

Isokinetic Certification 101

Episode 10: Lower Extremity Plan of Care

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Introduction to Isokinetic Training and Testing

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- CSMi
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- Email questions to Rob:
Rob.potash@csmisolutions.com



- Register your clinic for free at Cybextest.org**
- Catch up or review previous episodes at isokinetics101.org**
- csmisolutions.com**



Shout Outs

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Erik Meira PT, DPT, SCS, CSCS

J.W. Matheson PT, DPT, MS, SCS, OCS, CSCS

Discussion Topics

Past:

- History & Science
- Training Applications
- Testing Applications

Present:

- Lower Extremity Plan of Care

Future:

- November: UE POC
- December: Other items (BFR applications, calibration)

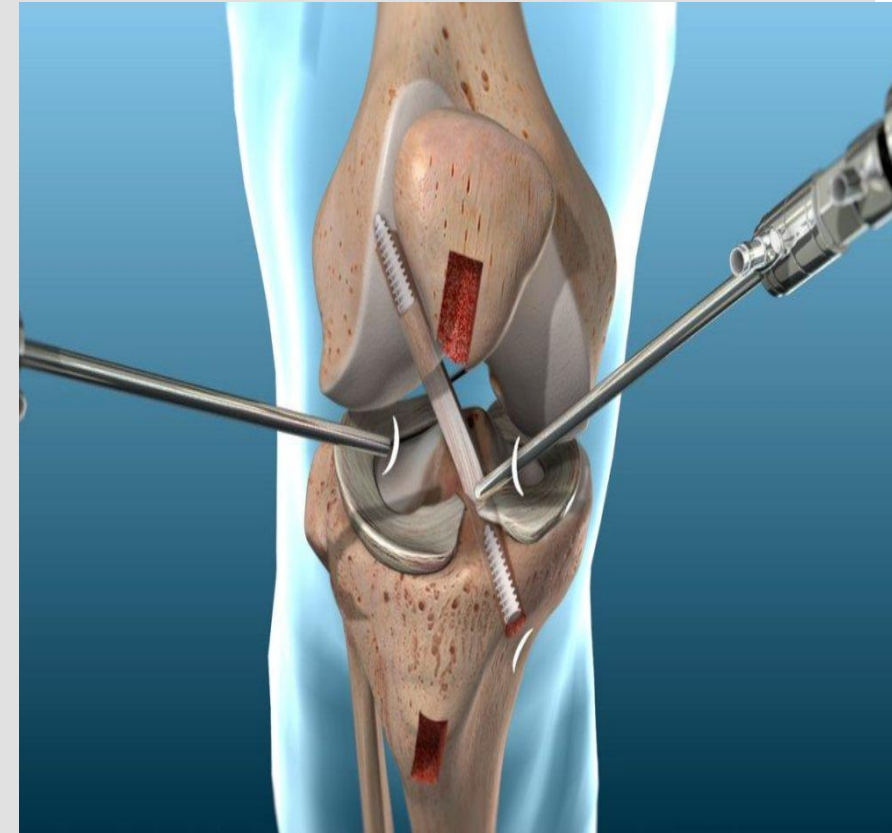
THE FIVE BASIC PHASES OF REHABILITATION

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HUMAC NORM Clinical Pathway to Function



ACL Isokinetic Plan of Care



ACLR Isokinetic Protocol

Prehab:

- CPM post-injury to reduce pain, swelling, and regain ROM
- Isometric contraction at 60deg focus is on NMR
 - Proximal pad for quad
 - Distal pad for hamstring
- Can test the uninvolved limb for later comparison

S/P Week 1-2

- CPM only in sitting position

ACLR Isokinetic Protocol

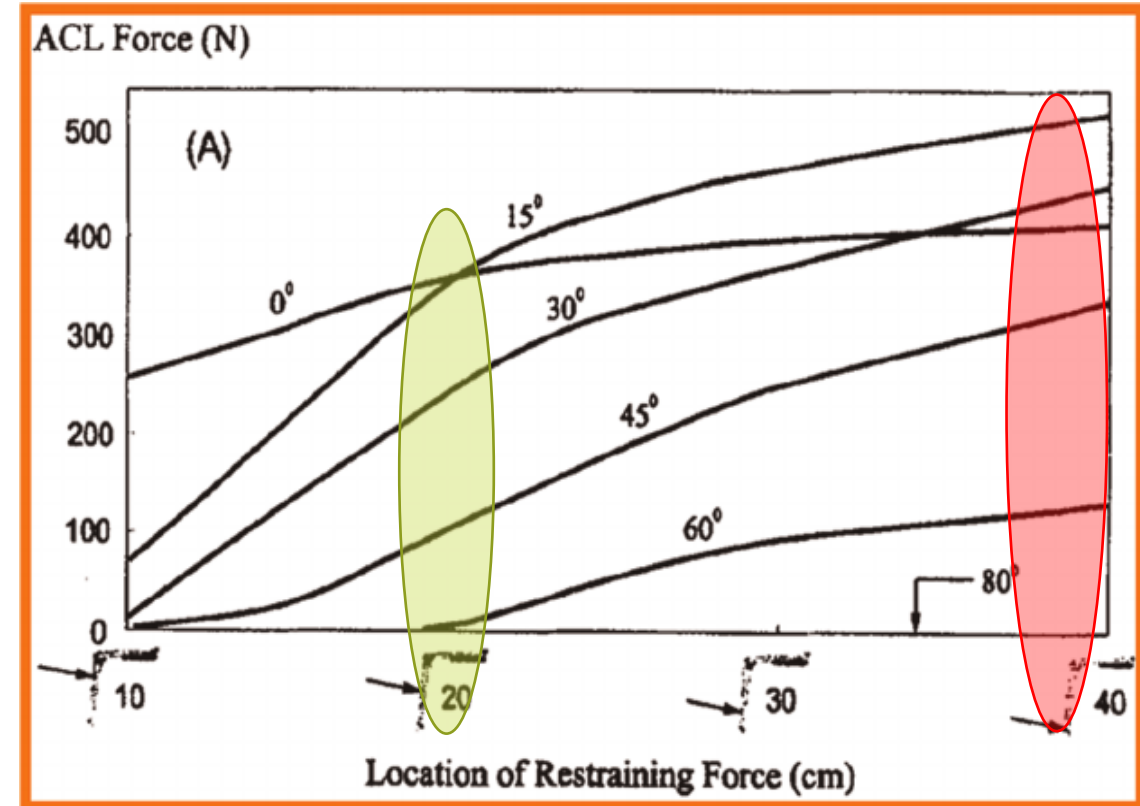
S/P Week 3-4:

