Injuries to the Medial Collateral Ligament

- One of the most frequently injured ligaments of the knee
- Can occur in isolation or in combination with other ligaments
- Also known as the tibial collateral ligament


MCL Injuries

- MCL most common knee ligament injury
- Most common knee injury in competitive and recreational sports

MCL Injuries

- In young and active patients – 90% of all knee ligament injuries are to ACL, MCL or combined ACL-MCL combination!


Medial Compartment

- Described by Warren and Marshall
- Divided into three anatomical layers


Layer 1

- **Superficial layer**
- Deep crural fascia that overlays pes anserinus & gastroc
- Medial patellar retinaculum and sartorius muscle
Layer 2
- Intermediate Layer or Superficial MCL
- Patellofemoral ligament “tibial collateral”
- Patellotibial ligament
- Semimembranosus muscle

Layer 2
- Superficial layer
- Lies further from instantaneous center of the knee
- The first loaded with valgus stress

Layer 3
- Deep layer
- Medial knee joint capsule
- Deep MCL ligament also called “middle capsule ligament”
- Meniscotibial ( coronary) ligaments
- Meniscofemoral ligaments
Layer 3

- Deep layer
- Described as the middle third of the medial joint capsule


Deep Portion of MCL

- Firm attachment to medial meniscus
- Known as meniscofemoral and meniscotibial ligaments

Biomechanics of MCL

- Superficial portion acts as primary restraint against valgus stress to knee at both full extension (57%) and 25 degrees of knee flexion (78%)


Biomechanics of MCL

- MCL stabilizes 78.2% with knee at 25 degrees of knee flexion
- ACL/PCL 13.4%
- Ant/Med & PL capsule 7.6 collectively


Biomechanics of MCL

- Sectioning of the MCL allows significant external rotation of the tibia in both full extension and in 90 degrees of knee flexion
- Sectioning of the MCL with an intact ACL will not increase anterior translation of tibia on femur
- Sectioning of the ACL and MCL results in dramatic anterior translation of the tibia

Three Functions of the MCL

- Primary restraint to valgus stress
- Prevention of external rotation of tibia on femur
- Secondary restraint to anterior tibial translation (when ACL is intact)
Mechanism of Injury

- Valgus force
- Combined valgus and external rotation force
- Direct blow to the lateral aspect of the knee
- Contact sports football, hockey
- Non-contact through fall laterally with foot firmly fixed

History

- Complete description of MOI
- Exact knee position when injury occurred
- Did patient feel a “pop”
- Did the knee shift
- Was the patient able to continue play
- Was there immediate swelling 1-2 hrs post injury
Physical Exam
- Assessment of swelling
  - Significant swelling following isolated grade I or II sprain rare.
  - If ACL also injured significant swelling common
  - May have minimal effusion due to extravasation!


Physical Exam
- Ligamentous integrity
- ROM assessment
- Palpation

Valgus Stress at 0°
- Medial laxity in full extension indicates injury to MCL, medial capsule and posteromedial capsule
- If gross instability at 0° suspect ACL tear also
Valgus Stress at 30° Knee Flexion
- Posteromedial and posterior capsule put on slack

Knee Instability Testing
- Grade I = Mild sprain
- Grade II = Moderate sprain
  - 1+ = 1-5 mm more laxity
  - 2+ = 6-10 mm more laxity
- Grade III = Severe sprain

MCL Stress Test Pearls
- When performing this test:
  - Start by closing joint first!
  - Actually begin by moving toward varus movement first to approximate tibia and femur.
  - Analogous to identifying starting reference point when performing ACL/PCL testing.
MCL Stress Test Pearls

- By approximating joint first, one can actually palpate the amount of medial joint line opening by kinesthetically feel the actual amount of motion.

Clinical Pearl

- In younger patient:
  - Think femoral epiphyseal plate injury!
  - Ligament stronger than physes in younger patient.


Clinical Pearl

- Also rule out PF subluxation!
- PF subluxation will be tender at patellar facet, MPFL
- **BUT** – no laxity on testing of MCL
Clinical Pearl

- Pain at the MPFL may occur with a valgus stress to the knee.

Clinical Pearl

- Joint line pain may indicate meniscus tear.
- Common meniscal tests are not reliable when performed with MCL injury due to rotary forces stressing MCL.

