

Original Rehabilitation Guidelines for autologous chondrocyte transplantation in the knee

By courtesy of Prof. Lars Peterson of the Göthenborg Medical Center.

Introduction

Rehabilitation after a chondrocyte transplantation takes a long time and requires much patience. Regular contact between the patient and physiotherapist is of great importance. The rehabilitation program depends on the site, size and extent of correction, and the specific situation of the patient. Therefore it is of great importance to keep constant contact with the physiotherapist. During the rehabilitation it is very important that mobility exercises are emphasized. These exercises should start directly after the operation and continue through out the rehabilitation process. Mobility exercises stimulate the growth and proper development of the transplanted cells.

Group 1*

1 – 6 weeks Use of 2 crutches with gradual increase in weight bearing within pain threshold. If there is no pain or limping and there is good muscle tone around the knee, walking is permitted indoors after 4-6 weeks. Walking outdoors without crutches is allowed after 6 weeks if the above mentioned criteria are met.

Group 2*

1-3 weeks Use of 2 crutches with a weight bearing up to 20 kilos (44 lbs.);
4-6 weeks Use of 2 crutches with a gradual increase in weight bearing – within pain threshold;
7-8 weeks Increase gradually to full weight, walking indoors without crutches is permitted.
(requirement: no pain or limping and good muscle tone around the knee);
9-> weeks Walking outdoors without crutches is permitted as soon as there is no pain or limping and good muscle tone around the knee.

Group 3*

1-6 weeks Use of 2 crutches with a weight bearing up to 20 kilos (44 lbs.);
7-9 weeks Increase gradually to full weight, walking indoors without crutches is permitted.
(requirement: no pain or limping and good muscle tone around the knee);
10-> weeks Walking outdoors without crutches is permitted as soon as there is no pain or limping and good muscle tone around the knee.

Always use 2 crutches when walking. Avoid the use of one crutch due to the risk for improper loading to the joint. It is not necessary to use crutches when standing if one has full muscle control of the knee. Equally loading both legs is required (goes for all three groups).

* The orthopaedic surgeon assigns the patient's group number.

CPM machine:

Continuous Passive Motion (CPM) is started six hours postoperatively, 8 hours a day. Day 1 and 2 10°-40°, increase to 0°-60° if this is acceptable for the patient.

Rehabilitation guidelines

1-3 weeks

Home program

- ⌚ Mobility exercises
- ⌚ Circulation exercises
- ⌚ Quadriceps development
- ⌚ Straight leg raises (picture 1)
- ⌚ Hip extension and abduction exercises (picture 2)
- ⌚ Heel raising (picture 3)



Picture 1



Picture 2

4-6 weeks

Continued Home program

- ⌚ Straight leg raises with 1-2 kilos (2.2 – 4.4 lbs)
- ⌚ Theraband rubber: standing straight leg resistance in all directions (picture 4)
- ⌚ Knee flexion, not > 90° (picture 5)
- ⌚ Walking (according to group)



Picture 3

Stationary bicycling

- ⌚ Bicycling on a stationary bike is allowed as soon as the passive range of motion is 100° and practical.
Low resistance for mobility, 10-15 minutes a day.
- ⌚ After bicycling 4 weeks the resistance and time on the bicycle should gradually increase. Increases in one minute intervals. Start example:
10 minutes low resistance – 1 minute increased resistance;
Or 5 minutes low resistance – 1 minute increased resistance;
Increase the number of sets gradually.



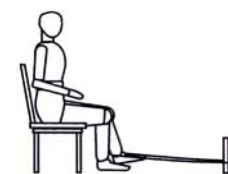
Picture 4

Aquatic therapy

- ⌚ Mobility training
- ⌚ Hip training with straight leg in different directions
- ⌚ Wet vest starts at the earliest 6 weeks after the operation

7-10 weeks

- ⌚ Gait training
- ⌚ Easy functional exercises (closed chain)
- ⌚ Balance training first with both legs gradually only one leg (according to group)
- ⌚ Isometric quadriceps training in different angles -closed chain- (picture 6)
- When full weight bearing and walking without crutches is achieved**
- ⌚ Leg press both legs start with 10° - 70°
- ⌚ Small step training (height adjustable) with support (picture 7)
- ⌚ Step machine short steps, start week 9



Picture 5



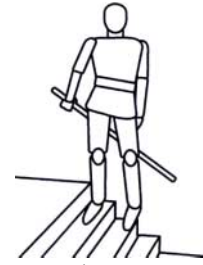
Picture 6

11-12 weeks

- ⌚ Increase functional exercising: i.e. step training without support, walking on soft surfaces
- ⌚ Bicycling on a stationary bike increasing resistance and duration
- ⌚ Isometric quadriceps exercises in different angles (open chain)

13 weeks

- ⌚ Increase functional training
- ⌚ Increase isometric quadriceps exercises in different angles
- ⌚ Step machine interval training
- ⌚ Gradually increase walking distance



Picture 7

Continued therapy should be tailored to the leg's function. It is very important to ascertain the patient's status in developing the therapy program.

