

ISOKINETIC TECHNIQUES IN REHABILITATION OF WATER POLO INJURIES

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METHODS OF MUSCLE STRENGTHENING USING RESISTANCE EXERCISES

ISOTONIC exercise - adjustable speed (about $60^{\circ}/\text{sec}$),
fixed resistance

ISOMETRIC exercise - fixed speed ($0^{\circ}/\text{sec}$); adjustable
resistance

ISOKINETIC exercise: constant speed is chosen ($1-300^{\circ}/\text{sec}$ –
dynamic speed), accommodating **resistance**

ISOKINETIC EQUIPMENT



SPECIFICS OF ISOKINETICS

1. resistance accomodating throughout ***whole range of motion***
2. resistance for ***each extremity separately***
3. resistance in ***both directions of motion***
4. ***muscle strengthening***, without loading the joints
5. ***efficiency*** - the muscle is dynamicaly activated
6. developing muscles ***strength or endurance***, depending on the selected speed
7. it can be performed on **damaged/painful joints**

USE OF ISOKINETICS



knee extension/flexion

• DIAGNOSTICS

- reliable estimate of muscle strength, muscle endurance, range of motion, etc
- muscle deficits and imbalances of the antagonistic muscle groups

• REHABILITATION

- in rehabilitation of different joint injuries
- in treatment of muscle atrophy due to joints' problems, especially painful joints
- before and after surgery
- in prevention of sports injuries
- is extremely fast, in average 3 weeks



hip extension/flexion



trunk extension/flexion



ankle extension/flexion



shoulder extension/flexion

ISOKINETIC DIAGNOSTICS



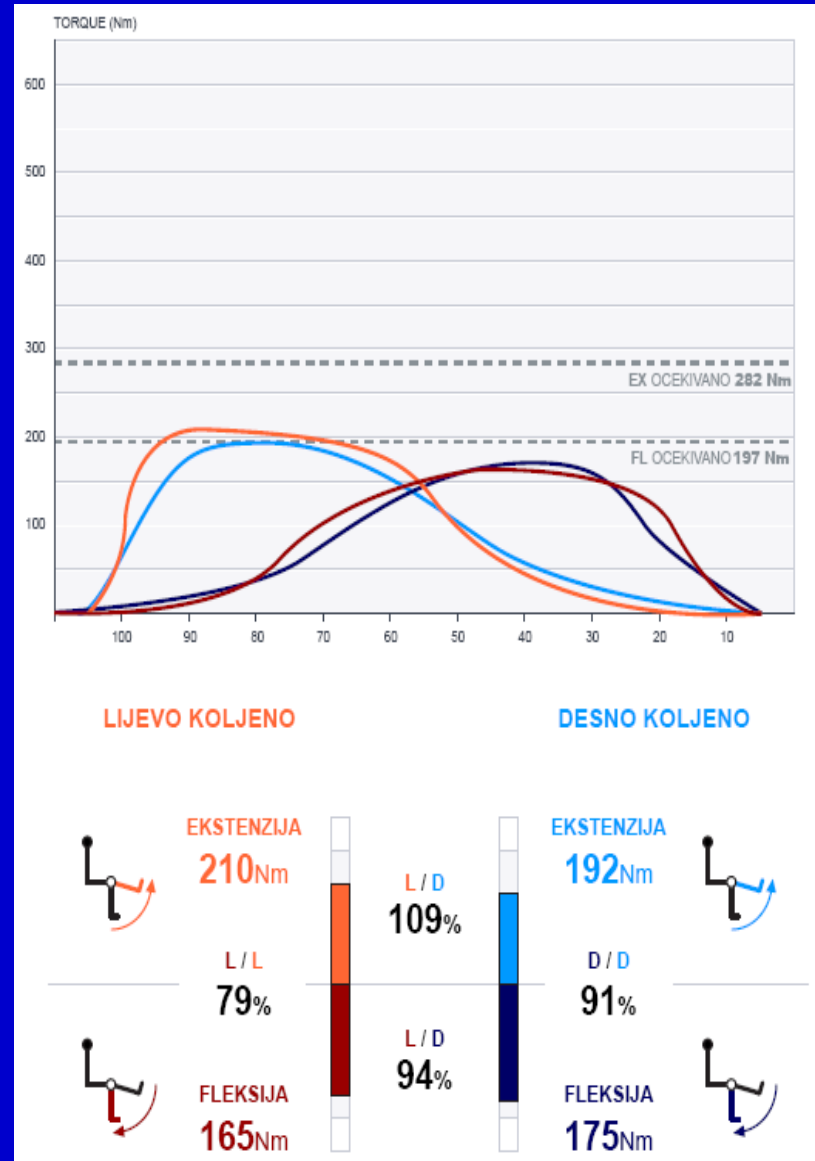
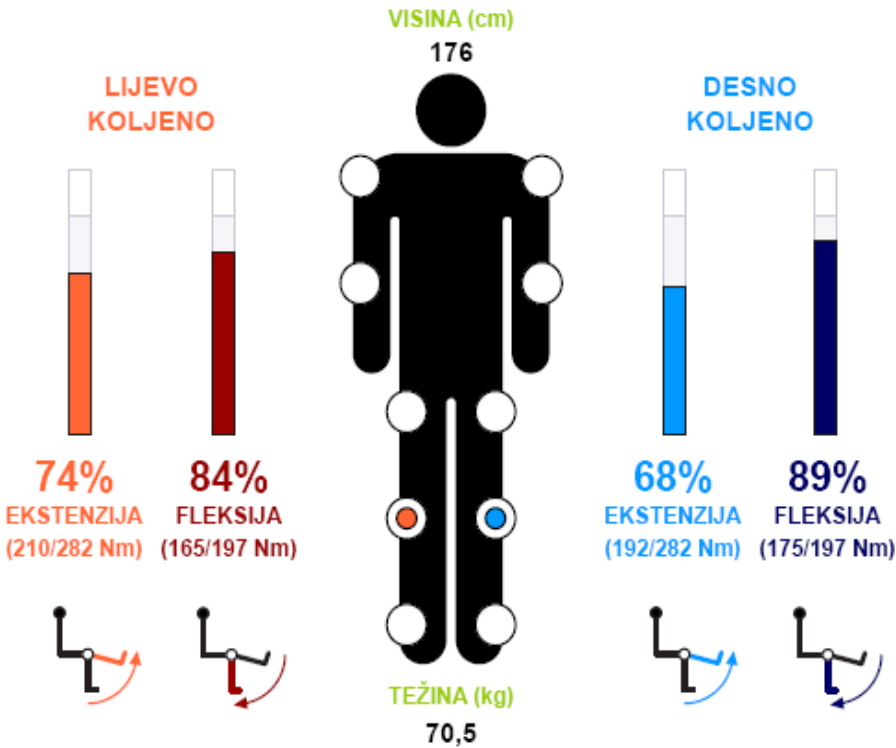
EXAMPLE OF THE ISOKINETIC DIAGNOSTIC TEST

