# Conservative Treatment of Knee Injury and Pain

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## Anterior Knee Pain

- Most common musculoskeletal problem seen in clinical setting
- 7% in young active adults
  25% in general population
- Other name :Patellofemoral pain, patellar malalignment, patellofemoral arthralgia

## Clinical manifestation

- Pain in the retropatellar region as well as the medial or lateral patellar borders
  - dull, aching nature
- Pain is exacerbated with activities that increase PF compressive forces
  - stair climbing, squatting, running, kneeling
- Pathogenesis : unclear

## Predisposing factors

- Biomechanical faults
  - Intrinsic factors
    * Dysplasia of the patella or femoral trochlea
  - Extrinsic factors
    * Increased Q-angle
    * Soft tissue tightness (Hamstrings, ITB, lateral retinaculum and gastrocnemius m.)
    * Abnormal foot pronation
    * Quadriceps muscle dysplasia
    * Muscle imbalances (VMO vs VL)

## Physical Examination

- Static observation
  - Quadriceps atrophy, swelling
  - L/E malalignment (femoral anteversion tibial ext. rotation or varum, abnormal Q angle)
  - Abnormalities in foot posture
  - Patellar orientation (glide, tilt, AP tilt, rotation)

## Physical Examination

- L/E flexibility( tensor fascia lata, hamstrings, iliopsoas, rectus femoris, gastrocnemius-soleus complex)
  - Hamstrings tightness→ ↑knee flexion at heel-strike → ↑PF jt. reaction force
  - Gastrocnemius tightness → ↑subtalar jt. pronation → ↑ valgus factor→ lateral tracking of patella

## Physical Examination

- Palpation of the patella and surrounding tissues
  - pain over medial retinaculum
    ; recent subluxation or inflamed synovial plica
  - pain over infrapatellar region
    ; patellar tendonitis or fat pad irritation
- Patellar mobility and lateral retinacular tightness

## Physical Examination

- Dynamic examination
  - Gait assessment, stair negotiation, squatting
  - Patellar tracking in both OKC and CKC movements
  - Quality and timing of quadriceps contraction

    * Normal knee : VMO to VL timing ratio - 1:1
    Patellofemoral pain pt. : delayed VMO activity

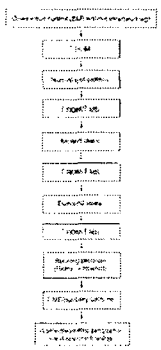
## Rehabilitation philosophy and principles

- Apply a working knowledge of basic science in the rehabilitation program.
- Base rehabilitation in current clinical research
- Adopt a team approach: physician, rehabilitaiton specialist, patient
- Adhere to the rules of rehabilitation

## Rehabilitation philosophy and principles

- Follow a functional progression
- Consider that "every step is therapy"
- Use the most appropriate kinetic chain environment
- Follow evaluation-based guidelines

## Knee Rehabilitation Functional Progress



## Pain management interventions

- Activity modification
- Interventions to decrease the loading
  - changes in shoe wear, orthotics, crutchs use for ambulation
- NSAIDs

## Stretching interventions

- Lateral retinacular stretching
- Patellar taping
- Hamstrings, tensor fascia lata and ITB stretching

## Lateral retinacular stretching

## Patellar taping

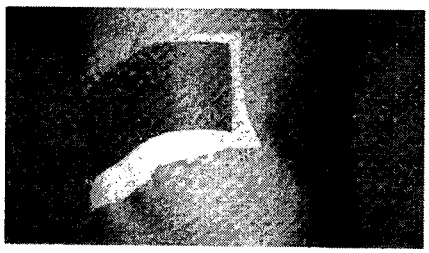
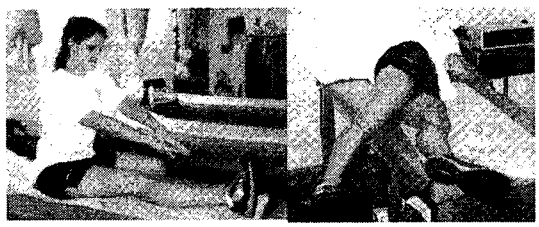


FIG. 44. Patellar taping technique for excessive lateral tilt.

