Treatment of Post-Operative Knee Motion Complications

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Case Presentation

- 20 year old college running back (DII Program)
- ACL injury, MCL sprain grade II, medial meniscus, meniscocapsular injury
- ACL/PTG, lateral meniscus repair, meniscocapsular repair (surgery 10 days post-injury)

Case Presentation #JM2801

- 6 weeks post-op
- ACL/PTG, LM repair, medial meniscus capsule repair
- Pre-Rx L PROM 0-12-82° Right Knee 7-0-148°

Case Presentation

Treatment approach: ???
- Emphasize knee extension, patella mobility, soft tissue
- Gradually increase knee flexion
- Quadriceps muscle hypertrophy

Case Presentation – follow up

- L knee: 2°-0°-142°
- R knee: 7°-0°-148°

Treatment of Post-Operative Knee Stiffness

Introduction

- “I can get it straight it just doesn’t stay straight”
- “I can get him/her down to zero”
- “It stiffens up during sleeping”
- “Just push it down hold it down for 10-15 sec and release – repeat”
- “Your hamstrings are tight”
Treatment of Post-Operative Knee Stiffness

Introduction

- Significant problem in Orthopaedics & Sports Medicine
- Joint stiffness remains the single *most common complication* following surgical intervention at the knee joint

Noyes: Knee Sports Trauma '00
Huegel & Indelicato: Clin Spts Med '88
Noyes: AJSM '81
Shelbourne: AJSM '91 & '96
Harner: AJSM '92

Shelbourne & Gray: AJSM '09

- ACL reconstruction PTG
- How the loss of motion compounds other factors related to development of OA
  - Loss of extension – even a loss of 3-5 degrees affected outcome
    - Especially with meniscus injury & art cart damage
    - Patients with loss of extension & flexion had worse results

Knee Rehabilitation

**Desired Outcome**

- Asympathetic knee joint
  - knee stability
  - muscular strength
  - knee ROM
- Symmetrical ROM
  - full knee extension
  - knee flexion
  - patellar mobility

Treatment of Post-Operative Knee Stiffness

Loss of Motion

- How is a loss of motion defined?
  - *Arthrofibrosis* → Loss of Motion
- Who has loss of knee motion?
  - Knee flexion less than 125 degrees
    - Harner: AJSM '92
  - Any symptomatic limitation in knee motion compared to normal contralateral knee
    - Shelbourne: AJSM '96
- How do you measure the ROM or LOM?

Treatment of Post-Operative Knee Stiffness

Loss of Motion

- Loss of extension usually more symptomatic compared to loss of flexion
  - Loss of extension – associated with:
    - Patellofemoral pain
    - Quadriceps weakness
    - Overall poor knee function

Sachs, Daniel: AJSM '89
Treatment of Post-Operative Knee Stiffness

Loss of Motion

- Arthrofibrosis
- Does everyone with a loss of motion have arthrofibrosis??
- Defined as:
  - Inflamed “angry” knee
  - With loss of motion
  - Loss of knee flexion & extension
  - Often not very swollen
  - May lead to progressive knee degeneration

Prevention & Treatment

- Focus of rehabilitation is on prevention
- Prevention:
  - Timing of surgery
  - Immediate post-op motion
  - Concomitant injuries/surgery
- Treatment:
  - Treatment protocols

Loss of Knee Motion

Loss of Extension

Correlation between loss of knee motion and PF Pain
Sachs, Daniel, et al: AJSM '89

1cm = 1°

Reliability of heel height measurements (.75-.78)

Loss of flexion correlates:
- Capsular contracture
- Intraarticular fibrosis
- Restriction of PF mechanism
- Graft placement

Extension loss of motion:
- Anterior scar formation
- Cyclops
- Graft-notch mismatch
- Graft tension position
- Posterior capsule tightness

