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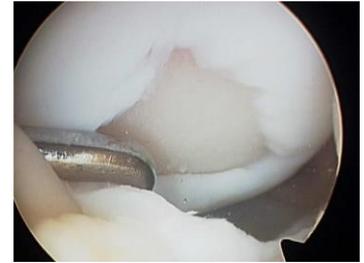
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REHABILITATION GUIDELINES FOLLOWING OSTEOCHONDRAL ALLOGRAFT TRANSPLANTATION FOR THE KNEE

Aaron M. Bott, M.D.

Articular cartilage is a layer of hyaline cartilage that covers the end of bones that articulate with other bones. In the knee, you have articular cartilage on the end of the femur (femoral condyles), the top of the tibia (tibial plateau) and the back of the knee cap (patella). The articular cartilage has a frictional coefficient approximately 1/5 of ice on ice – i.e. rubbing articular cartilage on articular cartilage would be 5x smoother than rubbing ice on ice. This allows for a very smooth gliding surface. A large component of articular cartilage is water, which provides significant resistance to compressive forces.

During athletic trauma or injury, focal areas of the articular cartilage can be damaged or torn, exposing the subchondral bone. This is referred to as an articular cartilage lesion. (Figure #1) When this happens, you lose the normal smooth gliding articulation and the ability to resist compressive forces at the joint. These changes can cause pain, swelling, loss of motion, weakness, and reduced function or performance.



The osteochondral allograft procedure involves transplantation of a dowel of bone with overlying articular cartilage from a cadaveric distal femur. The size of the harvested plug is sized to match that of the injury/lesion. This plug is then press fit into a hole created at the lesion. Initially, this plug can be susceptible to getting pushed in further, thus weight bearing is restricted for the first six to eight weeks to ensure that the cartilage plug heals “flush” with the rest of the cartilage surface. Because allograft tissue is being used, “creeping substitution” needs to occur, where the body replaces the cadaver bone with normal host bone. For some patients the goal will be to return to daily activities without pain, for others it may be returning to sports.

The rehabilitation guidelines are presented in a criterion based progression. Specific time frames, restrictions and precautions are given to protect healing tissues and the surgical repair/reconstruction. General time frames are also given for reference to the average, but individual patients will progress at different rates depending on the size and location of the chondral lesion, their age, associated injuries, pre-injury health status, and rehab compliance. Specific attention must be given to impairments that caused the initial problem. For example if the patient is s/p medial compartment osteochondral allograft procedure and they have a varus alignment, post-operative rehabilitation should include correcting muscle imbalances or postures that create medial compartment stress.

OSTEOCHONDRAL ALLOGRAFT TRANSPLANTATION

Phase I Surgery to 6 Weeks

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Appointments	Physician: 7-10 days and 6 weeks postoperatively Physical Therapy: 3-5 days postoperatively 1-2x/week
Guidelines	<ul style="list-style-type: none"> • Maintaining full extension is critical. • Weightbearing: <ul style="list-style-type: none"> -TTWB with the brace locked in extension x 6 weeks • Crutches: <ul style="list-style-type: none"> -Crutches must be utilized for the entirety of Phase I • Brace: <ul style="list-style-type: none"> -May be removed for ROM exercises -Must remain locked for all ambulation -Must be worn at night locked in extension for the first 2 weeks -May be removed at night from weeks 3-6 • Other exercises may be utilized at the therapist's discretion within the restrictions of the protocol
Range of Motion Exercises	<ul style="list-style-type: none"> • Extension <ul style="list-style-type: none"> -Knee extension on a bolster -Prone hangs • Flexion <ul style="list-style-type: none"> -CPM machine -Supine wall slides -Assisted heel slides -Week 1-2 = 0-90° -Week 3-4 = 0-110° -Week 5-6 = 0-125° • Stationary bike for motion only starting at week 4 • ROM exercises should be carried out frequently throughout the day with high repetitions to help remodel and contour the healing cartilage. The optimal goal during the first 6 weeks is to do 4-6 hours of ROM exercises per day
Strengthening Exercises	<ul style="list-style-type: none"> • Quad sets/SLRs/Ankle pumps • 4 way standing leg lifts with brace on for balance and hip strength • Patellar mobilizations
Aerobic Conditioning	<ul style="list-style-type: none"> • Upper body circuit training or UBE
Modalities	<ul style="list-style-type: none"> • Electrical stimulation • Cryotherapy
Progression Criteria	<ul style="list-style-type: none"> • 6 weeks postop • Trace to no effusion • Full knee extension

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Phase II 6 Weeks to 12 Weeks Postop

