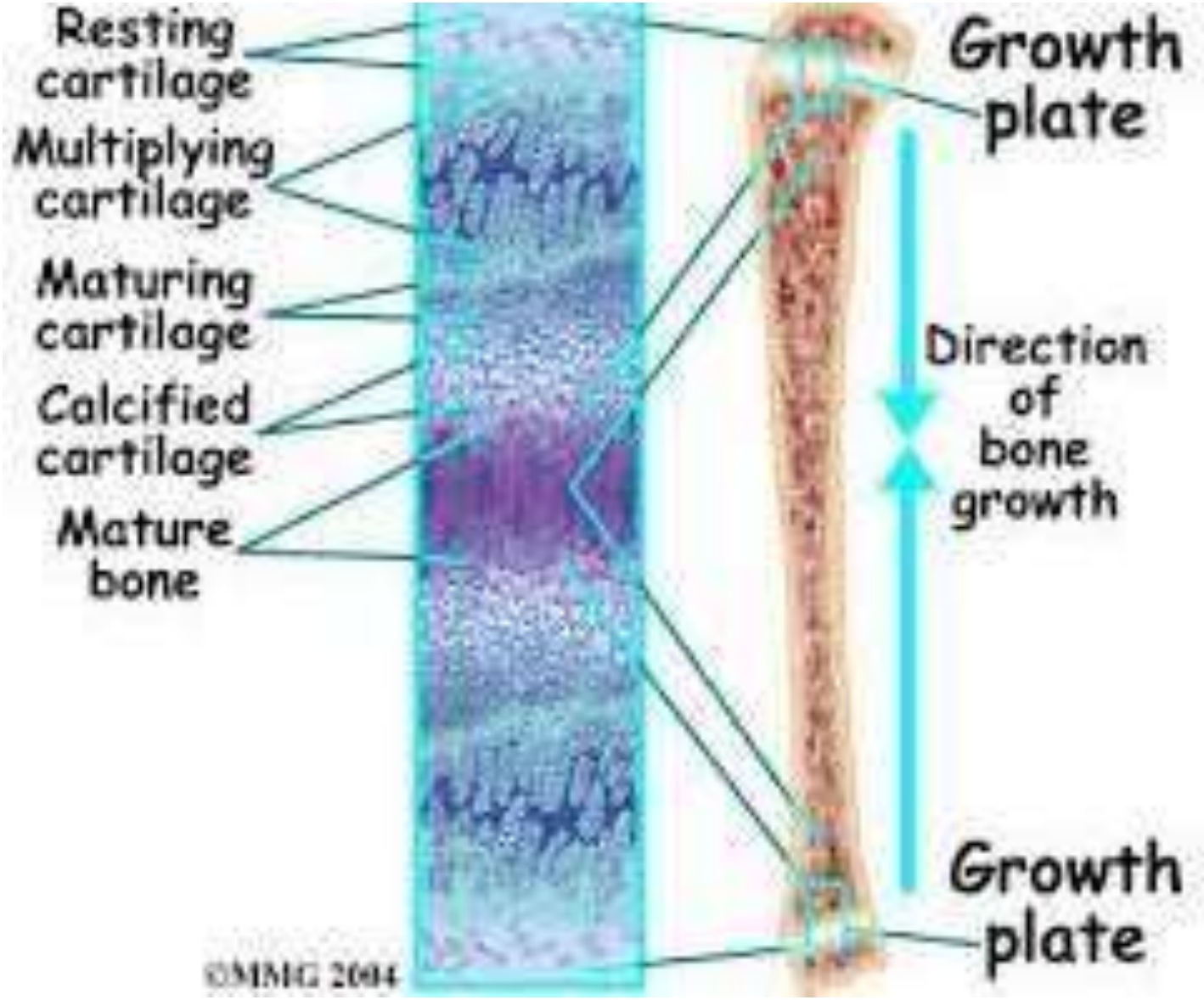
- Avoid excessive Hip Abduction (spreading the legs) more than 45 degrees
- Stretch internal rotation of hip (Flexion and abduction)
- Strengthen Hip Abductors (especially gluteus medius)

Breaststroker's Knee Treatment Tips

- Medial plica band topical treatment with Aspercream or Traumeel
- Limited judicial use of NSAID- Aleve or Motrin for 10-14 days
- Avoid Squats and exercises requiring kneeling.
- Avoid Breaststroke kick for 10-14 days

Growth Plate Conditions

- Normal human bone grows from the ends of the bone at the growth plates.
- Growth plates or epiphyseal plates
  are softer cartilage like substance
- Rapid growth of the child or sudden **increase** in stress across these areas cases inflammation called Apophysitis.