- Eccentric unloading at 5deg/sec for quad activation and terminal knee extension
- CPM as needed to reduce pain, swelling, and regain ROM in sitting or prone
- You can begin Multi-angle isometrics (MAI) for the UNINVOLVED LIMB to introduce it to the patient as they will begin this soon for the surgery limb.
- Begin eccentric progression to the UNINVOLVED LIMB to maintain strength.

ACLR Isokinetic Protocol

Anterior shearing and ACL strain:

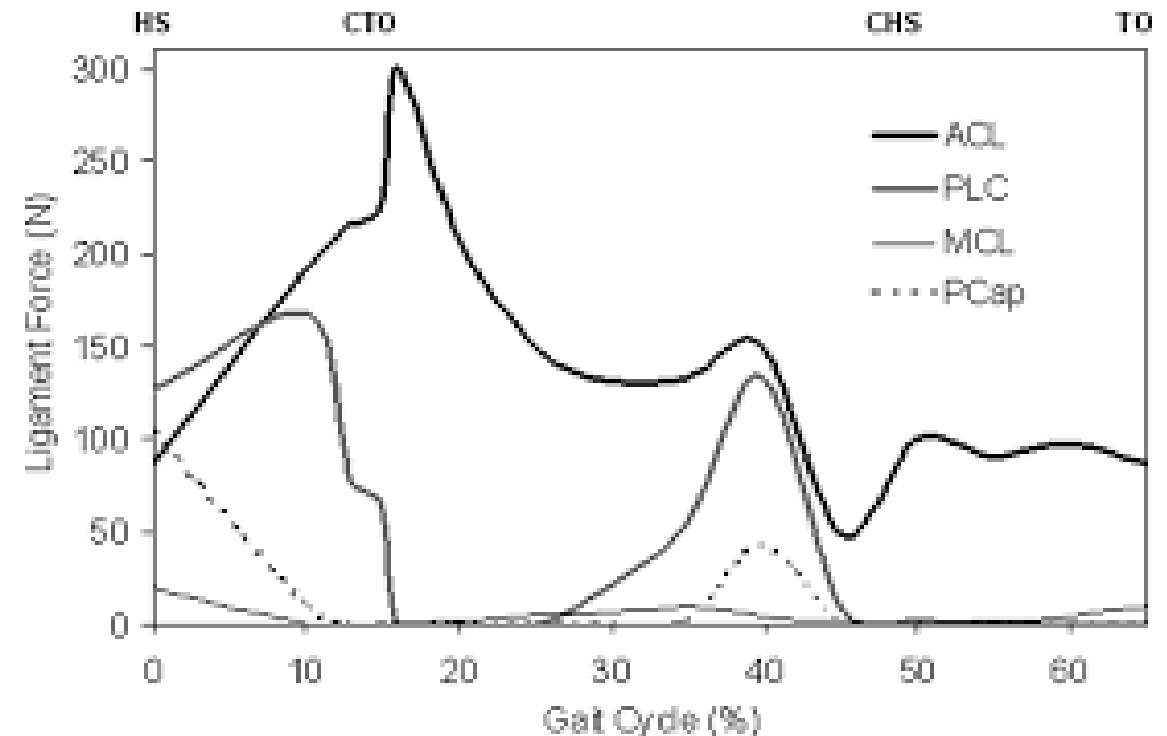
- Native ACL withstands up to 2000N
- ACL strain is least in the range between 90-40deg
- A proximal pad in the middle third of tibia will reduce ACL strain in half
 - 200N vs 400N at 30deg under external load



