TriHealth
Orthopedic & Sports Institute

ACL Reconstruction with Allograft

1. Defined

a. Primarily done with Achilles tendon allograft.
b. ACL reconstruction is often combined with a partial menisectomy or meniscus repair, and occasionally other ligamentous injury or repair.

2. Goals

a. Restore motion
b. Restore lower extremity control
c. Maintain knee stability
d. Reinforce concepts of longer graft incorporation time frames

3. Rehabilitation Principles (ACL specific)

a. Patient progression is time and function based and any deviation from clinical guidelines should be relayed to physician and documented.
    i. Incorporation and revascularization
b. Understand graft strain concepts in order to protect the graft.
c. Open chain exercises at low flexion angles (SAQ, knee extension) or closed chain exercises at high flexion angles may produce increased anterior shear.
d. In the first 6-12 weeks rehab the fixation of the graft rather than the graft itself is the limiting factor.
e. At 12 weeks revascularization is occurring and the graft is in its weakest state.
    i. Revascularization is complete at 20 weeks (5 months)
    ii. ***Graft strength is ~40% at 20 weeks***
        1. ***POINT: We have a "Tender" tissue requiring satisfactory NM control and it is critical to have supervised, graded progression of higher risk activity.***
f. Initiate early weight-bearing and ROM with heavy emphasis on obtaining full, early extension.
g. Limit muscular inhibition and atrophy from effusion.
h. Initiate early activity of quads and hamstrings (isometric, isotonic, resistive) with e-stim and biofeedback.
i. Protect the healing donor site by limiting aggressive hamstring stretches and heavy hamstring resistive training.

j. Initiate early (2nd visit) closed-chain activity to provide compression across the knee joint while activating co-contraction of the quads and hamstrings, as WB restrictions per MD allows
k. Address limb confidence issues with progression of unilateral activity
l. Address limb velocity issues during gait with verbal and tactile cueing
m. Incorporate comprehensive lower extremity (hip and calf) muscle stabilization and strengthening activities as well as core strengthening activities
n. Identify motion complications early and begin low-load, long duration stretching activity.
    i. Range of motion expectations
        1. Visit 2 - 0º of extension to 90º of flexion
        2. Week 1 - 0º to 100º
        3. Week 2 - 0º to 115º
        4. Week 3 – symmetrical extension to 125º flexion
        5. Week 4 – symmetrical extension to full flexion (heel to buttock)
o. Initiate early proprioceptive and kinesthetic techniques: Low to high, sagittal to frontal, bilateral to unilateral, stable to unstable, slow to fast, fixed to unfixed surface
p. Constantly monitor for signs and symptoms of patellofemoral irritation.
q. Encourage life-long activity modification to include low impact cardiovascular activity and patellofemoral protection strategies (especially those found to have CMP at surgery).
r. Incorporate sports-specific performance into rehab.

4. Post op functional guidelines

a. All Physician dependent
    i. Refer to physician preferences

b. Driving
    i. Refer to physician preference
    ii. No research to support recommendations for return to driving
    iii. Typically 7-14 days
    iv. Refer patient to drug precautions
    v. Refer patient to auto insurance coverage
    vi. Dependent on
        1. Extremity involved
        2. Adequate muscle control for braking and acceleration
        3. Proprioceptive/reflex control
        4. Adequate, functional ROM to get into driver's side
        5. Confidence level

c. Work
    i. Refer to physician preference
    ii. Sedentary up to 1-2 weeks
    iii. Medium to high physical demand level 8-12+ weeks which will be communicated with MD

d. Jogging on the treadmill
   - i. Check physician preference
   - ii. 12-16 weeks and in functional brace
   - iii. Observe and minimize limb velocity asymmetry
   - iv. Encourage lower impact activity

e. Hopping
   - *i.* ***Bilateral low amplitude (in functional brace, usually fitted on MD side at 8 weeks)***
      - *1.* ***No earlier than 10th week***
   - *ii.* ***Unilateral low amplitude (in functional brace)***
      - *1.* ***No earlier than 10th week***

f. Straight plane agility activity(in functional brace)
   - *i.* ***No earlier than 12th week, no lateral movement***

g. Agility with cutting
   - *i.* ***No earlier than 5-6 months in functional brace (consult with MD)***

h. Sports specific cutting and rotational activity (supervised by a professional)
   - *i. check physician preference*
   - *ii.* ***no earlier than 20th week (5 months) and in functional brace***

i. Sports
   - i. **Consult with MD, usually 6 plus months in functional brace**
   - ii. **Dependent on quad control, >80% score on hop test**

