

9

Case Studies

Sports Interventions for SCI Patients



Swiss
Paraplegic
Research



Index

Case Study 9: Sports Interventions for SCI Patients

General Introduction	3
Box 1: Effects of sports and athletics on physical capacity	5
Lisa's Story	7
The Rehab Cycle Assessment	11
Box 2: A Rehabilitative Challenge	9
The Rehab Cycle Assessment	10
Table 1: ICF Categorical Profile	13-15
Figure 1: ICF Assessment Sheet	16
The Rehab Cycle Goal Setting	17
The Rehab Cycle Assignment and Intervention	18
Table 2: ICF Intervention Table	20-21
Box 2: A Brief Introduction to the Feldenkrais Method®	22
The Rehab Cycle Evaluation	24
Table 3: ICF Evaluation Display	25-26
Discussion	28
Literature	31
Questions	33



Following a spinal cord injury (SCI), a reduced physical and psychological condition is the norm.^{1, 2} Physical capacity has been defined as the “combined ability of the cardiovascular, respiratory and musculoskeletal systems to attain certain levels of activity.”³ Such capacity of an SCI patient is closely related to the performance of the activities of daily living. The often extreme reductions in performance of daily activities combined with a sedentary lifestyle results in inadequate maintenance of a patient’s physical capacity.⁴ The physical deconditioning and premature aging that can occur in SCI patients can be extreme. This includes increased rates of secondary conditions such as cardiovascular and respiratory diseases, bone and joint diseases, pain and obesity.^{5, 6} The end result is more complications as well as reduced levels of functioning and quality of life.⁷



One critical goal of rehabilitation includes breaking the cycle that results in reduced physical capacity leading to limitations in functioning.⁸ In addition to a reduced physical capacity, SCI patients can have a range of psychological problems, sometimes continuing or even arising after returning to their communities. Higher incidences of depression, anxiety and lower quality of life have all been reported.⁹

Undertaking sports has repeatedly been shown to contribute to physical capacity and health maintenance as well as psychosocial well being among persons both with and without SCI (see Box 1). Additionally, among athletically active patients, indirect health status benefits have been demonstrated, including decreases in hospitalizations and morbidity with regard to urinary tract and respiratory infections, spasticity and ulcers.¹⁰

Sporting activities may also contribute to the improvement in SCI patients' psychosocial status (although the published studies in this area are not entirely conclusive, with some showing an effect while others show a negligible

impact).¹³ One study demonstrated that those patients not practicing sports had higher rates of anxiety and depression compared to those who did.¹⁴ Both tetra- and paraplegics who practice sports more often obtain greater psychological benefits.¹⁵

On a broader level, sports can facilitate aspects of community reintegration. Various sports have been shown to contribute to social interaction, adjusting to a disability, a sense of fun and as a coping mechanism for stress management — increasing self-efficacy overall in both the sport itself and activities of daily living.¹⁶

One survey that compared 985 persons with SCI found reasons for sports participation included (in order of the most frequent) “fun,” “fitness,” “health,” “competition,” and “social.” Furthermore, there are increasingly greater options for the expansion of athletic activities, as demonstrated by publications such as *Sports-n-Spokes* and organizations such as *Wheelchair Sports* in the USA.^{17, 18, 19} However, access to recreational resources can be a limiting factor in a patient's participation in sports.²⁰

Box 1: Effects of sports and athletics on physical capacity

The physiological effects of sports in SCI patients have been well studied and have been shown to lead to overall increases in the quality of life of patients. Some of the specific body functions that are affected include:¹¹

- Cardiac function
- Respiratory function — increases in ventilatory reserve and VO_2 peak, translating into better overall fitness
- Improved physical work capacity through better cardio-respiratory functioning
- Improved muscle strength: in complete SCIs above the level of injury; in incomplete SCIs through neural plasticity also below the level of injury.
- Vascular function — studies have shown mixed results in improving blood flow to the legs; reductions in the incidence of platelet aggregation have also been documented.
- Metabolically, highly trained SCI patients have higher levels of high density lipoprotein cholesterol (HDL-C), potentially reducing the risk of congestive heart disease.
- Training can increase muscular capacities, improve muscular aerobic metabolism and increase resistance to fatigue. Although aerobic power decreases in individuals following an SCI, endurance gains can be made with proper training.¹² Anaerobic power, which focuses on short-term exertion tasks, can likewise be improved in SCI patients through the appropriate training.
- Sports have been shown to be a factor in improving functional capacities based on the Functional Independence Measure over the first 10 years after SCI.

Given the range of positive effects that sports can have in persons with spinal cord injuries, integrating athletic activities into the rehabilitative process stands to do much to encourage regular exercise. In the long term, a person with SCI involved in sports stands to benefit in terms of functioning, health maintenance, reintegration and overall well-being.

This case study aims to illustrate how sporting activities can contribute both to physical health maintenance and psychosocial well-being. The study will describe intervention strategies that focus on physical functioning and the identification of suitable athletic activities for the rehabilitation of a person with traumatic SCI.