Clinical Pearl

- If in question may need further diagnostic testing.
- MRI!
Rabbit Model

- Untreated New Zealand rabbits
- Laboratory induced MCL ruptures
- Left alone – only skin closure


Rabbit Model

- Untreated New Zealand rabbits
- “Scar formation” rather than true ligament
- Still forming at 40 weeks
- Biomechanically inferior to regular ligament


Surgical Management

- Historically commonplace!


Isolated MCL Injuries Grade III

- Prospective design
- Group I: 16 patients
- Primary repair
- 6-weeks in immobilizer
- Rehab following


Isolated MCL Injuries Grade III

- Group II: 20 patients
- Plaster cast x 2-weeks
- Cast – brace for 4-weeks
- Rehab following


MCL Stability Scoring

<table>
<thead>
<tr>
<th>RESULT</th>
<th>I (n=16)</th>
<th>II (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective Score</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good/Excellent</td>
<td>15 (94%)</td>
<td>17 (85%)</td>
</tr>
<tr>
<td>Fair</td>
<td>1 (6%)</td>
<td>3 (15%)</td>
</tr>
<tr>
<td>Poor</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

| **Objective/Subjective**      |          |           |
| Good/Excellent                | 14 (88%) | 18 (90%)  |
| Fair                          | 2 (12%)  | 2 (10%)   |
| Poor                          | 0        | 0         |

Non operative Rehabilitation

- 74 professional football players
- Partial MCL sprain
- Treated non-operatively
- Mobilization
- Success rate of 98%
- All returned to play in 3-8 weeks


Non operative Rehabilitation

- 24 professional football players
- Partial MCL sprain
- Treated surgically
- Success rate of 74%


Non operative Rehabilitation

- 51 of 70 knees injured between 1974 and 1978
- Treated with active rehabilitation
- Grade I = full unprotected participation after 10.6 days
- Grade II = full unprotected participation after 19.5 days

Non operative Rehabilitation

- Prospective randomized study
- Operative compared to non-operative treatment
- Acute isolated MCL and combined ACL/MCL injuries
- 200 consecutively seen patients


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Non operative Rehabilitation

- Injuries to MCL did not benefit from surgery


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Non-Surgical Management

- Grade I and II
- ACL intact
- Acts as secondary stabilizer to valgus stress

- Grade III injuries remain area of controversy!
  - Includes both superficial and deep fibers of MCL
Surgical Management

- Generally in only cases of severe (grade III) disruptions
- If avulsed from bone, suture anchors are used
- Mid substance tears are re-approximated with absorbable sutures

Optimal Conditions for MCL Healing

- Maintenance of torn fiber approximation
- Intact and stable ACL and other supporting ligamentous structures
- Immediate controlled motion and stress to healing ligament
- Protection against deleterious valgus and external rotation stresses.

Optimal Conditions for MCL Healing

- Canine model for MCL healing
- 35 canine
- Group I = no repair (conservative)
- Group II = repair (3) weeks immobilization
- Group III = repair (6) weeks immobilization

Optimal Conditions for MCL Healing

- Group I had superior results
- Varus – valgus laxity and structural properties returned to control side in 12 weeks


Optimal Conditions for MCL Healing

- Tensile strength slowly increased
- Not yet equal to control even at 48 weeks
- Most improvement seen in group I


Optimal Conditions for MCL Healing

- MCL can heal spontaneously even though cut ends not re-approximated
- As long as ACL intact as secondary stabilizer of varus/valgus motion
- Prolonged immobilization has deleterious effects on healing MCL

Isolated MCL Sprain Rehab

- The effects of immobilization must be minimized
- Healing tissue must never be overstressed, but controlled stress is beneficial
- Patient must fulfill criteria to progress from one phase to another
- Rehab program should be based on current clinical and scientific research
- Rehab must be adaptable to each patient


Treatment Protocol for Non-Operative Grade I and II MCL Sprains

Phase I

- Goals
  - Early protected ROM
  - Prevent quadriceps atrophy
  - Decrease effusion/pain
- Criteria to progress to phase II
  - No increase in instability
  - No increase in swelling
  - Minimal tenderness
  - PROM 10-100 degrees
Treatment Phase I

