

# Physical Therapy After Upper Leg Injuries

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# Traumatic Lesions In Hip Joint

- Groin injuries
- Hip joint dislocation
- Acetabular fractures
- Proximal femoral fractures

# Groin Injuries

- Distention or a partial rupture of the adductor muscle at the origin
- Common in elite athletes, hockey players
- Weakness of the diaphragm, pelvic floor and abdominal muscles is one of the main reasons for this injury
- Subjective signs include suddenly developed sharp pain at the muscle's origin on the pubic symphysis with referred pain into the abdominal muscles, the groin and the inner aspect of the thigh

# Groin Injuries

- The objective findings include significant pain with palpation at the muscle's origin, reflexive changes in the muscle, and pain with resisted adduction and flexion

# Hip Joint Dislocation

- Belongs among the so called high-energy injuries (car accidents, falls from heights)
- Based on the position of dislocated head, dislocations are classified as **anterior**, **posterior** and **central**
- A posterior dislocation is often accompanied by the breaking away of a piece of the posterior ridge of the acetabulum
- In a central dislocation, the acetabular joint surface breaks through

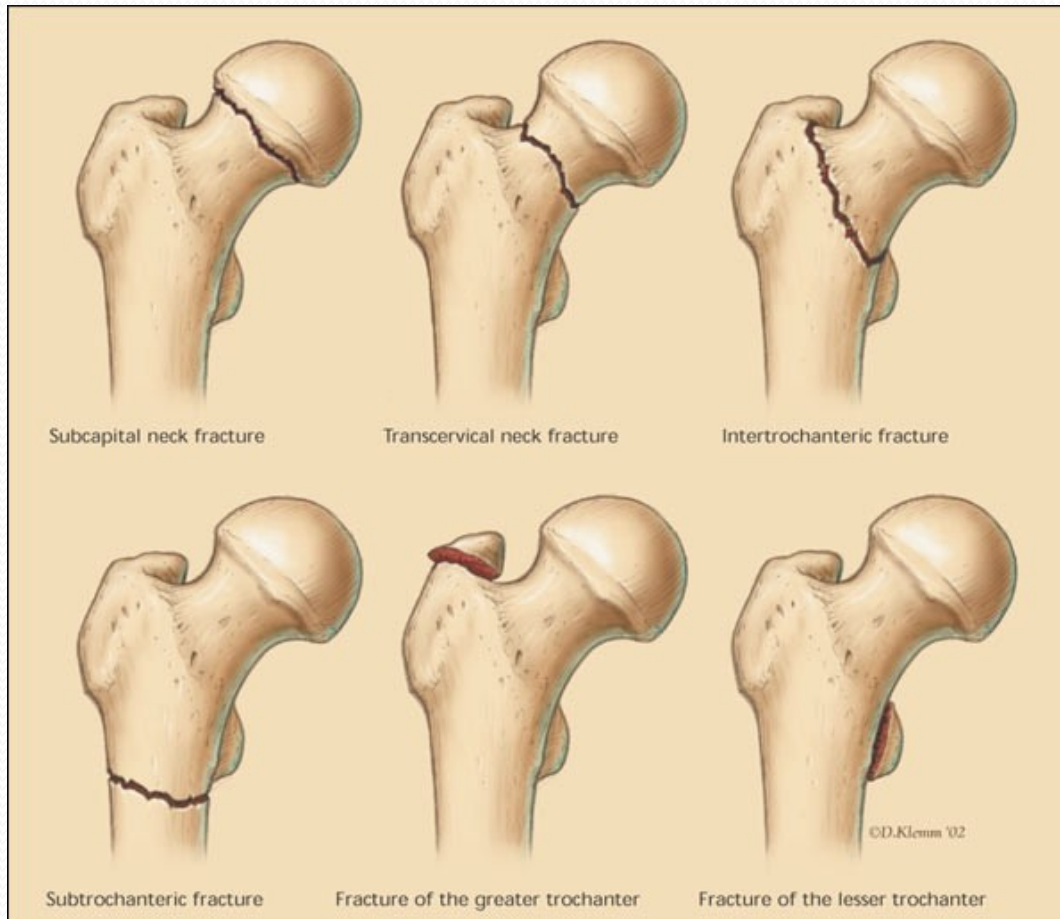
# Proximal Femoral Fractures

- Fractures of the proximal aspect of the femur are the most common fractures at a later age
- They are closely linked to skeletal osteoporosis when only a minimal impact can cause fracture (most often falling on the side)
- Proximal femoral fractures can be classified according to location as **femoral neck fractures**, **trochanteric fractures** and **subtrochanteric fractures**
- This classification is important for the selection of a surgical procedure