MJESTO Zagreb
DATUM 04.09.2006.

ROĐEN/A 14.12.1986.
STAROST 19 g

SPOL M
AKTIVNOST 1 2 3 4

Aktivno se bavi skijanjem. Do sada nije imao značajnijih medicinskih problema, kao niti težih ozljeda lokomotornog sistema.



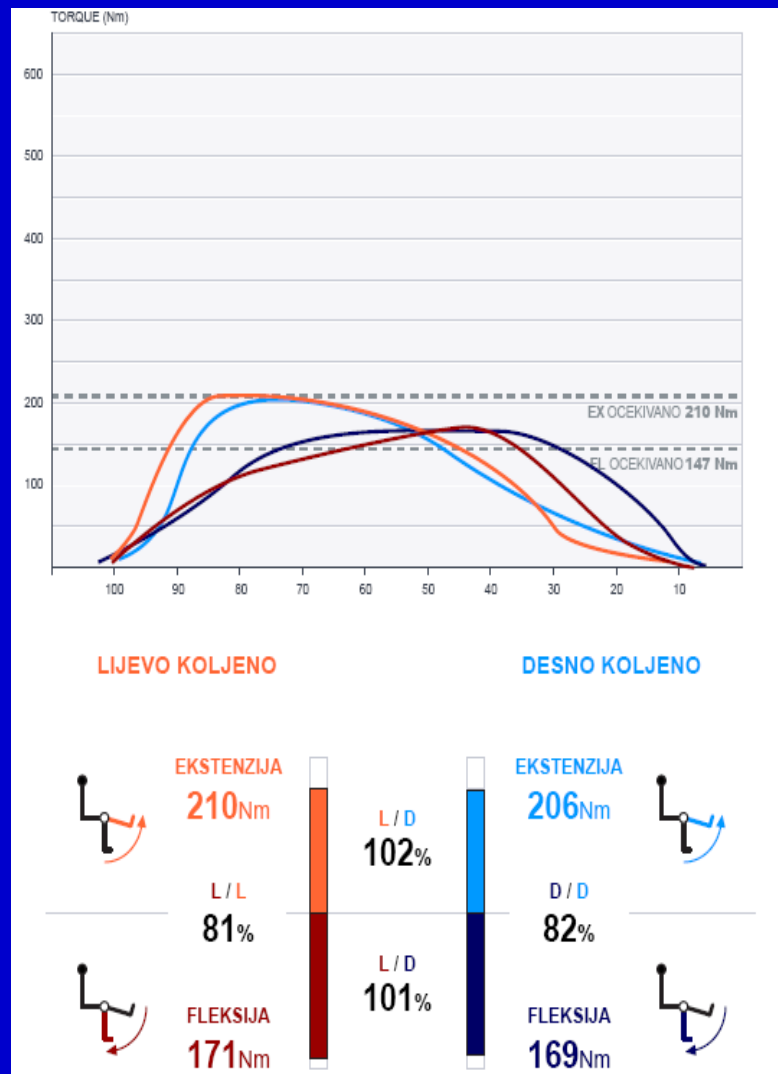
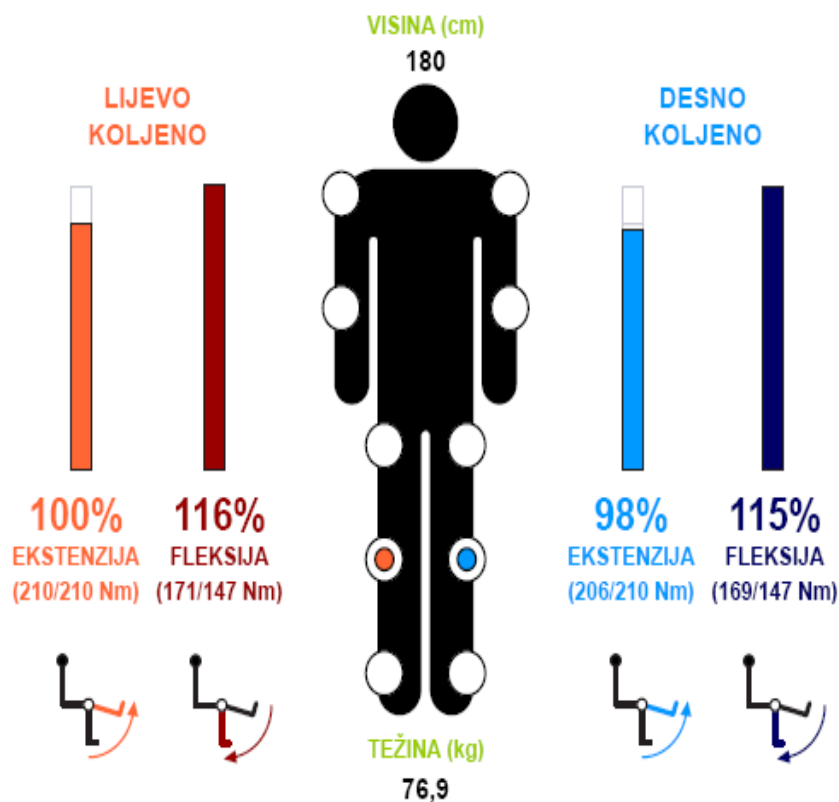
IMBALANCE OF THE ANTAGONISTIC MUSCLE GROUPS

MJESTO Zagreb
DATUM 14.11.2006.

ROĐENJA 1957.
STAROST 49 g

SPOL M
AKTIVNOST 1 2 3 4

Bavi se trcanjem, planinarenjem, triatonom i trekningom na visoko rekreativnoj razini. Do sada nije imao značajnijih medicinskih problema, kao niti težih ozljeda lokomotornog sistema.



MJESTO Zagreb
DATUM 22.11.2006.

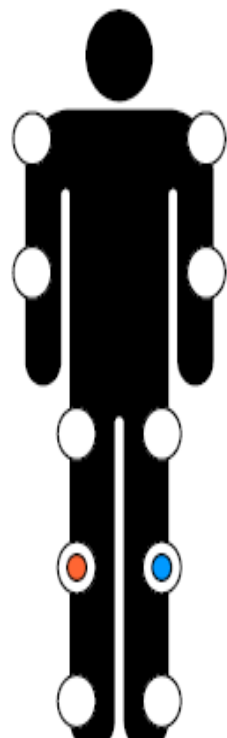
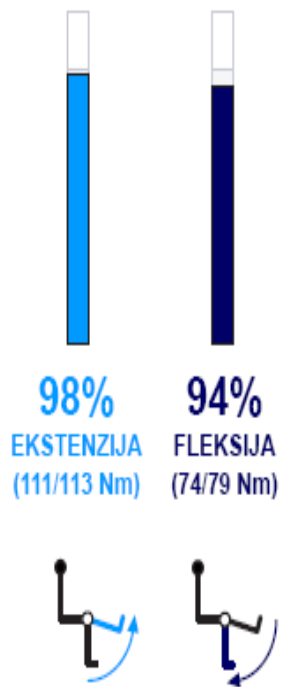
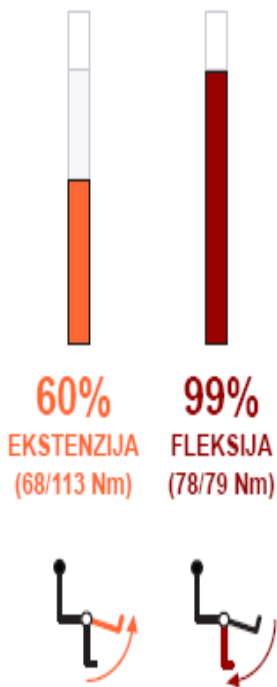
ROĐENIA 30.10.1950.
STAROST 56 g

