Rehabbing the Athlete’s Knee: Current Concepts in ACL Rehab

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Biography

- APTA Sports Certified Specialist
- NSCA Certified Strength and Conditioning Specialist
- Owner and Sports Orthopaedic PT at Holt Physical Therapy & Performance Training
- PT Consultant NHL Carolina Hurricanes 2007-2014
Biography

- East Carolina University
- BS Exercise Physiology 1995
- MS Adapted Physical Education 1997
- MPT Physical Therapy 1999

Mentors

- Pete Friesen
- Doug Geiger
- Gary Gray
- Walt Jenkins
- Bill Moore
- Kevin Wilk
- Co-workers
- Patients!!

Introduction

- ACL rehab used to take 12-18 months for full recovery
- Due to improved graft choices, surgical equipment/procedures, rehab time now can be closer to 6 months
Etiology and Incidence of ACL Injury

- Medscape May 2012
- 50% ACL tears have a meniscus tear
- 95,000 new ACL ruptures per year
- 60,000-75,000 reconstructions performed
- 2.4-9.7 times more likely in female
- Q angle ? inc femoral anteversion, ext tibial torsion, genu valgum, subtalar hyperpronation all causes

Successful Outcome

- 75%-95% success rate
- 8% failure rate
- Recurrent instability, graft failure or arthrofibrosis
- #1 predictor of successful outcome is experience of the surgeon and physical therapist

Knee Anatomy
ACL: Two Bands

- The ACL is composed of 2 groups, the anteromedial and the posterolateral bands. During flexion, the anterior band is taut, while the posterior band is loose; during extension, the posterolateral band is tight, while the anterior band is loose.

Ligament Strength

- The average tensile strength for the ACL is 2160 N.
- This is slightly less than the strength of the posterior cruciate ligament and approximately half as strong as the medial collateral ligament (MCL).

Mechanism of ACL Injury

- Typically, the ACL is torn in a noncontact deceleration situation that produces a valgus twisting injury.
- This usually occurs when the athlete lands on the leg and quickly pivots in the opposite direction.
Mechanism of Injury

- Mechanisms reported as possibly able to disrupt ACL w/ minimal injury to other structures are:
  - Hyperextension
  - Marked internal rotation of tibia on femur;
  - Pure deceleration
  - Padua's high risk movement profile: Hip Add and Knee Varus increases risk 27x's

Assessment of ACL Injury

- Mechanism of Injury
- Special Tests
  - Anterior Drawer
  - Lachman
  - Pivot Shift

Special Tests Video
Assessment of ACL Injury

- MRI has a sensitivity of 90-98% for ACL tears. MRI also may identify bone bruising, which is present in approximately 90% of ACL injuries.
- An MRI allows the physician to confirm an ACL tear, but it should not be used as a substitute for a good history and physical examination.

Unhappy Triad Injury

- The unhappy triad, also known as the terrible triad, or O’Donoghue’s triad is a severe knee injury. It involves full or partial tears of the ACL, MCL and medial meniscus.

ACL Surgery Options

"Nurse, go on the internet, go to SUGERY.COM, scroll down and click on the site you totally lost! Bom."
OR Setup

Exam Under Anesthesia
Lachman

Skin Incision
Diagnostic Arthroscopy

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Graft Harvest

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Graft Harvest

• Size for 10 mm tubes
• Drill holes in each side
• Place suture through holes
• Measure

Graft Preparation
Torn ACL Debridement

Tibial Tunnel Preparation

“Point to elbow” aimer
Femoral Tunnel Preparation

Graft Passage
Closure

- Pack bone defect with bone graft
- Helps with healing/decreased pain

Post-op X-Rays

Graft Choices

- BTB patellar tendon autograft
- Hamstring tendon
- Achilles tendon allograft
- Double Bundle
BTB Patellar Tendon

- Bone-patella-bone (BTB) autografts are currently popular because they yield a significantly higher percentage of stable knees with a higher rate of return to preinjury sports.
- The major pitfall of these grafts is their association with postoperative anterior knee pain (10-40%).

