



Akram Sport Med

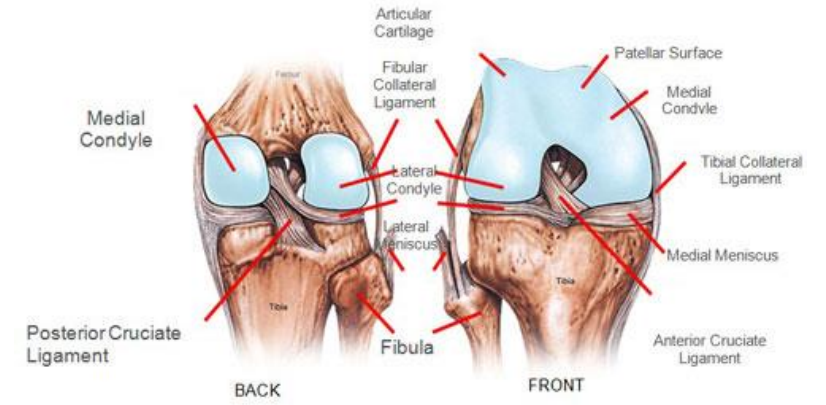
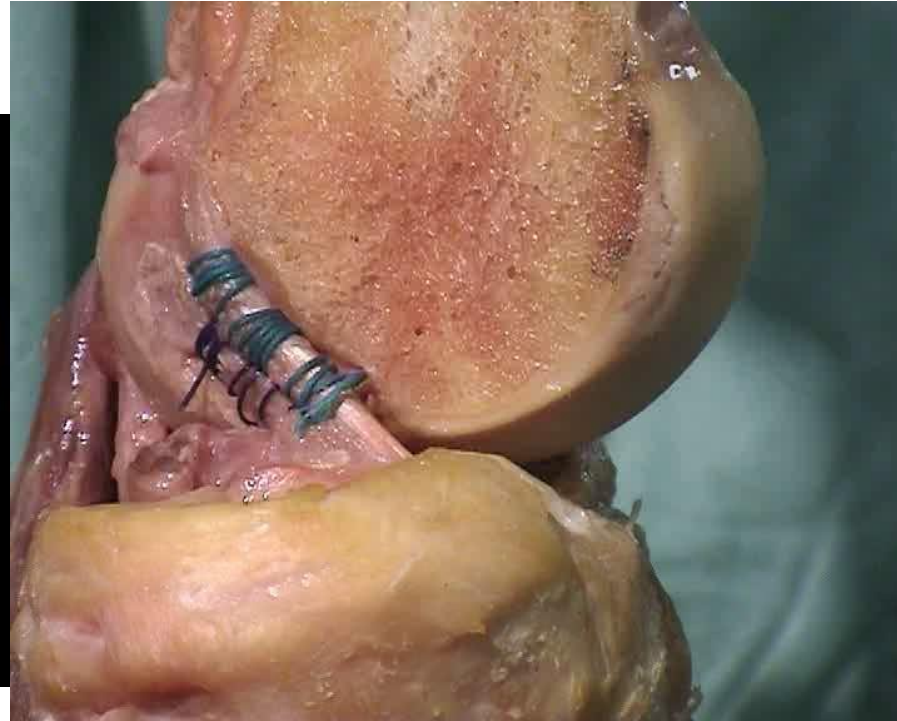
Knee injuries in sports overview

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Anatomy

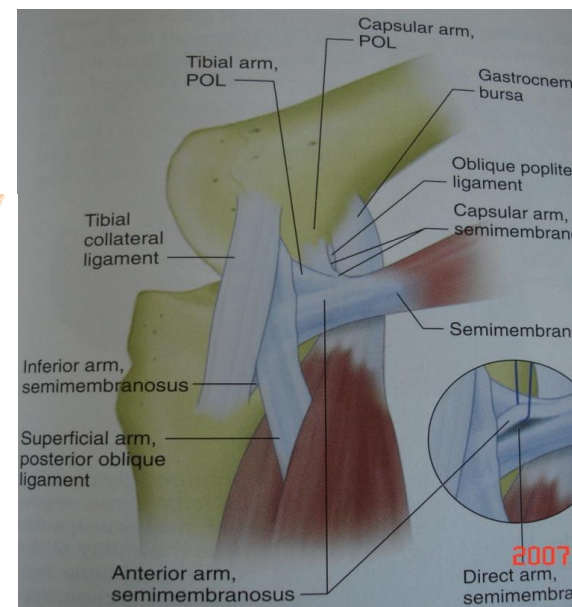
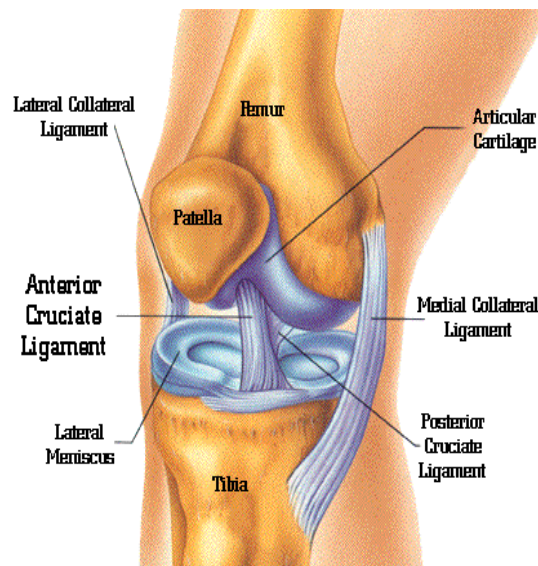


Anatomy

Medial structures

- MCL
- POL postero-medial capsular ligament

Augmented by dynamic effect of Semimembranosus tendon



Importance of lateral structures

Frank Noys, La-Prade, and many others

Lateral structures:

- Ilio tibial band, FCL, PT, PFL, Arcuate Complex,

Antero Lateral Capsular Ligament.

have contribution in withstanding against anterior translation and internal rotation.

- Exaggerated stress on ACL graft in PLC insufficiency.



