



# Isokinetic evaluation of hamstring to quadriceps ratio of contralateral leg in case of unilateral anterior cruciate ligament rupture

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Original article

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## Statistic

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## Summary

The purpose of this study was to evaluate the hamstring to quadriceps peak torque ratio of a healthy leg in case of unilateral anterior cruciate ligament injury. There were 20 patients (8 females, 12 males). The average age of patients was 31.5 years. Isokinetic evaluation of the hamstring and quadriceps peak torques was performed with the system 3 Biodex isokinetic dynamometer (180 degrees/s). The average H/QR was 50% thus 20% below its lower normative limit. There were no statistically significant differences between both females and males H/QR and age. Since the pathological hamstring to quadriceps peak torque ratio increases a risk of an anterior cruciate ligament injury its evaluation should be a standard procedure in high risk sports.

**Key words:** hamstring to quadriceps ratio, isokinetics, acl

An isokinetic contraction of a muscle occurs at a constant rate of speed thanks to accommodating variable resistance during range of motion [3]. As the force input changes, the resistance changes to match the input, but the speed remains constant [3]. This idea has found wide application in both measurement and monitoring of progress of muscle strength during training of an anterior cruciate ligament deficient knee [2,3,4,5,6,9,11,12,13]. A substantial number of ACL injuries occur in noncontact situation [7]. A number of parameters and factors have been recognized as a potential causes of noncontact ACL injury, and among them the hamstring to quadriceps strength ratio (H/Q) [1,3,13]. Moreover the H/Q equal 70% or greater is one of the criteria for return to sports after ACL reconstruction [14]. The aim of this study was an isokinetic evaluation of hamstring to quadriceps ratio of contralateral leg in case of unilateral anterior cruciate ligament rupture.

**MATERIAL AND METHODS**

Clinical material consists of 20 patients (8 females and 12 males) mean age 31,5 years (range 16 to 47 years). All the patients were operated on because of unilateral isolated anterior cruciate ligament rupture. Twelve weeks after surgery the isokinetic evaluation of the hamstring peak torque to quadriceps peak torque ratio was done with the system 3 Biodex isokinetic dynameter (180 degrees/s) [3]. Table 1 presents the data of the patients and results of hamstring to quadriceps ratio measurements of healthy contralateral leg. The U Mann-Whitney test was used for comparison between the female and male age and H/Q ratio (p<0,05).

**RESULTS**

There were no statistically significant differences between male and female groups as for as the age and H/Q ratio are concern p<0,05). The global, males and females H/Q ratio was 20% below lower limit of its normative value (table 2) [3]. The H/Q ratio was below the lower limit of its normative value for every patients (table ).

**DISCUSSION**

The United State Health Service spent almost billion dollars per year due to new 80000 anterior cruciate ligament injuries [7]. The pathologic H/Q is recognized as a factor which increase the risk of ACL injury [1,13,14]. An isokinetic evaluation offers an objective muscle peak torque evaluation and calculation of H/Q [3]. The pre-

sent study has shown that all patients suffering from unilateral ACL injury had pathological H/Q on the opposite healthy leg. On the basis of these data one may assume that the H/Q ratio of operated on leg was similar before surgery. Thus this was one of factors predisposing to ACL injury. Moreover it seemed that an isokinetic evaluation of H/Q should be a standard procedure in high risk sports in order to prevent ACL thanks to introduction of specific training focusing on its correction.

**CONCLUSIONS**

1. The hamstring to quadriceps peak torque ratio of the opposite healthy leg in case of unilateral anterior cruciate ligament injury was average 20% below its lower normative value in all patients.
2. Since the pathological hamstring to quadriceps peak torque ratio increases a risk of an anterior cruciate ligament injury its evaluation should be a standard procedure in sports.

**Table 1.** Basic data (sex, hamstring to quadriceps ratio, follow up, age and leg)

Sex	H/QR (%)	Folow – up (weeks)	Age (years)	Leg
♂	47	15	24	Righth
♂	35	12	23	Left
♂	42,3	14	45	Left
♂	55,1	16	23	Left
♂	54,2	12	34	Left
♂	49,7	12	47	Left
♂	44,4	12	29	Left
♂	49,3	12	25	Righth
♂	54,2	12	23	Left
♂	53,6	12	31	Righth
♂	49,7	12	29	Left
♂	51,2	12	42	Left
♀	58,8	11	38	Left
♀	36,9	12	47	Righth
♀	57,3	12	33	Left
♀	54,2	12	33	Left
♀	45,9	12	21	Left
♀	52,4	16	16	Left
♀	56,2	12	23	Left
♀	51,2	12	45	Left
Average value	49,8	12,6	31,5	
Standard deviation	6,4	1,4	9,6	

**Table 2.** The average hamstring to quadriceps ratio and age of females and males groups

	H/Q ♂	H/Q ♀	Global H/Q	H/Q normal value (180 degrees/s) (3)	H/Q ♂	H/Q ♀
Average value	48,7%	51,6%	49,8%	70% to 79%	31,3 years	32 years
Standard deviation	5,9	7,2	6,4		8,9	11,3

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