# Proximal Femoral Fractures



# Proximal Femoral Fractures, Classification





# Surgical Treatment

- Total endoprosthesis – implantation of total endoprosthesis is the method of choice for some femoral neck fractures (active younger patients)
- Cervicocapital endoprosthesis – used in biologically old and poor-cooperating patients
- Osteosynthesis – PFN, DHS – is indicated in trochanteric and subtrochanteric fractures

# TEP



# CCP



# PFN



# DHS



# Rehabilitation

- Restoration of hip range of motion while maintain hip joint stability is the goal of rehabilitation treatment
- The treatment has to respect the time needed to heal the tissues and the physician's decision regarding the permitted loading of the affected lower extremity
- Rehabilitation is initiated post-surgically and verticalization begins early (sitting 1st or 2nd day post-surgically, standing 2nd day, gait training with assistive devices 3rd day)
- Following osteosynthesis and endoprosthesis, patients follow the decreased weight-bearing status for three months


# Goals of rehabilitation

- Prevention of post-operative complications (pneumonia, deep vein thrombosis)
- Prevention of oedema
- Prevention of deep vein thrombosis
- Prevention of joint stiffness and muscle contractions or weakness of unaffected limbs
- Prevention of deconditioning
- Improvement of bed mobility
- Gait training with assistive devices such as walker, underarm or forearm crutches

# Physical Therapy Approaches

- Cryotherapy (application of ice reduces swelling), limb elevation, balling free parts
- Circulatory exercises (ankle pumps)
- Respiratory rehabilitation
- Active range of motion exercise and resistance exercise unaffected limbs (upper and lower limbs)
- Isometric exercises affected limb
- PROM or AAROM exercise of operated limb
- Continuous passive motion machine CPM



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- Functional mobility training – includes bed mobility and transfer training such as bridging, rolling to the sides, moving up or down the bed - scooting, transitions from lying to sitting in bed or on the edge of bed, from sitting to standing transfers from bed to chair/wheelchair
  - Gait training with assistive devices such as walker, underarm or forearm crutches – it depends on patient condition
  - Stair climbing

- Full weight-bearing or non-weight-bearing (toe-touch weight-bearing, partial weight-bearing 25/50/75%) – recommended by physicians, following type of osteosynthesis or endoprosthesis (PFN – 50% weight-bearing, CCP – more than 50% to full weight-bearing after 10-14 days post-surgery)
- ADL training (washing, dressing)
- Scar care – after stitches extraction
- Instruction patient to follow exercise 3-5 times a day

# Continuous Passive Motion Machine



# Following Rehabilitation


- Self-sufficient patients are discharged from hospital and follow rehabilitation in physiotherapy clinic
- Patients who require 24-hours nurse care, follow therapy and practicing independence in rehabilitation setting

# Goals Of Following Rehabilitation

- decrease oedema
- relieve pain
- improve ROM
- improve muscle strength
- improve or maintain physical fitness
- improve balance, improve coordination
- enable ambulation

# Physical Therapy Approaches

- Modalities – cryotherapy, magnet therapy (promotes fracture healing), hydrotherapy – whirlpool (reduces swelling and relieves pain)
- Soft tissues mobilization (PIR, balling) – to release contracted muscles, tendons and fascia
- Joint mobilization – to restore joint play
- Scare care
- AAROM – active assisted range of motion, AROM – active range of motion
- Resistance exercise to improve muscle strength (overball, theraband, weights)

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- Sensorimotor training – to improve balance skills and joint stability (includes simple exercises such as toe-standing, standing hip flexion, standing side leg raise following modifications doing exercise with eyes closed; balance training aids such as balance discs, unstable platform)
  - Gait training without assistive devices, gait pattern correction
  - Posture correction
  - Aquatic exercises
  - Appropriate sports - stationary bike, cycling, swimming, walking, jogging