BIOMECHANICS

Tibial rotation better controlled by collateral ligaments & capsular structures. *Noyes FR*

MCL provides resistance to anterior drawer test only after ACL is gone *shoemaker SC*

Combined ACL & MCL injury further compromise anterior stability. *Sullivan D*



Prevalence

In a meta analysis

Chowick. Prodromos, MD, et al 2007

- Female male ratio in basketball & soccer 3/1
- In alpine ski : the same
- In female athletes the injury preventive exercises are successful in soccer but not in basketball



Alpine Skiing Injuries

A Nine-Year Study

Davidson TM, Laliotis AT: Alpine skiing injuries-A nine-year study. West J Med 1996; 164:310-314)



A total of 24,340 injuries were reported for the 9 seasons

The overall injury rate was 2.6 injuries per 1,000 skier days and increased slowly over the period studied.

The knee was the most frequently injured area at 35% of all injuries.

The increasing trend in lower extremity, particularly knee, injury rates highlights the need for continued skier education and equipment

- 1.



Epidemiology of athletic knee injuries: A 10-year study

M. Majewski a,^{*}, Habelt Susanne b,¹, Steinbrück Klaus c,²

M. Majewski et al. / The Knee 13 (2006) 184–188



Epidemiology of athletic knee injuries: A 10-year study

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6434 patients (37%) had 7769 injuries (39.8%) related to the knee joint. 68.1% of those patients were men and 31.6% were women. Almost 50% of the patients were between the ages of 20–29 (43.1%) at the time of injury. The injuries documented were ACL lesion (20.3%), medial meniscus lesion (10.8%), lateral meniscus lesion (3.7%), MCL lesion (7.9%), LCL lesion (1.1%), and PCL lesion (0.65%). The activities leading to most injuries were soccer (35%) and skiing (26%)

Risk factors for injuries in alpine skiing, telemark skiing and snowboarding – case-control study

Steinar Sulheim,^{1,2} Ingar Holme,² Andreas Rødven,³ Arne Ekeland,⁴ Roald Bahr²

Sulheim S, Holme I, Rødven A, et al. Br J Sports Med (2011).



Results

The overall injury risk was increased among beginners

Snowboarders had a higher overall injury risk than skiers,

Alpine skiers; children and adolescents were prone to lower leg fractures.

Knee injuries occurred more frequently among alpine skiers, females and beginners

telemark skiers and adults had an increased risk for shoulder injuries.

Conclusions

Snowboarders, beginners, children and adolescents had an increased injury risk.



Risk Factors

- Poor landing + pivot style
- Stronger quads than hamstrings
- Shoe / playing surface interface
- Playing surface quality
- Female gender
- Family predisposition



Risk Factors

- Hamstring/Quadriceps imbalance
- Poor hamstring strength
 - Hamstrings protect ACL
 - Quads stretch/stress ACL
- Slow activation of hamstring muscles with pivot / landing



Risk Factors

- Uneven playing surface
 - Unexpected foot position may change muscle activation patterns
 - Balance thrown off