Treatment of Post-Operative Knee Stiffness

Loss of Motion
Rehabilitation Stiff Knee

**Key Points**
- Captured Patella
- Capsular Scarring/Infrapatellar Scar

The Effects of Surgical Timing on Post-Operative Knee Motion

The Effect of Post-Op Rehab

Shelbourne: AJSM '91
- Retrospective study 169 acute ACL reconstructions
- Young athletes (mean age 22 yrs)
- Three groups:
  - Group I: 33 pts had surgery between 0-7 days
  - Group II: 65 pts surgery between 8-21 days
  - Group III: 71 pts surgery greater than 21 days
- Patients with 5 degrees or more loss of extension
  - Group I: 17%
  - Group II: 11%
  - Group III: 0%
- Pts in group II who followed accelerated rehab lower rate of arthrofibrosis 4%

Hunter: Arthroscopy ’96

- Prospective study 185 acute ACL injuries in skiers
- Prospective assigned to one of 4 groups:
  - Surgery within 48 hrs
  - Surgery between 3-7 days
  - Surgery 1-3 weeks
  - Surgery greater than 3 weeks
- No significant difference in ROM between the 4 groups

Majors, Woodfin: AJSM ’96

- 119 consecutive ACL reconstructions
- Follow-up data on 111 surgeries
  - 21 early surgery (1-14 days)
  - 22 delayed surgery (15-28 days)
  - 68 late surgeries (more than 28 days)
- All patients early and delayed obtained full ROM
- 93% of late surgeries (5 patients not full extension)
Guerra, Joyce, Wilk et al: AOSSM ‘96

- Surgical timing on incidence of arthrofibrosis
- ACL/PTG surgery with aggressive motion rehab program - supervised
- 571 patients, retrospective analysis (90-94)
  - 158 acute (less than 2 weeks)
  - 107 subacute (2-6 weeks)
  - 306 chronic (greater than 6 weeks)
- Approximately 4% incidence (3.8, 3.7 & 4.2%)
  "Timing of surgery should be individualized"
  "Rehab must be individualized"

Treatment of Post-Operative Knee Stiffness

- Timing of surgery on loss of motion
- Appears to be a difference of opinion
  - Timing of surgery has significant effect
    - Shelbourne: AJSM '91
    - Mohatadi: AJSM '91
    - Harner: AJSM '92
  - Timing of surgery has little to no effect
    - Steadman: J Orthop Tech '93
    - Majors: AJSM '96
    - Hunter: Arthroscopy '96
    - Guerra: AOSSM '98

Multi-Ligament Injuries

- "The Perfect Storm" to cause stiffness
  - Traumatic knee injury
  - Acute ACL surgery with reconstruction
  - Acute PF surgery
  - Medial capsular involvement
  - Psychological characteristics
  - Factors influence post-operative complications

Clinical Treatment Guidelines
**Treatment of Post-Operative Knee Stiffness**

**Clinical Treatment Guidelines**

- Avoid acute knee surgery whenever possible
- Delay surgery until:
  - Inflammation/pain is reduced
  - Normal ROM is restored
  - Able to activate quads
  - Elimination of quad avoidance gait
- Timing of Surgery & Rehab must be Individualized

**If Acute Surgery is Performed**

Immediate/Agressive ROM Rehab Must Be Implemented

**Treatment of Post-Operative Knee Stiffness**

**Clinical Treatment Guidelines**

- Acute ACL surgery performed on:
  - Displaced bucket handle tears
  - Early meniscus repair
  - Primary repair MCL or LCL
  - Dislocated knees (ACL/PCL)
  - Patellar tendon repair
  - Patellar dislocation

**Principles of Early Post-Operative ACL Rehab:**

- Immediate motion
- Restoring full knee extension
- Motion milestones
- Restoring patellar mobility
- Frequency & duration of exercise bouts
- Immediate activation of quadriceps

**Treatment of Post-Operative Knee Stiffness**

**Clinical Treatment Guidelines**

- Prior to ACL surgery prepare the patient for surgery:
  - Immediate ROM exercises
  - Easy motion to restore full flexion
  - Gradually obtain full extension – push it
  - Reduce swelling & inflammation/pain
  - Activate the quadriceps
  - Restore normal gait pattern
  - Program emphasizes extension to flexion

