

**Dr. Larry “Chip” Bankston**

**Autologous Chondrocyte Implantation  
(ACI)**

There are various treatment options for the treatment of osteochondral injuries to the knee. The primary objective of any treatment protocol is to protect the repair/graft site and promote optimum conditions for healing to occur. Progression is based upon the understanding of surgical techniques, location of defect and graft site, tissue quality, healing restraints and their ability to tolerate load.

This protocol is a general guideline for femoral condyle ACI procedures and may be altered to accommodate specific surgical techniques, complications and/or tissue quality. Communication with the physician is essential for a successful outcome. Timeframes may vary dependent upon whether location of defect is within the femoral condyle, trochlea, or concomitant ligamentous procedures (ACL) are performed. Progression is based upon healing times as well as functional progression. In advancing treatment variables the patient is closely monitored for increase pain and effusion which may indicate the repair site is unable to tolerate the stress loads placed upon it.

The ACI technique is a two stage procedure in which through the initial arthroscopic procedure an autologous cartilage biopsy is harvested and sent to a lab followed by cell culture and proliferation. The second stage involves an open procedure for cell implantation under an autologous periosteal patch.

ACI is a biological repair and thus the rehabilitation process cannot be accelerated past tissue healing properties. In the first 6-8 weeks the tissue is very soft, delicate and fragile. Gradually the tissue begins to mature from a gelatin like consistency to putty like consistency. Protecting the repair within this timeframe is essential.

**Recommendations:**

Strict NWB 6-8 weeks

TDWB progressing 25% body weight per week to FWB as normal gait pattern is achieved (10-12 weeks).

ROM to tolerance

Knee brace is specific to surgical technique. Concomitant injuries may require various bracing requirements (ACL reconstruction, Meniscal transplants, Osteotomies). Typically it is a hinged brace locked in full extension 1-2 weeks and then slowly progressing ROM as quad control improves, planned discontinued use of brace @ 4 weeks. Discuss concomitant injury specifics with referring physician prior to discontinuing brace.

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Per physician preference, either home use of CPM (8-10 hours/day x 4-6 weeks) or the patient performs a minimum of 500 cycles of ROM per day. Although hyaline cartilage requires movement to promote healing, care is taken to avoid the detrimental shear/rotational stresses with weight-bearing until 10-12 weeks.

**Weeks 1-6:** NWB with progression to TDWB (6-8 weeks) with maintaining 2 crutches  
Hold on progressing to WBAT until 10-12 weeks and patient must demonstrate a normal gait pattern, minimal effusion (1-1.5 cm) and demonstration of adequate quad control.  
AROM to tolerance  
Ice and Elevation, 3-4 times a day  
Biofeedback or Electrical stimulation for muscle re-education  
Patella mobilization  
Isometrics for Quads, hip abductors and adductors  
Straight leg raises (SLR) adding weight as able (absence of SLR lag)  
    Hip Flexion, Abduction, Adduction and Extension  
Lower extremity flexibility program  
Control knee effusion as needed  
Multi angle quad isometrics progressing to active knee extension in painfree range (monitor patellofemoral complaints).  
If patella/trochlea involved hold on **resistive** knee extension until 12 weeks.  
Hamstring curls in pain free range  
Progression to multi-hip machine  
ROM - Achieve full ROM by 6-8 weeks  
Bike (low resistance), pool, wall slides

**Weeks 6-12:** Progress to open chain quad strengthening  
Rocker board; progress to BAPS (PWB initially then FWB standing at 12 weeks)  
Endurance training  
    Light bike work as ROM allows  
Re-evaluate patello-femoral complex and address any dysfunctions  
Begin progressive closed chain strengthening exercises (PWB to FWB) stay within weight bearing restrictions.  
    Squats, lunges, calf raises, leg press, shuttle, step downs, sports cord, etc.  
**Consider graft site location:**  
    **Anterior femoral condyle – avoid loading in terminal extension**  
    **Posterior femoral condyle – avoid loading in flexion > 45 deg.**

**Weeks 12-16:** Balance training on involved leg  
Eyes open, eyes closed  
Single leg balance, balance reach, etc. when allowed

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Ball throws  
Progressive resistance on Isotonic machines  
Isokinetics  
    High speeds 150-300 degrees/second  
Increase endurance activities  
    Increase resistance on the bike, pool, Elliptical, Versaclimber,  
    walking,  
Advance closed chain exercises to unsteady surfaces (pillow, half foam  
roll, BAPS board) as lower extremity muscle control allows

**4-6 months:** Full lower extremity biomechanical evaluation to address influence and/or  
“weak links” from hip and foot/ankle.  
Continue strengthening exercises three times per week  
Continue flexibility exercises daily

**Criteria For Return to Sports:**

Adequate healing time  
Full pain free ROM  
No effusion  
Normal isokinetic evaluation and function tests  
Satisfactory performance of sport specific activities without swelling

**Low Impact Activities 6-9 Months:**

Cycling, Cross country skiing, Golf (cart only)

**Repetitive Impact Activities 9-12 Months:**

Jogging, Running, Aerobic Classes  
Jogging (begin with 1 mile jog/walk and increase in 1/4 mile increments,  
based upon pain and effusion)  
Once patient is able to jog 20 minutes (2-3 miles) with no discomfort or  
swelling may progress functional activities to include figure 8's, cutting,  
jumping, etc.  
Sport specific activities (progressing as tolerated)  
Backward running, carioca, ball drills & other sport skills

**High Impact Activities 12-15 Months:**

Tennis, Basketball, Football

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