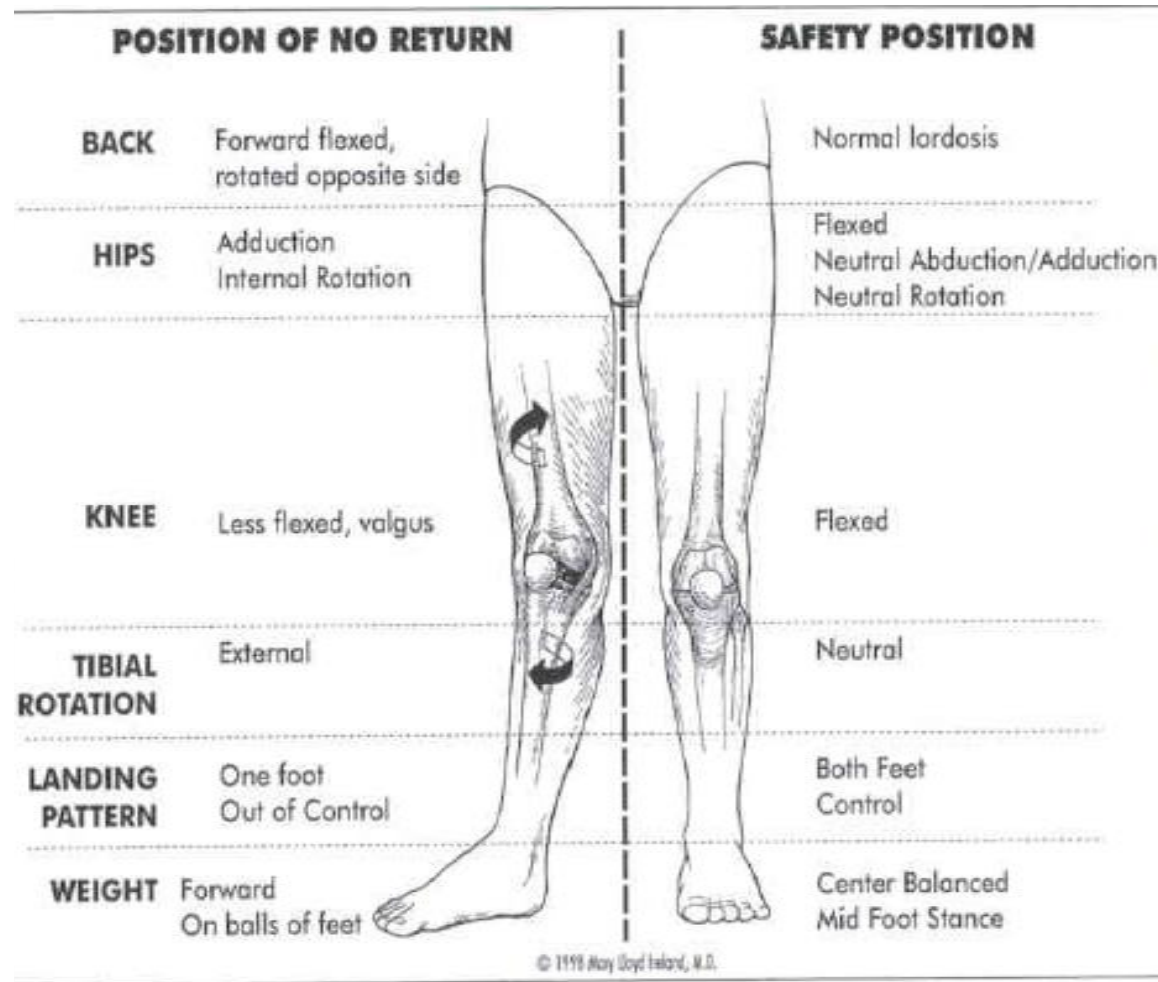


Female Gender Risk Factors

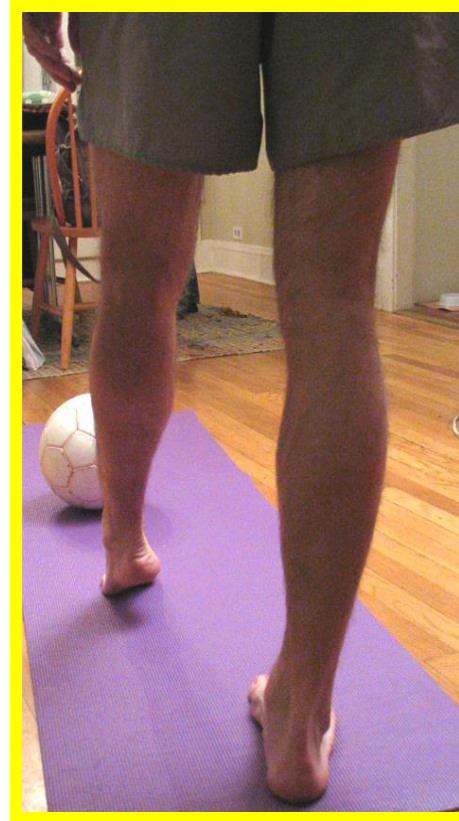
- 2-8x more common in girls
- Poor ham:quad strength
- Activate hams more slowly
- Land with knees slightly bent
 - *Boys land with knees more bent*



Lower limb malignment



Risk Factors





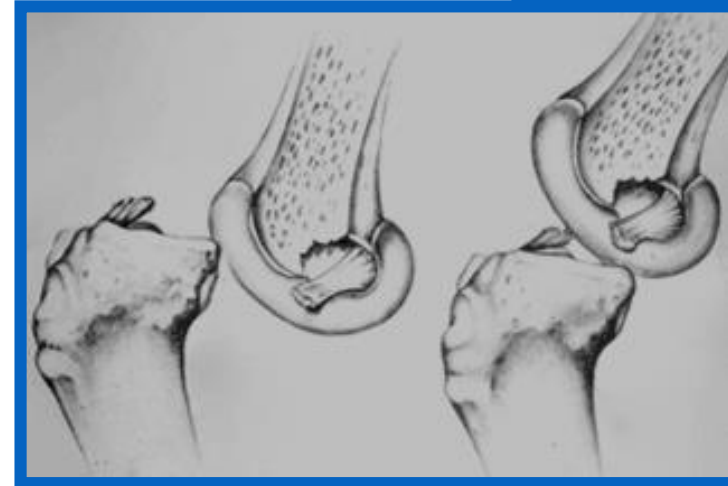
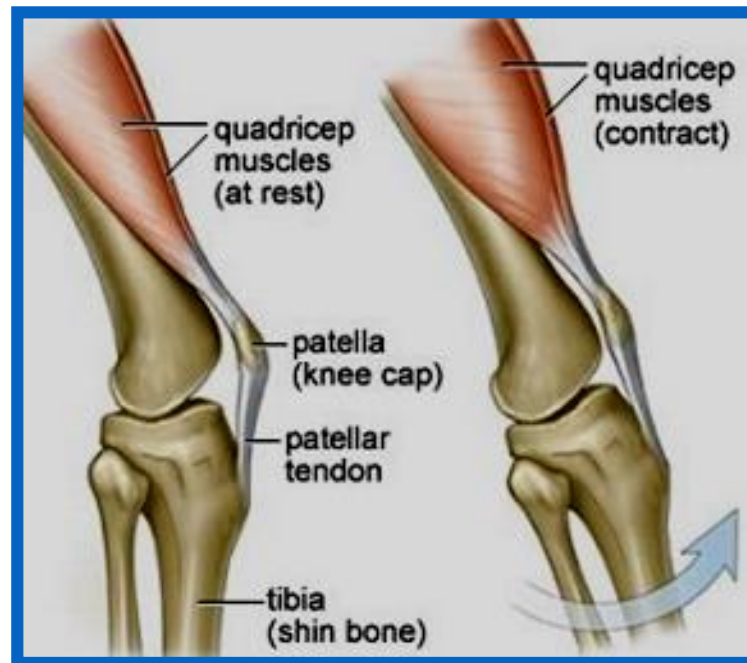
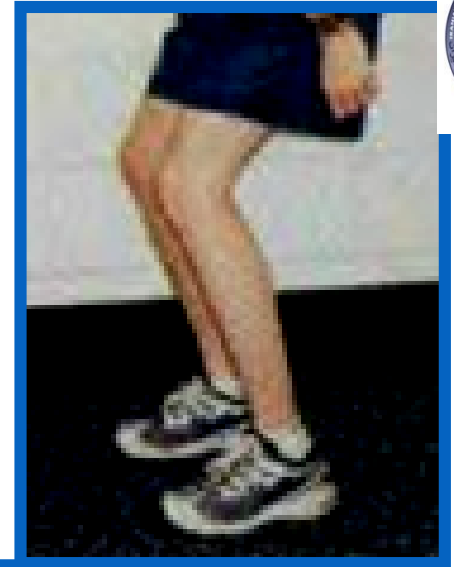
Mechanism

- Pivoting with knee slightly bent, twisting knee
 - Landing from jump: knees slightly bent, quads pull tibia forward
 - Too much shoe traction
 - Poor balance
- neven ground throwing off balance



Mechanism: landing

- slightly flexed on landing
- Quad pulls tibia forward



Mechanism: Contact

- Hit on outside of leg
- Foot planted
- Twisting of knee



Mechanism of injury

Deceleration + change of direction, foot planted

- Contact injuries
- Non-contact injuries: pivoting, cutting, Landing , Landing & stepping, deceleration

56% of Australian football injuries are non-contact during deceleration and sidestepping while knee is close to extension.