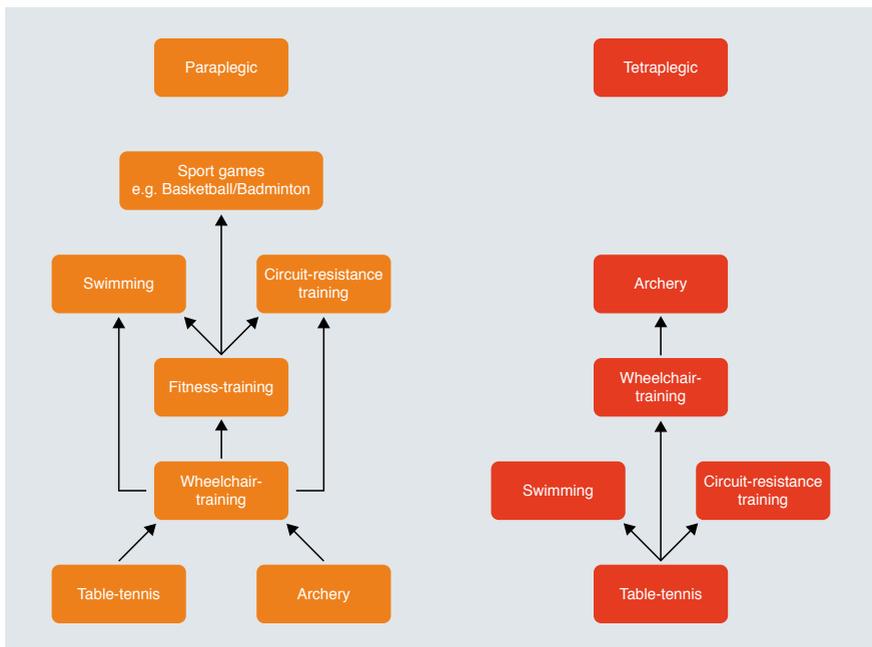


Figure 1: Sport Therapy Progression in Paraplegics and Tetraplegics



Lisa lived sports. Athletics played a large role both in her private and professional life, as an accomplished athlete and a respected high school sports (and geography) teacher. Following her spinal cord injury (SCI), Lisa's fitness and athleticism were significant contributors to her overall recovery. At 35, she regularly practiced a wide variety of sports — skiing, mountain biking, tennis, volleyball and climbing, to name a few.

Sports and athletics have always been incredibly important to me, to my relationship to the world — for my self-perception and body awareness and fitness, for the thrill and challenge of

competition and for all of the social aspects. And obviously it's played a professional role as well, in my career as a teacher — introducing sports to young people has been truly rewarding. A combination of a career I love and a life passion.

— Lisa

While each of these sports carries certain inherent risks, it was a mountain climbing accident that left two of her climbing partners dead and Lisa with a complete SCI. In the rehabilitation that followed her injury, a love of sports and fitness would prove to be valuable in surprising ways.



A Climbing Catastrophe

Press release:

Mountain climbing accident with two dead and one person seriously injured

On Thursday morning two men were killed and one woman injured in a mountain climbing accident in Switzerland... According to a report, a major rockfall occurred, with rocks falling up to 2,800 meters. The climbing team fell with the avalanche to the base of the mountain. Two climbers, ages 32 and 36, died from their injuries. One 35-year-old woman, seriously injured, was evacuated by helicopter to a trauma center in Bern...

The rockfall was unanticipated and massive; Lisa's survival was a matter of chance. She was buried and critically injured beneath the rockfall, already aware of her paralysis and not knowing whether or how long she would live. Fully conscious over the course of the entire disaster, Lisa was separated from her climbing partners, and could only wait and hope to be rescued before she died. Fortunately, a pair of hikers witnessed the accident and were able to report the event. A rescue team arrived by helicopter and rapidly evacuated her to an acute care hospital.

Lisa was in critical condition when she arrived in the emergency department, with major thoracic and abdominal trauma, as well as head injuries, fractured ribs and multiple lacerations. She presented with symptoms of spinal cord injury and was diagnosed as having a luxation fracture at Th8 and graded with an ASIA Scale A SCI. Acute care was undertaken to treat her pneumothorax and hemothorax (an accumulation of air and blood, respectively, in the chest cavity), a ruptured kidney, a major retroperitoneal hematoma (blood collecting in the internal space behind the abdomen),

her lacerations and head injury (mild traumatic brain injury). On the third day after the accident, Lisa's status deteriorated due to impaired internal organs. The acute care medical team kept her on artificial ventilation over the following three days while her condition stabilized. Once the medical team was satisfied with Lisa's stability, they were able to focus on her spinal fractures and luxation.

The next stage of her treatment involved the surgical stabilization of her spine from Th6 through Th10. The procedure was successfully completed and post-operatively her medical condition greatly improved. She was awake, oriented and her cardio-pulmonary situation was stable. She was moved to the early post-acute unit of a specialized rehabilitation center for the start of her rehabilitation program.



Rehabilitation – the first four months

Lisa began slowly and steadily recovering from her many injuries. She continued to suffer from extreme pain, primarily as a result of a number of fractured ribs. Because of the pain, the extent of her physical activity was limited. Another obstacle to her rehabilitation appeared unique to her situation. Since the accident, she had developed a fear of falling. This fear interfered with many aspects of her mobility, and activities such as transferring herself or even sitting upright became a challenge.

Despite the obstacles of pain and fear, Lisa's recovery progressed and her physical activities increased in intensity over the course of the first four months of rehabilitation. Her cardio-respiratory functioning was normal. She became more independent in both dressing and caring for herself as well as transferring herself into a wheelchair. Her spinal cord independence measure (SCIM) score reflected these improvements, increasing from 12 to 50 (see Figure 2) throughout the rehabilitation.

Given her steady recovery, the rehabilitation team planned another four-month rehabilitation period. They hoped that upon completion, she would be able to leave the facility and live an independent life, reintegrated into her community.

“Since the accident, she had developed a fear of falling. This fear interfered with many aspects of her mobility...”

In the second half of her rehabilitative process, the healthcare team would utilize the Rehab Cycle to identify and integrate appropriate sports and athletic activities based on Lisa's physiological problems and her own wishes.

Date	04.AUG.2007	19.NOV.2007
Selfcare		
Feeding	3	3
Bathing	1	3
Dressing	0	3
Grooming	2	3
	6	12
Respiration and sphincter management		
Respiration	6	10
Sphincter management-bladder	0	11
Sphincter management-bowel	0	5
Use of toilet	0	1
	6	27
Mobility in room and toilet		
Motion in bed and sore prevention	0	2
Transfers: bed-wheelchair	0	1
Transfers: wheelchair-toilet-tub	0	1
	0	4
Mobility indoors and outdoors		
Mobility indoors	0	2
Mobility for moderate distances	0	2
Mobility outdoors	0	2
Stair management	0	0
Transfers: wheelchair-car	0	1
	0	7
TOTAL SCORE	12	50

Figure 2: Lisa's SCIM (Spinal Cord Independence Measure) Scores at the Start of Rehabilitation and Four Months Later.