SPOL Z
AKTIVNOST 1 2 3 4

VISINA (cm)
165

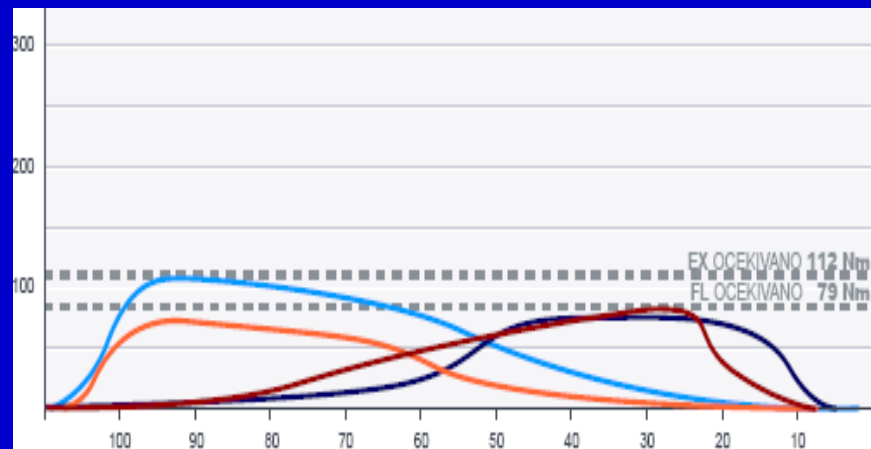
LIJEVO
KOLJENO

DESNO
KOLJENO



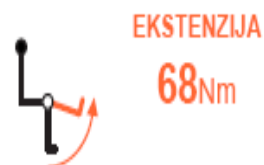
TEŽINA (kg)
56,0

WEAKER ONE LEG



LIJEVO KOLJENO

DESNO KOLJENO



L / D
61%

L / L
1,15/1

D / D
0,67/1



L / D
105%

ISOKINETIC DIAGNOSTICS AND WATER POLO PLAYERS

Isokinetic diagnostics is a very valuable method in testing water polo players since water polo is a highly asymmetric sport

- a lot of muscle strength imbalances of the antagonistic groups are found
- specific repetitive activity in water polo emphasizes adduction and internal rotation



shoulder adduction/abduction

SOME RELATED STUDIES:

McMaster et al.: *Isokinetic torque imbalances in the rotator cuff of the elite water polo players*, Am J Sports Med, 1991

- it was shown that water polo players were much stronger than the control subjects, but that they had great imbalance of the shoulder antagonistic muscle groups
- this imbalance of the rotator cuff was shown through much stronger internal rotators compared to external rotators, and stronger adductors compared to abductors

Yiannis et al. *The anthropometrical and physiological characteristics of the elite water polo players*, Eur J Appl Physiol, 2005

- Yiannis et al. also found that water polo players have much stronger internal rotators compared to external rotators than the control
- most common test used for evaluating muscle strength in water polo test is inside and outside isokinetic rotation of the arm described by Yiannis et al. The arm is in abduction at a 90° angle.

ISOKINETIC REHABILITATION

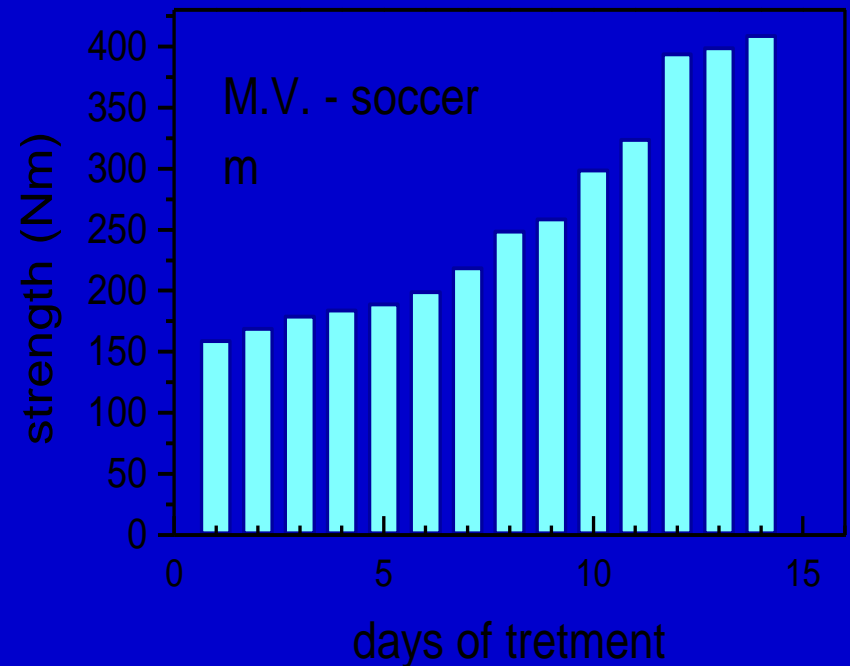
- isokinetic exercises are performed daily for about 45 minutes, depending on the joint: extension/flexion, abduction/adduction, internal/external rotation
- for each patient specific program is designed, based on the results of the isokinetic diagnostics
- isokinetic rehabilitation is being constantly monitored on computer and supervised
- there is a constant modification of protocol during exercising based on:
 - improvement from one phase to the other
 - increase in muscle strength
 - efficiency in different speeds
 - pain, tiredness
 - specific goals of the rehabilitation, etc