Jodie L . Cohrance et al 2006



Mechanisms of ACL Injuries



Prevention Training Programs

- Aim:
 - Change landing / pivoting patterns
 - Flex knees more
 - Stop over several steps instead of sudden stop
 - Improve hamstring strength + activation
- BOTH prevent ACL + other serious knee injury by achieving these aims



Proper Landing

Before Training



After training



PROPRIOCEPTIVE TRAINING

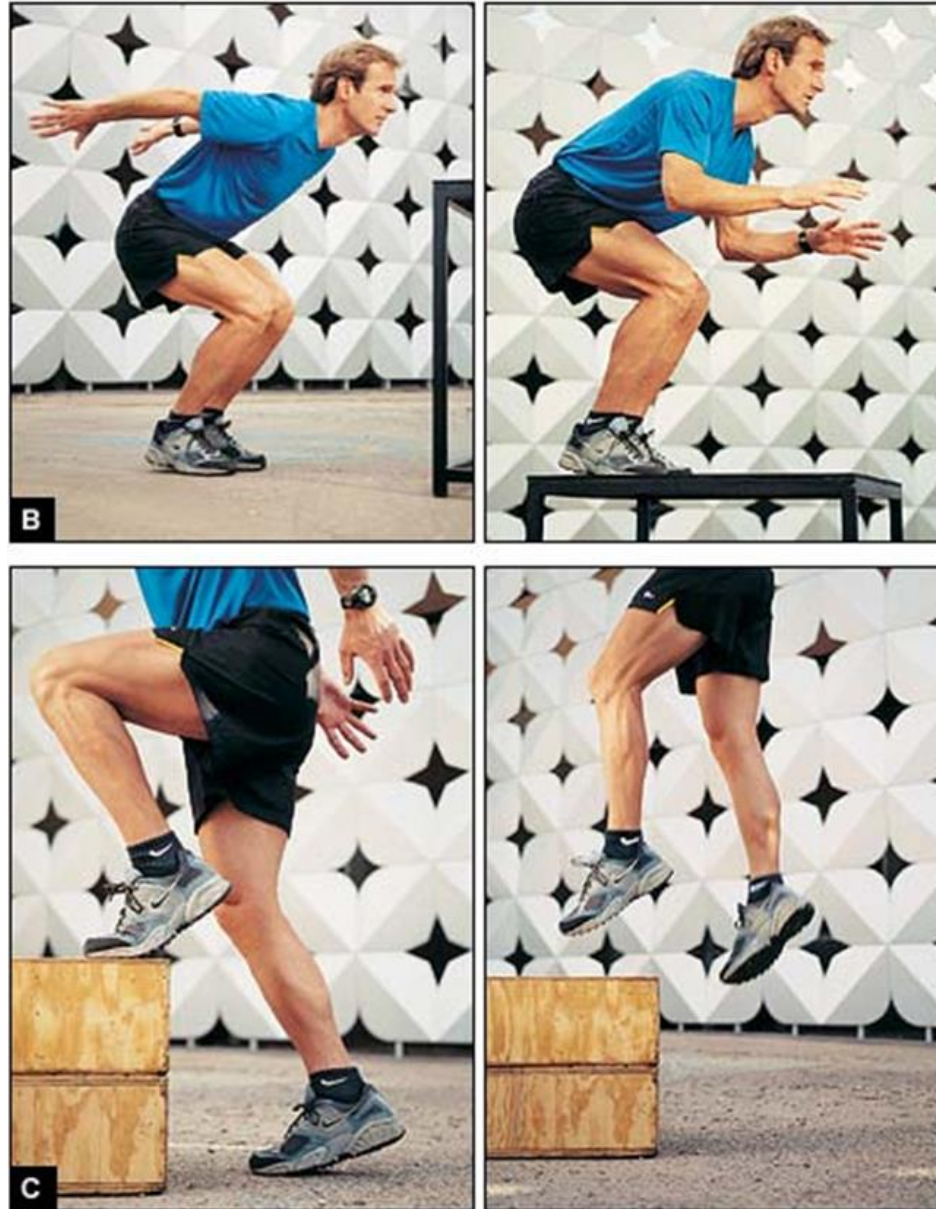


Training Programs for ACL Prevention

- Balance board training
 - Improves balance + joint position sense
 - 20 min training sessions
 - 87% ↓ ACL injuries
 - 7x ↓ injury



Plyometric EXE



Prevention Traditional plays



The 11+

PART 1 RUNNING EXERCISES · 8 MINUTES



1 RUNNING STRAIGHT AHEAD

The course is made up of 6 to 10 pairs of parallel cones, approx. 5-6 m apart. You always start at the lower cone from the first pair of cones. Jog together to the next pair of cones. On the way back, you can increase your speed progressively as you warm up. 2 sets



4 RUNNING CIRCLING PARTNER

Run forwards as a pair to the first set of cones. Shuffle sideways by 90 degrees to meet at the middle. Shuffle an entire circle around one another and then return back to the cones. Repeat for each pair of cones. Remember to stay on your toes and keep your centre of gravity low by bending your hips and knees. 2 sets



2 RUNNING HIP OUT

Walk or jog slowly, stepping at each pair of cones to lift your knee and rotate your hip outwards. Alternate between left and right leg at successive cones. 2 sets



5 RUNNING SHOULDER CONTACT

Run forwards in pairs to the first set of cones. Shuffle sideways by 90 degrees to meet in the middle then jump sideways towards each other to make shoulder-to-shoulder contact. Repeat for each pair of cones. Note: Make sure you land on both feet with your hips and knees bent. Do not let your knees buckle inwards. Make it a full jump and synchronise your timing with your team-mate as you jump and land. 2 sets



3 RUNNING HIP IN

Walk or jog slowly, stepping at each pair of cones to lift your knee and rotate your hip inwards. Alternate between left and right leg at successive cones. 2 sets