ACLR Isokinetic Protocol

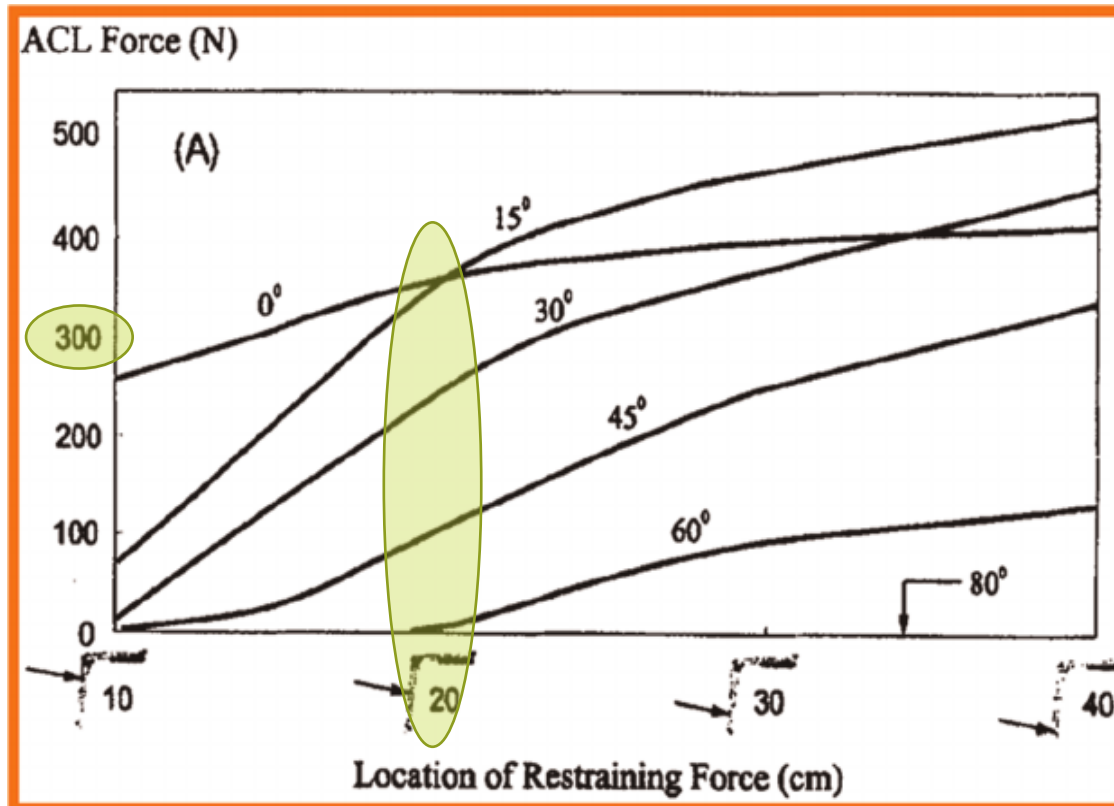
Anterior shearing and ACL strain:

- For comparison:
 - Level ground walking: 300N at 16deg in early stance phase
 - Stair climbing 146N at 50deg