ISOKINETIC REHABILITATION

- isokinetic rehabilitation is finished when:

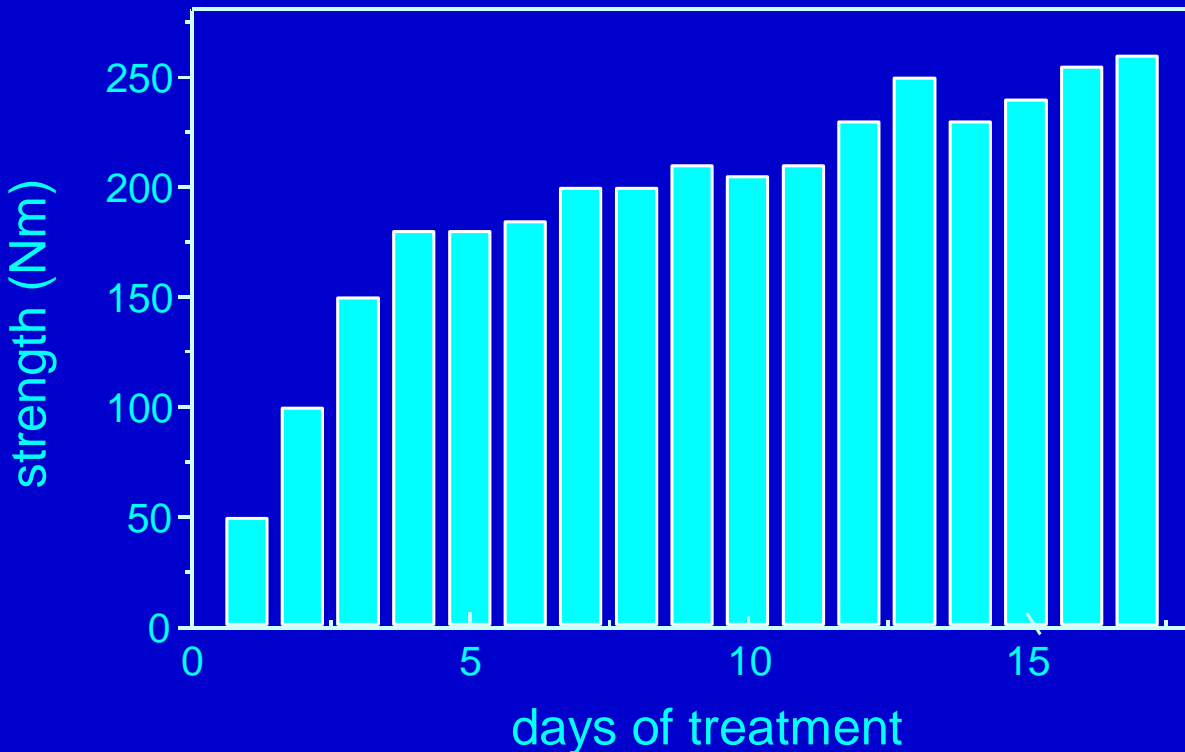
- muscle strength is increased up to 10% of muscle strength of healthy extremity
 - balance between antagonistic muscle groups is reached (f.e. quadriceps – hamstrings)
 - subjective symptoms disappear or are greatly diminished
- after the rehabilitation muscle strength should remain on this level with further exercising, such as working out in a gym, on the bike, etc



USE OF ISOKINETIC REHABILITATION

- ♦ **Knee** – injuries of the menisci, ACL and PCL ruptures, collateral ligaments, chondral defects, lig.patellae, deformations and dislocations of the patella, arthrosis of the knee, femoropatellar arthrosis, etc
- ♦ **Hip** - displasions, fractures, luxations, arthrosis, after endoprothesis, etc
- ♦ **Ankle** – different injuries of the ankle, bone fractures, nerve and muscle impairment in this area, etc
- ♦ **Shoulder** - impingement syndrome, habitual luxations, nerve, ligamentar and muscle impairment in this area, etc
- ♦ **Elbow** – fractures in the elbow area, tendinitis (tennis elbow), etc
- ♦ different injuries and illnesses of *muscles* (rupture, muscle dystrophy, muscle paresys, muscle atrophy, etc)
- ♦ condition after **bone fracture** and after **nerve impairment**
- **postoperatively**, in all the above mentioned joints
- **preoperatively** ⇒ much better and faster postoperative rehabilitation