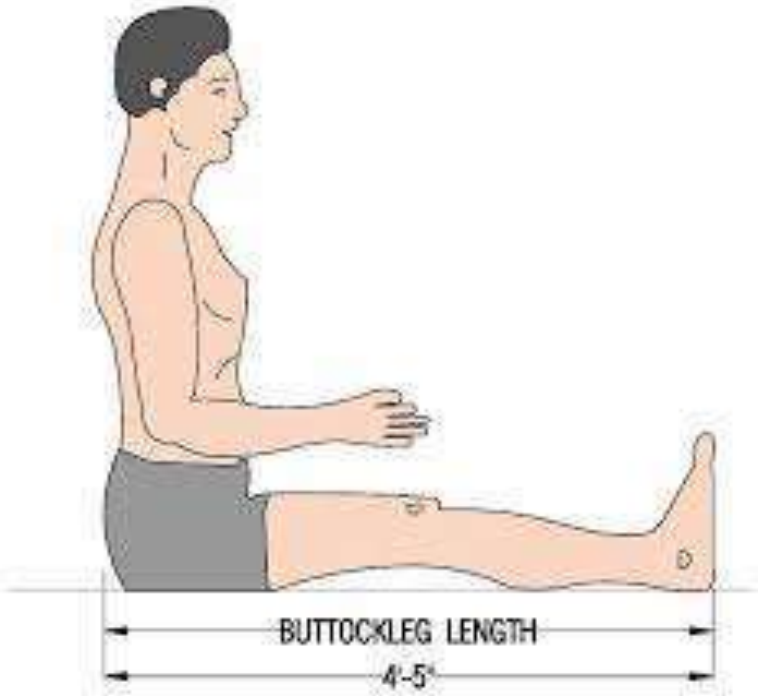


Growth Plate Conditions

- Common apophysitis include:
  - **Osgood- Schlatter** – Tibial tubercle- knobby knee pain .
  - **Sinding-Larsen- Johansson** syndrome- inferior pole patellar pain- Jumper's knee.
  - **Seaver's Disease**- Heel pain where Achilles tendon attaches.

Growth Plate Injury Symptoms

- More common in males than females
- Occur in the younger athletes- Freshman and Sophomores-
- Relationship of Heel-Buttock Distance (HBD) - The longer the leg, the bigger the fulcrum & the higher the chance of stress on the growth plate.
- Usually in earlier season when they excessive stress over the joint – ie Box Jumps



Growth Plate Injuries- Diagnosis

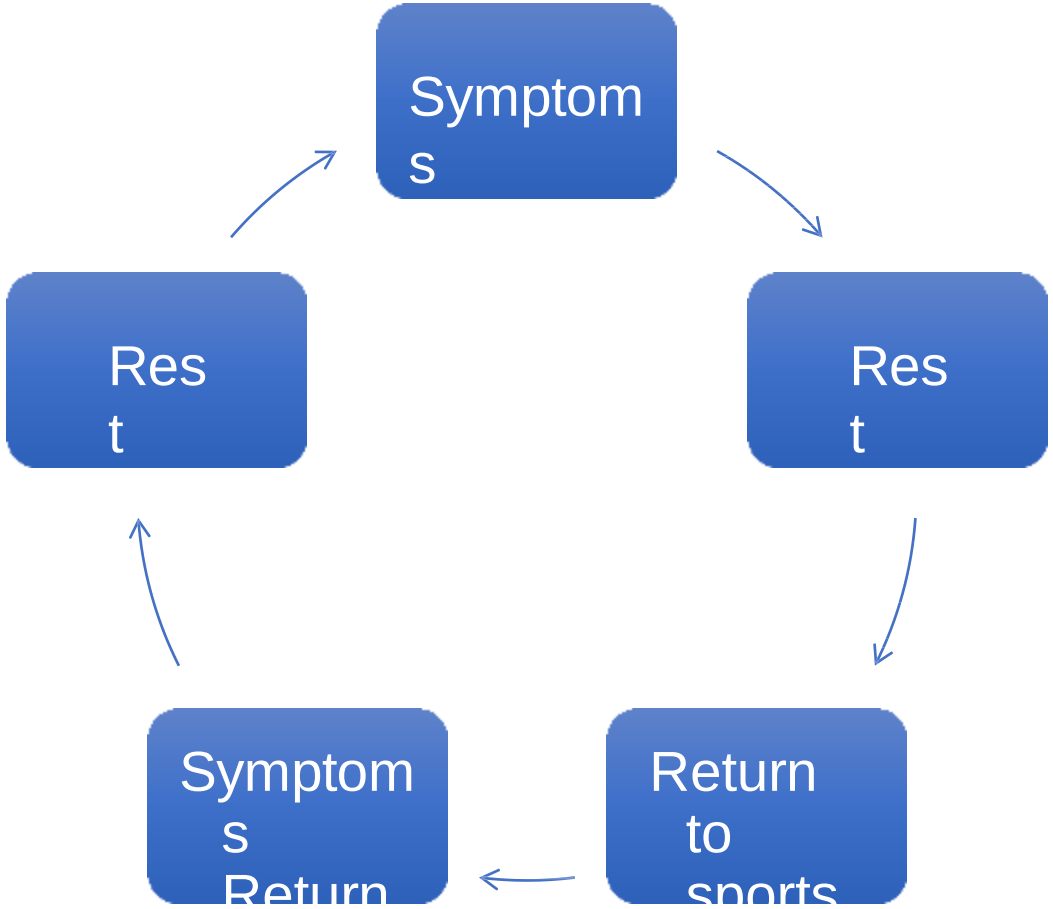
- Acute tenderness where the tendon attaches to the bone.
- Occasional redness and swelling at tendon-bone interface.
- Pain with push off and starts.
- X-rays not always positive
- MRI not required but very sensitive for diagnosis