6 RUNNING QUICK FORWARDS & BACKWARDS

As a pair, run quickly to the second set of cones then run backwards quickly to the first pair of cones keeping your hips and knees slightly bent. Keep repeating the drill, running two cones forwards and one cone backwards. Remember to take small, quick steps. 2 sets

PART 2 STRENGTH · PLYOMETRICS · BALANCE · 10 MINUTES

LEVEL 1



7 THE BENCH STATIC

Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders. Exercise: Lift your back legs, supported on your forearms, and pull your stomach in. Lift each leg in turn, holding for a count of 2 sec. Continue for 20-30 sec. Your body should be in a straight line. Try not to sway or arch your back. 3 sets



8 SIDWAYS BENCH STATIC

Starting position: Lie on your side with the knee of your foremost leg bent to 90 degrees. Support your upper body by resting on your forearm and knee. The elbow of your supporting arm should be directly under your shoulder. Exercise: Lift your uppermost leg and hip until your shoulder, hip and knee are in a straight line. Hold the position for 20-30 sec. Take a short break, change sides and repeat. 3 sets on each side.



9 HAMSTRINGS BEGINNER

Starting position: Kneel on a soft surface. Ask your partner to hold your ankles down firmly. Exercise: Your body should be completely straight from the shoulder to the knee throughout the exercise. Lean forward as far as you can, controlling the movement with your hamstrings and your gluteal muscles. When you can no longer hold the position, gently raise your weight on your hands, falling into a push-up position. Complete a minimum of 3-5 repetitions and/or 60 sec. 1 set



10 SINGLE-LEG STANCE HOLD THE BALL

Starting position: Stand on one leg. Exercise: Balance on one leg whilst holding the ball with both hands. Keep your body weight on the ball of your foot. Remember: Try not to sway or arch your back. Hold for 20 sec. Change legs and repeat. The exercise can be made more difficult by passing the ball around your waist and/or under your other knee. 2 sets



11 SQUATS WITH TOE RAISE

Starting position: Stand with your feet hip-width apart. Place your hands on your hips if you like. Exercise: Imagine that you are about to sit down on a chair. Perform squats by bending your hips and knees to 90 degrees. Do not let your knees buckle inwards. Descend slowly then straighten up more slowly. When your legs are completely straight, stand up on your toes then slowly lower down again. Repeat the exercise for 30 sec. 2 sets



12 JUMPING VERTICAL JUMPS

Starting position: Stand with your feet hip-width apart. Place your hands on your hips if you like. Exercise: Imagine that you are about to sit down on a chair. Bend your legs slowly until your knees are flexed to approx. 90 degrees, and hold for 2 sec. Do not let your knees buckle inwards. From the squat position, jump up as high as you can. Land softly on the balls of your feet with your hips and knees slightly bent. Repeat the exercise for 30 sec. 2 sets

LEVEL 2



7 THE BENCH ALTERNATE LEGS

Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders. Exercise: Lift your back legs, supported on your forearms, and pull your stomach in. Lift each leg in turn, holding for a count of 2 sec. Continue for 20-30 sec. Your body should be in a straight line. Try not to sway or arch your back. 3 sets



8 SIDWAYS BENCH RAISE & LOWER HIP

Starting position: Lie on your side with both legs straight. Lean on your forearm and the side of your foot so that your body is in a straight line from shoulder to foot. The elbow of your supporting arm should be directly beneath your shoulder. Exercise: Lower your leg to the ground and raise it back up again. Repeat for 20-30 sec. Take a short break, change sides and repeat. 3 sets on each side.



9 HAMSTRINGS INTERMEDIATE

Starting position: Kneel on a soft surface. Ask your partner to hold your ankles down firmly. Exercise: Your body should be completely straight from the shoulder to the knee throughout the exercise. Lean forward as far as you can, controlling the movement with your hamstrings and your gluteal muscles. When you can no longer hold the position, gently raise your weight on your hands, falling into a push-up position. Complete a minimum of 7-10 repetitions and/or 60 sec. 1 set



10 SINGLE-LEG STANCE THROWING BALL WITH PARTNER

Starting position: Stand 2-3 m apart from your partner, with each of you standing on one leg. Exercise: Keeping your balance, and with your stomach held in, throw the ball to one another. Keep your weight on the ball of your foot. Remember: Keep your knee just slightly flexed and try not to let it buckle inwards. Keep going for 30 sec. Change legs and repeat. 2 sets



11 SQUATS WALKING LUNGES

Starting position: Stand with your feet at hip-width apart. Place your hands on your hips if you like. Exercise: Lunge forward slowly at an even pace. As you lunge, bend your leading leg until your hip and knee are flexed to 90 degrees. Do not let your knee buckle inwards. Try to keep your upper body and hips steady. Lunge your way across the pitch (approx. 10 times on each leg) and then jog back. 2 sets



12 JUMPING LATERAL JUMPS

Starting position: Stand on one leg with your upper body bent slightly forward from the waist, with knees and hips slightly bent. Exercise: Jump approx. 1 m sideways from the supporting leg on to the free leg. Do not let your knees buckle inwards. Repeat the exercise for each leg opposite arms and leg. Try not to let your leading leg cross the midline of your body or let your knees buckle inwards. Repeat the exercise until you reach the other side of the pitch, then jog back to recover. 2 sets

LEVEL 3



7 THE BENCH ONE LEG LIFT AND HOLD WITH LEG LIFT

Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders. Exercise: Lift your back leg, supported on your forearms, and pull your stomach in. Lift one leg about 10-15 cm off the ground, and hold the position for 20-30 sec. Your body should be straight. Do not let your opposite hip dip down and do not sway or arch your lower back. Take a short break, change legs and repeat. 3 sets



8 SIDWAYS BENCH WITH LEG LIFT

Starting position: Lie on your side with both legs straight. Lean on your forearm and the side of your foot so that your body is in a straight line from shoulder to foot. The elbow of your supporting arm should be directly beneath your shoulder. Exercise: Lift your uppermost leg up and slowly lower it down again. Repeat for 20-30 sec. Take a short break, change sides and repeat. 3 sets on each side.



