

REHABILITATION MANUAL OF KNEE FOR AUTOLOGOUS ADULT LIVE CULTURED CHONDROCYTES (CARTIGROW™)

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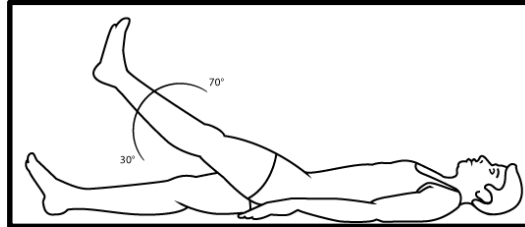
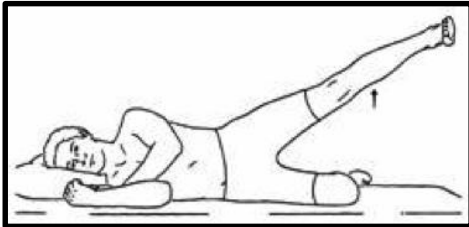
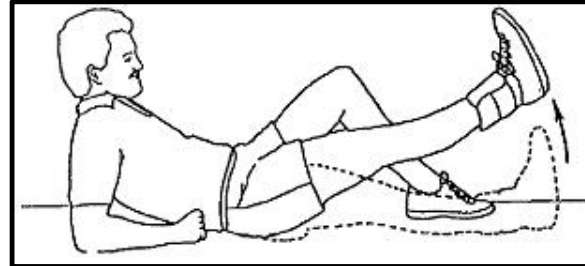
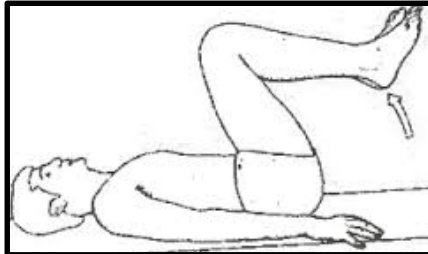
INTRODUCTION

- The purpose of this manual is to provide guidance for the development of a physician-prescribed rehabilitation program that fosters early mobilization and load protection to promote implant maturation and reduce post-operative risk.
- Autologous Adult Live Cultured Chondrocytes (CARTIGROW™) Rehabilitation Manual Guidelines are based on clinical experience* that supports the use of a controlled rehabilitation program to promote a progressive return to full range of motion and weight bearing as well as muscle strengthening and conditioning.
- The rehabilitation program is designed using knowledge of basic science, anatomy and biomechanics of articular cartilage, as well as the natural course of healing following implantation, and is not intended as a substitute for individual clinical judgment. The goal is to restore optimal function in each patient as quickly and safely as possible.

Principles of Rehabilitation:

It stresses the importance of a tailored approach to each individual's rehabilitation that will protect the implant while stimulating the cells to promote optimal healing. Mechanical loading is an important regulator of chondrocyte differentiation. Key types of loading include cyclic compressive loading (enhances chondrogenesis); shear loading (increases matrix production and improves biomechanical structure); and static compression (which can be detrimental to development and repair of cartilage).

PHASE I (1-2 WEEKS POST-OPERATIVE)



Goals:

- Maintain joint mobility and muscle tone.
- Protect healing tissue from load and shear forces
- Decrease pain and effusion.
- Gradually improve knee flexion.

Rehabilitation Plan		
Weight bearing	Range of motion	Activities
<ul style="list-style-type: none"> • Non-weight bearing 	<ul style="list-style-type: none"> • Flexion start after 48 to 72 hours after operation. • Start with settings of 0-30⁰, increase flexion by 5-10⁰ per day. • Exercise 2 hours/day after operation 	<ul style="list-style-type: none"> • Gradual return to daily activities. • If symptoms occur, reduce activities to reduce pain and inflammation • Extended standing should be avoided.

Indoor Exercise:

- 4-directions exercise:** straight implanted leg up and down for four directions.
- Isometric:** contract your thigh muscle straitening implanted leg for about 6 seconds.
- Hamstring:** Straight leg and draw the tiptoe in the direction of the body for about 6 seconds

PHASE II (2-4 WEEKS POST-OPERATIVE)



Goals:

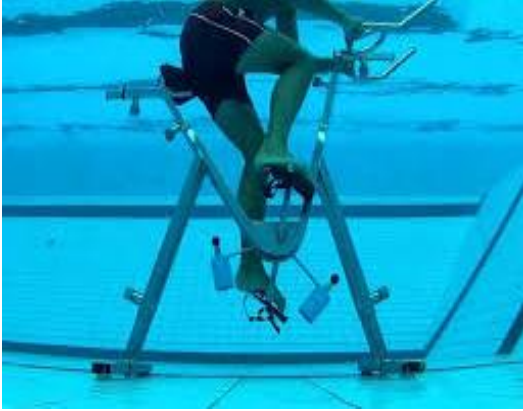
- Pain free knee flexion of 90° by 4 weeks after implantation.
- Pain free and full passive knee extension.
- Reduced post-operative pain and edema.
- Ability to generate an active, isometric quadriceps contraction.
- Proficiency with home exercise program.