Growth Plate Treatments

- **<u>Symptomatic Adjustments:</u>**
  - Rest according to pain
  - Complete rest 2 weeks (usually with splint and crutches)
  - Trial of low dose NSAID (Aleve)
  - Low Level Laser
  - Topical analgesics- Aspercream
  - Injections:
    - NO for steroids
    - Possible benefit with:
      - Platelet Rich Plasma
      - Traumeel/Zeel
      - Prolotherapy

Growth Plate Treatments

- Frustration for Coach, Parent and Swimmer-
  - Cyclical symptoms with growth spurts and strain to growth plate.
  - Requires constant communication and understanding this is unpredictable.
- Will subside with closure of growth plate- aka – “they will grow out of it.”

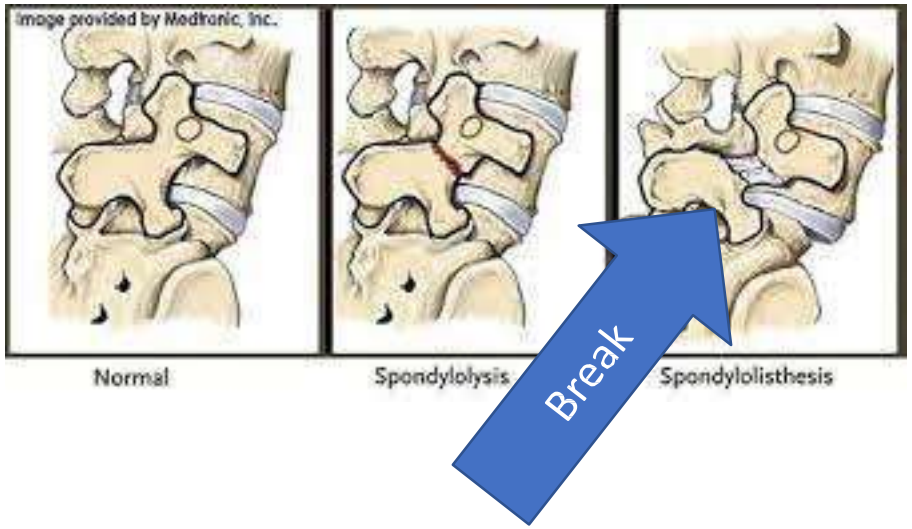


Low Back Pain

- **Spondylolysis –**
  - Stress fracture of Pars Intrarticularis
  - Found more commonly in butter- fliers and breast- strokers
  - Caused by repetitive stress by over-extension of lower spine.
- Spondylolysis as a cause of low back pain in swimmers.Nyska M, Constantini N, Calé- Benzoor M, Back Z, Kahn G, Mann G. Int J Sports Med. 2000 Jul;21(5):375-9.