Assessment

During the initial assessment phase, both patient and health professional perspectives were evaluated for each of the ICF components: body structures and functions, activity, participation, and environmental and personal factors.

Given her injuries and prior rehabilitation, Lisa felt that while she had made some progress, there was still much which could be improved. Medically, she had many of the typical impairments associated with a spinal cord injury at the Th8 level. Pain, reduced muscle power in the upper extremity, a lack of exercise tolerance, unstable blood pressure and a moderate degree of spasticity were impaired body functions that would need to be addressed in this Rehab Cycle.

Although she felt herself to be emotionally stable, her fear of falling, though improved, remained an issue. The health-care team defined this as an “impaired emotional function” due to the accident. However, her neuro-psychological assessment was normal for her condition (recall the traumatic brain injury she suffered during the fall).

From Lisa’s perspective regarding activities, she found it challenging that she continually toppled over when sitting and sometimes exhausted herself performing tasks such as dressing and transferring herself from bed to wheelchair. Her fear of falling also contributed to the limitations in physical activity. Still, there were things she realized she could do: transfer into a car, manage her bladder and care for her skin. Other activities that were still compromised included complete dependence in caring for her skin and emptying her bowels; partial dependence in dressing, washing and transferring; and limitations in her ability to maintain a sitting position.

“Although she felt herself to be emotionally stable, her fear of falling remained an issue.”

Lisa’s injuries altered the life she had led up until the injury in terms of participation and environment. As a teacher, particularly with her skill and enthusiasm in the area of sports, the conditions for her future work had to be clarified. However,

returning to her profession was one of her aims. Additionally, her living situation needed to be clarified. She lived with her boyfriend in an apartment that was not completely wheelchair accessible and would require some adaptations if they decided to remain there. Lisa had an active social and familial network. She felt that her relationship with her boyfriend had intensified as he sought to support her and meet her needs. She met often with her immediate family and received many visits from friends — which at times she felt were almost too frequent. Her healthcare team noted that for a former athlete,

Lisa's involvement in sports was too restricted up to this time-point within her rehabilitation process and needed to be addressed now.

Among Lisa's relevant personal factors, there was a high level of body awareness and intrinsic motivation, both important components for an SCI patient's engagement in sports. Additionally, there were some environmental factors that would need to be addressed before Lisa's discharge. These included selecting the best wheelchair and adapting her car and accommodation.



Goal Setting

Based on the perspectives from the assessment, three Cycle Goals were defined that would work towards Lisa's Service Program Goal of independence in daily living and the previously established Global Goal of community reintegration. To achieve this, both Lisa and the healthcare providers agreed that mobility and self-care — fundamental aspects of independent living — required further rehabilitative efforts.

In addition, it was agreed that a third Cycle Goal would be added for recreation and leisure in order to focus on promoting Lisa's athleticism and love of sports. Congruent with the benefit that sports can offer SCI patients, this last Cycle Goal would act on a number of rehabilitative levels, hopefully improving functioning, activity and participatory aspects of Lisa's rehabilitation.

Determination of intervention targets

For each Cycle Goal, intervention targets were determined and assigned goal values. For example, to achieve the Cycle Goal for recreation and leisure the following intervention targets needed to be addressed: choice of sports activities; emotional functions (i.e. Lisa's fear of falling); maintenance of blood pressure; exercise tolerance and muscle power functions; spasticity;

transferring oneself; and maintaining a sitting position. Many of these targets overlapped the other two Cycle Goals. Additionally, to achieve the Cycle Goals, contextual factors would be involved: body awareness, motivation and selecting an appropriate wheelchair. Table 1 details the goals, targets and values for this Rehab Cycle.

Assessment 4 months post-trauma		ICF Qualifier		Goal Relation		Goal Value						
		Problem		Barrier								
		0	1	2	3	4	0	1	2	3	4	
Global Goal: Community integration												0
Service Program Goal: Independence in daily living												0
Cycle Goal 1: Self-Care												0
Cycle Goal 2: Mobility												0
Cycle Goal 3: Recreation and leisure												1
ICF categories												
b130	Energy and drive functions											-
b134	Sleep function											SPG
b152	Emotional functions											-
b260	Proprioceptive functions*											-
b265	Touch functions*											-
b270	Sensory functions related to temperature and other*											-
b280	Sensation of pain											CG2
b410	Heart functions											
b415	Blood vessel functions											
b420	Blood pressure functions											CG2
b430	Hematological system functions											
b440	Respiration functions											
b445	Respiratory muscle functions											
b455	Exercise tolerance functions											CG3
b525	Defecation functions											
b530	Weight maintenance functions											
b550	Thermoregulation functions											
b620	Urination functions											
b640	Sexual functions											
b710	Mobility of joint functions											CG2
b715	Stability of joint functions											
b7300	Power of isolated muscles and muscle groups											CG2, 3
b7303	Power of muscles in lower half of the body											
b7353	Tone of muscles of lower half of the body											CG2, 3
b740	Muscle endurance functions											CG 3
b750	Motor reflex functions*											
b755	Involuntary movement reaction functions											
b760	Control of voluntary movements*											
b7603	Supportive functions of arms											CG2
b810	Protective functions of the skin											
s120	Spinal cord and related structures											
s610	Structure of the urinary system											CG1
s810	Structure of areas of skin											
d230	Carrying out daily routine											
d240	Handling stress and other psychological demands											
d410	Changing basic body positions											CG2
d4106	Shifting the body's center of gravity											CG2
d4153	Maintaining a sitting position											CG2, 3
d420	Transferring oneself											CG1, 2
d430	Lifting and carrying objects											
d445	Hand and arm use											
d450	Walking											
d4600	Moving around within the home											CG2
d4602	Moving around outside the home and other buildings											CG2
d465	Moving around using equipment											CG2
d470	Using transportation											SPG
d475	Driving											CG2
d510	Washing oneself											CG1
d520	Caring for body parts											CG1
d5300	Regulating urination											CG1
d5301	Regulating defecation											CG1
d540	Dressing											CG1
d550	Eating											CG1
d560	Drinking											CG1
d570	Looking after one's health											
d850	Remunerative employment											GG
d920	Recreation and leisure											CG2
e110	Products or substances for personal consumption											
e115	Assistive products... for pers. use in daily living											SPG
e120	Assistive products... for personal... mobility...											CG2
e140	Products and techn. for culture, recreation and sports											CG3
e150	Design, construction... of buildings for public use											
e155	Design, construction... of buildings for private use											
e310	Immediate family											SPG
e320	Friends											
e340	Personal care providers and personal assistants											
e355	Health professionals											
e410	Individual attitudes of immediate family members											
e420	Individual attitudes of friends											
e555	Associations and organizational services, systems...											
e580	Health services, systems and policies											
Influence of personal factors												
Positive												
Neutral												
Negative												CG2, 3
pf	Sportive person											
pf	Motivation											
pf	Body awareness											
pf	Coping with disease											

