

# Applying the isokinetic and the isokinetic diagnostics at the injures of Ligamentum anterior cruciate-ACL

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## Sažetak

Povrede ligamenata koljena u zadnje vrijeme raste među sportistima. U sportskoj literaturi termin sportsko koljeno je više prisutan nego ranije. Svježe povrede ligamentarnog aparata u suštini predstavljaju ozbiljnu distorziju koljena, koja ako se nepravilno tretiraju mogu izazvati ozbiljna oštećenja kinematike koljena. Prema Bousgetu teška distorzija koljena znači: izolovana ozljeda ACL; izolovani kvar zadnjeg unutrašnjeg ugla ili popliteusa, izolovani kvar zadnjeg internog ugla sa ponovno uključivanje meniskusa i najmanje dve ili više povreda kapsule ligamentarnog aparata koljena.

Svjetske trendove pokazuju značajan kvantitativni porast sportskih i rekreativnih aktivnosti kojim se bave ljudi u svoje slobodno vrijeme. Nažalost, takvi pokušaji često rezultiraju sa više štete nego koristi, jer se izvode spontano, obično bez plana i programa, bez adekvatnog nadzora i pripreme kostiju, zglobova, mišićnog i kardiorespiratornog sistema.

Stoga, u takvim aktivnostima ponekad dolazi čak i do ozbiljnih posljedica kao što su infarkt, moždani udar, ali u većini slučajeva problemi obično su povezani sa lokomotornog aparata. Tako često nailazimo na rastezanje i rupturu mišića i tetiva, povrede zglobova, rupturu ligamentarnog aparata, degenerativnih oštećenja (uglavnom hrskavice), a u najgorem slučaju čak i do stress frakture kostiju. Stoga, bilo bi lijepo prvo da se ojačaju mišići i tek onda početi sa aktivnostima. Jedna izuzetno efikasna metoda za to su izokinetičke vježbe, pri čemu mišići razvijaju aktivnu snagu bez opasnosti od preopterećenja zglobova. To je važno u prevenciji, jer dovodi u balans antagonističke grupe, odnosno optimalno priprema cijeli koštano-mišićni sistem za planiranu rekreaciju.

Izokinetičke vježbe su najkorisnije za ljude kod kojih su već nastale neke patološke promjene, prije svega oštećenja zglobova (povreda, degenerativnih, upalnih bolesti, itd). Nakon završetka izokinetičkog tretmana je izuzetno važno da se sto prije nastavi sa nekom vrstom planirane fizičke aktivnosti, kako bi se bolje održavala razvijena mišićna snaga, a i kardiorespiratorni sistem bi se razvijao više.

**Ključne riječi:** ACL, Biodex, Izokinetika, dijagnostika, koljeno, povrede

## Abstract

Injury to the ligaments of the knee lately is growing among athletes. In the sports literature the term sports knee is more present than before. Fresh injuries of the ligament apparatus essentially represent a serious distortion of the knee, which if improperly are treated can cause serious damage to the kinematics of the knee. According Bousget heavy distortion of the knee means: isolated ACL injury; isolated failures of the last internal angle or popliteus, isolated failures of the last internal angle with desinsertion of the meniscus and at least two or more violations of the capsule of the ligament apparatus of the knee.

The world trends show a significant quantitative increase in the sport and recreation activities dealing with people during their leisure time. Unfortunately, such attempts often result in more damage than good, because they are performed spontaneously, usually without a plan and

program, and especially without adequate supervision and preparations of the bones, wrists, muscular and cardiorespiratory system.

Therefore, in such activities sometimes it comes even to severe consequences such as heart attack, stroke, but in most cases the problems usually are associated with the locomotors apparatus. So often we find stretched and ruptured muscles and tendons, wrists problem in terms of ruptured ligament, degenerative damage (mostly cartilage) and in the worst cases even stress fractures of the bones. Therefore, it would be nice firstly to strengthen muscles, to enable the wrists, tendons and bones and only then to start with activity. One extremely effective method for this is isokinetic exercise, whereby the muscles are actively strength without danger of overload of the wrists. That is important in the prevention, because it brings into balance the antagonistic groups i.e. we prepare optimally entire bone-muscle system for the planned recreation.