5. Post op equipment guidelines

a. CPM
   - i. Physician dependent
   - ii. 4 times per day
   - iii. 60-90 minute sessions
   - iv. Start 0º-70º with a 5º per day increase

b. Polar care
   - i. Physician dependent
   - ii. As needed for pain and inflammation

c. Post-op Brace
   - i. Check for physician preferences
   - ii. Locked at 0 degrees for first two days
   - iii. Unlock brace 0-90 degrees post-op day 2 (typically done on MD side) and per quad control
   - iv. DC brace at the end of week 4 (typically coincides with MD follow up appointment) (Dr. Reilly)
   - v. In the first four weeks patient can be out of the brace at night if full extension is achieved
   - vi. Dr. Ruhnke- knee immobilizer x2 weeks, then d/c brace

d. Crutches
   - i. Check physician preferences

1. Dr. Reilly WBAT after surgery based on quad control
2. Dr. Ruhnke 50% WBAT x2 weeks in knee immobilizer then WBAT

ii. Dependent upon adequate quad control, no observed gait deviations, no change in pain, swelling, or effusion

e. Functional Brace

i. Physician dependent

ii. Typically fit at week 8 in MD office by DME coordinator

6. Clinical Restrictions

a. No short arc quads

b. No knee extension machine with heavy resistance (6 months)

i. Initiate knee extension from 90-40 with 1# at week 2

ii. Progress 1# per week

c. No deep knee bend under body weight

7. Rehabilitation for ACL reconstruction with Allograft

a. Week 1

i. **Rehab Guidelines**

1. Control post-op swelling and effusion
2. restore ROM
3. Inhibit post-op muscle shut down (e-stim, biofeedback,, verbal/tactile cueing)
4. Progress comprehensive, lower-extremity stretching program
5. Progress bilateral, closed-chain activity to improve limb-confidence
6. Progress bilateral proprioceptive activity and reactive neuromuscular training (RNT)
7. Progress hip, calf and core strengthening activities
8. cue for proper gait with 2 axillary crutches based on WB restrictions if present
9. Initiate submax, subpainful, isometric hamstring contraction.
10. Initiate gentle hamstring stretching and calf stretching in non-weight bearing.

ii. **Rehab Expectations by the end of week 1**

1. ROM: 0 º to 100º
2. Visible quad contration (rated fair- to fair) (home stim if poor)
3. Independent straight leg raise without extensor lag
4. Independent ambulation with 2 axillary crutches without deviation

b. Week 2:

i. **Rehab guidelines**

1. initiate unilateral closed-chain activity to improve limb confidence
2. initiate unilateral proprioceptive activity (dependent on quad tone)
3. initiate unilateral flexion under weight-bearing activity (i.e. step up)
4. initiate knee extension from 90-40 degrees knee flexion with 1# (supervise closely)
5. initiate active hamstring activity without resistance (prone leg curl)

ii. **Rehab Expectations by the end of week 2**

1. ROM: 0º extension without guarding to 115º
2. Visible/moderate intensity quad contraction (fair to fair+) (home stim unit if poor)
3. Independent straight leg raise without extensor lag
4. Ambulation with 2 axillary crutches without deviation

c. **Week 3:**

i. **Rehab guidelines**

1. progress bilateral and unilateral, closed chain activity to improve limb confidence
2. progress bilateral and unilateral proprioceptive activity and reactive neuromuscular training
3. cue for proper gait with 1 axillary crutch
4. progress unilateral flexion under weight-bearing activity (i.e. step ups)
5. progress knee extension from 90-40 degrees flexion with 2# (supervise closely)

ii. **Rehab Expectations by the end of week 3**

1. ROM: 0º extension without guarding to 125º
2. Visible/moderate quad contraction (fair+ to Good -) (home stim?)
3. Ambulation with single crutch without deviation

d. **Week 4:**

i. **Rehab guidelines**

1. cue for proper gait without assistive device
2. progress knee extension from 90-40 degrees knee flexion with 3# (supervise closely)
3. Initiate and progress low impact endurance activity (monitor knee reaction)

ii. **Rehab Expectations by the end of week 4**

1. 0 degrees extension without guarding, full knee flexion (heel to buttock)
2. visible and moderate intensity quad contraction (Good -)
3. ambulating without deviation and without assistive device.

e. **Week 5:**

i. **Rehab guidelines**

1. cue for proper gait without assistive device and address limb velocity asymmetries
2. progress knee extension from 90-40 degrees knee flexion with 4# (supervise closely)
3. incorporate core strengthening into rehab program

ii. **Rehab Expectation by the end of week 5**

1. symmetrical extension without guarding, full knee flexion (heel to buttock)
2. visible and moderate intensity quad contraction (Good -)
3. ambulation without deviation and without limb velocity asymmetry

f. Weeks 6 - 10:

i. **Rehab Guidelines**

1. continue activities from weeks 1-6
2. progress knee extension from 90-40 degrees with 5# (week 6) and 6# (week 7) (supervise closely)
3. Graft is still weak and should not be overstressed

ii. ***Rehab Expectations by the end of week 8***

1. symmetrical extension without guarding, full knee flexion (heel to buttock)
2. visible, strong, but asymmetrical quad contraction (Good -)
3. ambulating without deviation and without limb velocity asymmetry

g. Weeks 10-12

i. ***Rehab/Post-Rehab*** **guidelines**

1. Continue activities from weeks 1-8
2. progress knee extension from 90-40 degrees knee flexion with 7-11# (supervise closely)
3. If functional brace obtained: initiate bilateral, low-amplitude hopping activities with emphasis on deliberate, quality movement.
4. If functional brace obtained: initiate unilateral, low-amplitude hopping activities with emphasis on deliberate, quality movement.
5. If functional brace obtained: progress to bilateral then unilateral, moderate-amplitude hopping activities with emphasis on quality movement. (moderate amplitude =0-6 inches high and /or 25-50% max distance)
6. If functional brace obtained: initiate bilateral, high-amplitude hopping activities with emphasis on quality movement. (high amplitude = 6-12 inches high, 50-75% max distance.)
7. continue to progress speed with modified NFL combine training
8. can begin jogging in brace at 12 weeks (check physician preferences)