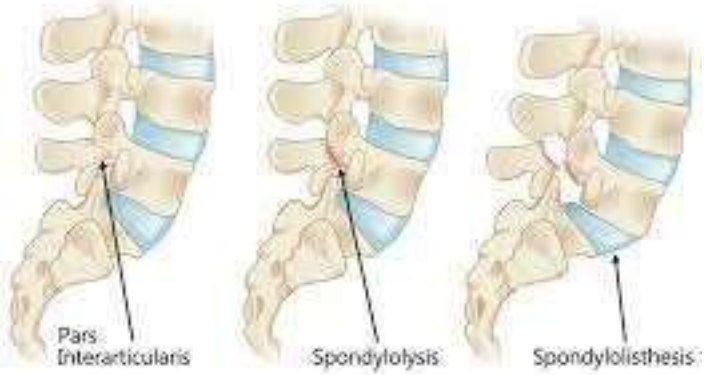
Spondylolysis – Diagnosis

- Low back pain with extension of low spine
- Tight hamstrings
- No loss of feeling or weakness
- X-rays must include oblique views- look for scotty dog neck
- CT or MRI or Bone Scan helpful if x-ray is negative.



Spondylolysis – Treatment

- Majority will resolve with just rest of 3-6 months
- Brace- Lumbar Corset
- Try to avoid NSAID (effect on bone healing)
- Low Level Laser
- Therapy to stretch hamstring and off load spine with abdominal core strength.
- Repeat x-rays or CT scan to confirm healing .

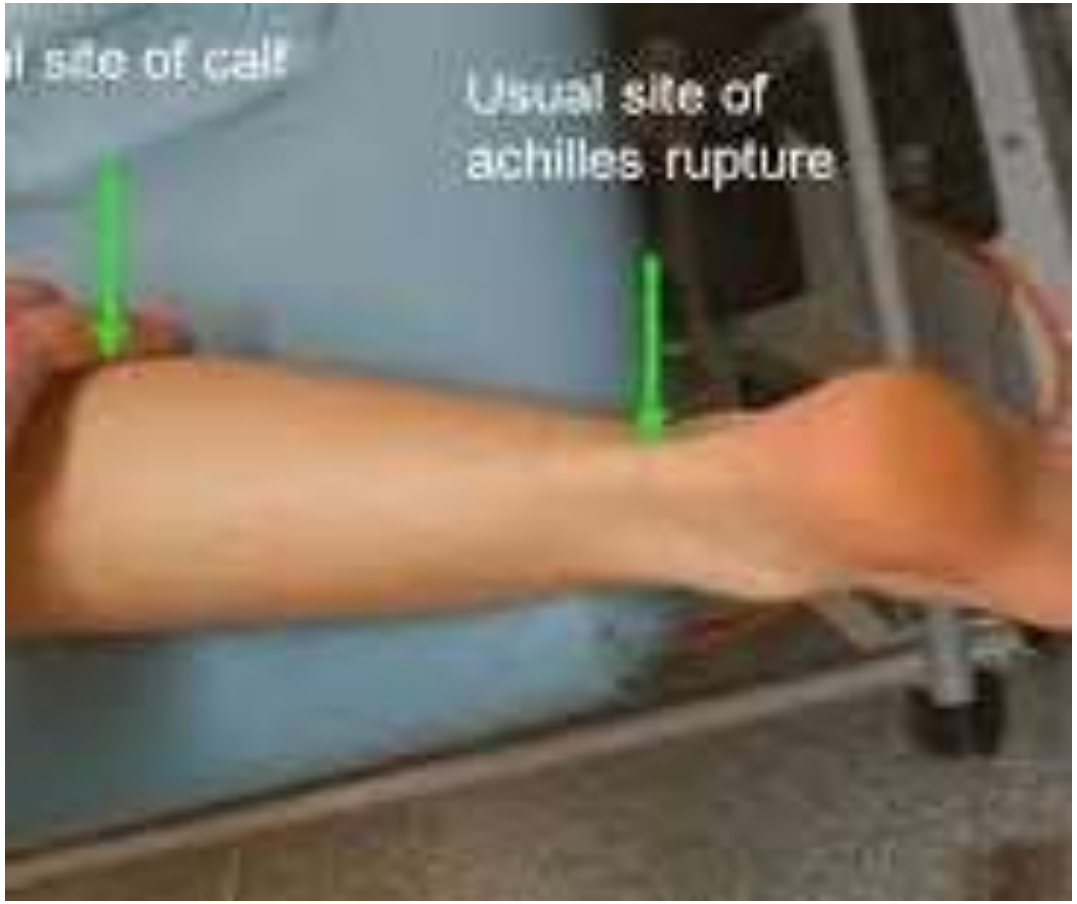


Sprains and Strains

- Muscle Pulls/ Tears/ Sprains
- Normal work hazard of any athlete.
- Normally occurs with:
  - Increased stress in early season.
  - Cross training- legs and ankles
  - Weight training – Military press
  - Change in stroke technique