Table 1 – ICF Categorical Profile:

*ICF qualifiers range from 0 = no problem to 4 = complete problem in the components of body functions (b), body structures (s), activity and participation (d) and from 4 = complete barrier to +4 = complete facilitator for environmental factors. Among personal factors (pf), the signs + and - indicate to what extent a pf has a positive or negative influence on the individual's functioning.

°Specific cycle goals are indicated by CG 1, 2 and/or 3; SG = Service Program Goal, G = Global Goal

Patient's perspective	Sometimes I am afraid of falling	Sitting without toppling over is difficult	I will not be able to work as a physical education teacher
	My emotions are quite stable	I have to hold on to something while showering	At the moment I am not able to go shopping and socializing with friends
	I could sleep if it were silent in the room	I can transfer from the bed, but it is exhausting	I receive a lot of visits (sometimes too many)
	I have pain in my back from sitting	I can transfer into a car nearly by myself	I meet my family more often
	Blood pressure is sometimes instable	I have to learn how to drive an adapted car	My relationship with my partner has become more intense
	My body balance increases	I am able to catheterize my bladder	Recreation and leisure
	My bladder does not work	I am not able to empty my bowel yet	
My bowel does not work	Dressing is tiring		
My skin is very dry and sometimes reddened	I exercise to care for my skin at the moment		
Body Functions/ Structures Activity Participation			
Health professional	Mental capacity mildly impaired	Independent in catheterizing the bladder	Sport activities restricted
	Emotional functions due to accident experience impaired	Completely dependent in emptying the bowel	
	Bowel functions completely impaired	Partially dependent in washing herself	
	Maintenance of blood pressure impaired	Partially dependent in dressing	
	Exercise tolerance functions	Completely dependent in skin care	
	Muscle power functions in the upper extremity reduced	Partially dependent in changing body positions	
	Propping up on her hands is insufficient	Partially dependent in transferring	
	Moderate spasticity	Maintaining a sitting position is moderately limited	
	Body balance impaired	Wheelchair handling is limited	
	Afraid because of the accident	Driving a car is completed limited	
Environmental factors		Personal Factors	
Drugs against pain	Compression hosiery, Rubbing plate	35 years old, female	
Wheelchair is not chosen yet, new car has to be adapted	Clarification of payments for adapted devices is not clarified yet	Living with boyfriend	
The flat is not adapted	Steps and obstacles are barriers for moving the wheelchair	Teacher for sport and geography	
Positive attitude of friends and family	Accident insurance pays	Was engaged in many outdoor sport activities (skiing, tennis, mountain biking)	
		Body awareness	
		Highly motivated	
		Coping with disease	

Figure 1 — ICF Assessment Sheet

Assignment

Specific interventions for each of the targets were defined and assigned to the appropriate members of the healthcare team. In this Rehab Cycle, in addition to the standard healthcare professionals, a sports therapist, phys-

ical therapist and psychologist would be added to meet Lisa's athletic, physical therapy and psychological needs. Table 2 offers greater detail on the assignments for specific interventions in Lisa's Cycle.

Interventions

Focusing again on the recreation and leisure Cycle Goal, as an example of Lisa's interventions, sporting and athletic activities played a central role. In this case, selection of many of these athletic activities were guided by the sports therapist; a physical therapist may also be able to take on this role, depending upon his or her expertise. Interventions in the areas of physical therapy and sports are clearly closely related and mutually supportive. Together, the interventions would help improve muscle endurance, sporting abilities and promote the supportive functions of the arms, as well as work to broadly further the other two Cycle Goals.

In Lisa's case, the physical therapist was responsible for her overall fitness, the improvement of which was a prerequisite for most sporting activities. For instance, her transferring abilities and wheelchair mobility skills would need to be developed to a degree that would allow participation in athletics. Therefore repetitive training of various transferring techniques and wheelchair maneuvering

“Interventions in the areas of physical therapy and sports are clearly closely related and mutually supportive.”

(e.g. around and over obstacles) was undertaken. To improve Lisa's body balance and overall movement ability, reaction training was tailored and integrated into her physical therapy as well as into group training led by the sports therapist. The sports therapist also focused on building muscle power in the upper extremities through circuit resistance training and on increasing Lisa's exercise tolerance three times weekly.

“...her transferring abilities and wheelchair mobility skills would need to be developed to a degree that would allow participation in athletics.”