9 HAMSTRINGS ADVANCED

Starting position: Kneel on a soft surface. Ask your partner to hold your ankles down firmly. Exercise: Your body should be completely straight from the shoulder to the knee throughout the exercise. Lean forward as far as you can, controlling the movement with your hamstrings and your gluteal muscles. When you can no longer hold the position, gently raise your weight on your hands, falling into a push-up position. Complete a minimum of 12-15 repetitions and/or 60 sec. 1 set



10 SINGLE-LEG STANCE TEST YOUR PARTNER

Starting position: Stand on one leg opposite your partner and at arm's length apart. Exercise: Whilst you both try to keep your balance, each of you turn twice to push the other off balance in different directions for 20-30 sec. Remember: Keep your knee just slightly flexed and prevent your knee from buckling inwards. Continue for 30 sec. Change legs and repeat. 2 sets



11 SQUATS ONE-LEG SQUATS

Starting position: Stand on one leg, loosely holding onto your partner. Exercise: Slowly lower your knee as far as you can manage. Concentrate on preventing the knee from buckling inwards. Bend your knee slowly then straighten it slightly more quickly. Repeat the exercise 10 times on each leg. 2 sets



12 JUMPING BOX JUMPS

Starting position: Stand with your feet hip-width apart. Imagine that there is a cross marked on the ground and you are standing in the middle of it. Exercise: Alternate between jumping forwards and backwards, from side to side, and diagonally across the pitch. Jump as quickly and explosively as possible. Your knees and hips should be slightly bent. Land softly on the balls of your feet. Do not let your knees buckle inwards. Repeat the exercise for 30 sec. 2 sets

PART 3 RUNNING EXERCISES · 2 MINUTES



13 RUNNING ACROSS THE PITCH

Run across the pitch, from one side to the other, at 75-80% maximum pace. 2 sets



14 RUNNING BOUNDING

Run with high bounding steps with a high knee lift, landing gently on the ball of your foot and sprint 1-2 steps at high speed (80-90% maximum pace) before you decelerate and do a new plant & cut. Do not let your knee buckle inwards. Repeat the exercise until you reach the other side of the pitch, then jog back to recover. 2 sets



15 RUNNING PLANT & CUT

Jog 4-5 steps, then plant on the outside leg and cut to change direction, decelerate and sprint 1-2 steps at high speed (80-90% maximum pace) before you decelerate and do a new plant & cut. Do not let your knee buckle inwards. Repeat the exercise until you reach the other side, then jog back. 2 sets



KNEE POSITION CORRECT



KNEE POSITION INCORRECT



Expected goals of treatment

Stable

Painless

Supple

Functional knee

Normal enough to withstand early DJD



Patient Specific Approach

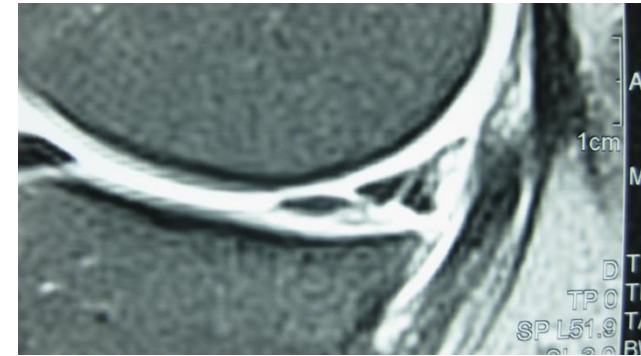
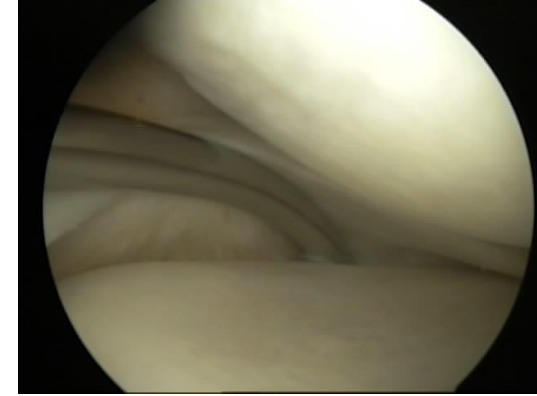
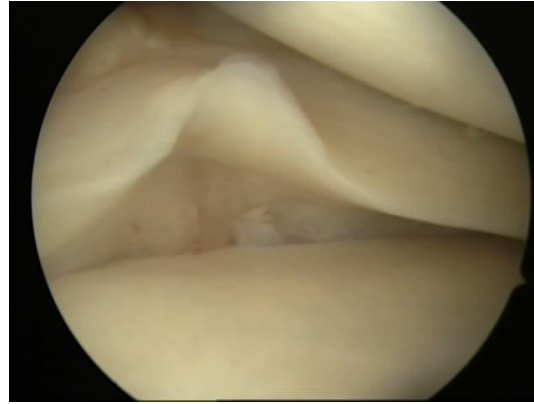