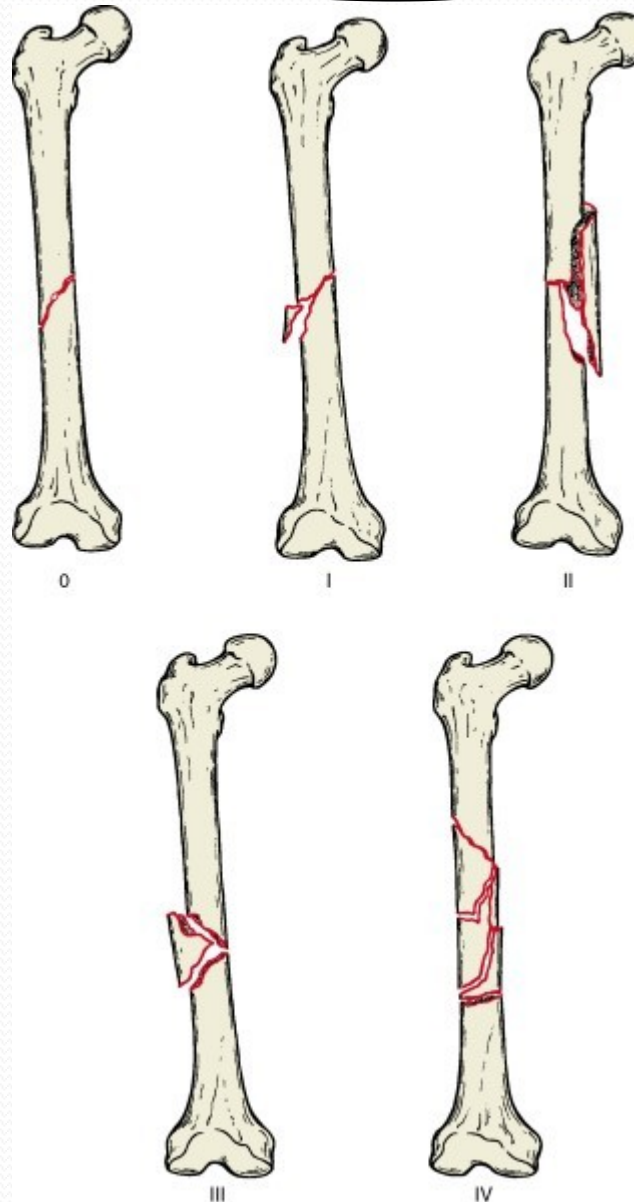
# Femoral Shaft Fractures, Classification

## **Winquist and Hansen Classification**

- Type 0 • No comminution
- Type I • Insignificant amount of comminution
- Type II • Greater than 50% cortical contact
- Type III • Less than 50% cortical contact
- Type IV • Segmental fracture with no contact between proximal and distal fragment



# Winqvist and Hansen Classification



# Mechanism of Femoral Shaft Fractures

- traumatic
  - high-energy
    - most common in younger population
    - often a result of high-speed motor vehicle accidents
  - low-energy
    - more common in elderly
    - often a result of a fall from standing
    - gunshot

# Treatment of Femoral Shaft Fractures

- **SURGICAL treatment**
- Intramedullary nail
- ORIF (open reduction/internal fixation) with plate
- External fixation with conversion to intramedullary nail within 2-3 weeks

# Intramedullary Nail



# Rehabilitation

- Rehabilitation program follows as the same rules as rehabilitation after the proximal femoral fractures
- Cryotherapy (application of ice reduces swelling), limb elevation, balling free parts
- Circulatory exercises (ankle pumps)
- Respiratory rehabilitation
- Active range of motion exercise and resistance exercise unaffected limbs (upper and lower limbs)
- Isometric exercises affected limb
- PROM or AAROM exercise of operated limb
- Continuous passive motion machine

# Rehabilitation

- Functional mobility training – includes bed mobility and transfer training such as bridging, rolling to the sides, moving up or down the bed -scotting, transitions from lying to sitting in bed or on the edge of bed, from sitting to standing transfers from bed to chair/wheelchair
- Gait training with assistive devices such as walker, underarm or forearm crutches (during healing with toe touch WB with progression to PWB and FWB within 8 weeks)
- Stair climbing
- ADL training (washing, dressing)
- Scar care – after stitches extraction
- Instruction patient to follow exercise 3-5 times a day