With guidance from her sports therapist, a range of sporting activities appropriate to Lisa's level of injury and degree of recovery were included in her rehabilitation. Basketball and other games were added to her fitness training. Lisa was enrolled in a swimming course which took place once a week. Four times per week she took lessons to learn archery,

a sport that is one of the early rehab program sports activities and which precludes participation in other sports such as competitive racing. Based on her initial experiences, Lisa decided to test her capacity in two areas. A canoeing test offered the hope that she would discover an activity she could share with her boyfriend. A handbike racing test established her as a competitor in the sport. She was extremely enthusiastic about both.

Finally, in order to address the intersecting needs of Lisa's body functions and her emotional state, her psychologist began Feldenkrais therapy— a technique of complementary medicine that utilizes body movement for raising awareness (see Box 2 on page 24).

	Intervention target	Intervention	Phys	Nurse	PT	Spo	OT	Psych	SW	First value	Goal value	Final value
Body functions / structure	b152 Emotional functions	Psychological counseling						X		3	1	
		Feldenkrais therapy						X				
	b420 Blood pressure functions	Compression hosery		X						0	0	
	b455 Exercise tolerance functions	Swimming, Fitness training				X				1	1	
	b7300 Power of isolated muscles and muscle groups	Circuit training			X					2	1	
	b7353 Tone of muscles of the lower half of the body	Sauna			X					1	1	
		Hippotherapy			X							
		Drugs	X									
	b740 Muscle endurance functions	Circuit training, Fitness training				X				2	0	
	b755 Involuntary movement reaction functions	Body balance training			X					3	1	
b7603 Supportive functions of arms	Circuit training				X				2	0		
	Prop up training			X								
s810 Structure of areas of skin - at risk	Daily skin control		X						1	0		
Activity / Participation	d410 Changing basic body positions	Repetitive training			X					2	1	
	d4153 Maintaining a sitting position	Body balance training			X					2	0	
	d420 Transferring oneself	Repetitive training of transfers			X		X			3	0	
	d4602 Moving around outside the home and other buildings	Outdoor training					X			2	0	
	d465 Moving around using equipment	Wheelchair training			X	X				2	0	
	d475 Driving	Instruction and training					X			4	0	
	d510 Washing oneself	Assistance and instruction		X						2	0	
	d520 Caring for body parts	Assistance and instruction		X						2	0	
	d5300 Regulating urination	Assistance and instruction		X						0	0	
	d5301 Regulating defecation	Assistance and instruction		X						4	0	
	d540 Dressing	Assistance and instruction		X			X			2	0	
	d850 Remunerative employment	Vocational counseling						X		2	1	
	d920 Recreation and leisure	Sport activities				X				3	1	
Environmental factors	e110 Products or substances for personal consumption	Drugs	X							2+	3+	
	e115 Assistive products... for personal use in daily living	Choice / adaptation of required devices					X			2+	4+	
	e120 Assistive products... for personal mobility	Clarification, counselling and order					X			2+	4+	
	e140 Products and techn.. for culture, recreation, sport	Choice and adaption of sport equipment				X				0	1+	
	e155 Design, construction...of buildings for private use	Clarification and organization					X		X	2	4+	
Personal factors	pf Coping of disease	Psychological counseling						X		+-	+	
	pf Body awareness	Feldenkrais therapy						X		+-	+	

Table 2 – ICF Intervention Table



Additionally, a number of interventions were included that would impact her overall fitness. In addition to all-around care (including the instruction of independent bladder and bowel manage-

ment, and improvement of dressing and transferring abilities), Lisa's nurse fit and managed her compression hose which helped control her blood pressure. Hippo therapy was utilized by the

Box 2: A brief introduction to the Feldenkrais Method®

“Movement is life. Life is a process. Improve the quality of the process and you improve the quality of life itself.”

— Dr. Moshé Feldenkrais

The Feldenkrais Method is a movement-based learning system that focuses on somatic education. This somatic learning aims to heighten self-awareness of and through movement, while minimizing stresses to the body and other limitations to body movement.²¹ The method was originally developed by Dr. Moshé Feldenkrais, a physicist, engineer and martial arts practitioner, in an effort to overcome his own knee injury. Dr. Feldenkrais went on to teach the method to other practitioners.

While not specifically intended as a medical therapy, the Feldenkrais Method can help individuals to move more efficiently and less painfully. Focusing on poorly organized movement, chronic tension and emotional stress, the Feldenkrais Method seeks to help both healthy and injured individuals overcome the immobility associated with such conditions.²² While the mechanisms of the Method are not clearly understood and its effects are not yet conclusive, some studies have shown improved health related quality of life and self-efficacy of pain.²³

Two main approaches to the Feldenkrais Method exist — each with differing instructional philosophies:²⁴ **awareness through movement** and **functional integration**. The former is led verbally by an instructor and can be undertaken in groups. Functional integration involves the instructor using his or her hands to guide the student's or patient's movements.

physical therapist to help improve the muscle tone in Lisa's lower extremities. To improve the increasing spasticity, sauna and drug treatment were also started. Lisa's occupational therapist would help support her ability to dress and look after her health, as well as organize and manage the purchase of assistive devices and the adaptations required for her home and automobile. Psychological counselling helped to alleviate Lisa's fear of falling and support her coping with the disease.

In addition to the athletic interventions, a number of non-sports related activities were included that focused on recreation and leisure in Lisa's weekly schedule (see Figure 3). These included spiritual guidance, art therapy and Spanish lessons. Lisa received a great deal of enjoyment from each of these, particularly her art therapy which utilized clay sculpture as a medium.



Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00	Nursing	Nursing	Nursing	Nursing	Nursing
8:30				Sauna	
9:00	Ward round		Physical therapy	Rest period	Ward round
9:30	Fitness training	Fitness training	Occupational therapy		Fitness training
10:00					
10:30					Physical therapy
11:00	Spanish lessons	Ward round	Swimming		Occupational therapy
11:30					
12:00	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
12:30					
13:00	Physical therapy	Art therapy		Physical therapy	Canoeing test
13:30	Archery		Archery	Archery	
14:00	Occupational therapy			Occupational therapy	Goal setting talk
14:30					Physical therapy
15:00	Spiritual guidance	Circuit training	Circuit training	Art therapy	Technical investigation MRI
15:30					
16:00	Physical therapy	Physical therapy	Physical therapy	Physical therapy	
16:30	Standing training	Standing training	Standing training	Standing training	
17:00					
17:30		Archery	Fitness training		
18:00					

Figure 2: Sample Weekly Treatment Schedule from Month Five

Date	04.AUG.2007	19.NOV.2007	14.JAN.2007	27.FEB.2008
Selfcare				
Feeding	3	3	3	3
Bathing	1	3	3	3
Dressing	0	3	4	4
Grooming	2	3	3	3
	6	12	13	13
Respiration and sphincter management				
Respiration	6	10	10	10
Sphincter management-bladder	0	11	11	11
Sphincter management-bowel	0	5	5	5
Use of toilet	0	1	5	5
	6	27	31	31
Mobility in room and toilet				
Motion in bed and sore prevention	0	2	6	6
Transfers: bed-wheelchair	0	1	2	2
Transfers: wheelchair-toilet-tub	0	1	1	1
	0	4	9	9
Mobility indoors and outdoors				
Mobility indoors	0	2	2	2
Mobility for moderate distances	0	2	2	2
Mobility outdoors	0	2	2	2
Stair management	0	0	0	0
Transfers: wheelchair-car	0	1	1	1
	0	7	7	7
TOTAL SCORE	12	50	60	60

Figure 4: Final SCIM (Spinal Cord Independence Measure) Scores

I've improved so much — my muscle power, using my wheelchair, transferring myself, and especially in sports. Immediately after the accident, I absolutely knew that sports would continue to be a very big part of my life. It offers me an opportunity to move, to feel joyful, to meet other people and to really experience my improvements as I recover.

I feel like my fear of falling is almost gone; I think the Feldenkrais helped the most with this.

— Lisa, at the end of the Rehab Cycle

"I absolutely knew that sports would continue to be a very big part of my

Two months later, Lisa had progressed well, meeting the goals set for two of her three Cycle Goals: self-care and recreation and leisure. Her SCIM score increased to 60 and remained there, likely reflecting the physical limitations of her injury (see figure 3). Her mobility had improved, but did not reach

the level that her healthcare team had hoped for.

While improvements to her mobility were made, a number of factors resulted in Lisa falling short of the goals set by the team. Fear, although greatly decreased, continued to work against her mobility. Likewise, ongoing pain, an increasing and significant degree of spasticity and poor arm support functions all contributed to the difficulties Lisa had in transferring and changing body positions. Also, she still needed to take an examination in order to obtain a driver's license — clearly a prerequisite to her being mobile with a modified car. It was hoped that each of these contributing factors would improve over time and with them, naturally, Lisa's mobility.

Lisa improved in many areas of physical functioning, but her fear limits some activities — she still has difficulties transferring to her wheelchair; I think absent the fear she could have made even more gains.

— Lisa's physical therapist



The art therapy class, spiritual guidance and Feldenkreis therapy that she received were valuable to her recovery. From her own perspective, Lisa felt that these interventions qualitatively had an introspective and calming effect, helping her to adapt to her new life situation and even to alleviate some of her falling fear.

Regarding her occupation, Lisa's former employer readily agreed to take

her back; she could continue teaching Geography, and potentially other subjects. Given her love of sports, she hoped someday to be able to integrate into her career her athletic enthusiasm and passion for teaching, possibly as a motivational sports instructor. She planned on returning to work as soon as she was able, though feelings of insecurity remained and her occupational therapist would continue to offer support.

In pursuing the Cycle Goal for recreation and leisure, Lisa was highly motivated and pro-active in both sports-related and non-athletic interventions. She made gains achieving her objectives physiologically in both exercise tolerance and muscle power, as well as in the area of mobility, learning to better use a wheelchair — a prerequisite for many other athletic interventions. Although her muscle endurance fell short of the stated goal, she still made significant strides in all of the sporting activities she undertook.

“Not only do sports benefit her physically, but they also help to support her emotionally and socially...”

Throughout this Rehab Cycle, Lisa’s love of sports and athletic history shined through in all she tried. By admission of her sports therapist, she excelled in swimming, archery and tennis, while also performing well in team sports such as basketball. Her canoeing test went well and she planned on pursuing this activity with her boyfriend, who had been highly supportive. She even discovered a new passion for hand biking. She now planned on purchasing her own bike and intended to compete.

Sports are extremely important to Lisa. Not only do they benefit her physically, but they also help to support her emotionally and socially — with her boyfriend and others.