## Hamstrings and ITB stretching



## Strengthening Interventions

- VMO and Quadriceps strengthening and training.
  - In acute setting
    ; electrical muscle stimulation
  - Should be performed in an environment that limits PF jt. reaction force
  - Biofeedback to encourage VMO activity

## Biofeedback to encourage VMO activity

- Useful for reeducation of the muscle
- Using EMG monitoring, a visual or auditory signal is provided to the pt. when a preset threshold of m. activity is achieved.
- Promote the improved timing of m. activation, which in turn benefits dynamic stabilization of the knee

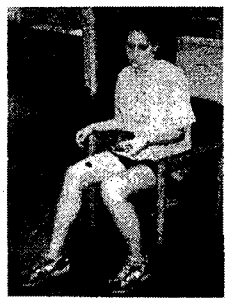
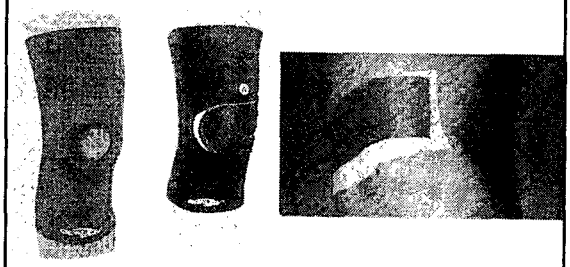


FIG. 46. Biofeedback unit applied to vastus medialis oblique muscle belly during a closed-kinetic-chain quadriceps exercise.

## Adjunctive Interventions

- Goals : to optimally position the patella in the trochlear groove and thus improve patellar tracking.
- Patellar bracing
- Patellar taping
- Foot orthotics

## Patellar stabilizing brace & Patellar taping



## Anterior Cruciate Lig. injury

- One of the more commonly injured knee ligaments in general population
- Occur during sports activities that involve rapid change of direction and jumping (basketball, soccer, skiing etc)

## ACL functions

- Primary stabilizer for resisting anterior translation of the tibia on the femur
- Secondary stabilizer in resisting int. and ext. rotation as well as varus and valgus stress

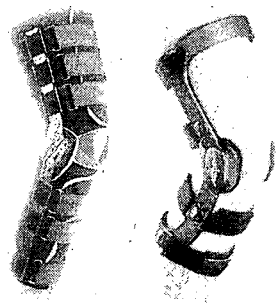
## Pathomechanisms of ACL injury

- Noncontact mechanism
  - Up to 78%
  - Deceleration and rotation with the foot planted
- Contact mechanism
  - Valgus force
  - ACL, MCL, MM tears ("Unhappy triad")

## Conservative Tx. of ACL injury

- Early stage
  - protecting knee from further trauma
  - Wt.-bearing as tolerated with crutches
  - Cold, compression and electrical stimulation(TENS)
  - Bracing with ROM stops
  - Therapeutic exercise
    :QSE, SLR, ROM(active, active-assisted)

## ACL brace



## Conservative Tx. of ACL injury

- As inflammation subsides,
  - Enhanced ROM, strength, and gait
  - Emphasizing m. strengthening and endurance exercises, conditioning activities, as well as neuromuscular training.
    - * OKC: isolated hamstrings and quadriceps m. strengthening
    - * CKC: more functional approach to develop strength and endurance of the L/E musculature

## Open-Kinetic-Chain exercises

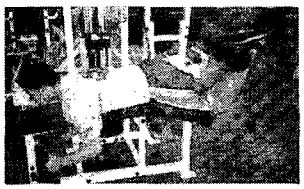


FIG. 5. Hamstring strengthening with open-kinetic-chain knee flexion.

FIG. 6. Quadriceps strengthening with open-kinetic-chain knee extension.

## Closed-Kinetic-Chain exercises


Lateral step-ups  Step machine

## Neuromuscular Training

- The presence of mechanoreceptors in the human cruciate ligaments → the presence of a proprioceptive reflex arc that serves to protect the knee from deformation beyond its anatomic limits.( by Schultz, 1984)
- Perturbation training
  ; stimulates reflex m. activation

## Perturbation training

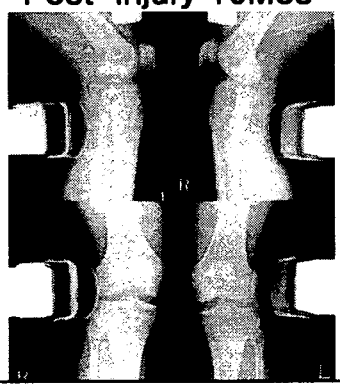
FIG. 11. Perturbation training. The rehabilitation specialist provides an unanticipated force to a rocker board as the patient attempts to maintain balance.

