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MATRIX-INDUCED AUTOLOGOUS CHONDROCYTE IMPLANTATION
PHYSICAL THERAPY PRESCRIPTION

Diagnosis: s/p Matrix-Induced Autologous Chondrocyte Implantation

Pre-operative Rehabilitation

Goals:

- Patient education on the surgical procedure, tissue maturation, and relevance to post-operative activity progression
- Physical preparation of the patient and knee

Weight Bearing:

N/A

Knee ROM:

Promote full active ROM to reduce preoperative contractures

Knee Brace:

N/A

Exercises:

- Lower-limb resistance and joint ROM exercises to improve bilateral strength, mobility, balance, and general function of muscles and connective tissue
- Upper-limb and trunk resistance exercises to assist early post-operative weight-transfer activities and crutch ambulation
- Cardiovascular exercise to improve general health, promoting weight reduction and a faster recovery from surgery

Phase 1 (0-7 days post-surgery)

Goals:

- Avoid excessive WB (>20% BW)
- Avoid shear forces generated across the articular surface
- Maintain lower-limb mobility, muscle tone, and circulation
- Reduce post-operative pain and edema

Weight Bearing:

Patient is NWB, 0% of BW through the operated limb

Knee ROM:

Passive and active assisted knee ROM from 0° to 30°

Knee Brace:

Protective brace set at 0° to 30°, worn 24 hours per day

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Exercises:

Passive and active assisted knee flexion and extension ROM exercises (0° to 30°)
CPM (0° to 30°) 12 to 24 hours post-surgery for a minimum of 1 hour daily
Active ankle dorsiflexion and plantar flexion
Isometric contraction of the quadriceps, hamstrings, adductors, and gluteal musculature
Instruction and practice in proficient non-WB ambulation (0% BW) using 2 crutches

Phase 2 (2-3 weeks post-surgery)

Goals:

- Pain-free knee flexion to 90°
- Pain-free and full passive knee extension
- Proficient heel-toe gait at 20% BW with 2 crutches
- Regain active quadriceps control
- Reduce post-operative pain and edema
- Proficiency in undertaking home exercise program

Weight Bearing:

Progress from 0% of BW (weeks 1 and 2) to 20% BW (week 3)

Knee ROM:

Passive active knee ROM from 30° (week 2) to 90° (week 3)

Knee Brace:

Knee brace 0° to 30° (week 1) to 0° to 45° (week 3)

Exercises:

Continue phase 1 exercises
Patellar mobilization in all directions
CPM employed if possible
Isometric quadriceps and quadriceps-hamstring cocontraction activities with and without the use of NMES
Introduce SLR activities (hip, flexion, abduction, adduction, extension)
Introduce hydrotherapy, deep-water walking (forward, backward, sideways), heel raises, squats, straight-leg hip flexion, extension, abduction, and circumduction (to begin at week 3)

Phase 3 (4-6 weeks post-surgery)

Goals:

- Pain-free knee flexion to 125°
- Proficiency in performing all home-based exercises, including an SLR
- Pain-free gait using 1 crutch and 50% BW through operated limb

Weight Bearing:

Progress from 20% of BW (week 4) to 50% BW (week 6)

Knee ROM:

Progress active knee ROM from 110° (week 4) to 125° (week 6)

Knee Brace:

Knee brace 0° to 60° (week 4) to full flexion permitted (week 6)

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Exercises:

Continue phase 1 and 2 exercises
Increase demand of plinth-based exercises, including SLR with external hip rotation, sidelying gluteal exercises in knee flexion
Introduce hamstring and calf stretches
Introduce seated or standing machine-based exercises, including standing calf raises (dependent on WB status), weighted hip abduction and adduction, trunk strengthening (supine sit-ups, weight-supported trunk flexion)
Introduce recumbent cycling (week 5)
Hydrotherapy: continue phase 2 exercises, plus active knee flexion (with resistive devices), shallow-water walking (waist-depth), heel raises, step-ups/step-downs, lunges, cycling, scissor kicks, lower-limb flexibility and proprioception exercises

Phase 4 (7-12 weeks post-surgery)

Goals:

- Pain-free and full active knee ROM with anatomical limits
- Pain-free 6-minute walk test without the use of walking aids
- Pain-free upright cycling without a protective knee brace
- Proficiency in performing home and clinic-based exercise for the independent continuation of post-discharge rehabilitation

Weight Bearing:

Progress from 50% of BW (week 7) to full WB (week 8), pending clearance from orthopaedic specialist

Knee ROM:

Progress to full active knee ROM (weeks 7-8)

Knee Brace:

Full flexion permitted

Exercises:

Continue phase 2 and 3 exercises
Further knee flexion through intensive quadriceps stretching and passive rowing ergometry
Introduce bridging exercises and weighted knee flexion (week 8)
Introduce proprioceptive WB exercises
Introduce upright stationary cycling (weeks 9-12)
Continue phase 2 and 3 hydrotherapy exercises, plus "pattern kicking" (weeks 11-12)

Phase 5 (3-6 months post-surgery)

Goals:

- Normal gait pattern without pain, walking aids, or a knee brace
- Ability to negotiate stairs and mild gradients without pain
- Return to work (dependent on occupational demands)
- Proficiency in performing all full WB strengthening and proprioception activities

Weight Bearing:

Full WB, no crutches

Knee ROM:

Full and pain-free active knee ROM

Knee Brace:

No brace

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Exercises:

Continue phase 3 and 4 exercises
Introduce modified non-WB exercises (eg. terminal leg extension), dictated by graft location and size
Introduce modified WB exercises (eg. single-leg heel raises, leg press, squats, lunges, steps)
Increase duration and intensity of stationary and outdoor road cycling FORMCHECKBOX
Introduce rowing ergometry and elliptical trainers
Hydrotherapy generally not required, pool may be used for ongoing cardiovascular exercise

Phase 6 (6-9 months post-surgery)

Goals:

- Hamstring and calf strength within 90% of the contralateral limb
- Ability to tolerate pain-free walking distances of more than 5 to 10 km
- Ability to effectively negotiate uneven terrain and soft sand
- Return to preoperative low-impact recreational activities

Weight Bearing:

Full WB, no crutches

Knee ROM:

Full and pain-free active knee ROM

Knee Brace:

No brace

Exercises:

Continue phase 3 to 5 exercises
Ongoing progression of WB and non-WB activities with respect to duration, intensity, proprioceptive component, and overall complexity
Exercises employed should begin to replicate what is required for the patient's individual activity goals

Phase 7 (9-18 months post-surgery)

Goals:

- Quadriceps strength within 90% of the contralateral limb
- Ability to perform all activities of daily living pain free
- Ability to commence a progressive running program at 9 to 12 months
- Resumption of dynamic recreational and sporting activities; however, **sports that generate high compression, shear, and torsional loads should be avoided until 12 to 18 months post-surgery**

Weight Bearing:

Full WB, no crutches

Knee ROM:

Full and pain-free active knee ROM

Knee Brace:

No brace

Exercises:

Continue phase 3 to 6 exercises pertinent to the patient's individual activity goals
Ongoing progression of WB activities with respect to duration, intensity, proprioceptive component, and overall complexity
Introduction of agility and plyometric drills relevant to the patient's individual activity goals