INCREASE IN MUSCLE STRENGTH DURING ISOKINETIC REHABILITATION

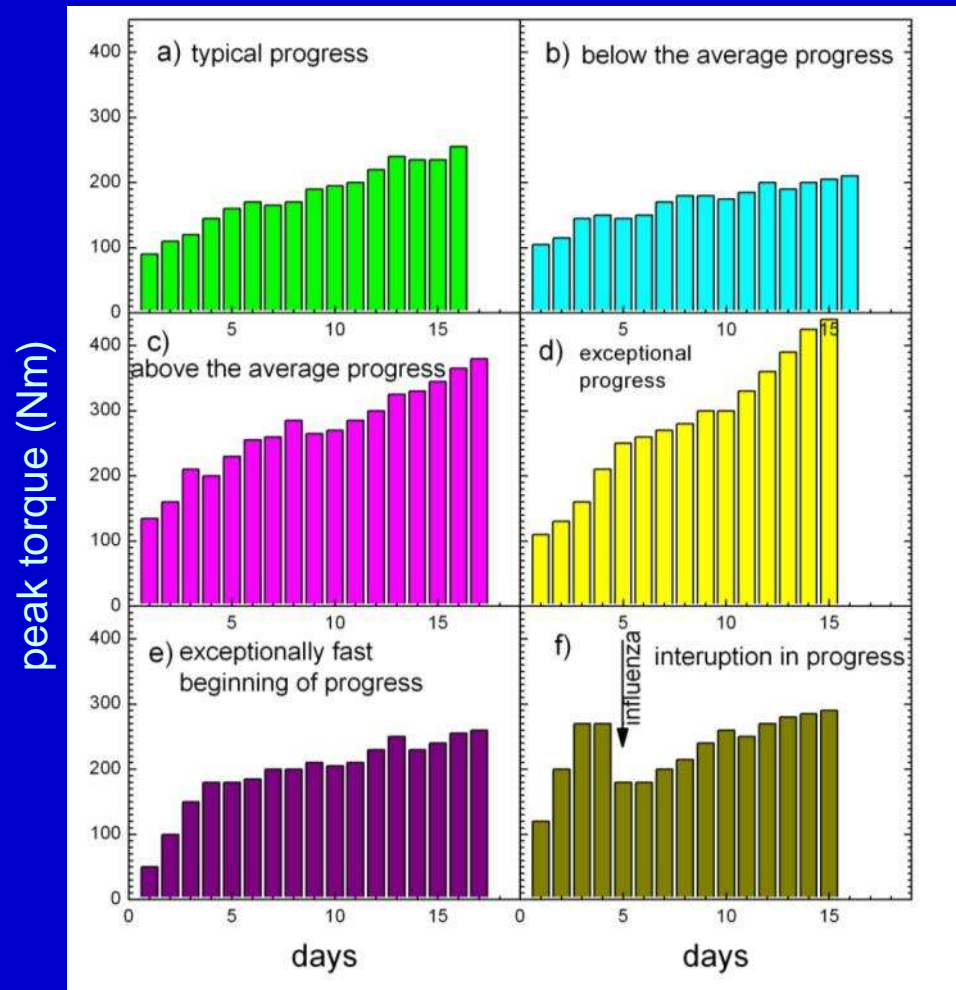


Patient: B.M.

Dg: Chondromalacia patellae
dex. Instabilitas gen.bil.