Isokinetic exercise is the most beneficial for people that have already led to some pathological changes, primarily damage to the joints (injuries, degenerative inflammatory diseases, etc.). After completing the isokinetic treatment it is extremely important that before to proceed with some kind of planned physical activity, as the resulting muscular force would better maintained, and cardiorespiratory system would be developed more.

**Key words:** ACL, BIODEx, Isokinetic, diagnostics, knee, injures

**The aim of the study** is to determine the influence of the isokinetic on the injures of Ligamentum cruciate anterior - ACL. The survey was conducted in the clinic for sports medicine "KINETIKUS". The patient was treated with BIODEx through isokinetic exercise i.e. method of "Pyramid" (from easier to more difficult level loads). The obtained data is presented as case study. For monitoring the difference in the parameters, isokinetic tests was displayed through isokinetic machine BIODEx in which flexion and extension of the injured knee was tested.

***The main tasks are:***

To show the effectiveness of isokinetic diagnostic and isokinetic exercise at injuries of athletes ACL; To determine the difference in the rehabilitation of ACL injury with and without application of isokinetic. To show the possibility of early diagnostic

**Material and methods:**

As a case study we have taken a professional footballer of the first Macedonian football league at the age of 26 years. The player had operation of the ACL. The rehabilitation of the ACL was performed without the participation of isokinetic machine, where after 10 months of the operation the player is returned in the training process. However, after every workout occurs pain and swelling in the knee of the player. Following the recommendation, the player was put out of the regular training process. It was recommended physical therapy to soothe the pain and swelling in the knee. Once you settle down pain and swelling of his knee recommend to make isokinetic diagnostic. After a seven-day physical therapy the pain was calmed and the swelling reduced and the player was ready to perform isokinetic testing. The test results were incredible no wonder why after every workout there was a pain and swelling in the knee of the player.

# Results:

## General Evaluation

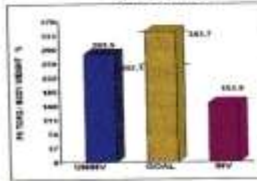
Name: Session: 11/14/2008 11:50:38 AM Windowing: None  
 ID: 100 Involved: Right Protocol: Isokinetic Bilateral  
 Birth Date: 2/24/1989 (MM/yyyy) Clinician: Referral: Extension/Flexion  
 HI: 182 Referral: Mode: Isokinetic  
 Wt: 80.0 Joint: Knee Contraction: CON/CON  
 Gender: Male Diagnosis: GET: No Gravity Correction

# OF REPS (SD/100): 5	EXTENSION 60 DEG/SEC			FLEXION 60 DEG/SEC			EXTENSION 180 DEG/SEC			FLEXION 180 DEG/SEC		
	UNINVOL	INVOLVED	DEFICIT	UNINVOL	INVOLVED	DEFICIT	UNINVOL	INVOLVED	DEFICIT	UNINVOL	INVOLVED	DEFICIT
# OF REPS (SD/100): 10												
PEAK TORQUE N-M	226.5	122.9	45.7	138.1	113.1	18.1	127.0	85.2	32.9	111.4	95.2	11.5
PEAK TORQUE %	283.5	153.9		172.8	141.8		159.0	106.7		139.4	122.9	
MAX REP TOT WORK J	249.1	135.5	45.9	177.5	140.1	21.1	180.9	129.8	29.3	169.7	131.0	22.8
COEFF. OF VAR. %	59.4	12.2		56.1	8.9		8.9	5.0		21.9	21.7	
AVG. POWER WATTS	135.1	80.9	40.8	99.2	82.5	16.8	209.1	154.4	26.2	185.2	156.3	18.9
TOTAL WORK J	840.5	598.3	28.8	673.7	648.9	3.7	1545.2	1156.3	25.2	1455.5	1173.8	19.4
ACCELERATION TIME MSEC	30.0	30.0		30.0	30.0		50.0	40.0		60.0	70.0	
DECELERATION TIME MSEC	40.0	50.0		40.0	60.0		180.0	170.0		180.0	150.0	
ROM DEG	100.1	94.3		100.1	94.3		115.5	112.1		115.5	112.1	
AVG PEAK TQ N-M	163.4	109.5		110.0	107.1		110.5	78.2		99.6	88.4	
AGONY:ANTAG RATIO %	61.0	92.0	G: 61.0				87.7	115.2	G: 72.0			