Sprains and Strains Diagnosis

- Diagnosis :
- How do I know it is not anything more serious?
- Palpate the area
  - Look for defect or deformity
- Massive swelling immediate
- Pain out of proportion
- Rarely requires x-rays or MRI



Sprains and Strains- Treatment

- Instruct on RICE
  - Rest
  - Ice
  - Compression
  - Elevation
- Limited use of NSAID
- Low Level Laser
- Rest Goals:
  - Recovery
  - Examine cause of strain
  - Adapt exercise or stroke
  - Time to use other muscles
- **Return to Activities- Rule of 1/4th's**
  - Trial of 25% of original
  - Increase 25% either every 3-7 days

REHABILITATION TECHNIQUE IN SPORTS

DEFINATION OF REHABILITATION

- The action of restoring someone to health or normal life through training and therapy after imprisonment, addiction, or illness.
- He action of restoring someone to former privileges or reputation after a period of disfavor.
- The action of restoring something that has been damaged to its former condition.

- **Rehabilitation** is a treatment or treatments designed to facilitate the process of recovery from injury, illness, or disease to as normal a condition as possible.
- **Rehabilitation**: The process of helping a person who has suffered an illness or injury restore lost skills and so regain maximum self-sufficiency

- Joint Health
- Nerve Injuries
- Pain Therapy
- Sports Injuries
- Bone Health
- Congenital Conditions
- Brain Disorders
- General Physical Medicine

About Sports Injury Rehabilitation

- Targeted exercises are used to help you return to pre-injury function.
- Personalized exercise prescription is used to improve mobility restrictions.
- Helps reduce susceptibility to further sport-related injuries.

- Preparation to avoid recurring injury episodes.
- Helps achieve peak athletic performance.
- pt Health Sports Injury Rehabilitation is a safe therapeutic approach that helps athletes effectively treat pain and achieve optimal performance.

What is Sport Injury Rehab?

- Sports Injury Rehabilitation helps athletes effectively treat pain and return to normal function. We emphasize the importance of early injury recognition and treatment.
- In conjunction with receiving a course of treatment, specific strengthening and flexibility exercises will be implemented. Progressive exercises are included in rehabilitation programmes to ensure the injury site returns to a fully functional state.

- Our therapists provide care that is unsurpassed and unique to each individual patient. Our team approach includes close communication with all involved parties (referring physician, etc.) on the progress of each individual.
- Sports Injury Rehabilitation treats a range of conditions including acute sports injuries, strains, sprains, muscle, tendon and ligament repairs, tendonitis, hand injuries, shoulder dislocation, foot or ankle dysfunction and surgery rehab.

- The Sports Injury Rehabilitation Program will benefit those with:
- Post-operative injuries.
- ACL reconstruction.
- Meniscus tears.
- Rotator cuff repair.
- Acute and chronic musculoskeletal injuries.
- Sprains and strains.
- Tedonitis and bursitis.

How it Helps

Sports Injury Rehabilitation is a multi-disciplinary approach to the prevention, evaluation, and treatment of injuries. The first step towards recovery is getting an accurate diagnosis from a certified sports-injury specialist. Typically, the initial stage of treatment involves reducing pain and promoting healing. Once pain and swelling are reduced, progressive reconditioning treatment will begin.

Exercises will be prescribed to target specific goals such as mobility, flexibility training, coordination of balance and joint positioning. As progress is made, the athlete and trainer can work together towards re-establishing strength.

We use state-of-the-art techniques and procedures including:

- Functional activities.
- Sports/Activity specific exercises and training.
- Bracing and taping (athletic and kinesiotaping).
- Fabrication of protective pads.

- Modalities.
- Manual Therapy.
- Muscle reconditioning.
- Proprioceptive training.

Health Benefits

Sports Injury Rehabilitation is critical to help ensure you return to the activities you love as quickly and as safely as possible. We are committed to providing state-of-the-art clinical care for athletes of all ages and skill levels. Although you may be injured, you can stay in shape.

The athlete can use the injury period as an opportunity to strengthen other areas of the body. A personal, committed investment in healing is a strategy that will help you regain optimal performance.