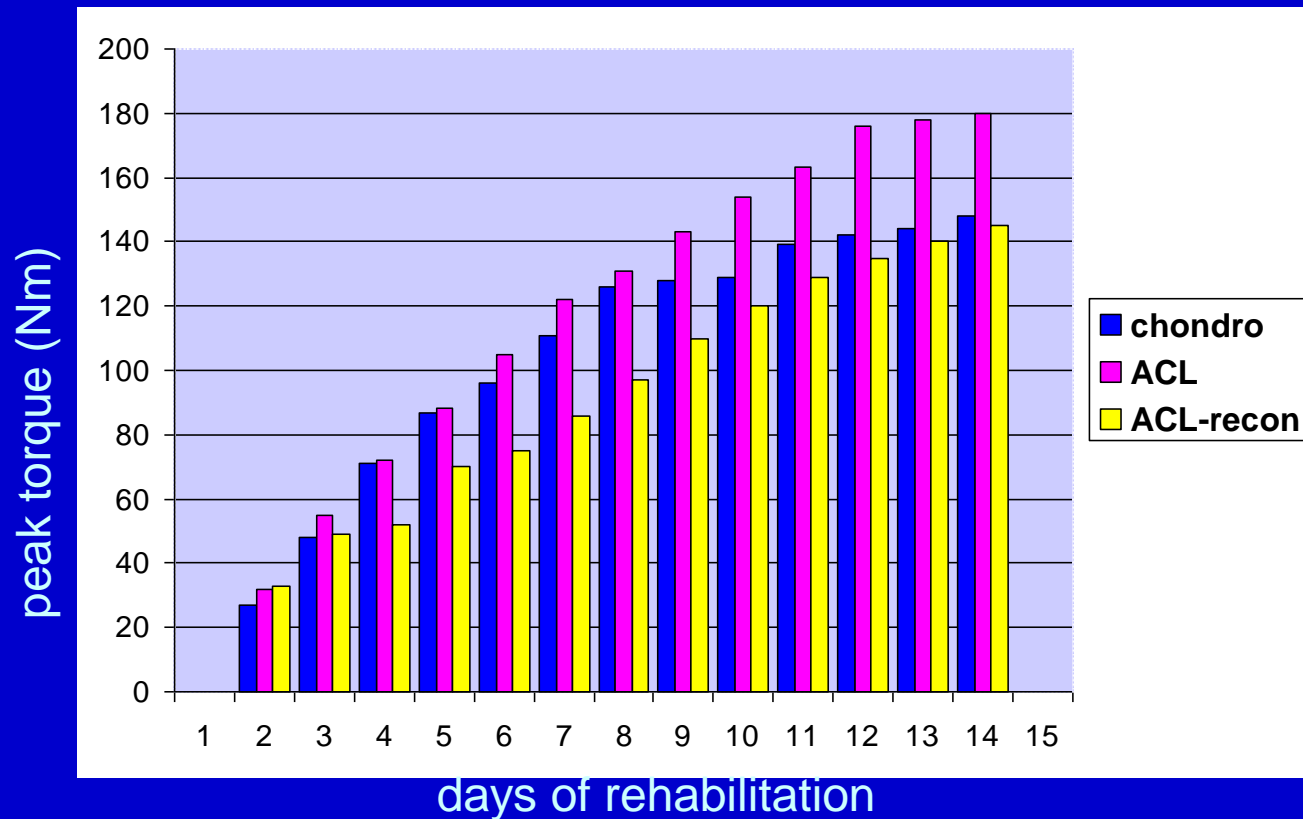
Desnica N., Sucur Z. : *Young athlete's knee instability treated with isokinetic rehabilitation*,
6th International conference in orthopedics and biomechanics, Asissi, Italy, 2002

INCREASE IN MUSCLE STRENGTH DURING ISOKINETIC REHABILITATION