Hamstring Tendon

- Hamstring tendon (HT) grafts are associated with a faster recovery and less anterior knee pain.
- Critics believe that these are more susceptible to graft elongation.
- Wipfler et al comparing BTB autografts to HT grafts at 9 years demonstrated significantly better International Knee Documentation Committee (IKDC) scores in the HT group, with no significant differences in laxity, tunnel widening, or any other parameters.[7]

Allografts

- Allografts have also been very popular because of their efficiency, their ability to provide bony fixation, and the lack of associated patella morbidity.
- Associated with a risk of viral transmission.
- Allografts are best used in revisions.
- In addition, concerns exist regarding what effects the immunologic response and delayed revascularization and remodeling may have on clinical outcomes.
Double Bundle

- Double-tunnel ACL reconstructions attempt to reproduce stability in internal rotation and valgus torque applied to the knee.
- Investigations into the benefits of such surgical treatment versus the increased level of difficulty and operative time are currently ongoing.

The results of a 2-year randomized trial noted that the double-bundle technique resulted in fewer graft failures and significantly lower revision rates than the single-bundle technique in anterior cruciate ligament reconstruction.
- Much harder technically speaking

Graft Choices

- Depends on pt's age, sex, rehab goals, knee history
- My advice to patients:
  - Whatever graft your surgeon is most comfortable and experienced with
Pre-operative Patient Education

- Introduce the patient and family to staff
- Briefly review operative procedure
- What their knee will look like when they wake up
- Immediate post op exercises to do
- Discuss my promises and their responsibilities
- No OKC leg ext! max load on ACL at 20 deg of ext. What is the value in OKC vs CKC?

Pre-operative Patient Education

- Rehab goals and time frames
- Mention Week 8-11 “Danger Zone”
- Discuss “When can I return to _____?”
- What to expect first post op appointment
- Nutrition consult??

Nutrition

- Nutrition can make a good athlete great or a great athlete good!
- Body Fat, Weight, Goals
- Urine test
- Meal Builder
- Hydration
- Supplements as needed: Food first
First Two Weeks are the Worst!

- Getting used to meds, pain, swelling
- Hate having brace locked in full extension
- Can’t walk
- Can’t fire quad
- Just want to be better already
- Mental anxiety (sports psyc referral?)

Post Operative ACL Protocol (no meniscus involvement)

What to do that first visit??

- Dressing and Brace removal
- Necessary post op measurements
  - Edema
  - ROM
  - Quad activation
  - Patellar mobility
What to do that first visit?

- Patellar mobs
- Quad sets with NMES and ankle DF
- Assisted heel slides (unless HS graft)
- Ankle PNF
- Standing weight shifts
- Standing calf raises
- Ice (GameReady)

First Post Op Visit Video

Goals

- ROM 0-90 degrees
- Gait with one crutch/no crutch by 2 weeks
- Full extension in brace x 2 weeks
- Monitor for infection
FYI

- At this stage, edema is the biggest problem.
- Athlete needs to ice frequently and elevate knee.
- Continue with ankle pumps and quad sets for HEP.
- Extension is critical from the beginning, don’t focus too much on flexion at this point.

Weeks 2 and 3

- NMES quad sets (if needed)
- Patella mobs (if needed)
- Passive seated knee flexion (NO ACTIVE knee extension)
- Bike for ROM 10mins
- Ankle PNF
- TKE’s 2 x 20

Weeks 2 and 3

- 4 Way SLR 2 x 10
- Rebounder 2 x 30
- Step up with TKE
- Wall sit 2:30min (See Hurricane Series)
- Sustained lunge (See Hurricane Series)
- Gait Training
Goals

- ROM 0-110 degrees
- No Crutch use
- Unlock brace to appropriate ROM/ possible short runner brace
- Must be able to complete with correct form 4inch anterior step down

FYI

- Gait Mechanics must be correct (Locker Room Walk)
- Use scales if necessary to monitor weight distribution during wall sit.
Weeks 4 to 7

- Bike for exercise
- Dynamic Warm-up (see attachment)
- Rebounder 3 way (progress to Airex pad)
- Complete Hurricane Isometric Series (see attachment)
- Hip Mini band (See attachment)
- BOSU step ups anterior/lateral
- BOSU lunges anterior only
- Medial step downs

Weeks 4 to 7

- Kettlebell Single leg RDL's
- Kettlebell Plie Squats
- Core strengthening (Plank, situps, crunches with a med ball…)
- AIS stretching (hamstring, hip adduction)
- Cross Friction massage to ITB (if needed)
- Prone passive knee flexion
- Y balance testing (week 6/7)

Weeks 4 to 7 Video
Goals

- ROM 0-120 degrees
- Normalized Gait
- No measurable edema
- D/C brace by week 6 (MUST be able to complete 8" anterior step down)

FYI

Monitor technique and compensatory patterns during mini band exercises.