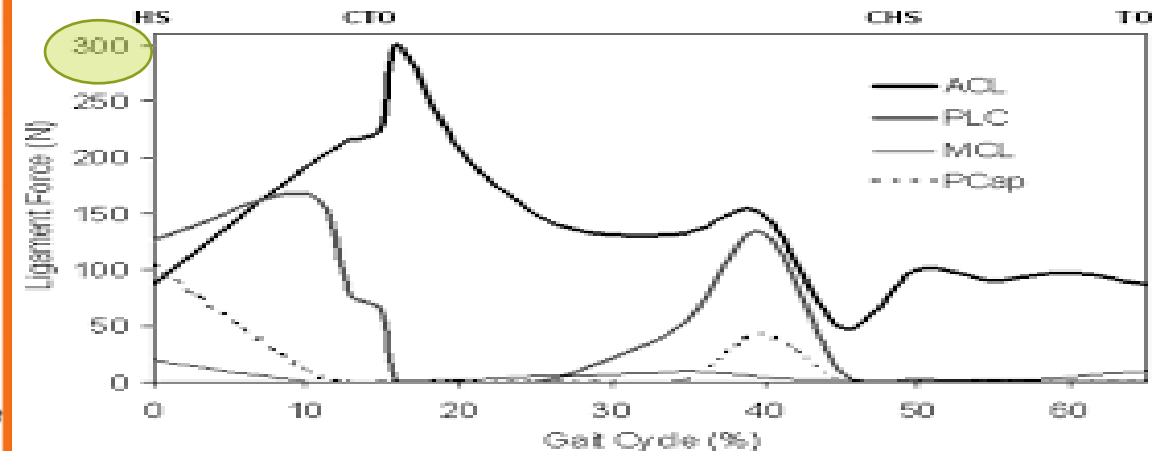


Knee Extension vs Gait

Knee Extension



Gait Cycle



ACLR Isokinetic Protocol

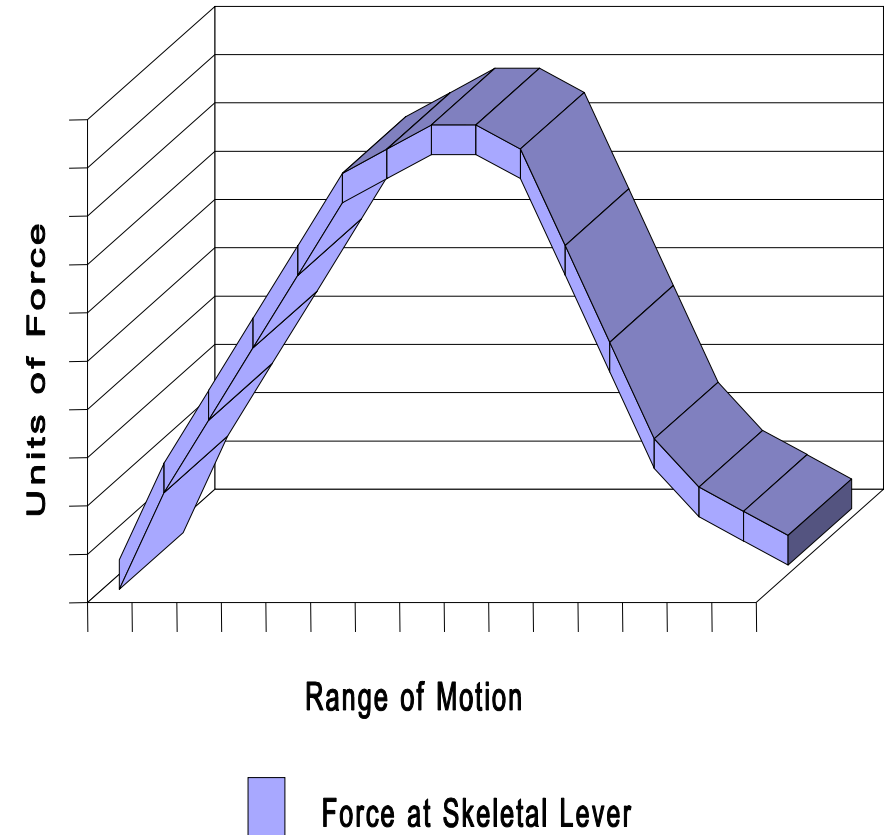
S/P Week 4-6

- Begin Isometric Exercise
 - Multi-angle isometrics (MAI) every 20deg from 40-90deg
 - 3-5 reps at each angle (Daniel's preference)
 - 1 rep each angle and then it repeats 3-5 times (John's preference)
 - 5 sec contraction and 10sec rest
 - Angles set to 40-60-80-90deg
 - *John and I have used this all the way to 20deg without issues
 - Proximal pad for quad, distal for hamstring

ACLR Isokinetic Protocol

S/P Week 4-6

- Begin Isometric Exercise
 - Light torque (5-20ftlbs)
 - Remember torque curves
 - You can set torque limits
 - Targets feature for torque control and NMR
 - If hamstring graft utilized or medial meniscus repair, do not perform for the hamstring until week 6 at the earliest.
 - Continue eccentric progression for the UNINVOLVED



ACLR Isokinetic Protocol

S/P Week 6-7:

- Progress isometric torque production
- Begin Slow Eccentric Progression for INVOLVED
 - Perform eccentric at 5ds for 1-2set x10reps the first 1-2 times on the machine.
 - Light torque production with focus on contraction control
 - Progress to 5/10/15ds protocol when good control of torque and tolerating well
 - Proximal pad for quad, distal for hamstring
 - Progress UNINVOLVED as able

ACLR Isokinetic Protocol

Video: Create an eccentric exercise protocol

ACLR Isokinetic Protocol

S/P Week 6-7:

- If hamstring graft or medial meniscus repair, begin hamstring MAI
- Isotonic Control Training
 - Reaction time
 - Proprioception assessment
 - No additional load applied and full ROM

ACLR Isokinetic Protocol

S/P Week 8-11:

- Continue SLOW Eccentric Progression
 - Perform each protocol on at least 2 sessions *
 - 1-2 sets of the protocol per session
 - Progress when pain-free and torque lines are ideal and free of force oscillation.
 - Up to 50% effort for INVOLVED
 - Up to 75% effort for UNINVOLVED and progress as able into Medium speed deceleration training
 - Continue proximal pad for quads

ACLR Isokinetic Protocol

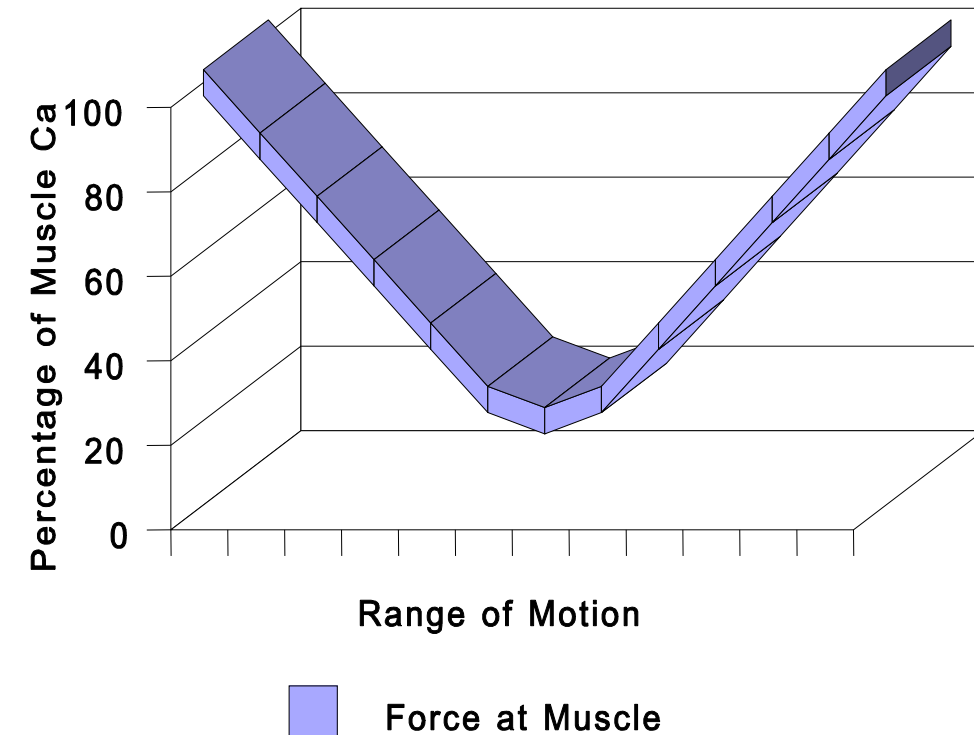
S/P Week 8-11:

- Continue SLOW Eccentric Progression
 - SLOW Protocols
 - 10/15/20ds
 - 15/20/25ds
 - 20/25/30ds
 - 25/30/35ds

ACLR Isokinetic Protocol

S/P Week 8-11:

- Isotonic
 - Light torque allowed 0-5ftlbs
 - Interactive line and path
 - Pacing bar and Roadway
 - Games
 - I typically do this after strengthening sets



ACLR Isokinetic Protocol

S/P Week 8-11:

-Testing

-Isometric Test at week 8

- Quad and Ham (unless hamstring graft or medial meniscus repair)
- Baseline testing and remain completely pain-free
- Test at 60deg, 3 reps, 5 sec contraction and 10sec rest

ACLR Isokinetic Protocol

S/P Week 12-15:

- Medium Speed Deceleration Training
 - Allow up to 75% effort
 - Progress when pain-free and torque lines are ideal
 - Based on patient performance
 - Train through eccentric inhibition
 - Continue proximal pad
 - You can now strengthen the entire ROM to full extension, however we limit extension to 10deg to not allow screw-home mechanism during eccentric loading

ACLR Isokinetic Protocol

S/P Week 12-15:

- Medium Speed Deceleration Training
 - Medium Protocols
 - 40/60/80ds
 - 60/80/100ds
 - 80/100/120ds
 - 100/120/140ds

ACLR Isokinetic Protocol

S/P Week 12-15:

- Medium Speed Deceleration Protocol Types
 - Agonist Muscle Sets
 - Active Eccentric and Resting Concentric
 - Active Eccentric and Active Concentric
 - Agonist/Antagonist Muscle Sets
 - Alternating Sets
 - Reciprocal Muscle Groups

ACLR Isokinetic Protocol

S/P Week 12-15:

- Agonist Muscle Sets

- Active Eccentric and Resting Concentric

- This is the standard eccentric loading that we have performed so far

- Active Eccentric and Active Concentric

- Now we are truly using isokinetic mode of exercise requiring concentric action but we are still only using one muscle group at a time.

- Concentric contractions require more oxygen as well as increase the total time under tension which increases the fatigue factor significantly

ACLR Isokinetic Protocol

S/P Week 12-15:

- Agonist/Antagonist Muscle Sets
 - Alternating Sets
 - One set x10 reps of Quad followed immediately by a set of Hamstring
 - Significantly minimizes time spent resting and maximizes time spent on machine
 - This is my favorite way to perform training in this phase
- Reciprocal Muscle Groups
 - Standard isokinetic training
 - All concentric (Con quad / Con Ham)
 - No eccentric muscle contractions

ACLR Isokinetic Protocol

S/P Week 12-15:

- Isotonic at medium torque load
 - 30% Eccentric Overload (10/13ftlb, 20/26ftlb, 30/39ft/lb, 40/52ftlb)
 - Interactive Path/Line
 - Games
 - Pacing Bar / Roadway
 - I typically do this after deceleration sets to work on endurance and control

ACLR Isokinetic Protocol

S/P Week 12-15:

- Testing
 - Repeat Isometric test at week12
 - Can now test hamstring if hamstring graft or medial meniscus repair

ACLR Isokinetic Protocol

S/P Week 16-24:

- Visits/treatment varies depending on visit POC and their outside treatments (ATC, strength coaches, independent gym program)
- Begin Power Training
- Progress Deceleration Training into High Speed (140+ d/s) as able
- Progress dynamic isotonic training as able

ACLR Isokinetic Protocol

S/P Week 16-24:

- Begin distal pad placement for quadriceps
- I like to perform isokinetic training in the middle of the session after plyometric/agilities to fatigue the leg and then perform CKC and NMR activity in fatigued state.

ACLR Isokinetic Protocol

S/P Week 16-24:

- Testing
 - Week 16
 - Repeat isometric test or perform standard isokinetic (2-speed con/con)
 - Week 20
 - Perform first interrupted stroke test
 - Week 24
 - Re-test interrupted stroke

ACLR Isokinetic Protocol

S/P Week 24+:

- Testing
 - Repeat Interrupted stroke testing to help determine appropriate RTP.