## 박 O 규(M/40)

- 내원 1주전 ski injury후 외부병원에서 MRI 검사후 "좌측 슬관절 십자인대손상" 이란 말 듣고 환자 원하여 본원 외래로 내원
- ROM; 10° - 70°
  Stress test; valgus Gr 1-2
  Lachmann Gr 2

## Initial

## Post-injury 10Mos



## Post-injury 10Mos

- ROM : 0 – full
- Lachmann test : -/-
- Pivot-shift test : -/-
- KT-1000 arthrometer
  15lb : 4/8.5mm
  20lb : 5.5/9.5mm

## Posterior cruciate lig. injury

- Incidence: 5-20% of reported knee injuries
- Injury mechanism
  - direct post. blow to the ant. aspect of prox. tibia
  - Hyperflexion of the knee with an ant.-directed force on the femur
  - Hyperextension of the knee

## Biomechanics of Exercise

- Posterior shear force occurs during CKC exercise throughout the entire ROM of the knee, with greater forces generated as knee flexion increases.
- With OKC activities, there appears to be a tremendous force exerted on the PCL during flexion exercises.
- However, with OKC extension, minimal or no force appears to be generated in the PCL from 0 to 60 degrees, but from 60 to 90 degrees, significant stress is produced in the PCL

## Conservative treatment of PCL injury

- Wt.-bearing as tolerated with crutches with an open brace limited to a 0→60°
- Cryotherapy, compression, activity modification
- QSE, SLR are initiated early

## Conservative treatment of PCL injury

- As ROM, gait, quadriceps control normalize, more aggressive strengthening exercise start
  - OKC knee isometric at multiple angles and CKC squats and leg presses are incorporated inside 0→60° ROM
  - Isolated OKC hamstring strengthening is avoided

## Conservative treatment of PCL injury

- Phase 1
  - **Days 1-7**
    - * ROM 0-60°
    - * Weight-bearing with 2 crutches
    - * Electrical m. stimulation to quadriceps
    - * Exercises : QSE, SLR, Hip abduction and adduction, Mini-squats/leg press(0-45°)

## Conservative treatment of PCL injury

- Phase 1
  - **Weeks 2-3**
    - * ROM 0-60°
    - * Wt.-bearing without crutches
    - * Progress exercises using weights
    - * Bike(week 3) for ROM
    - * Pool program
    - * Leg press(0-60°)

## Conservative treatment of PCL injury

- **Phase 2**
  - **Week 3**
    - * ROM to tolerance
    - * Discontinue brace
    - * Bike, Stairmaster, Rowing
    - * Progress exercise with weights
    - * Mini-squat(0-60°)
    - * Leg press(0-60°)
    - * Step-ups
    - * Hip abduction and adduction
    - * Toe-calf raises

## Conservative treatment of PCL injury

- **Phase 2**
  - **Week 5-6**
    - * Continue all exercise
    - * Fit functional brace
    - * Pool running

## Conservative treatment of PCL injury

- **Phase 3**
  - Weeks 8-12
    - * Begin running program
    - * Continue all strengthening exercises
    - * Gradual return to sports activities

## Conservative treatment of PCL injury

* Criteria to return to sports
  - ① No change in laxity
  - ② No pain, tenderness, or swelling
  - ③ Satisfactory clinical examination
  - ④ Functional testing 85% of contralateral knee
  - ⑤ Quadriceps strength 85% of contralateral knee

## Medial Collateral Lig. Injury

- The most injured lig. In the knee
- Primary restraint to abduction and ER
- M/C injury mechanism
  : Laterally applied valgus force with the foot fixed to the ground
- M/C site
  : femoral insertion, 65%

## Grade

- Grade 1; Sprain
  Firm end point with no change in laxity compared with contralateral knee
- Grade 2; partial tear
  Firm end point is maintained when tested at 30° of knee flexion
- Grade 3; complete tear
  No end point when tested in full extension

## Healing process

- Phase I ; acute inflammatory phase
  first 72 hours after injury
- Phase II; repair and regeneration phase
  from 3days to 6wks after trauma
- Phase III; remodeling or maturation phase
  up to 12 months or longer

## Grade 1

- Symptomatic treatment
  - cryotherapy, compression
- Early ROM exercise, early wt.-bearing, and quadriceps setting exercise
- Functional brace is seldom required

## Grade 2

- Brace : 10° - 90° flexion
  → after 2wks full ROM
- Wt. bearing as tolerated with crutches for first 2wks
- ROM and strengthening exercises of both OKC and CKC types are used, with valgus and rotational forces avoided.

## Grade 3

- Hinged rehabilitation brace for 6wks
- 20° - 70° flexion for the first 3wks after injury
- At 6wks after injury, small double-hinged brace is used for AOI
- For the first 3wks, toe-touch weight bearing with crutches

## Lateral Collateral Lig. Injury

- Resisting varus rotation of the knee
- Restraint to ER of the flexed knee
- Injury mechanism
  ; Varus force directed at the medial aspect of the knee with foot planted
- Occur at the fibular head with or without avulsion approximately 75%.

## LCL injury

- LCL injury often occurs concomitantly with other knee ligament injuries( PCL, ACL, PLC)
- Associated injuries to the peroneal N. are common
- The management and rehabilitation of isolated LCL sprains are similar to isolated injuries of the MCL

*Thank You for your attention !!*