# Knee Injuries

- The most common sports injuries to the knee involve ligament tears or meniscus lesions
- Small tears can be treated conservatively by a period of immobilization followed by a controlled ROM program, strengthening and proprioception exercises
- However, complete ligamentous ruptures and meniscus lesions may require surgical intervention

# Rehabilitation Following Meniscal Injuries and Repairs

- Quite common injury
- Caused by either traction or compression force and usually occurs when the knee is flexed and rotated
- Exercise activities including football, tennis, squash, skating, skying
- Currently, meniscal tears are treated orthopedically by an early arthroscopic intervention
- Surgical treatment involves **total meniscectomy**, **partial meniscectomy** and **meniscal repair**



# Rehabilitation Following Meniscal Injuries and Repairs

- The rehabilitation program most commonly used contains five functional phases
- The length of the program is variable, it takes weeks or months, it depends on the type of injury, surgical techniques and patient's motivation
- Rehabilitation after arthroscopic surgery for partial or total meniscectomy is rapid. Patients ambulate with crutches PWB with rapid progression to FWB (within 1 week)

## Phase I – Early Protective Mobilization

- Begins immediately after the arthroscopic procedure
- The goal – prevention of soft tissue adhesions, maintain capsular mobility and nutrient supply to the joint structures, reduce pain and edema (which inhibit muscle activity and decrease muscle strength – such as reflexive weakness of quadriceps femoris)
- Modalities – cryotherapy to reduce edema and pain, electrotherapy (IF, TENS) for pain modulation, magnetic therapy to promote healing soft tissues
- Soft tissue mobilization on the thigh and manual lymphatic drainage

# Phase I – Early Protective Mobilization

- Exercises to maintain joint ROM – PROM, CPM, AAROM, AROM
- The distal aspect of the lower extremity is activated as soon as possible to maintain proprioceptive signals from this area and to maintain muscle strength
- The exercise position (lying, sitting, standing) is selected based on weight-bearing restrictions
- Progression from PWB to FBW depends on surgical procedure and the degree of protection needed
- After partial meniscectomy – fast progression from PWB to FBW within 1 week

# Phase I

- Meniscal suture requires the exact rehabilitation program, guidelines need to be followed – limited ROM, during the healing phase toe touch WB, in approximately 4 weeks PWB with progression to FWB after 6 weeks, exercises in the horizontal position, after 4 weeks stabilization exercises in sitting

## Phase II – Neuromuscular Proprioceptive Training

- NPT is an integral part of the rehabilitation program in patients with a meniscal injury
- Meniscus function is biomechanically reinforced by their relationship with the quadriceps femoris, semimebranosus and the popliteus muscles
- The menisci don't function in isolation from the dynamic stabilizers
- It's important to restore soft tissue flexibility together with neuromuscular proprioception and coordination to restore joint function and to prevent future injuries

## Phase II

- Neuromuscular proprioceptive training – to improve balance skills and joint stability (includes simple exercises such as toe-standing, standing hip flexion, standing side leg raise following modifications doing exercise with eyes closed; balance training aids such as balance discs, unstable platform)
- Initiation of these exercises even prior reaching of full ROM
- This exercising stimulates quadriceps and hamstrings co-contraction and stabilizes the knee joint

## Phase III – Strengthening of the Dynamic Stabilizers

- The criteria to initiate this phase include full and pain-free knee ROM, controlled co-contraction of the dynamic stabilizers, no edema
- Closed kinetic chain exercises are preferred with the elimination of full knee flexion
- Follow these principles as long as possible

## Phase IV – Functional Training

- Directed rehabilitation ends during this phase
- To improve muscle strength, endurance, neuromuscular proprioceptive abilities
- Muscle strengthening, closed-kinetic chain exercises, sensorimotor training
- In general, repetitive movements with heavy loads should be minimized



## Phase V – Return to Common Activities

- Return to full level of activity is allowed when the patient achieves pre-injury condition
- Prevention of new injuries – knee strength, endurance and dynamic stabilization need to be maintained
- Correction of body posture – posture plays an important role in the prevention of a knee joint injury during all movement activities