**Treatment of Post-Operative Knee Stiffness**

**Clinical Treatment Guidelines**

- Immediate motion
  - Immediate motion following ACL reconstruction does not compromise the ACL graft
  - Immediate motion is safe & useful

Noyes: CORR ’81
Noyes: AJSM ’87
Noyes: CORR ’92
Treatment of Post-Operative Knee Stiffness

Clinical Treatment Guidelines

• Restore full knee extension
• How much extension should you restore??
• What does full extension mean??

Equal to contralateral limb — 0 degrees extension

» Our goal is to establish some
  hyperextension immediately post-op
» Depends on how much hyperextension
  is present on contra-lateral side
» Gradually gain more hyperextension
  during the course of rehab
» Day 5-7: 5-7 deg of hyperextension

Wilk: Orthop of North Am ’04

TERT Principle
Total End Range Time
McClure et al: PT ’94
» Intensity
» Frequency
» Duration

Low Load Long Duration Stretching
• Low intensity
• Long duration
• Plastic deformation of collagen tissue

Treatment of Post-Operative Knee Stiffness

Clinical Treatment Guidelines

• Motion Milestones:
• Easy & gradual motion the first week
  Progress Motion Too Quickly — Swelling

» Our goal is to establish motion milestones:
  Day 1-3: 0-75 degrees (at least)
  Week 1: 5-0-90 degrees
  Week 2: 7-0-115 degrees
  Week 4: 7-0-135 degrees
  Progress to full knee flexion
  Heels to Gluts

Start Slow — Progress — Finish Strong
 Appropriately
Treatment of Post-Operative Knee Stiffness

Clinical Treatment Guidelines

- **Restore Patella Mobility:**
  - Immediate patellar mobilization
  - Especially when PTG is used
  - Translations & Tilts
  - Instruct patient how to mobilize
  - Perform mobs hourly for 5 min.
  - Mobilize patella in clinic also
  - Patella mobility should move 8-10 mm – esp superior direction
  - Numerous times per day (10-12x daily)

Patellar Mobility

Patellar Mobilizations

Loss of Motion Following ACL Surgery

Infra-Patellar
(Fat Pad and Tendon)

With or without Supra-Patellar Entrapment is a totally different animal

Retinaculum
Fat Pad
Inflammation

Fibrosclerosis
of Fat Pad

Immobility
in flexion
(less pain)

Contraction of Kaplan’s Ligaments
Factors to Minimize Anterior Knee Pain in an ACL/PTG Knee

Passive Knee Flexion

Patellar Mobility

Passive Knee Extension

Treatment of Post-Operative Knee Stiffness

Clinical Treatment Guidelines

• Immediate Activation of Quads:
  ➢ Electrical muscle stimulation
  ➢ Voluntary contraction with EMS
  ➢ Several goals of EMS:
    ✓ Prevents muscular atrophy
    ✓ Mobilizes patellar (superior)
    ✓ Assists in restoring full extension
    ✓ Reduces pain complaints
Treatment of Post-Operative Knee Stiffness
Clinical Treatment Guidelines

- **Frequent Bouts of Exercise & Motion – Prevention Program**
  - Ideal session: 5-10 min of motion exercises hourly
  - Approximately 10 x per day
  - Not aggressive – moderately aggressive
  - Over aggressive motion may lead to an increase in swelling & scarring

  *Patient Must Accomplish Milestones!!*

**Conclusion**

- Immediate motion is critical in preventing loss of knee motion
- Establish ROM goals or milestones
- Restore patellar mobility
- Be aggressive but don’t wait until knee is really stiff
- Aggressive motion means moderation
- Team approach to treatment
- Risk factors for knee stiffness

  *Motion, motion, & more motion!!*

Thank You !!!!