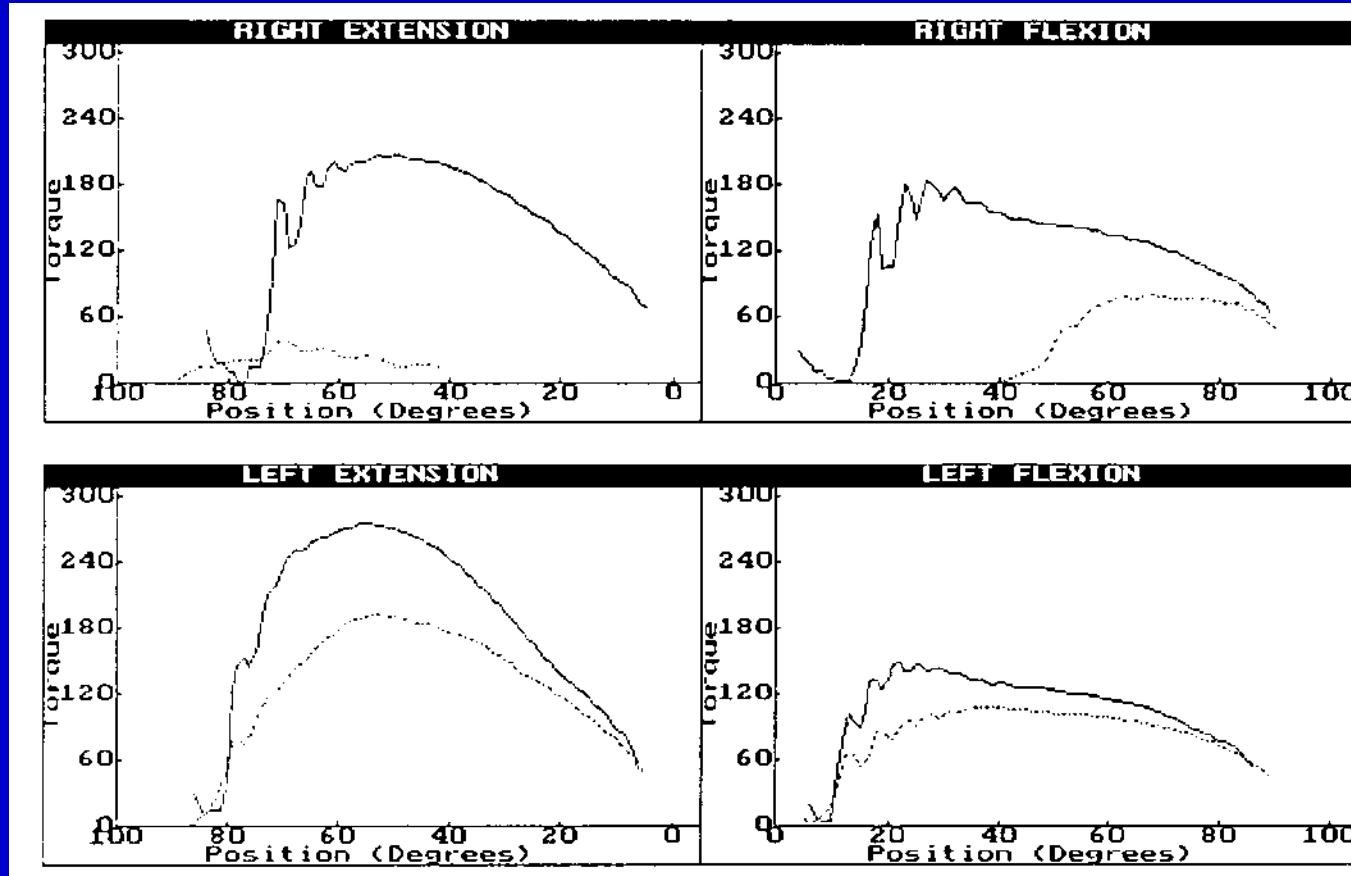
Desnica N.: *Dynamics of muscle strength improvement during isokinetic rehabilitation of the athletes with ACL rupture and Chondromalacia patellae*, Journal of Sports Medicine and Physical Fitness, 43(1):69-74, 2003.