# Meniscal Lesions Rehabilitation Exercises

**A B C difficulty**

**1. Pelvic lift** **Position:** Lying supine, legs on Swiss ball **Purpose:** Improve core stability and strength

Lift/lower pelvis from floor

Unilateral pelvic lift

Pull ball towards you...  
...and back again while keeping the pelvis lifted

**2. Sliding and stepping lunge** **Position:** Standing, with or without hand support, on even or uneven surface **Purpose:** Functional exercise for the lower extremity

**3. Step up** **Position:** Standing in front of step-board, with or without hand support **Purpose:** Functional exercise for the lower extremity simulating stair climbing

Step-up and step-down on lower (dashed line) or higher step-board

**4. Chair stands and squat** **Position:** Seated or standing position, with or without hand support **Purpose:** Functional exercise for the lower extremity, resembling rising/sitting

Stand up and sit down putting equal load on legs

Squat

Single-leg squat

ILLUSTRATION: CARIN CARLSSON / WWW.HITBOLAGET.SE

## Meniscal Tear Rehabilitation Exercises

Passive knee extension

Heel slide

Standing calf stretch

Hamstring stretch on wall

Straight leg raise

Prone hip extension

Chair exercise

Wall squat with a ball

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# Rehabilitation Following Medial Collateral Ligament Injury

- The ligaments belong among a group of passive stabilizers of the knee and their injury significantly affects knee stability
- In general, it doesn't matter which treatment (conservative or surgical) the orthopedist or the traumatologist selects, the following rehabilitation is very important
- Well timed rehabilitation treatment begins immediately following the injury
- Caused by a direct external force directed at the lateral aspect of the thigh or the lower leg (86%) or by a non-contact activity improving a valgus force
- Often, direct MCL injury is accompanied by an ACL and medial meniscus injury

# Phase I

- Goal – reduce pain, edema and inflammation
- Cryotherapy and compression – cold decreases pain and compression limits edema formation and increases perception of stability
- From the beginning, ROM is restored (maintained), especially extension
- Maintenance of soft tissue mobility surrounding the joint and patellar mobility in all directions
- The treatment of contractile and non-contractile soft tissues to restoring joint mobility
- Assistive devices (crutches, brace) are used in case presence of the knee instability and an antalgic gait pattern
- Criteria to progress to the next phase include the absence of edema, active knee ROM 0-90°, the ability to perform a basic quadriceps contraction

## Phase II

- The main goal is increasing lower extremity strength (especially the extensor group)
- Active strengthening exercises in sitting, standing on both and later on one lower extremity on a firm surface and then, when sufficient stability is achieved, progress to unstable surfaces and balls
- Increasing of strength and coordination abilities of the dynamic stabilizers
- Increasing of co-contraction synergy level of the thigh muscles

## Phase III

- Goal – patient's return to functional activities
- Closed kinetic chain strengthening exercises while utilizing equipment (leg-press)

# Rehabilitation Following Anterior Cruciate Ligament Injury and Reconstruction

- An anterior cruciate ligament (ACL) injury affects knee joint function and stability
- Typical sports activity- skiing, tennis, squash
- The main symptoms – perception of instability, joint inefficiency, repeated occurrences of the joint giving way and recurrent joint swelling
- The injury is often accompanied by a medial meniscus injury and MCL tear (unhappy triad)
- Insufficiently treated instability leads to an early onset of gonarthrosis

# Rehabilitation Following Anterior Cruciate Ligament Injury and Reconstruction

- Arthroscopy allows for accurate diagnosis as well as successful treatment
- A perfect reconstruction of this ligament with flawless graft centralization is essential for correct function of the implanted ligament
- Knee immobilization is not needed and the joint can be mobilized starting one day after surgery to prevent secondary damage on the connective tissue system
- The most commonly used grafts include a section of patellar tendon stabilized by interferential screws or semitendinosus or gracilis graft



# Rehabilitation Following Anterior Cruciate Ligament Injury and Reconstruction

- Early ligament reconstruction effects long-term longevity of the knee joint
- Postponing surgery or permanent lack of ACL increase the risk of other intra-articular damage, especially in active and athletic individuals

# Actual Rehabilitation Program

- The rehabilitation protocol is divided into 5 phases
- The entire program begins with the pre-operative stage
- The second phase begins during the actual reconstruction and ends within 14 days of reconstruction
- The third phase includes the third, fourth and fifth week following reconstruction
- The fourth phase is the time period up to eight weeks post reconstruction
- The fifth, final phase smoothly follows after the prior phase and it is completed by a full, functional return to (mainly) sports activities