Large variations occur amongst patients.

Rehabilitation guidelines for combination operations

Chondrocyte transplantation and:

- ⌚ Cruciate ligament reconstruction
- ⌚ Reconstruction of the extensor mechanism
- ⌚ Tibia osteotomy
- ⌚ Cruciate ligament reconstruction and Tibia osteotomy

1-3 weeks

- ⌚ Orthosis; ROM individual variation
- ⌚ Home program

4-6 weeks

- ⌚ Orthosis 0° - 90°
- ⌚ Continued Home program

6 → weeks

- ⌚ Bicycling on a stationary bike is allowed as soon as the passive range of motion is 100° and practically available
- ⌚ Start aquatic therapy
- ⌚ Continue rehabilitation according to the chondrocyte transplantation guidelines

Dynamic quadriceps strength training (open chain)

The rule is to gradually start without weight, when this goes well without pain or “catching” increase with weight cuff or theraband rubber resistance. Exercising in a knee extension machine should start at the earliest 6 months after the operation.



Patella-/Trochlea-transplantation and kissing lesion transplantations

Dynamic quadriceps training should be carefully started 6-12 months after the operation. Pain and “catching” guide the use of these exercises.

IsoKinetic Exercises

Starting Isokinetic exercising (open chain) for the knee should be started in compliance with the orthopedic surgeon.

Walking/Jogging

Increase the distance and speed gradually. When the patient is able to walk briskly in uneven terrain 5-10 kilometers (3-6 miles) without problems one can try jogging:

- ⌚ Start with 100 meters jog, 500 meters walking x 5



Swimming

Crawl with straight legs is allowed after 6 weeks.

Breast stroke is allowed after 2-4 months (it should be pain free).

Inlines, ice skates, cross country skiing (flat surface)

This is allowed after 4-6 months, but previous experience is required.

Golf, is allowed after 4 months.

Bicycling outdoors

It is imperative that you have good muscular control and can get on and off the bicycle. Make sure to start on a flat surface.



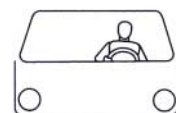
Car driving

It is necessary to have good muscular control and co-ordination. The right leg must be able to endure a forceful braking.

Strength testing

Testing of the knee should be done in co-ordination with the orthopedic surgeons recommendation.

- ⌚ Isometric test: recommended earliest 6 months after the operation at 15°, 30° and 60°
- ⌚ Isokinetic test:
 - Femur/tibia transplantations recommended earliest 9 months after the operation,
 - Patella/trochlea transplantations recommended earliest 12 months after the operation.



Testing is warranted for athletes who will be returning to competition and industrial workers with physically demanding work.

General rules

- ⌚ Mobility exercises stimulate the transplanted cells growth and proper development. A correct dosage of mobility and strength training combined with functional exercises and rest will give the best results.
- ⌚ It's normal to experience local swelling and increased warmth in the knee the first few months. If pain and swelling occur in connection with exercise reduce the load.
- ⌚ Crepitation can occur in the knee. If it is not associated with pain it can be described as a hypertrophic tissue growth or soft tissue that will be formed by loading.
- ⌚ If a disturbing or functional "catching" occurs in the range of motion, dynamic quadriceps exercises should be performed above and below the "catch" exercise without weight through the entire range of motion.
- ⌚ The maturing process for the transplantation is slow and can be up to 12-24 months. The transplanted chondrocytes is calculated to fill the cavity after 3-6 months. The consistency and the "new" cartilage is after:
 - 3 months like cotton;
 - 6 months like dough
 - 9-12 months like cheese or rubber.

Summary

- ⌚ The key words for chondrocyte transplantation rehabilitation are:
 - Mobility exercises
 - Isometric strength training
 - Functional exercises
 - **Patience**

Within these guidelines there is space for a lot of individual adjustments. The rehabilitation program should be tailored around the patient's status and needs, as well as increases and changes. The rehabilitation process expands over a long period of time. Even when the patient is training alone the physiotherapist should be available for consultation.