The Use of Cryotherapy in Sports Injuries

The use of cold therapy in acute sports injuries as well as in the rehabilitation of the injured athlete has become a generally accepted treatment method. Various cooling modalities are used to apply cold to the injured area, e.g. ice packs, ice towels, ice massage, frozen gel packs, ethyl chloride and other vapocoolants, chemical reaction devices and inflatable splints using refrigerant gas.

Most clinical studies report that the use of cryotherapy has a positive effect on pain reduction and on the recovery of various injuries. When the physiological processes produced by cryotherapy are examined in experimental situations, some of these reactions differ from expectations.

Contrast-Bath Therapy

It has been suggested that contrast-bath therapy alters sensation and enables patients to return to exercise more quickly.

Hydrotherapy

Hydrotherapy, formerly called hydropathy and also called water cure, is a part of medicine and alternative medicine, in particular of naturopathy, occupational therapy and physiotherapy, that involves the use of water for pain relief and treatment. The term encompasses a broad range of approaches and therapeutic methods that take advantage of the physical properties of water, such as temperature and pressure, for therapeutic purposes, to stimulate blood circulation and treat the symptoms of certain diseases.

Wax therapy

Wax therapy, which uses a bath of molten paraffin **wax**, is one of the most effective ways of applying heat to improve mobility by warming the connective tissues. **Wax therapy** is mainly used on your hands and is often used by hand therapists in a hospital setting along with an exercise programme.

THERMAL INJURIES

Definition:

- It is defined as tissue injury due to application of heat in any form to the external or internal body surfaces.

THERMAL INJURIES

- **General Classification**
  - Dry Heat - flame
  - Moist Heat - scalds
  - Cold injuries
  - Chemicals - corrosives
  - Electric Contact
  - Radiation Burns - x-rays, ultraviolet rays.

Thermal injuries

- **Heat injuries** – general (hyperpyrexia) and local injuries (burn)
- **Cold injuries** – general and local injuries.

- Dry lesion
- Does not bleed
- Hard to touch
- Very painful
- Erythema
- Coagulated and roasted patches area

- Singing of hair
- Burnt cloths
- Carbon material in air passages
- Vesicles not appear / small
- Dry cooked appearance of muscles
- Dry and coagulated blood and pink tissues

Moist heat / scalds

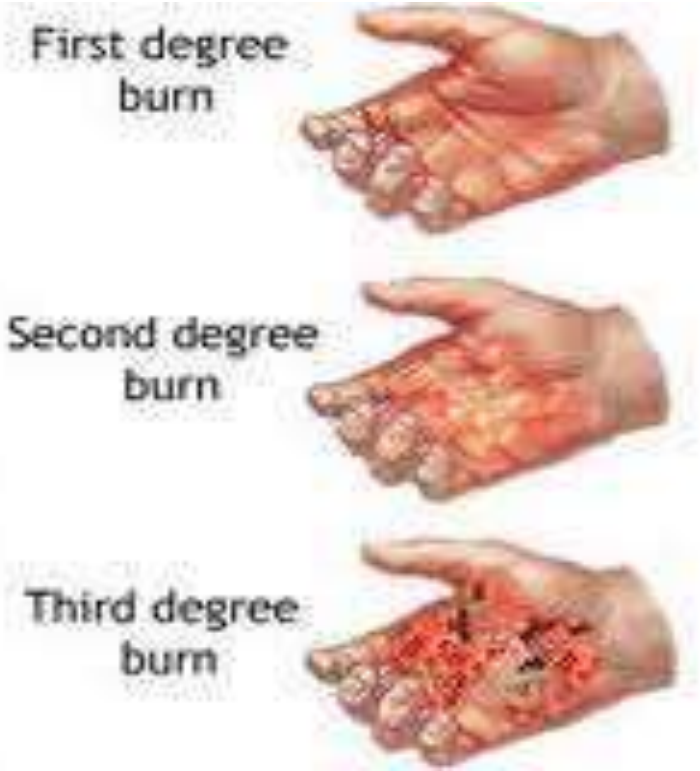
- Liquids / pressure steam at high temp.
- Erythema
- Extensive vesication of large sizes
- No singing / burning of hair / clothes
- Clothes wet
- No deposit of carbonaceous material
- Limited to skin / mouth or throat
- Skin and mucosa blister

Corrosive burns

- Strong acids / alkalis
- Destroying texture of tissue
- Vitriolage

Types of BURNS

- Depending on the depth of burn:
  - Epidermal (first degree)
  - Dermo – Epidermal (second degree)
  - Deep (third degree)



- **Rule of Nine**: To see the extent or percentage of Body surface bearing Burns.
  - **In adults**
  - 9% for head
  - 9% + 9% for arms
  - 9 + 9% for front of trunk
    9 + 9% for back of trunk
  - 9% + 9% for front and back of right leg
    9% + 9% for front and back of left leg
  - 1% for perineum.