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Appointments	Physician: 6 weeks and 3 months postoperatively Physical Therapy: 1-2x/week
Guidelines	<ul style="list-style-type: none">• Weightbearing:<ul style="list-style-type: none">-Weeks 6-9: Progress from 25-100% WB with brace locked in extension-Weeks 9-12: Unlock brace for WB and wean to allow FWB out of brace by end of Phase II• Crutches:<ul style="list-style-type: none">-Crutches may be weaned once the patient is FWB in brace with normal to near normal gait• Avoid post-activity swelling• Avoid loading knee at deep flexion angles• No impact activities until Phase III• Radiographs will be obtained at the 6 week and 3 month appointments to assess for incorporation of the allograft• Other exercises may be utilized at the therapist's discretion within the restrictions of the protocol
Range of Motion Exercises	<ul style="list-style-type: none">• Stretching for patient specific muscle imbalances• Stationary bike for ROM
Strengthening Exercises	<ul style="list-style-type: none">• Protected weight bearing hip and core strengthening• Quadriceps strengthening<ul style="list-style-type: none">-Quadriceps isometrics at various flexion angles-Closed chain exercises from 0-60° flexion once full weight bearing• Hamstring curls 0-90°• Toe/calf raises
Balance Training	<ul style="list-style-type: none">• Weight shifting• Pool program<ul style="list-style-type: none">-Gait drills-Protected WB strengthening exercises• Double leg balance and proprioceptive drills
Aerobic Conditioning	<ul style="list-style-type: none">• Non-impact endurance training<ul style="list-style-type: none">-Swimming (stiff knee flutter kick)-Deep water run• Upper body circuit training
Modalities	<ul style="list-style-type: none">• Cryotherapy
Progression Criteria	<ul style="list-style-type: none">• Normal gait on level surfaces• Full range of motion/No effusion• Ability to carry out functional movements without unloading affected leg or pain, while demonstrating good control.• Single leg balance greater than 15 sec.

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Phase III 12 Weeks to 6 Months Postop

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Appointments	Physician: 3 months and 6 months postoperatively Physical Therapy: 1x/1-2 weeks
Guidelines	<ul style="list-style-type: none">• High-impact activities should be avoided until Phase IV• Post-activity soreness should resolve within 24 hours• Avoid post-activity swelling.• Avoid knee pain with strengthening• Radiographs will be obtained at the 3 and 6 month appointments to assess for incorporation of the allograft• Other exercises may be utilized at the therapist's discretion within the restrictions of the protocol
Range of Motion Exercises	<ul style="list-style-type: none">• Stretching for patient specific muscle imbalances
Strengthening Exercises	<ul style="list-style-type: none">• Functional leg strengthening<ul style="list-style-type: none">-Squats-Lunges – all 3 planes-Step backs-Retro step ups-Single-leg leg press• Hip and core strengthening<ul style="list-style-type: none">-Mini band drills-Physioball
Balance Training	<ul style="list-style-type: none">• Movement control exercise beginning with low velocity, single plane activities and progressing to higher velocity, multi-plane activities• Single leg balance and proprioception progression• Sport/work specific balance and proprioceptive drills
Aerobic Conditioning	<ul style="list-style-type: none">• Non-impact activities<ul style="list-style-type: none">-Stationary bike-Elliptical trainer-Ski machine-Swimming
Modalities	<ul style="list-style-type: none">• Cryotherapy
Progression Criteria	<ul style="list-style-type: none">• Dynamic neuromuscular control with multi-plane activities, without pain or swelling• 6 months postop

OSTEOCHONDRAL ALLOGRAFT TRANSPLANTATION
Phase III 12 Weeks to 6 Months Postop
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Appointments	Physician: 6 months and 12 months postoperatively Physical Therapy: 1x/1-2 weeks
Guidelines	<ul style="list-style-type: none"> • Post-activity soreness should resolve within 24 hours • Avoid post-activity swelling. • Avoid knee pain with impact. • Goals include good control and no pain with sport and work specific movements, including impact
Range of Motion Exercises	<ul style="list-style-type: none"> • Stretching for patient specific muscle imbalances
Strengthening Exercises	<ul style="list-style-type: none"> • Hip and core strengthening • Continued lower extremity PRE's
Balance Training	<ul style="list-style-type: none"> • Impact control exercises beginning 2 feet to 2 feet, progressing from 1 foot to other and then 1 foot to same foot. • Movement control exercise beginning with low velocity, single plane activities and progressing to higher velocity, multi-plane activities. • Sport/work specific balance and proprioceptive drills
Aerobic Conditioning	<ul style="list-style-type: none"> • Replicate sport or work specific energy demands • Progressive walk/run conditioning program can be initiated 6 months • Sprinting and cutting/pivoting can be initiated in months 7-8 if performed without pain
Modalities	<ul style="list-style-type: none"> • Cryotherapy
Progression Criteria/Return to Sports	<ul style="list-style-type: none"> • Good dynamic neuromuscular control with multi-plane activities, without pain or swelling • Biodex scores at least 85-90% of opposite side • Osteochondral allograft transplantation is a salvage procedure. High-impact athletic activities may jeopardize the long-term health of the graft. Low-impact activities are recommended indefinitely. If high-impact activities are going to be pursued, they should probably be delayed for 9-12 months following surgery.