

**DR. BUTKOVICH AUTOLOGOUS CHONDROCYTE
IMPLANTATION (ACI) AND OSTEOCHONDRAL AUTO/
ALLOGRAFT TRANSPLANTATION (OATS)
REHABILITATION PROTOCOL**

STAGE I: IMMEDIATE POST SURGICAL/ PROTECTION PHASE

GOALS:

- PROTECT HEALING TISSUE FROM LOAD AND SHEAR FORCE
- DECREASE PAIN AND EFFUSION
- GRADUALLY IMPROVE KNEE FLEXION
- RESTORE FULL PASSIVE KNEE EXTENSION
- REGAIN QUADRICEPS CONTROL

WEEKS 0-6:

PATIENT INSTRUCTIONS:

1. KEEP INCISIONS CLEAN & DRY
2. CRYOTHERAPY AT HOME FOR PAIN & INFLAMMATION
3. BRACE LOCKED AT 0 DEGREES DURING WEIGHT BEARING ACTIVITIES
4. SLEEP IN BRACE LOCKED FOR 2-4 WEEKS
5. NON-WEIGHT BEARING FOR 1-2 WEEKS, MAY BEGIN TOE TOUCH WEIGHT BEARING IMMEDIATELY PER MD
6. TOE TOUCH WEIGHT-BEARING (APPROX. 20-30 LBS) WEEKS 2-3
7. PARTIAL WEIGHT-BEARING (APPROX. 25% BODY WEIGHT) AT WEEKS 4-5
8. EXTENDED STANDING SHOULD BE AVOIDED
9. IF SYMPTOMS OCCUR, REDUCE ACTIVITIES TO REDUCE PAIN AND INFLAMMATION

TREATMENT:

RANGE OF MOTION

1. MOIST HEAT AND OTHER MODALITIES PRIOR TO THERAPY
(CONTINUE THROUGHOUT THERAPY PROGRAM AS NECESSARY)
2. FULL PASSIVE KNEE EXTENSION IMMEDIATELY
3. BEGIN PATELLA MOBILIZATION
4. BEGIN PASSIVE KNEE FLEXION RANGE OF MOTION (TO BE PERFORMED 2-3 TIMES DAILY)
5. KNEE FLEXION RANGE OF MOTION GOAL IS 90 DEGREES BY 1-2 WEEKS
6. KNEE FLEXION RANGE OF MOTION GOAL IS 105 DEGREES BY 3-4 WEEKS
7. KNEE FLEXION RANGE OF MOTION GOAL IS 120 DEGREES BY 5-6 WEEKS
8. STRETCH HAMSTRINGS AND CALF

STRENGTHENING

1. ANKLE PUMP USING TUBING
2. QUAD SETTING
3. MULTI-ANGLE ISOMETRICS (CO-CONTRACTIONS Q/H)
4. ACTIVE KNEE EXTENSION 90-40 DEGREES WITH NO RESISTANCE
5. 4-WAY STRAIGHT LEG RAISES
6. STATIONARY BIKE AS RANGE OF MOTION ALLOWS
7. BIOFEEDBACK AND ELECTRICAL MUSCLE STIMULATION AS NEEDED
8. ISOMETRIC LEG PRESS BY WEEK 4 (MULTI-ANGLE)
9. MAY BEGIN USE OF POOL FOR GAIT TRAINING AND EXERCISES BY WEEK 4

CRITERIA TO PROGRESS TO PHASE II

1. FULL PASSIVE KNEE EXTENSION
2. MINIMAL PAIN AND SWELLING
3. KNEE FLEXION TO 120 DEGREES
4. VOLUNTARY QUADRICEPS ACTIVITY

STAGE II: TRANSITION PHASE**GOALS:**

- GRADUALLY INCREASE RANGE OF MOTION
- GRADUALLY IMPROVE QUADRICEPS STRENGTH/ENDURANCE
- GRADUALLY INCREASE FUNCTIONAL ACTIVITIES

WEEKS 6-12:**PATIENT INSTRUCTIONS:**

1. DISCONTINUE POST-OPERATIVE BRACE BY WEEK 6
2. CONSIDER UNLOADING KNEE BRACE
3. PROGRESS TO WEIGHT-BEARING AS TOLERATED
4. PROGRESS TO FULL WEIGHT-BEARING BY 8-9 WEEKS
5. DISCONTINUE CRUTCHES BY 8-9 WEEKS
6. GRADUAL INCREASE TO FUNCTIONAL ACTIVITIES AS PAIN AND SWELLING DIMINISH
7. GRADUAL INCREASE OF STANDING AND WALKING

TREATMENT:**RANGE OF MOTION**

1. GRADUALLY INCREASE RANGE OF MOTION
2. MAINTAIN FULL PASSIVE KNEE EXTENSION
3. PROGRESS KNEE FLEXION TO 125-135 DEGREES
4. CONTINUE PATELLAR MOBILIZATION AND SOFT TISSUE MOBILIZATION AS NEEDED
5. CONTINUE WITH STRETCHING PROGRAM