ACLR Isokinetic Protocol

Off season

- Have patient come back 4-6 weeks prior to first practice for assessment of readiness and training needs.

TKA Isokinetic Plan of Care



TKA Isokinetic Protocol

Prehab

- Multi-Angle Isometric or slow eccentric loading (if able) for quad and/or hamstring strengthening

S/P Week 1-2

- CPM for pain, swelling, stiffness, and regain ROM

S/P Week 3-4

- Eccentric unloading for quad activation and terminal extension

TKA Isokinetic Protocol

S/P Week 5-6

- Multi-angle isometrics with torque to tolerance
- Can use distal pad
- Can exercise the entire ROM

S/P Week 6-8

- Begin SLOW eccentric progression (same rules as ACLR)
- Up to 50% effort
- Early Isotonics (as described for ACLR)
- Isometric test week 8 if appropriate

TKA Isokinetic Protocol

S/P Week 9-12

- Continue Eccentric Progression (typically slow speeds only)
 - Up to 75% effort but pain-free
 - Progression based on patient
- Progress isotonics gently
- Isometric test week 12

Non-surgical Knee Isokinetic Plan of Care



Non-Surgical Isokinetic Protocol

- Based on the findings of your examination, determine what testing is appropriate.
- This can be performed as part of your examination or on the follow-up visit.
- Many times we will perform Multi-Angle Isometrics (MAI) or slow eccentrics as an intervention on the first visit as an unofficial test and to assess tolerance.

Who Doesn't Get Testing?

Patients who are:

- NWB
- Not safe to transfer on/off machine
- Acute injury
- Inflamed joint
- MMT < 4/5
- High pain with MMT

Who Gets Isokinetic Testing?

Patients who are:

- Ambulatory
- AROM WNL
- Minimal pain with normal ADL's that does not restrict activity
- Pain with vigorous activity or exercise
- Trained
- MMT \leq 5/5 with minimal to no pain
- Patients who tolerate slow eccentrics
- Patients who have minimal isometric test findings
- Interrupted stroke test for either quad, hamstring, or both

Who Gets Isometric Testing?

- Patients with dysfunction but who are not appropriate for isokinetic testing.
 - Ambulatory
 - Pain with normal ADL's that restrict activity.
 - Non-trained
 - Mild pain with MMT and/or <5/5
 - Pain-free AROM is restricted
 - Did not tolerate slow eccentric on first visit

Non-surgical Isokinetic Protocol

Three categories:

- Passive Training
- Isometric Training
- Eccentric Training

For each type of patient, typically the dynamometer intervention is performed after warm-up, soft tissue work, functional training but prior to proprioception training and cool down/ice.

HUMAC NORM Clinical Pathway to Function



Isolated-Joint Testing Provides Feedback Loop to Success



Non-surgical Isokinetic Protocol

Passive Training 5 minute bouts at 5-10deg/sec

- This is for acute knee injuries, muscle strain, stiff/sore degenerated joints
- Sitting position
 - General position for acute knee joint injury or arthritis
 - Good starting position for quad strains (with or without manual therapy)
- Prone position
 - Good starting position for hamstring strains (with or without manual therapy)
 - Progress them to sitting for more tissue elongation
 - Progress quad strains for more tissue elongation
- Progress into Isometric training as able

Non-surgical Isokinetic Protocol

- Isometric Training:
 - Perform 1 set of MAI at 25-50% effort on first session
 - If they tolerated session well, on next session you can progress to 1-2 sets.
 - If they tolerate that well, you can progress to 50-75% effort.
 - Do not progress sets / difficulty of isometrics if you are also significantly progressing other interventions in that same visit
 - Progressing mini-squat to sit-to-stand or step-downs
 - Progress into slow eccentric progression as able and as needed.

Non-surgical Isokinetic Protocol

Isometric Training:

- Long hold / heavy resistance for patellar tendonopathy
 - 24 sets of 10sec hold with 30sec rest (11min 30sec total)
 - or 6 sets of 40sec with 80sec rest (16min 20sec total)
 - At 85% of MVIC or below pain threshold
 - Exercise angle at 60deg of knee flexion
- Once pain is reduced, if they can tolerate eccentric training, then progress them into eccentric training.

Non-surgical Isokinetic Protocol

Isokinetic Eccentric Training:

- First session begin with 1-2 sets of slow eccentrics (10/15/20ds protocol) up to 50% effort.
- Progress as able adjusting parameters as needed
 - increase to 2-3 sets
 - increase to 75% effort
 - move to the next protocol (15/20/25)
- When you move to the next protocol, reduce the sets to 1-2, and effort back down to 50%

Non-surgical Isokinetic Protocol

Isokinetic Eccentric Training:

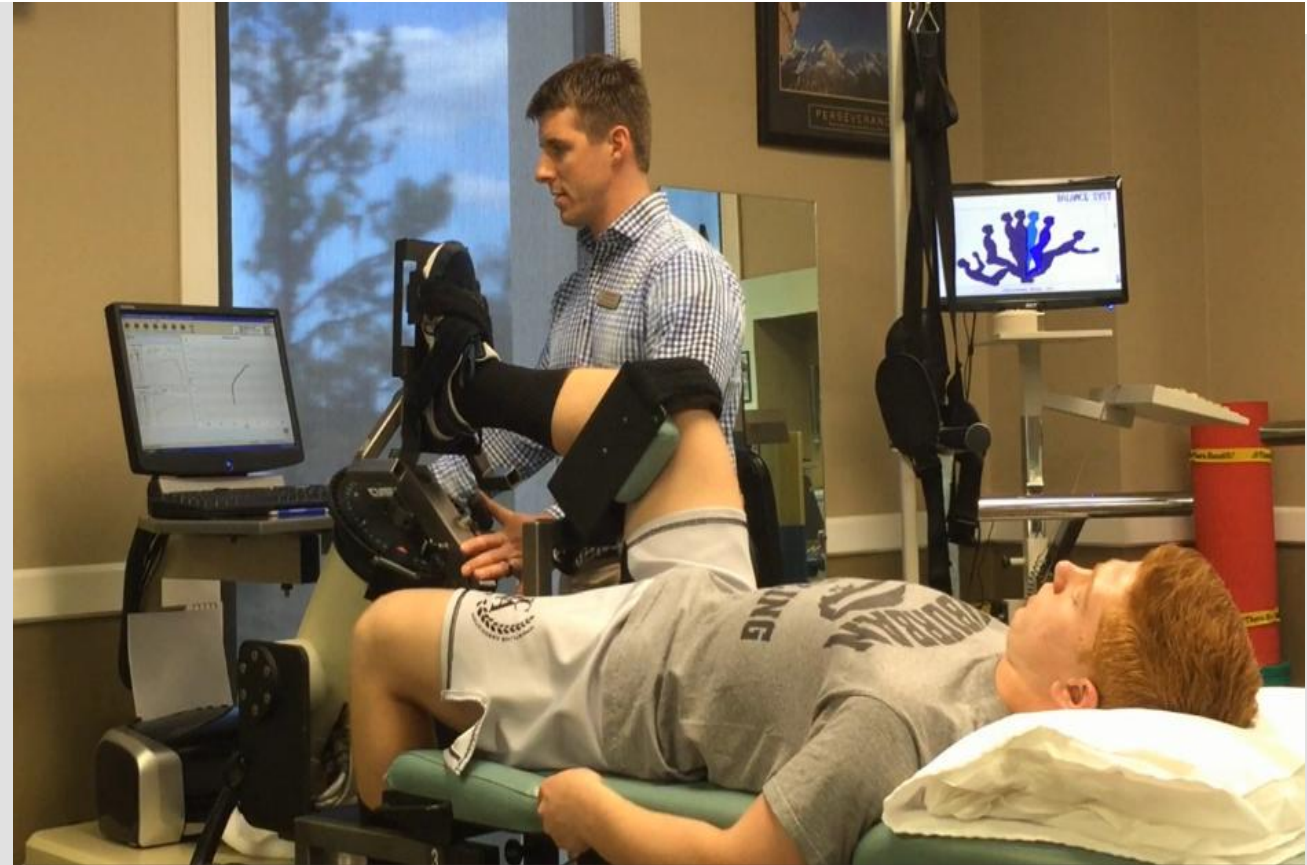
- For more active patients, progress into medium speed eccentrics
- You can perform isotonic training as well if appropriate

Non-surgical Isokinetic Protocol

Follow-up Testing

- Perform follow up testing
- Even if they initially performed isometric testing, they may now be appropriate for interrupted stroke test.

Foot / Ankle Isokinetic POC



Post-surgical Ankle Isokinetic Protocol

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- Achilles tendon repair
- Brostrom repair

Nobody:

The ground:

My Ankle:



Achilles Tendon Repair POC

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S/P Week 2-5

- CPM to neutral DF
- Begin in supine position with knee bent for week 2-3 and then move to prone with knee extended in weeks 4-5

S/P Week 6-8

- Begin MAI for PF with maximal 0deg DF
- Begin MAI for Inv-ever



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Achilles Tendon Repair POC

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S/P Week 9-12

- Begin slow eccentrics
 - Start at 5deg/sec
 - Up to 15deg/sec for plantar flexors
 - Up to 30deg/sec for inverters/everters