Challenge on bike for cardio exercise (3 mile bike test, 5 mile bike)

Monitor anterior knee pain.

May need to adjust mechanics for possible tendonitis development.

Dynamic warm-up

- Purpose: To prepare the body for the athletic demands that are about to be placed on the skeletal, muscular, proprioceptive and cardiovascular systems.
Dynamic Warm Up Video

Hip activation exercises

Purpose: Activate the hip musculature to get ready for athletic movements, as well as assist in injury prevention.

Hip Activation Videos
Maintaining tissue mobility

- Purpose: Create an environment where tissues are at maximum efficiency and ROM/power output.

Active Isolated Rope Stretches (video)

Weeks 8 to 11

- *****DANGER ZONE***** the highest incidence of re-tears occurs during this time frame. At this point, the graft is at its weakest. Concurrently, the athlete feels secure with their knee and can sometimes do ill advised activities that can compromise the integrity of the graft.

- Continue previous exercises
- Anterior sustained lunge on BOSU with up/downs: 30 hold/15 lunges/30 hold
- Hurricane series with BW movements after isometric hold.
- Walking DB lunges
Weeks 8 to 11

- Goblet squats
- Friesen Squat Series
- Vertimax (if available)
- TRX single leg strengthening
- Interval bike sprints for cardio
- Functional Movement Screen (FMS) and Y Balance Test

Weeks 8 to 11 Video

Goals

- Full knee ROM
- Comparable proprioception/balance btw L/R
- Obtain Girth measurement 10cm/20cm above suprapatellar pole. (<10% difference)
FYI

NO running before 12 weeks.

This is a very frustrating time for both clinician and athlete due to lack of progression.

However, this is the most important time to continue strengthening, balance, proprioception and core training.

Challenge core, cardio and upper body strength.

Weeks 12-16

- Continue strengthening exercises increasing weight, reps, sets
- Consider consult with Sport Psych if needed
- Incorporate Metabolic workouts (High intensity circuit training)
- EASY straight ahead jogging (Treadmill ok)
- Re-test Y balance
- Agility
- Lateral skillets
- Carioca
- Ladder drills

Weeks 12 to 16

- Resisted Bungee drills
- Plyometric Training
- Depth jumps
- Box jumps
- Alternating single leg deceleration lunges
- Squat jumps
- Skiers
Monitor closely varus/valgus movement during plyometric training.

If girth measurement differences were > 10%, alter training to incorporate lower reps/heavier weight to encourage hypertrophy.
Weeks 16+

- Re-test FMS
- Sport specific training
- Complete training in the setting of the sport (basketball court, soccer field)

Return to Sport Training Video

Return to Sport Testing

- When is it safe to return?
- Surgeons sometimes DC patients way too early just dependent on time frame
Hop Test Videos

- Single Leg
- Crossed
- Triple
- Timed

- Delaware-OSLO ACL Cohort Study: pts w less than 88% of uninvolved side in 6-m hop test at 6 months are not ready to return to full sport.

Hop Test Video

Y Balance Test Video
Functional Movement Screen

#1: Get extension early and often!
#2: Learn to trust the knee

#3 STRENGTHENING THE HIP CUFF

#3: Strengthening the hip cuff
#4: Understanding the mental grind

#5: Be aware of the “danger zone”
#6: It's not about time

#7: PUT ME IN COACH!

- FUNCTIONAL MOVEMENT SCREEN
- Y BALANCE TEST
- SINGLE LEG HOP DISTANCE
- SINGLE LEG HOP TIME GM
- CROSSOVER HOP
- BROAD JUMP

#7: Put me in coach!
Conclusion

Advances in technology have allowed us to rehab ACL patients quicker but we still MUST respect tissue healing times.

On going debates and proper graft choice, single bundle vs double bundle and how/when to safely clear for return to sport.

To be continued........

References


References

References


QUESTIONS?