### EXTENSION



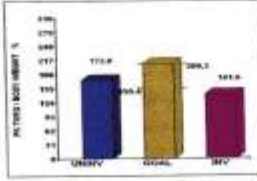
60 DEG/SEC



### FLEXION



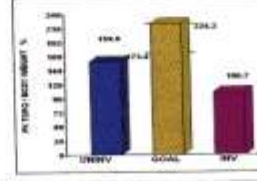
60 DEG/SEC



### EXTENSION



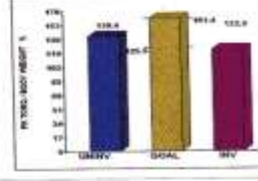
180 DEG/SEC



### FLEXION



180 DEG/SEC



## Comments:

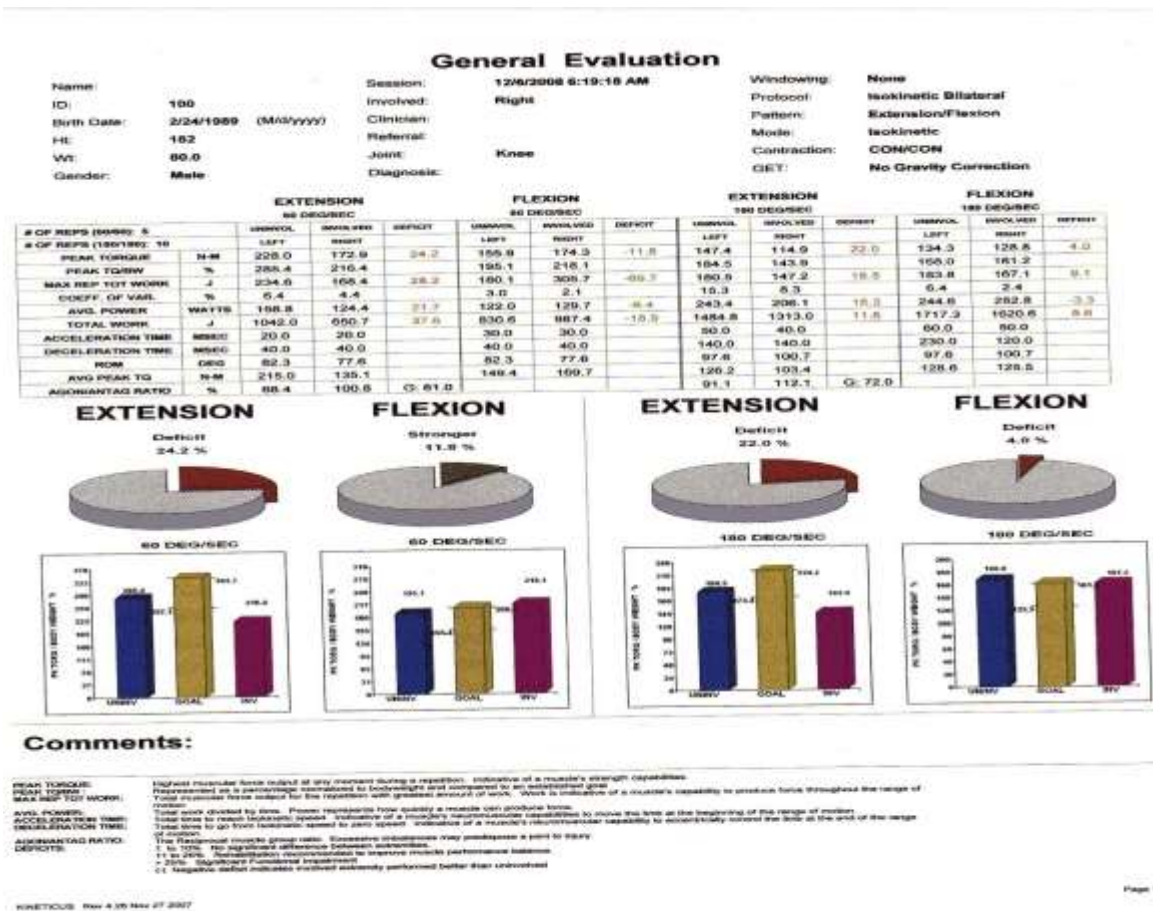
PEAK TORQUE: Highest muscular force output at any moment during a repetition. Indicative of a subject's strength capabilities.  
 PEAK TORQUE %: Represented as a percentage normalized to bodyweight and compared to an established goal.  
 MAX REP TOT WORK: Total muscular force output for five repetitions with greatest amount of work. Work is indicative of a muscle's capability to produce force throughout the range of motion.  
 COEFF. OF VAR. %: Total work divided by time. Power represents how quickly a muscle can produce force.  
 AVG. POWER: Total time to reach maximum force. Indicative of a muscle's neuromuscular capabilities to move the limb at the beginning of the range of motion.  
 ACCELERATION TIME: Total time to get from isokinetic speed to joint speed. Indicative of a muscle's neuromuscular capability to accurately control the limb at the end of its range of motion.  
 DECELERATION TIME: The neuromuscular group rate. Extensive imbalances may compromise a joint's injury.  
 ROM: 0 to 100%. No significant difference between extremities.  
 AGONY:ANTAG RATIO: 0 to 20%. Redistribution recommended to improve muscle performance balance.  
 DEFICIT: 0 to 25%. Significant functional impairment.  
 0: Negative deficit indicates involved extremity performed better than uninvolved.

