

REHABILITATION PROTOCOL AFTER MESENCHYMAL STEM CELLS IMPLANTATION FOR CARTILAGE LESIONS



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Many authors have recognized that nucleated cells found in bone marrow are a useful source of cells for restoration of damaged tissue. Recent advances in our understanding of the functions of Mesenchymal stem cells (MSC) have shown the chondrogenic potential of MSC and the new possibilities for biological cartilage regeneration. Once MSC are cultured in the appropriate microenvironment, they can differentiate to chondrocytes and form cartilage. Recent studies show the capacity of these cells to influence the local tissue environment and exert protective effects, stimulating regeneration in situ.

The surgical one-step procedure of MSC implantation represents a promising alternative to cartilage transplantation in the treatment of full-thickness cartilage lesions, and permit a significant reduction of operating time and related costs.

The rehabilitation program is crucial to optimize the results of the surgery. It promotes the ideal physical environment for mesenchymal stem cells to differentiate into articular cartilage-like cells, leading to development of a durable repair cartilage that fills the original defect.

The rehabilitation protocol is similar to that used after cartilage transplantation. The recovery follows precise functional criteria and objectives to be achieved in various stages of rehabilitation (1° stage: implant protection and recovery of walk, 2° stage: transition and recovery of running, 3° stage: maturation and recovery of athletic condition, 4° stage: cartilage turnover and athletic maintaining). The timing and modalities of exercises are determined by the size and location of the lesion and the type of fixation (or scaffold) used for the implant.

	PHASE	OBJECTIVES	CRITERIA TO PROGRESS
1	Implant protection and recovery of walk	<ul style="list-style-type: none"> • Protect the transplant • Decrease pain and effusion • Increase range of movement • Retard muscle atrophy • Recovery of a correct gait pattern 	<ul style="list-style-type: none"> • Full active knee extension • Knee flexion > 120° • No swelling • No pain during weight-bearing • Correct walk pattern • Adequate muscle recruitment (quadriceps)
2	Transition and recovery of running	<ul style="list-style-type: none"> • Recovery of full range of motion • Increase of muscular strength • Increase of neuro-muscular control • Return to a correct running pathway 	<ul style="list-style-type: none"> • Running without pain/swelling at 8 km/h for 10 minutes • Adequate recovery of coordination and neuro-muscular control. • Recovery of strength > 80% contralateral limb. • Single leg hop test: > 80% contralateral limb
3	Maturation and athletic recovery Turnover and athletic maintaining	<ul style="list-style-type: none"> • Stimulate the cartilage tissue remodelling by exercise with progressive resistance • Sustain high loads and impact activities • Prepare athlete for a return to competition with good recovery of the aerobic endurance • Recovery of sport specific skills 	<ul style="list-style-type: none"> • Go up and down stairs and for athletes running without pain/effusion at 10 km/h for 15 minutes without a significant increase of blood lactate concentration above resting values • Correct execution of sport specific skills
4	Turnover and athletic maintaining	<ul style="list-style-type: none"> • Maintain a good quality of life and a good physical condition • Avoid excess of body fat • Prevent risk of re-injury • Return to the team and competitions 	