— Lisa’s sports therapist

Assessment 4 months post trauma					Evaluation 7 months post trauma														
Global Goal: Community integration					0	not evaluated yet													
Service Program Goal: Independence in daily living					0														
Cycle Goal 1: Self-care					0														
Cycle Goal 2: Mobility					0														
Cycle Goal 3: Recreation and leisure					1														
ICF categories		ICF Qualifier				Goal	Goal	ICF Qualifier				Goal							
		Problem	0	1	2	3	4	Relation	Value	Problem	0	1	2	3	4	Achievement			
b152	Emotional functions					SPG	1					-							
b280	Sensation of pain					CG2	0					-							
b420	Blood pressure functions					CG2	0					+							
b455	Exercise tolerance functions					CG3	1					+							
b710	Mobility of joint functions					CG2	0					+							
b7303	Power of isolated muscles and muscle groups					CG2, 3	1					+							
b7353	Tone of muscles of lower half of the body					CG2, 3	1					-							
b740	Muscle endurance functions					CG 3	0					-							
b755	Involuntary movement reaction functions					CG1,2,3	1					+							
b7603	Supportive functions of arms					CG2	0					-							
s810	Structure of areas of skin					CG1	0					+							
d410	Changing basic body positions					CG2	0					-							
d4106	Shifting the body's center of gravity					CG2	1					+							
d4153	Maintaining a sitting position					CG2, 3	0					+							
d420	Transferring oneself					CG1, 2	0					-							
d4602	Moving around outside the home... and other buildings					CG2	0					+							
d465	Moving around using equipment					CG2	0					+							
d470	Using transportation					SPG	0					+							
d475	Driving					CG2	0					-							
d510	Washing oneself					CG1	0					+							
d520	Caring for body parts					CG1	0					+							
d5300	Regulating urination					CG1	0					+							
d5301	Regulating defecation					CG1	0					+							
d540	Dressing					CG1	0					+							
d850	Remunerative employment					GG	0					-							
d920	Sport					CG2	1												
		Facilitator		Barrier					Facilitator		Barrier								
		4+	3+	2+	1+	0	1	2	3	4	4+	3+	2+	1+	0	1	2	3	4
e110	Products or substances for personal consumption					CG2	3+					-							
e115	Assistive products... for pers. use in daily living					SPG	4+					+							
e120	Assistive products—for personal... mobility...					CG2	4+					+							
e140	Products and techn. for culture, recreation and sport					CG3	1+					+							
e155	Design, construction... of buildings for private use					SPG	4+					+							
		Influence of personal factors					Influence of personal factors												
		Positive	Neutral	Negative	Positive	Neutral	Negative												
pf	Coping of disease				SPG	+				+									
pf	Body awareness				CG2	+				+									

Table 4: ICF Evaluation Display:
ICF Qualifiers range from 0 = no problem to 4 = complete problem in the components of body functions (b), body structures (s), activity and participation (d) and from -4 complete barrier to +4 complete facilitator in the environmental factors. In personal factors, the sign + and - indicates to what extent a determined pf has a positive or negative influence on the individual's functioning. 1, 2, 3 show the relations to Cycle Goals 1, 2, 3; SG is related to the Service Program Goal, G is related to the Global Goal.

Discussion

Sports and other athletic activities can play an important role in the rehabilitative process of spinal cord injury patients. Beyond enhancing physical fitness and functioning, sports can benefit psychological and emotional functioning, promote quick returns to the activities of daily life and community reintegration, and reduce SCI-associated morbidities. Thus, sports can be seen as a significant contributor to the overall health maintenance and health promotion of patients.

“...interventions had an introspective and calming effect, helping her to adapt to her new life situation and even to alleviate some of her falling fear.”

Going back to as early as 1948, sports have been a component of rehabilitation for SCI. The history of this begins with Dr. Ludwig Guttmann, who utilized sports in the rehabilitation of those sustaining SCIs in World War II. This led to the first wheelchair olympics held in 1960. The outstanding athletes of the subsequent Paralympic Games demonstrate the “immeasurable potential

that is possible when their determination is met with social and technological efforts to promote access.” While these athletes may not be representative of the general population of persons with SCI, participation in sports has many positive outcomes beyond just the physical and psychological. Athletic activities can enhance the values of cooperation, participation and life enjoyment — key elements of community reintegration.

A sports therapist can help to integrate sports and athletic interventions into the rehabilitation process. Such interventions will necessarily need to be adapted to individual cases. A patient’s age, physical fitness before and after the injury, emotional state and personal interests, as well as the type of injury (tetraplegia vs. paraplegia, complete vs. incomplete) and the resources available are all factors that are relevant to selecting which sports are most appropriate.

In Lisa’s case, a young, extremely athletic woman suffered a climbing-related accident that resulted in paraplegia, multiple injuries and related emotional



disorders. The initial rehabilitative efforts aimed at recovery from her injuries, alleviating her fear of falling and increasing her mobility (including using a wheelchair). These early interventions were pre-requisites to the sporting activities that were to come in the subsequent Rehab Cycle. Together with her sports therapist, a range of sports were explored and the optimal interventions were selected. Given her fitness level and athletic experience,

quite a number of sports were included for her to choose from. Some of them had additional social benefits — enhancing old friendships and offering an opportunity to develop new ones. She would be able to play tennis, hand bike and canoe with non-injured people, most notably her boyfriend. Other more competitive sports would allow her to meet others in similar circumstances with similar interests.

In this way, sports offered an important path to community reintegration. Additionally, each of the Cycle Goals was mutually reinforcing. Fitness training improved mobility which in turn improved athletic ability — and all contributed to greater self care for the reasons described above. Non-sports related interventions (art therapy and Feldenkrais therapy in particular) also made significant contributions. Feldenkrais in particular helped to decrease Lisa's fear of falling and increasing her body awareness.

Overall, a comprehensive rehabilitative approach that includes sports in combination with other fitness, mobility and non-athletic interventions did much to help with Lisa's rehabilitative progress. Effects of this approach range from the physiological to the emotional/psychosocial and through broader community reintegration aspects. Lisa's case offers an almost ideal example of integrating sports into rehabilitation. She was physically active and fit prior to the

injury and highly motivated afterwards. However, significant and unanticipated challenges remained that needed to be addressed through individual approaches to her rehabilitation. Her fear of falling was one example. Based on Lisa's own needs, abilities and resources, the Rehab Cycle's assessment phase promoted setting goals that were appropriate to her situation. The result was a sports-intensive cycle whose outcomes demonstrated significant gains.

“Lisa's case offers an almost ideal example of integrating sports into rehabilitation.”

In summary, patients stand to greatly benefit physiologically as well as psychosocially from a rehabilitative process that is able to integrate individually tailored sports and athletic interventions while also taking specific needs and abilities into consideration.