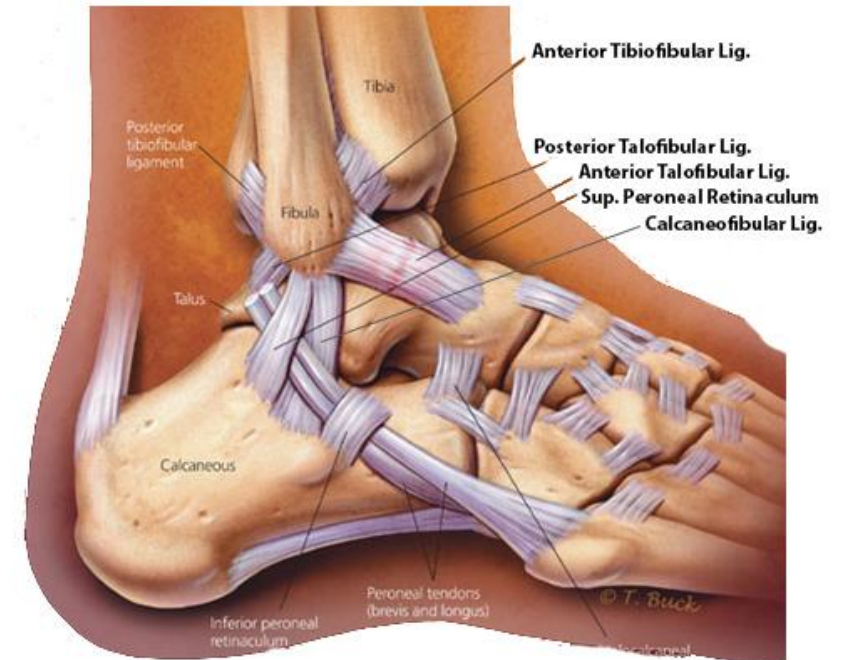


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Brostrum Repair POC

S/P Week 6-9

- No dynamometer intervention for first 6 weeks
- No ROM for inversion/eversion in this phase
- Can begin light isometrics for inversion/eversion in neutral position



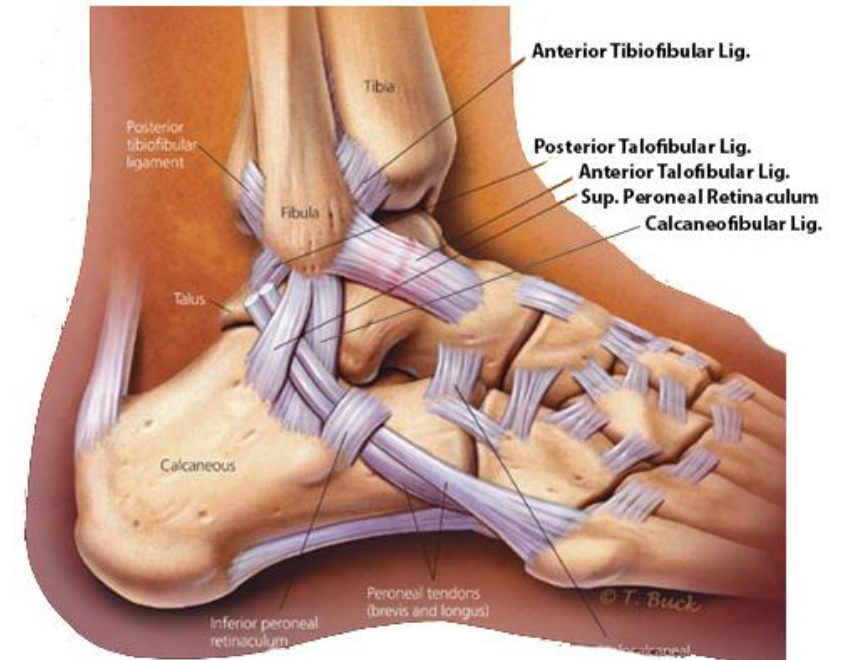
Brostrum Repair POC

S/P Week 10-12

- Can use CPM for inversion/eversion up to restriction
- Begin MAI within available ROM

S/P Week 13-16

- Begin eccentric loading starting at 5deg/sec up to 30deg/sec
- Begin isotonic control training without any load



Non-surgical Ankle Isokinetic Protocol

Determine appropriate testing during examination (remember this can be performed on a follow-up visit)

- Isometric test
 - WBAT or greater
 - Minimal to no pain with MMT
 - Reduced pain-free AROM
- Isokinetic test
 - FWB
 - Irritation only with athletic activity
 - Full pain-free ROM and MMT

Not appropriate for testing
Acute injury
Inflamed joint
NWB to PWB
Moderate pain with MMT
Apprehension

Non-surgical Ankle Isokinetic Protocol

Three categories:

- Passive Training
- Isometric Training
- Eccentric Training

For each type of patient, typically the dynamometer intervention is performed after warm-up, soft tissue work, and functional training but prior to proprioception training and cool down/ice.



Non-surgical Ankle Isokinetic Protocol

- Passive Training
 - For acute injuries or grade 2 sprains
 - For any patient who lacks full pain-free AROM/PROM
 - Inversion/eversion pattern or DF/PF in supine
 - 3-5deg/sec max as the ROM is smaller
 - Can perform soft tissue mobilization if not in acute phase

Non-surgical Ankle Isokinetic Protocol

- Isometric Training
 - For patients who are able to produce torque isometrically in a limited portion of the ROM.
 - Non-acute injury but swelling is okay
 - Start in neutral position for inversion/eversion or DF/PF and increase 5-10deg at a time in each direction until end-range is achieved or until no longer pain-free
 - Begin with light torque (25% effort and increase to 50% effort as able)
 - May need to perform CPM before, after, or between sets

Non-surgical Ankle Isokinetic Protocol

- Isokinetic Training
 - For patients who are able to produce torque throughout the ROM
 - May have been progressed from isometric training
 - Keep speeds slow
 - 5/10/15deg/sec
 - 10/15/20deg/sec
 - 15/20/25deg/sec
 - 20/25/30deg/sec
 - Begin with light torque (25% effort and increase to 50% and 75% effort as able)
 - Can perform light isotonic with dynamic feedback for proprioception training
 - Do not work into extreme end-ranges

Questions/Answers

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“Always pass on what you have learned”

Other References

- Music Provided by Bensound.com