Roughly

- One palm of individual is equal to 1% burn area.

If burn area > 15% in an adults and > 10% in a child then the loss of blood must be replaced.

EFFECTS OF BURNS

- Scarring less in scalds than in dry burns
- Curling's ulcer occasionally seen in gastric and duodenal mucosa.
  - Superficial circular Less than 1mm Diameter.

EFFECTS OF TEMP ON BODY

- Classified according to severity of condition and effects on body
- HEAT STROKE
- HEAT CRAMPS
- HEAT EXHAUSATION

Age of Burn

- Immediately redness
- 2 to 3 hours, vesication
- 36 to 72 hours, purulent inflammation
- 1to 2 week, sloughing
- After 2 weeks, granulation tissue formation
- End result,Scar formulation

POST MORTEM FINDINGS

External appearances:

- Skin blackening
- Shortening of muscles
- Pugilistic attitude
- Skin splits

External Appearances

- Presence of burnt material
- Distribution of burns on Clothes
- Presence of Smell
- Burnt areas (Blister)

Internal Appearances

- Marked Pallor of LIVER and KIDNEY
- dry and cooked muscles
- dry and coagulated blood
- soot particles in air passages
- Curling Ulcers
- Heat fractures, heat hematoma

DEATH FROM BURN

- Surface area involved is more than one third of total body surface

GENERAL EFFECT

- **PRIMARY SHOCK** due to fear or pain
- **SECONDARY SHOCK** due to hypovolemia**.**
- **TOXEMIA**
- SEPTICEMIA
- **Asphyxia**: due to inhalation of smoke, CO and CO_2.
- Cyanide Intoxication
- Fat Embolism

ML IMPORTANCE

- ACCIDENTAL Mostly
- SUICIDAL Occasionally
- HOMICIDAL
- CONCEALMENT OF CRIME

Antimortem BURN

- Vital Reaction
- Soot Particles

HEAT STROKE or Sun stroke, Heat hyperpyrexia or Thermal fever.

- There is complete absence of sweating and Body Temp raised to 106^0F and may go upto111^0F.
- Results from a combination of high temp and Humidity.
- High air temp increasing Body temp by CONDUCTION
- Humidity impairing cooling mech. by arresting the process of EVAPORATION of SWEAT.
- High Mortality
- DEATH occurs with in one to two days

HEAT HYPERPYREXIA

SYMPTOMS:

- Dryness of Skin and Mouth
- Extensive Thirst
- Nausea ,Vomiting
- Myalgia
- Mental Confusion, Headache
- Attacks of Faintness
- Rapid Pulse, hypotension,
- Delayed Death 3-4 Days extends upto 7 days

TREATMENT

- Shift to Cooler and well ventilated Place
- Cold Water Sponging
- I/V fluids and electrolyte therapy.
- Antibiotics
- Steroids

HEAT CRAMPS

- Also called ***Miner`s cramps, Stoker`s cramps***.
- The painful spasm of voluntary muscles during physical activity in a hot environment.
- Depletion of salt is main cause.
- Flushing of face and dilatation of pupils occurs.
- Treatment: salt intake in food
- I/v physiological saline.

HEAT EXHAUSTION or Heat prostration / Heat collapse

- Caused by Gradual loss of Water and Salts from body
- Due to Prolonged exposure to Dry, High Environmental Temp
- PULSE weak, Rapid
- RESP- Shallow
- B.P Low
- Temp. - May or may not rise.
- Oliguria
- Death results from heart failure.

TREATMENT

- Rehydration
- Salt Supplements
- Shifting to Cooler Environment

AUTOPSY FINDINGS

- Non Specific
- All Organs Show EDEMA,CONGESTION and PET. HAEMORRHAGES
- Brain congested CEREBRUM Shows Flattening of Gyri
- LUNG carries FROTHY Heamorrhagic FLUID in air passages
- HEART manifests EPI/ENDOCARDIAL Hemorrhages

Hypothermia / EFFECTS OF COLD

- Produced by Prolonged Exposure to Cold.
- Cooling of the body < 95F (35C)
- Causes Failure of Temp Regulation Mechanism.