- ¹ **Devillard X, Rimaud D, Roche F, Calmels P.** Effects of training programs for spinal cord injury. *Ann Réadapt Méd Phys.* Jul 2007; 50(6): 490–498. Epub 2007 Apr 24
- ² **Scivoletto G, Petrelli A, Di Lucente L, Castellano V.** Psychological investigation of spinal cord injury patients. *Spinal Cord.* Aug 1997; 35(8): 516–520
- ³ **Ibid.**
- ⁴ **Hoffman MD.** Cardiorespiratory fitness and training in quadriplegics and paraplegics. *Sports Med.* Sep–Oct 1986; 3(5):312–330
- ⁵ **Jacobs PL, Nash MS.** Exercise recommendations for individuals with spinal cord injury. *Sports Med.* 2004; 34(11):727–751
- ⁶ **Slater D, Meade MA.** Participation in recreation and sports for persons with spinal cord injury: Review and recommendations. *NeuroRehabilitation* 2004; 19(2):121–129
- ⁷ **Haisma JA.** Changes in physical capacity during and after inpatient rehabilitation in subjects with a spinal cord injury. *Arch Phys Med Rehabil.* June 2006; 87:741–748
- ⁸ **Ibid.**
- ⁹ **Muraki S, Tsunawake N, Hiramatsu S, Yamasaki M.** The effect of frequency and mode of sports activity on the psychological status in tetraplegics and paraplegics. *Spinal Cord.* May 2000; 38(5):309–314
- ¹⁰ **Muraki S, Tsunawake N, Hiramatsu S, Yamasaki M.** The effect of frequency and mode of sports activity on the psychological status in tetraplegics and paraplegics. *Spinal Cord.* May 2000; 38(5):309–314
- ¹¹ **Devillard X, Rimaud D, Roche F, Calmels P.** Effects of training programs for spinal cord injury. *Ann Réadapt Méd Phys.* Jul 2007; 50(6): 490–498. Epub 2007 Apr 24
- ¹² **Ibid.**
- ¹³ **Muraki S, Tsunawake N, Hiramatsu S, Yamasaki M.** The effect of frequency and mode of sports activity on the psychological status in tetraplegics and paraplegics. *Spinal Cord.* May 2000; 38(5):309–314
- ¹⁴ **Gioia MC, Cerasa A, Di Lucente L, Brunelli S, Castellano V, Trallesi V.** Psychological impact of sports activity in spinal cord injury patients. *Scand J Med Sci Sports.* 2006; 16(6):412–416
- ¹⁵ **Muraki S, Tsunawake N, Hiramatsu S, Yamasaki M.** The effect of frequency and mode of sports activity on the psychological status in tetraplegics and paraplegics. *Spinal Cord.* May 2000; 38(5):309–314
- ¹⁶ **Slater D, Meade MA.** Participation in recreation and sports for persons with spinal cord injury: Review and recommendations. *NeuroRehabilitation* 2004; 19(2):121–129

- ¹⁷ **Scelza WM, Kirshblum SC, Wuermsler LA, Ho CH, Priebe MM, Chiodo AE.** Spinal cord injury medicine. 4. Community reintegration after spinal cord injury. Arch Phys Med Rehabil. Mar 2007; 88(3)Suppl.1:S71–S75
- ¹⁸ See also: Sports n’ Spokes Magazine online. <http://www.pvomagazines.com/sns/>
- ¹⁹ See also: Wheelchair Sports USA homepage. <http://www.wsusa.org/>
- ²⁰ **Scelza WM, Kirshblum SC, Wuermsler LA, Ho CH, Priebe MM, Chiodo AE.** Spinal cord injury medicine. 4. Community reintegration after spinal cord injury. Arch Phys Med Rehabil. Mar 2007; 88(3)Suppl.1:S71–S75
- ²¹ **Jain S, Janssen K, DeCelle S.** Alexander technique and Feldenkrais method: a critical overview. Phys Med Rehabil Clin N Am. Nov 2004; 15(4):811–825, vi
- ²² **Strauch R.** An overview of the Feldenkrais Method. 1996
- ²³ **Jain S, Janssen K, DeCelle S.** Alexander technique and Feldenkrais method: a critical overview. Phys Med Rehabil Clin N Am. Nov 2004; 15(4):811–825, vi
- ²⁴ **Ibid.**
- ²⁵ **Slater D, Meade MA.** Participation in recreation and sports for persons with spinal cord injury: Review and recommendations. NeuroRehabilitation 2004; 19(2):121–129
- ²⁶ **Devillard X, Rimaud D, Roche F, Calmels P.** Effects of training programs for spinal cord injury. Ann Réadapt Méd Phys. Jul 2007; 50(6): 490–498. Epub 2007 Apr 24
- ²⁷ **Gioia MC, Cerasa A, Di Lucente L, Brunelli S, Castellano V, Traballesi V.** Psychological impact of sports activity in spinal cord injury patients. Scand J Med Sci Sports. 2006; 16(6):412–416
- ²⁸ **Scelza WM, Kirshblum SC, Wuermsler LA, Ho CH, Priebe MM, Chiodo AE.** Spinal cord injury medicine. 4. Community reintegration after spinal cord injury. Arch Phys Med Rehabil. Mar 2007; 88(3)Suppl.1:S71–S75
- ²⁹ **Slater D, Meade MA.** Participation in recreation and sports for persons with spinal cord injury: Review and recommendations. NeuroRehabilitation 2004; 19(2):121–129
- ³⁰ **Ibid.**
- ³¹ **Ibid.**

Q1. What are consequences of a sedentary lifestyle in people with SCI?

Refer to page 3 for the answer.

Q2. What are benefits in body functions from sports participation in people with SCI?

Refer to page 4 for the answer.

Q3. How can sports contribute to community integration?

Refer to page 6 for the answer.

Q4. What are appropriate sports in the beginning of rehabilitation in para- and tetraplegic patients? Refer to page 24 for the answer.

Q5. Who began to utilize sport in rehabilitation of patients with SCI?

Refer to page 30 for the answer.



Swiss
Paraplegic
Research

Swiss Paraplegic Research
P.O. Box
CH-6207 Nottwil, Switzerland

Phone: +41 41 939 65 65

Fax: +41 41 939 65 66

Email: spf@paranet.ch