INCREASE IN MUSCLE STRENGTH DURING ISOKINETIC REHABILITATION



Desnica N., *Isokinetic rehabilitation in treating knee injuries*, 4th Annual Congress of the European college of sports science, Rome, Italy, 1999

IMPROVEMENT AFTER ISOKINETIC REHABILITATION (comparative analysis-graphs)



dotted lines = Test 1 (initial)
full lines = Test 2 (final)

knee extension/flexion

IMPROVEMENT AFTER ISOKINETIC REHABILITATION

(comparative analysis-numerical values)

	EXTENSION			FLEXION		
	Test1	Test2	Change	Test1	Test2	Change
LOW SPEED TEST RESULTS						
Peak Torque (Newton-Meters)						
Right:	35	202	477 %	75	183	144 %
Left:	198	268	35 %	100	148	48 %
Work Per Repetition (Joules)						
Right:	18	194	978 %	46	152	230 %
Left:	188	251	34 %	113	141	25 %
Range of Motion (degrees)						
Right:	42	8	-34 °	91	88	-3 °
Left:	5	11	6 °	89	86	-3 °

HIGH SPEED TEST RESULTS

Initial Peak Torque (Newton-Meters)						
Right:	0	137	0 %	0	137	0 %
Left:	125	172	38 %	87	103	18 %
Fatigue Index						
Right:	0	31	0 #	0	20	0 #
Left:	9	31	22 #	11	11	0 #
Total Work Done (Joules)						
Right:	0	1058	0 %	0	1056	0 %
Left:	1463	1793	23 %	948	1094	15 %

ISOKINETIC REHABILITATION IN WATER POLO INJURIES

- muscle strength asymmetries found in water polo players have been connected to functional discrepancies and injuries
- these findings should be taken into consideration in training and rehabilitation since muscle imbalances could lead to injuries
- isokinetic rehabilitation has been established as a most effective method in solving imbalances of the antagonistic muscle groups
- isokinetic rehabilitation can be used for treating various water polo injuries. It is fast and pain-free and can be used on different joints, in acute and chronic injuries, preoperatively, postoperatively, etc

CONCLUSIONS

Isokinetic diagnostics

- evaluates present status of the musculoskeletal system
- if an athlete is injured \Rightarrow provides exact parameters for isokinetic rehabilitation
- if an athlete is healthy \Rightarrow prevention (knowing muscle deficits/imbbalances)

Isokinetic rehabilitation

- to treat injuries and malfunctions of the locomotor system
- muscle strengthening in athletes with some muscle strength deficits or imbalances, based on exact isokinetic diagnostics
- is constantly computer-monitored and supervised
- rehabilitation is very fast, efficient, and can be performed on damaged/painful joints

Isokinetics in water polo injuries

- water polo players are much stronger than the control subjects, but they generally have great imbalance of the shoulder antagonistic muscle groups
- this imbalance of the rotator cuff was shown through stronger internal rotators and stronger adductors
- isokinetic rehabilitation has been established as a very effective method in solving imbalances of the antagonistic muscle groups
- isokinetic rehabilitation is very valuable in treating different water polo injuries, acute and chronic. It is fast and pain-free
- isokinetic diagnostic and rehabilitation is successfully being used in prevention of injuries, especially in sports such as water polo, in which muscle imbalances are very common

Thank you for your attention!



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