DEGREES/CLASSIFICATION

- Depending upon the Recorded Temp of the Body and the severity of Symptoms
- DEGREE 1
- 9O-95^{0}F
- Shivering
- Increased Voluntary Activity
- Cutaneous Vasoconstriction

- DEGREE II
- 75-89^{0}F
- Cessation of shivering
- Fall in Basal Metabolic Rate
- Fall in B.P
- Deterioration of Consciousness

- DEGREE III
- 75^0F or Below
- Complete Failure of Temp Regulating Mechanism
- Complete Loss of Consciousness
- Irreversible Fall in Body Temp

CLINICAL FEATURES

- Body cold to touch, stiffing of neck muscles,
- Shallow and irregular resp. movements
- Semiconscious and responding only to painful stimuli.
- hypotension,
- Skin- pallor , red patches over the skin.
- Hemorrhagic tendency- blood stained vomiting and diarrhea
- Chest infection

Local cold injuries

- **Frost bite**: Exposure to dry cold.
- the exposed parts such as ears, nose, fingers and toes may show localized effects.
- Lesions (blisters) may superficial involving skin and subcutaneous tissue.
- Necrosis of tissues.
- Temp. usually below 0C.

- **Immersion foot / trench foot**: prolonged exposure of extremities to cold sea water or cold trenches for many hours produces immersion foot.
- Temp. usually above 0 C.

TREATMENT

- Hospitalization
- O_2 inhalation
- Gradual re-warming
- Antibiotics
- Steroids

AUTOPSY FINDINGS

Mainly due to vasoconstriction and stagnant anoxia

EXTERNAL	INTERNAL
Pink skin Cutaneous erythematous patches on face Gangrene of fingers and toes Edematous face, arms and legs	Congestion of internal organs Focal hemorrhages of pancreas Cardiac dilatation Hemorrhagic erosion of G.I. Mucosa Droplets of fats in liver/ spleen / kidney

Electrical injuries.

- Electric current may be direct or Alternating.
- Alternating current is more dangerous than direct current.
- **Current** 220 –240 volts is domestic supply , usually causes death.
- Less then 50 volts death is uncommon.

KINDS OF ELECTRIC BURNS

- **CONTACT BURN**
- Due to close contact
- POINT OF ENTRY Raised Blister containing GAS or FLUID
- POINT OF EXIT Punctured or lacerated Wound
- **SPARK BURN**
- Due to poor or intermittent contact
- Dry Pitted Lesion Surround by Yellow Parchment Scab
- **FLASH BURN**
- Due to without actual contact with very high voltage, more then 1000 volts.

Electrical burns

- Local whitening
- Zone of hyperemia
- Chain of blisters
- Dried and wrinkled skin
- Scorched and blackened skin.
- Explosively splitting of clothes.

FLASH BURN

- Charring of tissues with carbonisation is common.
- Brownish discoloration of skin.
- Arborescent pattern due to passage of current through blood vessels. (Branches of tree)
- Crocodile skin – multiple spark burns over large areas of skin.

- **Low voltage current injuries:**
- Voltage is less then 1000.
- Causes generalized muscular spasm which cause grasp the conductor firmly.
- Sudden death may occur if the current passes through the heart and respiratory centers.
- The burn area is dry, charred and insensitive.
- Signs of inflammation are devoid and line of demarcation is seen.
- Skin ridges are flattened.
- Metallization may present.

- **High voltage injuries.**
- The voltage is more then 1000.
- Injuries are resembling to bullet, stab or cut wounds.
- Small balls of molten metals may carried deep into tissues, called current pearls.
- Conduction of current through blood stream causes coagulation of blood and blockage of vessels leading to gangrene.

LIGHTNING

- A natural electric discharge in the atmosphere is called lightning or lightning flash.
- It is electric discharge from cloud to earth.
- Lightning has 100-1000 million volts.

- **Charred body and skin Burns**
- **Arborescent marking** due to passage of current through blood vessels. (Branches of tree)
- **Megnitisation** of metallic articles e.g rings, spectacle frames, keys, watches etc. due to tremendous heat.
- Cardiac failure.
- Rupture of tympanic membrane is common.
- Bone fractures.
- Torn clothes

Example of a Lichtenberg figure due to lightning strike.

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POSTMORTEM APPEARANCES:

EXTERNAL	INTERNAL
• Body signs. • Rigor mortis appear soon and pass off quickly.	• Pulmonary hemorrhages • Pulmonary edema. • Parenchymal necrosis • Fracture of bones.