Rehabilitation Plan		
Weight bearing	Range of motion	Activities
<ul style="list-style-type: none"> • Non-weight bearing 	<ul style="list-style-type: none"> • Increase flexion by 5-10° per day to reach 90° by 4 weeks. • Exercise 4 hours a day. 	<ul style="list-style-type: none"> • Gradual return to daily activities. • If symptoms occur, reduce activities to reduce pain and inflammation • Extended standing should be avoided.

Indoor Exercise:

- 4-directions exercise:** straight implanted leg up and down for four directions.
- Isometric:** contract your thigh muscle straitening implanted leg for about 6 seconds.
- Hamstring:** Straight leg and draw the tiptoe in the direction of the body for about 6 seconds

PHASE III (4-6 WEEKS POST-OPERATIVE)



Goals:

- Pain free knee flexion of 110-120° by 6 weeks after implantation.
- Proficiency in performing home exercises including a straight leg raise.

Rehabilitation Plan		
Weight bearing	Range of motion	Activities
<ul style="list-style-type: none">• Partial-weight bearing	<ul style="list-style-type: none">• Increase flexion by 5-10° per day to reach 110-120° by 6 weeks.• Exercise 4-6 hours a day.	<ul style="list-style-type: none">• Stationary biking should be done without resistance.

Indoor Exercise:

- 4-directions exercise:** straight implanted leg up and down for four directions with a sandbag.
- Isometric:** contract your thigh muscle straitening implanted leg for about 6 seconds.
- Hamstring:** Straight leg and draw the tiptoe in the direction of the body for about 6 seconds

PHASE IV (7-12 WEEKS POST-OPERATIVE)



Goals:

- Pain free active knee ROM within anatomical limits.
- Pain free upright cycle ergometry without the protecting knee brace.
- Proficiency in performing home and gym based exercises.

Rehabilitation Plan

Weight bearing	Range of motion	Brace	Strengthening Program	Activities
<ul style="list-style-type: none"> • Progress WB as tolerated. • Progress to full WB by 8-9 weeks • Discontinue crutches by end of 7th week. 	<ul style="list-style-type: none"> • TF joint: progress to full active knee ROM (weeks 7-8) • PF joint: progress to full active knee ROM (weeks 7-8) • Continue patellar mobilization and soft tissue mobilization • Continue stretching program 	<ul style="list-style-type: none"> • Discontinue post-operative brace by week 7. • Consider unloading knee brace. 	<ul style="list-style-type: none"> • Continue phase II-III strengthening exercises. • Introduce standing weighted hip adduction and abduction. • Introduce weighted knee flexion (week 8) • Introduce upright cycling (knee flexion: 105⁰-110⁰) (weeks 9-12) 	<ul style="list-style-type: none"> • Water squatting activities • Weight supported lunge activities • Weight supported “step up and down” activities • Introduce patter kick (week 12) • Treadmill walking program • Gradually increase standing and walking

PHASE V (3-6 MONTHS POST-OPERATIVE)



Goals:

- Normal gait pattern without pain, walking aids or knee brace.
- Ability to negotiate stairs and mild gradients.
- A return to work depending on demands of job.
- Proficiency in performing full WB activities.

Rehabilitation Plan		
Indoor exercise	Outdoor Exercise	Knee strengthening training
<ul style="list-style-type: none"> • Exercise bike, stair climber, treadmill etc. 	<ul style="list-style-type: none"> • Walk 30 minutes 3 times a week on the ground • Slowly increase the running distance. 	<ul style="list-style-type: none"> • Squatting exercise • Throwing a ball exercise

PHASE VI (6-9 MONTHS POST-OPERATIVE)



Goals:

- Ability to tolerate walking distances of more than 5-10 km.
- Ability to return to pre-operative low impact recreational activities.
- Ability to effectively negotiate uneven ground, including soft sand.

Rehabilitation Plan		
Indoor exercise	Outdoor Exercise	Knee strengthening training
<ul style="list-style-type: none"> • Exercise bike, stair climber, treadmill etc. 	<ul style="list-style-type: none"> • Walk 30 minutes triweekly on the ground 	<ul style="list-style-type: none"> • Initiate running on the one side leg from 9 months onwards.

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