Factors influencing

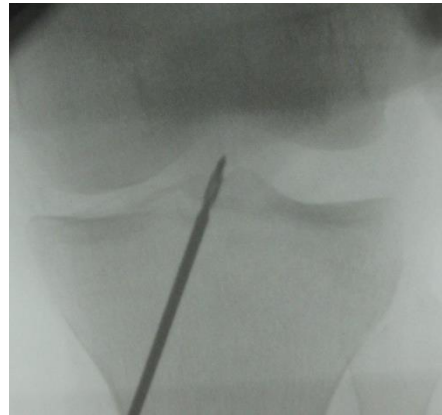
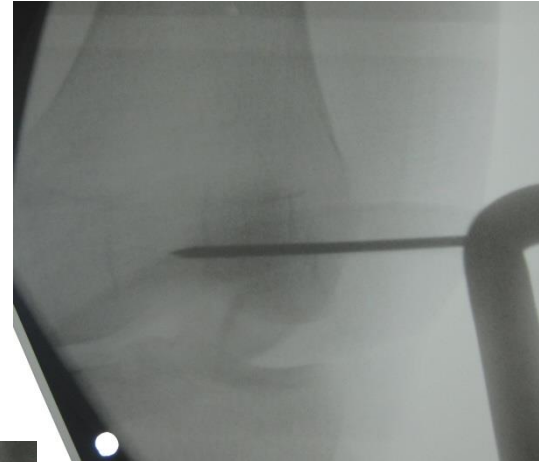
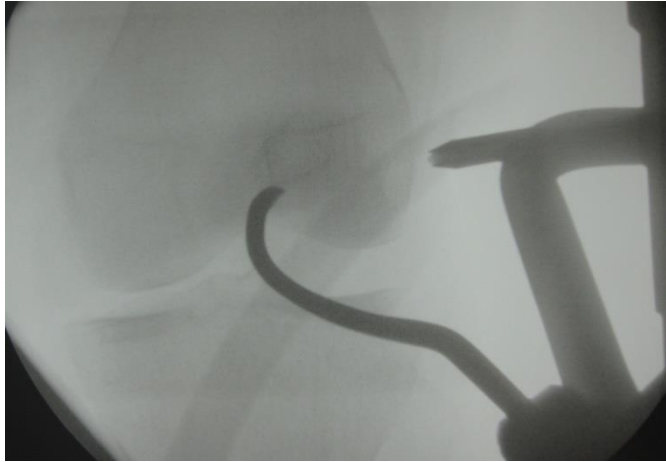
- Cartilage injuries
- Meniscal injuries
- Combined ligament injuries
- Joint laxity
- Gender
- Psychological impact
- others



Combined injuries



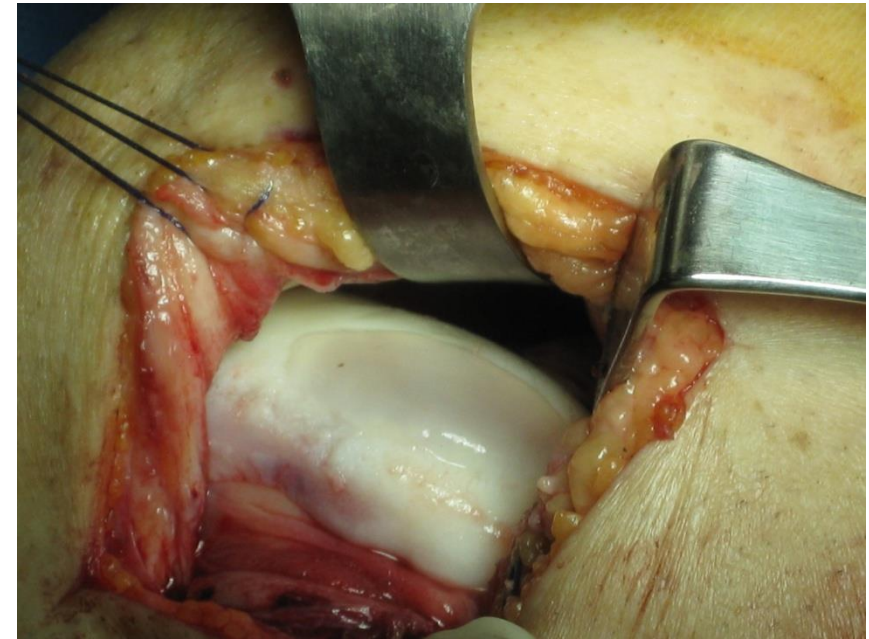
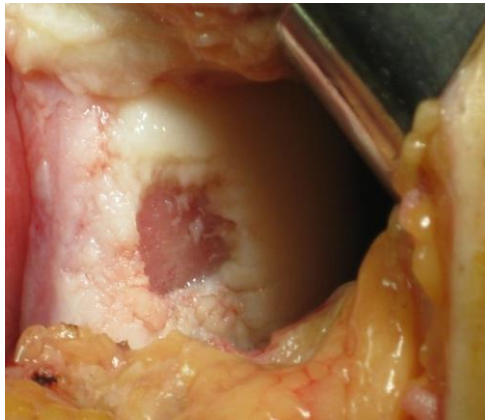
ACL injury in immaures



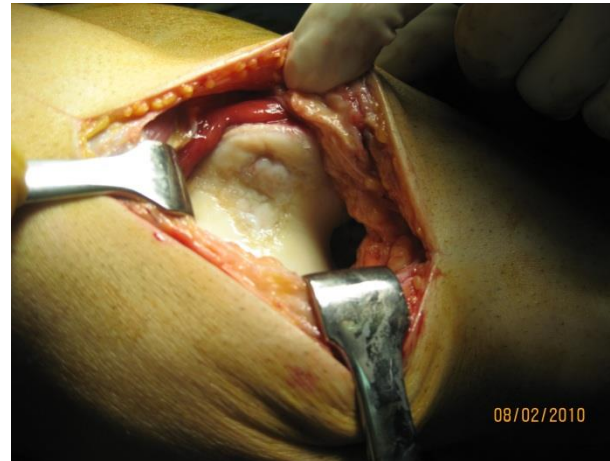
Cartilage injuries

Traumatic

chondral injuries



Cartilage injuries



Psychological impact of returning to sport after ACL reconstruction

- Emotion , confidence in performance , & Risk of appraisal.
- Using ACL – return to sport after injury (RSI) scale in 220 patients by “Kate E.webster et al”
 - in 24% of those unable to return to sport had fear of re-injury
- **Psychological Recovery is as important as physical Recovery**



Conservative or operative treatment

- *Wittenberg et al* : unlimited activity in 36% of operated but in 14% of non operated individuals.
- *Buss et al* :57.7% pre injury activity level in non operated individuals.
- *Lee Harrington et al* : no significant difference in passive knee laxity in Coper and non Coper ACL deficient knees



Risk factors for failure of both operative and non operative treatment

- Female athletes in pivoting sports
- Clinical & sub-clinical joint laxity
- Family predisposition
- Bilaterally involved knees
- Non traumatic non contact injuries
- Lack of psychological recovery
- Combined ligament injuries: PLS, MCL
- Non suitable graft for special groups



The results of our recent study

- In random selection of 203 operated patients from 2000 to 2006
- 107 Responding to telephone call.
- 64 (62.3%) soccer players & 40 (36.3%) other sports

Able to back to sports: (77) 72%	Same level: (39) 36.4%
	lower level: (38) 35.5%
Not return to sports: (30) 28%	13% personal reasons
	14.9% unable to back

ACL reconstruction current trends

- BPTB yet golden standard ?
- Hamstrings STG T ? or Semi T ?
- Allografts ?
- Which tunnel position ?
- Single tunnel ?
- Double tunnel ?
- Partial tears ?