9. ***Once Physical Therapy has been maximized, transition patient to Post-Rehab program***

ii. ***Rehab/Post-Rehab* Expectations by the end of week 12**

1. symmetrical extension without guarding, full knee flexion (heel to buttock)
2. visible, strong, but asymmetrical quad contraction (Good -)
3. ambulating without deviation and without limb velocity asymmetry
4. able to land with symmetry to landing pattern during bilateral and unilateral low-amplitude hopping
5. able to demonstrate good landing with low and moderate amplitude hopping activities to include the following:
   a. good athletic posture (spine erect and shoulders back)
   b. no valgus with landing
   c. soft landing
   d. able to "stick" the landing
6. continue to progress speed with modified NFL combine training
7. ***Demonstrate 60-100% score on single leg hop test.***
8. ***60-100% score on vertical jump and broad jump compared to mean from Meyer et.al.***
9. ***Transitioned to Post-Rehab program***

h. Weeks 12-16 (3-4 months)

i. **Post-Rehab guidelines (must be in functional brace)**

1. Continue activities from weeks 1-12
2. progress knee extension from 90-40 degrees knee flexion with 11-15# (supervise closely)
3. progress bilateral, high-amplitude hopping activity
   a. high-amplitude = 6-12 inches high and/or 50-75% max distance.
4. initiate unilateral, high-amplitude hopping activity
5. continue to progress speed with modified NFL combine training
6. test using modified NFL combine norms (Meyer et.al)
7. initiate higher level agility activities
   a. forward, retro and lateral only
   b. no cutting

ii. **Post-Rehab Expectations**

1. symmetrical extension without guarding, full knee flexion (heel to buttock)
2. visible, strong, symmetrical quad contraction (Good)
3. ambulating without deviation and without limb velocity asymmetry

4. able to demonstrate good landing with low, moderate and high-amplitude hopping activities to include the following:
    a. good athletic posture (spine erect and shoulders back)
    b. no valgus with landing
    c. soft landing
    d. able to "stick" the landing
5. ***Demonstrate 70-100% score on single leg hop test.***
6. ***70-100%score on vertical jump ad broad jump compared to mean from Meyer et.al.***
7. ***50-100%score on triple hop for distance***

i. Weeks 16-20 (4-5 months)

i. **Post-Rehab guidelines**
    1. Continue activities from weeks 1-16
    2. progress knee extension from 90-40 degrees knee flexion with 15-19# (supervise closely)
    3. continue to progress modified NFL training and testing
    4. progress higher level agility activities and **include cutting**.

ii. **Post-Rehab expectations**
    1. symmetrical extension without guarding, full knee flexion (heel to buttock)
    2. visible, strong, symmetrical quad contraction (Good)
    3. ambulating without deviation and without limb velocity asymmetry
    4. able to demonstrate good landing with low, moderate and high-amplitude hopping activities to include the following:
        a. good athletic posture (spine erect and shoulders back)
        b. no valgus with landing
        c. soft landing
        d. able to "stick" the landing
    5. Proper coordination with higher-level agility activity **with cutting.**
    6. ***Demonstrate 80-100% score on single leg hop test.***
    7. ***80-100% of mean score for broad jump and vertical jump from Meyer et.al.***
    8. ***70-100% score on triple hop for distance***
    9. ***60-100% single leg crossover hop test***
    10. ***Transition competitive athletes to GAP Phase II***

j. Weeks 20-24 (5-6 months)

i. ***Post-Rehab guidelines***
    1. Continue activities from weeks 1-20
    2. progress knee extension from 90-40 degrees knee flexion with >20# (supervise closely)

3. continue with speed progression on modified NFL combine training and testing
4. progress higher level agility activities to **include cutting once cleared by MD**
5. initiate sports-specific cutting and agility activity

ii. ***Post-Rehab expectations***

1. symmetrical extension without guarding, full knee flexion (heel to buttock)
2. visible, strong, symmetrical quad contraction (Good)
3. ambulating without deviation and without limb velocity asymmetry
4. able to demonstrate good landing with low, moderate and high-amplitude hopping activities to include the following:
    a. good athletic posture (spine erect and shoulders back)
    b. no valgus with landing
    c. soft landing
    d. able to "stick" the landing
5. Proper coordination with sport specific agility activity.
6. ***Demonstrate 90-100% score on single leg hop test.***
7. ***90-100% score for vertical jump, broad jump, modified agility T-test, modified pro-shuttle and modified long shuttle from Meyer et.al.***
8. ***80-100% on triple hop for distance***
9. ***80-100% score on single leg crossover hop test***
10. ***Return to sport as appropriate***