# Actual Rehabilitation Program

- The time-based classification and the suggested course of the entire rehabilitation process depends on the following: type of surgery, patient motivation, patient's body healing potential, patient's prior movement experience, degree of the patient's intramuscular coordination, physiotherapist knowledge

## Phase I – Pre-Operative Phase

- Rehabilitation begins at the time of the injury
- Rehabilitation of the soft tissues of the knee
- The goal – edema control and maintenance of full ROM
- Cold application with compression to relieve pain and to prevent intra-articular bleeding, to increase knee ROM (especially full extension)
- PROM, frequent positioning, relaxation of the muscles on the dorsal aspect of the thigh and active exercises
- To maintain joint flexion, the same methods and exercises are used as in post-operative phase

## Phase I – Pre-Operative Phase

- When the acute post-injury phase subsides – restoring gait pattern and muscle function
- Patients usually ambulate with crutches and a brace
- Stabilization exercises and strength training (when patients are able to ambulate without crutches, without limping)
- Closed-kinetic chain exercises
- The goal is to prepare the patient for reconstructive surgery – no edema, normal ROM, normal gait pattern

## Phase I – Pre-Operative Phase

- It is important to time the surgery well – it's not recommended performing the reconstruction earlier than three months after the initial trauma – full healing of the soft tissues of the knee needs to be allowed and to minimize post-operative complications such as edema, prolonged joint mobility limitation, prolonging of rehabilitation
- Instruction the patient to all methods and techniques used during post-operative treatment

## Phase II (0-2 weeks post-surgery)

- The most important time period during the entire rehabilitation program
- **Accelerated rehabilitation** includes five important parameters:
- **Maintain full extension**
- **Control post-operative edema by rest and elevation of the lower extremities**
- **Allow surgical incision healing**
- **Maintain quadriceps activity**
- **Achieve 90° of knee flexion at the end of this period**

## Phase II

- Cryotherapy (cold pack application), elevation of the lower extremity
- When the Redon drain is removed - CPM at 0-30° of range
- Patellar mobilization, soft tissues mobilization surround the knee joint, lymphatic drainage
- Isometric contraction of the extensors
- Using a large ball for positioning and performing flexion-extension ROM
- The patient is discharged to home the third or fourth day following surgery, educated to follow exercises at home



## Phase II

- In the second half of phase II guided rehabilitation by physiotherapist in physiotherapy clinic is initiated
- Soft tissues mobilization
- Non-forceful passive movement to increase range (flexion/extension)
- Inhibition techniques to decrease hamstrings tension
- Patellar mobilization
- The patient is instructed in a home program (isometric contraction of the knee extensors, active exercises with the knee extended through minimal ranges in all planes, self-massage of the thigh muscles)
- Ambulation with crutches and a short knee brace with range restricted to 30-60° to improve stability
- The criteria for progression to the next stage include 90° flexion and minimal edema, full extension

## Phase III (3-5weeks)

- Progression toward greater knee flexion is continued
- Scar mobilization, soft tissues mobilization surrounding the knee joint
- Stabilization exercises in sitting, standing on the floor with symmetrical bilateral lower extremity weightbearing, exercises with ball
- Stationary bicycle (after 100-110° knee flexion is reached)
- Hydrotherapy –whirpool, aquatic therapy in a pool
- At the end of this phase – no edema, normal gait pattern and nearly normal joint stability
- The graft is still at a high a risk of injury when exposed to shear and compressive forces

## Phase IV (6-8 weeks)

- Sensorimotor training – coordination and strengthening exercises on unstable surfaces – balance discs, trampoline, balls
- Closed kinetic chain exercises (mini-squat, leg-press, step ups)
- The exercises should not cause pain, lead to edema
- At the end of week 8 post-surgery, outpatient physical therapy is completed

## Phase V (from completed week 8)

- The patient is instructed in following exercises at home
- Return to full level of activity (to prevent repeated loading the knee flexion greater than  $60^\circ$ )
- Prevention of new injuries – knee strength (CKC exercises), endurance and dynamic stabilization need to be maintained
- Correction of body posture – posture plays an important role in the prevention of a knee joint injury during all movement activities