- Day 1
  - RICE
  - Hinged brace (non-painful ROM)
  - PF mobilization
  - Crutches (WBAT)
  - PROM/AROM to tol.
  - QS and SLR

- Day 2
  - Continue previous
  - SLR into flex, abduction, extension (?)
  - Hamstring sets
  - Well-leg exercises

Treatment Phase I

- Electrical Muscle Stimulation


Treatment Phase I

- Day 3-7
- Continue previous
- ROM as tol
- Eccentric quads
- Cycle for ROM only
- Hip adduction and extension if tolerated

Treatment Phase I

- Day 3-7
- Mini squats
- Leg press isotonics
- Brace prn

Phase II

- Goals
  - Full painless ROM
  - Restore strength
  - Ambulation without crutches

- Criteria for progression to phase III
  - No increase in instability
  - No increase in swelling or tenderness
  - Full painless ROM
Phase II

- Week 2
  - PRE
  - EMS
  - Continue ROM
  - CKC exercise
  - Cycle (endurance)
  - H2O ex’s
  - Full ROM ex’s

Phase II

- Week 2
  - Flexibility
  - Balance and proprioception

Phase II

- Days 11-14
  - Continue previous
  - Initiate isokinetic exercise – submaximal to maximal contractile velocities
  - Begin running program if tolerated
Phase III

- Goals
  - Increase strength/power
- Criteria for progression to phase IV
  - Full ROM
  - No instability
  - Muscle strength 85% of contralateral side
  - Proprioceptive ability satisfactory
  - No tenderness over MCL
  - No effusion; Quadriceps strength; PT/BWR

Phase III

- Week 3
  - Continue previous
  - Squats – vertical, lateral lunges
  - Leg press
  - Step ups
  - Knee extension

Phase III

- Week 3
  - Emphasis on functional return to activity
  - Functional drills
  - Higher speed activities
  - Balance proprioception
  - Eccentric loading
  - Endurance training
  - Initiate agility drills
Phase III
- Functional progression
  - Slow to high speed
  - Bilateral to unilateral
  - Low to moderate weight
  - Soft to hard surface

Phase IV
- Maintenance Program
- Criteria for return to competition
  - Full ROM
  - No instability
  - Muscle strength 85%
  - Proprioception ability satisfactory
  - No effusion
  - No tenderness MCL
  - Knee brace (prn)

Return to Sports
- Ability to perform sports specific drills without pain or instability
- Bracing not necessary
- Prophylactic
Variation in Rehabilitation
- MCL injuries that occur at the femoral origin or in mid-substance tend to become stiff and may develop motion loss sooner.
- Thus immediate motion is initiated with full motion by 2-3 weeks.


Combined ACL – MCL Injuries
- Most favor conservative management of MCL and later reconstruction of ACL


Combined ACL – MCL Injuries
- 23 – MCL’s treated operatively
- 24 – MCLs conservative
- Both groups early ACL reconstruction

Combined ACL – MCL Injuries

- No significant difference in:
  - Subjective function
  - Postoperative stability
  - ROM
  - Muscle power
  - Return to activities


Variation in Rehabilitation

- Tibial insertions injuries tend to heal with slight valgus laxity
- May require brief time of bracing (2-4 weeks).


Surgical Reconstruction

- When done - usually for grade III injuries
- Done in conjunction with repair of ACL and meniscus tears
Surgical Reconstruction

- Because of dual injuries rehabilitation must be aggressive at obtaining full knee extension
- Dual injuries/surgeries have been known to result in loss of motion

Phase I – Immediate motion

- Goal
  - Obtain full passive knee extension
  - Decrease swelling
  - Decrease inflammation
  - Protect the knee with limited weight bearing

Phase I – Immediate motion

- Placed in slight hyperextension immediately following surgery.
- Flexion ROM will be gradually increased
  - Day 5 – 90°
  - Week 2 – 105°
  - Week 3 – 115°
  - Week 4 – 125°
Phase I – Immediate motion

- Hinged knee brace used to provide support until patient can dynamically stabilize knee on their own.

Exercises after 1-3 weeks

- Exercises similar to that of non-operative treatment for MCL and or ACL injuries.
Smoking and Ligament Healing

- MCL healing and mice
- Found decreased cellular density and Type I collagen expression in the injured ligament of mice exposed to cigarette smoke


Thank You!

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