## Discussion

On the graphic in the first table (extension, flexion 60 ° / sec) which gives us the results of muscle strength may be noticed that during the extension of the fetlock of the operated knee, the quadriceps of the right leg is weaker or deficit to 45.7% compared with the no involved leg. According to graphic the involved leg is 153.9 compared to the left leg 283.5 torq /body Weigh%. It's a big deficit to allow a professional athlete (soccer player) to return to the training process after operation of the ACL. Firstly we have to reduce the deficit of the operated leg, to equal the quadriceps or to be up to 10% difference which is within the limit. It may also be noted that there is a deficit of 18.1 (141.6 to 172.8) in the hamstrings during flexion. In the second table which shows us the muscle speed is also a difference during extension, there is a deficit of 32,9% (159.0 vs. 224.2), while during flexion it shows a deficit of 11,8% (from 139.4 to 122.9) . It is a big difference in which the player must be out of the training process, not with the team, on the contrary the player should take individual training process on a predetermined schedule and plan. According to the data obtained from the isokinetic testing we can conclude that the player was released earlier in training process with the team with large deficits result , pain and swelling, and if he continued with the training new injures may occurred.

Following the recommendation we put the player out of the training process. A special plan and program of work is prepared, in which is involved working with isokinetic machine biodex.

After two to three weeks we control the situation again, i.e. we prepare isokinetic testing to see if the deficit is reduced and we compared it to the previous testing.



## Conclusion:

According to the results of isokinetic testing we may notice that there is a great improvement, that the work of isokinetic machine Biodex has a major contribution and role in reducing the deficit. In the first table where the muscle strength is tested during extension the deficit is decreased and now stands at 24.2% and during flexion the deficit no longer exists, now, it is even 11% better than the not involved leg. In the second part, where are the test results for muscle speed, during extension there is reduction 22.0% and during flexion there is reduction to 4.0%. According to the result obtained, there is a recommendation, the player still not to be included in the training process, to continue with the isokinetic rehabilitation for 15 to 20 days in order to reduce or equalize the deficit of the not involved leg. But unfortunately under pressure from the team coach the player enters the training process, does not accept the proposal for further rehabilitation of the knee using the biodex machine and enters the training process with the rest of the team. According to the information we have, the player still has pain and swelling occurs in the Knee, therefore he can't be a part of a normal training process.

## Reference

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