STRENGTHENING

1. INITIATE WEIGHT SHIFTS AT 6 WEEKS
2. INITIATE MINI-SQUATS 0-45 DEGREES
3. CLOSED KINETIC CHAIN EXERCISES (LEG PRESS)
4. TOE-CALF RAISES
5. OPEN KINETIC CHAIN KNEE EXTENSION PROGRAM (1-LB/WEEK)
6. STATIONARY BICYCLE, LOW RESISTANCE (GRADUALLY INCREASE TIME)
7. TREADMILL WALKING PROGRAM
8. BALANCE AND PROPRIOCEPTION DRILLS
9. INITIATE FRONT AND LATERAL STEP UPS
10. CONTINUE USE OF BIOFEEDBACK AND ELECTRICAL MUSCLE STIMULATION, AS NEEDED
11. CONTINUE USE OF POOL FOR GAIT TRAINING AND EXERCISE

CRITERIA TO PROGRESS TO PHASE III

1. FULL RANGE OF MOTION
2. ACCEPTABLE STRENGTH LEVEL
 - a. HAMSTRING WITHIN 10-20% OF CONTRALATERAL LEG
 - b. QUADRICEPS WITHIN 20-30% OF CONTRALATERAL LEG
3. BALANCE TESTING WITHIN 30% OF CONTRALATERAL LEG
4. ABLE TO WALK 1-2 MILES OR BIKE FOR 30 MINUTES

STAGE III: MATURATION PHASE**GOALS:**

- IMPROVE MUSCULAR STRENGTH AND ENDURANCE
- INCREASE FUNCTIONAL ACTIVITIES

WEEKS 12-26:**PATIENT INSTRUCTIONS:**

1. INITIATE MAINTENANCE PROGRAM/HOME EXERCISE PROGRAM
 - a. WALL SQUATS
 - b. STRAIGHT LEG RAISES
 - c. WALKING PROGRAM
 - d. HIP ABDUCTION & ADDUCTION
 - e. WALKING PROGRAM
 - f. BIKE/SWIMMING/ ELLIPTICAL
 - g. STRETCHING PROGRAM

TREATMENT:**RANGE OF MOTION**

1. PATIENT SHOULD EXHIBIT FULL RANGE OF MOTION

STRENGTHENING

1. LEG PRESS 0-90 DEGREES
2. BILATERAL SQUATS 0-60 DEGREES
3. UNILATERAL STEP-UPS FROM 2" TO 8"
4. BICYCLE-LOW RESISTANCE INCREASE TIME
5. OPEN KINETIC CHAIN KNEE EXTENSION 0-90 DEGREES
6. WALKING PROGRAM
(AS PATIENT IMPROVES INCREASE WALKING –DISTANCE, CADENCE, INCLINE ETC.)

CRITERIA TO PROGRESS TO PHASE IV

1. FULL NON-PAINFUL RANGE OF MOTION
2. STRENGTH WITHIN 80-90% OF CONTRALATERAL LEG
3. BALANCE AND/OR STABILITY WITHIN 75% OF CONTRALATERAL LEG
4. REHABILITATION OF FUNCTIONAL ACTIVITIES CAUSE NO OR MINIMAL PAIN, INFLAMMATION OR SWELLING

STAGE IV: FUNCTIONAL ACTIVITIES PHASE**GOALS:**

- GRADUAL RETURN TO FULL UNRESTRICTED FUNCTIONAL ACTIVITIES

WEEKS 26-52:**PATIENT INSTRUCTIONS:**

1. CONTINUE MAINTENANCE PROGRAM PROGRESSION 3-4 TIMES/WEEK
2. PROGRESS RESISTANCE AS TOLERATED
3. EMPHASIS ON ENTIRE LOWER EXTREMITY STRENGTH AND FLEXIBILITY
4. PROGRESS AGILITY AND BALANCE DRILLS
5. IMPACT LOADING PROGRAM SHOULD BE SPECIALIZED TO THE PATIENTS DEMANDS
6. PROGRESS SPORT PROGRAMS DEPENDING ON PATIENT VARIABLES

FUNCTIONAL ACTIVITIES:

1. PATIENT MAY RETURN TO VARIOUS SPORT ACTIVITIES AS PROGRESSION IN REHABILITATION AND CARTILAGE HEALING ALLOWS
 - a. GENERALLY, LOW IMPACT SPORTS SUCH AS SWIMMING, SKATING, AND CYCLING ARE PERMITTED AT 6 MONTHS
 - b. HIGHER IMPACT SPORTS SUCH AS JOGGING, RUNNING, AND AEROBICS MAY BE PERFORMED AT 8-9 MONTHS FOR SMALL LESIONS AND 9-12 MONTHS FOR LARGER LESIONS
 - c. HIGH IMPACT SPORTS SUCH AS TENNIS, BASKETBALL, FOOTBALL, AND BASEBALL MAY BE ALLOWED AT 12-18 MONTHS