Recommendations to reduce post operative failures

Important notice

- Non operated ACL have enough chance to return to sport BUT complicated ACL reconstruction may have no chance.

Emphasize proper jump/land techniques

- Land on balls of feet
 - Soft landing
 - Toe-to-heel rocking of the foot
 - ↓ ground reactive forces
- Knees flexed
- Knees forward
 - Discourage inward buckling of knees (knock-kneed landing)
- Chest over knees



Recommendations to reduce post operative failures

- BPTB ACL reconstruction in high demand athletes & joint laxity
- BPTB ACL reconstruction in female athletes
- Consider combined injuries in management of ACL injuries

Training Programs for ACL Prevention

- Balance board training
 - Improves balance + joint position sense
 - 20 min training sessions
 - 87% ↓ ACL injuries
 - 7x ↓ injury



Recommendations to reduce post-operative failures

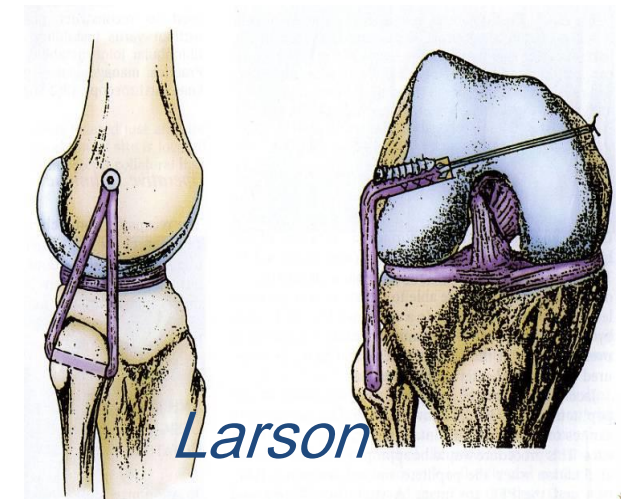
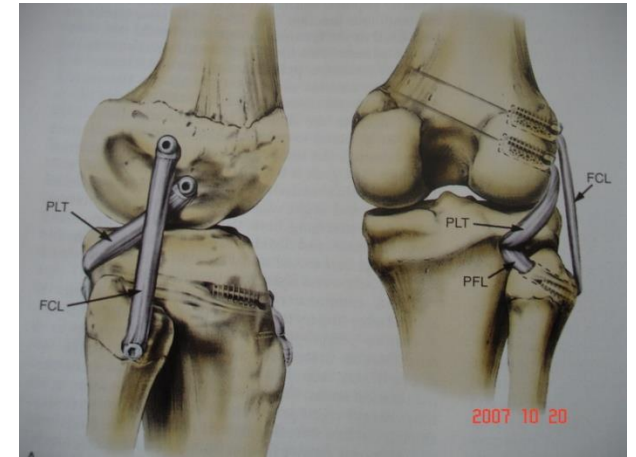
- ✓ Conservative treatment for 6 to 12 weeks to obtain full ROM and enough time for evaluation
- ✓ **BTB ACL reconstruction In subtle MCL tears**
also consider limb alignment
- ✓ Combined BTB ACL & MCL & posterior oblique ligament reconstruction by semi T from normal side in grade II & III tears.

Over treatment of MCL in the past & under estimation in recent years.

Recommendations to reduce post operative failures

Posterolateral structure PLS and ACL injuries:

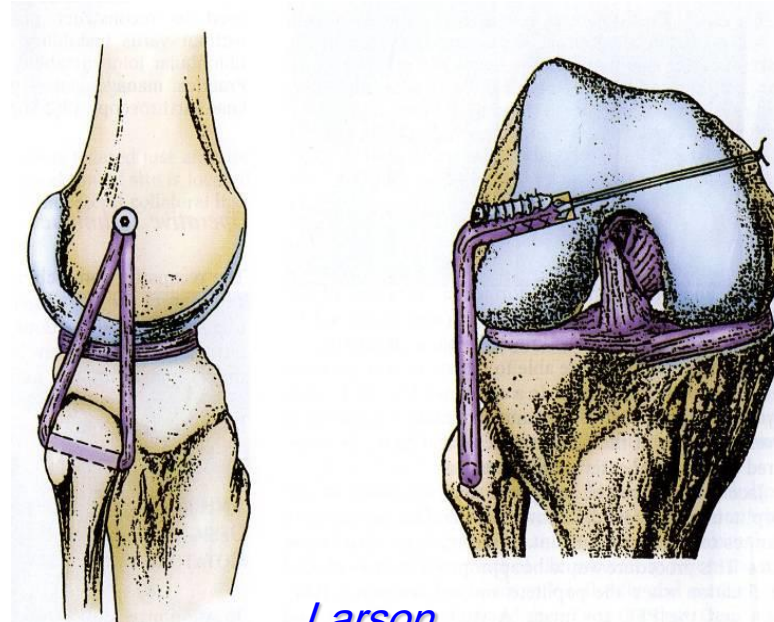
- Well known but difficult to manage!
- Difficult diagnosis in subtle injuries
- Surgical treatment recommended
- Limb alignment is an important factor



Recommendations to reduce post operative failures

Consider also extra articular augmentation :

- severe instabilities or joint laxity
- Subtle PLS instability
- Varus knees



Recommendations to reduce post operative failures

- Do not perform HTO in soccer players
- In performing HTO consider subtle MCL injuries
- Do not use ipsilateral hamstring graft in MCL deficient knee
- Beware of stiffness in multiple ligament injuries



Ligament Injuries Primary Care

P R I C E



thank you



Perspolis



