Neuromuscular Strengthening Exercises following ACL and Meniscal Repair in a 15 Year Old Female Athlete with Generalized Knee Laxity: A Case Report

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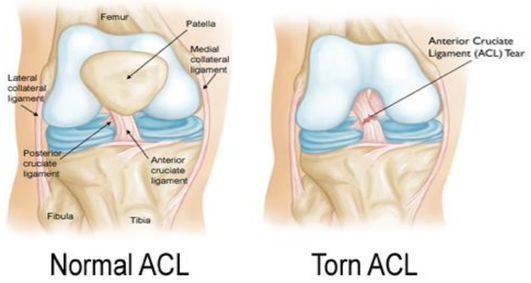
Unique

- Adolescent females are 4-6 times more likely to sustain a non-contact anterior cruciate ligament (ACL) injury compared to their male counterparts.[1]
- Generalized knee laxity decreases dynamic knee stability and significantly increases the odds of an ACL injury 5-fold.[2]
- It is crucial to return the surgically repaired knee to its former function. However, it is just as vital to direct attention to the uninjured knee with joint laxity.
- Research has found that those who have torn one ACL are six time more likely to tear the contralateral ACL. [3]
- There is currently a lack of research that directly addresses intervention programs that target specific rehabilitation protocols for the injured and uninjured knee simultaneously.



Purpose

- The purpose of this case report was to investigate the use of a progressive neuromuscular control and strengthening protocol in both the ACL injured and un-injured knees in an adolescent female with generalized knee joint laxity.

Foundation

- Traditional rehabilitation following a surgical ACL reconstruction (ACLR) focuses on edema reduction, range of motion, strengthening, gait re-training, dynamic stability and neuromuscular exercises[4].
- Additionally, ACL injury prevention programs that concentrate on proper biomechanical alignment, strength, agility and dynamic balance have been shown to decrease the incidence of ACL tears in female athletes [5].
- Balancing the rehabilitation protocol while also concentrating on injury prevention techniques for generalized knee laxity of the contralateral knee can be challenging.
- It was hypothesized that a rehabilitation program that addressed both the surgical and uninjured knees would improve functional outcomes and likely benefit the patient.

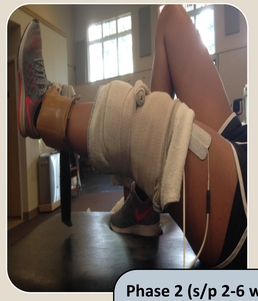
Case Description

- JD was a 15-year-old female track athlete who was competing in the long jump for the first time and upon landing , sustained a left ACL and medial meniscus tear
- Surgical intervention included an allograft reconstruction and medial meniscus repair
- She used crutches for 4 weeks, due to weight-bearing restrictions
- Her initial evaluation at 2 weeks after surgery revealed ROM, strength, balance and gait deficits
- The patient exhibited poor trunk control and core stability, and also revealed knee hyperextension in the uninjured knee.

Initial Evaluation Systems Review

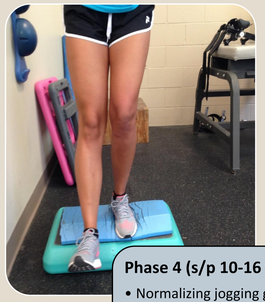
System	System Status
Musculoskeletal	**Left LE**: **AROM**: Impaired/Limited Flexion & Extension **Gross Strength**: Impaired **Right LE**: Not impaired
Neuromuscular	**Gait / Locomotion:** Impaired
Integumentary	Impaired: Incision site medial to patellar tendon clean, dry and covered with steri-strips. Multiple small incisions on lateral and medial aspect of left knee clean and dry. Residual post-surgical swelling and ecchymosis surrounding left knee
Cardiovascular/Pulmonary	There were no significant findings for cardiovascular or pulmonary systems.
Communication Affect, Cognition, Learning Style	Patient was alert and oriented x3 and preferred demonstration and pictures for the home exercise program.

Interventions: ACL Rehabilitation & Neuromuscular Strengthening Program (s/p 2-11 weeks)



Phase 2 (s/p 2-6 weeks)
- Ice & elevation
- NMES for quadriceps activation
- Straight leg raises
- Single quadriceps set
- Stretching for TKE
- Recumbent bike
- Hip PRE's
- Leg press
- Mini squats
- Gait training
- Step up / downs

Phase 3 (s/p 6-10 weeks)
- Single leg balance
- Lunges (dynamic/static)
- Double leg squats
- BOSU step ups
- Begin jogging
- **Progressions**:
  - Increase step height
  - Dynamic balance
  - SL leg press
  - Use of AirEx
  - Medicine ball for core control



Phase 4 (s/p 10-16 weeks)
- Normalizing jogging gait
- Focus on proper midfoot strike

- **Feedback to avoid right knee hyperextension:**
  - Verbal
  - Visual
  - Tactile

Observations

- The patient was seen 2x/week for 9 weeks.
- Improvements were noted in ROM, strength, balance, and dynamic activity on her surgically repaired extremity.
- Her uninjured limb made minor improvements in hamstring and quadriceps strength. She was able to control hyperextension influences of the right knee during all exercises.
- The patient was able to safely return to running and transitioned to a gym program in preparation for the upcoming track season.
- She was discharged at 12 weeks meeting all goals for physical therapy.

Tests & Measures	Impairments at Initial Examination (S/P 2 weeks)	Impairments at Final Assessment (S/P 11 weeks)
ROM	**L LE**: Flexion: 100° Extension: (15°) **R LE**: Hyperextension 10°	Flexion: 120° Extension: 0° **R LE**: Hyperextension 10°
MMT **Bilateral LE Strength**	**L LE**: not formally tested (noted poor quadriceps tone with attempted contraction & extension lag with functional SLR) **R LE**: Quads: 5-/5 Hamstrings: 5-/5 Gluteus Maximus: 4+/5 Glute Medius: 4+/5	**L LE**: Quads: 4/5 Hamstrings: 4+/5 Gluteus Maximus: 4+/5 Gluteus Medius: 4+/5 **R LE**: Quads: 5/5 Hamstrings: 5/5 Gluteus Maximus: 4+/5 Gluteus Medius: 4+/5
Numeric Pain Rating Scale (0-10)	Best: 0 Worst: 3 Current: 1 Description: Dull/Achy	Best: 0 Worst: 0 Current: 0
Gait / Locomotion	-50% weight bearing per physician protocol -Antalgic -Using axillary crutches	-Normal gait pattern -Decreased stride length of left leg compared to right -Return to jogging
Palpation	Popliteal space – edematous Tibial tuberosity – painful to light palpation Medial / Lateral joint line – edematous	Normal tenderness and decreased inflammation of popliteal space and medial/lateral joint line
Outcome Measure: LEFS	Score: 26/80	Score: 54/80

Conclusions

- A neuromuscular strengthening protocol that focused on neutralizing generalized knee laxity was beneficial for a 15 year old patient after ACLR.
- The patient met all goals as well as potential decreased risk of contralateral ACL injury due to increased knee strength and dynamic stability and patient's increased awareness of body mechanics to combat knee hyperextension during dynamic tasks.
- Future studies should investigate most effective PT interventions that combine rehabilitation of the injured knee with prevention strategies for the uninjured knee.

Acknowledgements & References

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Figure 1: http://orthoinfo.aaos.org/topic.cfm?topic=a00549