PROPRIOCEPTION AND KINESTHESIS IN SUBJECTS WITH AN ANTERIOR CRUCIATE LIGAMENT UNILATERAL LESION

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The purpose of this study was to evaluate proprioception and kinesthesis in subjects with an ACL unilateral lesion with standard Biodex isokinetic dynamometer procedures. Ten ACL deficient subjects, who had been conservatively treated, were evaluated, everyone submitted to conservative treatment. The test consisted of three stages for each limb: active and passive positioning and kinesthesis with three repetitions of each stage starting with the uninjured limb. The results showed no significant difference among the values of active positioning, passive positioning and kinesthesis between the injured and uninjured limbs ($p \leq 0.05$). Thus, new works that approach this subject are necessary for a better understanding of the alterations occurred in subject with ACL lesion.

KEY WORDS: proprioception, kinesthesis, knee, anterior cruciate ligament.

INTRODUCTION: Proprioception refers to a specialised variation of the sensorial modality of touch that comprises the joint movement sensation and the joint position sense (Lephart, 1997). According to Laskowski (1997), proprioception embraces two aspects of position sense: 1. Static, that is, the conscious orientation of a body part relative to another body part, and 2. Dynamic, that is, feedback to the neuromuscular system about speed and motion direction allowing the body to maintain stability during any activity. For a long time, ligaments of the human body were considered merely static and passive structures that functioned to maintain joint stability. However, with the recent identification of specific sensory receptors within ligaments, such as the Ruffini end organs and the Pacinian corpuscles (Schultz et al., 1984; Zimmy and Wink, 1991), a sensory role for ligaments has been raised. Through its mechanoreceptors the Anterior Cruciate Ligament (ACL) plays an important role in knee proprioception. Therefore, rupture of the ACL could alter proprioceptive function if the mechanoreceptors were damaged (Johansson et al., 1991). That is, lesions to the ligament could cause direct and indirect alterations to the input information originating from these mechanoreceptors, tending to cause a decrease or loss of the afferent input and, thereby, a proprioceptive deficit. It is measured by sensory receptors distributed throughout joint capsules, tendons, muscles and ligaments (Machado, 1993). The purpose of this study was to evaluate proprioception and kinesthesis in subjects with an Anterior Cruciate Ligament (ACL) unilateral lesion with the Advantage version 4.5 software available at Biodex Multi Joint System 2 isokinetic dynamometer.

METHOD: Ten male ACL deficient subjects (mean age = 25.3 ± 3.0 years) who had received only conservative treatment for their injury were evaluated. The subjects, including both acute and chronic patients, had a unilateral ACL lesion, diagnosed clinically or arthroscopically (see Table 1). Before participating in this study, the subjects signed an informed consent form in accordance with guidelines established by the University's Human Subjects Research Committee. Proprioceptive and kinesthetic ability of the subjects was evaluated and standardised using a Biodex Multi Joint System 2 isokinetic dynamometer and the Advantage version 4.5 software. The test protocol consisted of three stages, all in this sequence, for each limb: 1. Active positioning. 2. Passive positioning. 3. Kinesthesis, beginning with the uninjured limb and repeating each stage three times. The target angle that subjects were attempting to replicate was 45° of knee flexion. The subjects were blind to avoid visual feedback. Proprioceptive ability was then calculated as the difference at module (in degrees) between the target angle and the angle that the subject replicated with their test

limb, referent to a initial calibration. The active and passive positioning tests were conducted at 30 °/sec., whereas the kinesthetic assessment was conducted at 2 °/sec. The test was limited at 100 to 0° of flexion and extension, respectively. For the analysis of the data was used the Student's t-Test with a significance level of $p \leq 0.05$ and Pearson's Correlation.

Table 1 General Description of the Sample through Clinical Examination

Subject	Dominance of Injured Limb	Lesion Time	Arthroscopic	Tests of Lachman	Anterior Drawer Test
1	ND	A	Yes	1+	1+
2	ND	C	Yes	3+	3+
3	D	C	Yes	2+	2+
4	ND	C	No	2+	2+
5	D	A	No	2+	2+
6	D	A	No	1+	1+
7	ND	A	Yes	2+	2+
8	D	A	Yes	2+	2+
9	D	A	No	1+	1+
10	D	C	No	3+	3+

Legend: ND - nondominant; D - dominant; A - acute; C – chronic; 1+ = until 0.5 cm; 2+ = 0,5-1.0 cm and 3+ = beyond 1.0 cm of anterior displacement of the tibia.

RESULTS: No significant differences were found between the injured and uninjured limbs of the subjects for any parameters (see Table 2).

Table 2 Correlation and t-Test, Given on the Average and Standard Deviation Found in the Passive, Active and Kinesthesis of the Injured and Uninjured Limbs **(n=10).**

	Iniured Limb	Uniniured Limb	Pearson Correlation	P value*
Active	9.77± 6.74	10.17± 8.27	0.74	0.83
Passive	7.00± 3.60	6.97± 3.97	0.28	0.98
Kinesthesis	0.67± 0.27	0.47± 0.36	0.13	0.17

*$p \leq 0.05$.

DISCUSSION: Some studies that examine the role of knee proprioception have been accomplished, but have concentrated on the consequences of the lesions that occur in the ligaments. In the study of Barrack et al (1989), the proprioception was evaluated in 11 subjects with complete ACL lesion. The test was carried out using the isokinetic dynamometer CIBEX between the injured and uninjured limbs, in the test group and the normal limbs in the control group. An inflated cuff was placed in the limbs and the volunteers were blinded to avoid external incentives. Ten repetitions were accomplished in a random sequence, at a speed of 0.5 °/sec. In the control group, it has not been found statistically significant difference between limbs, while in the test group there was significant alteration. The work of Corrigan et al (1992), agreed with the results found by Barrack et al (1989), where 20 subjects with ACL rupture were evaluated for an experimental equipment. The target angle was of 35°, at a constant speed of 10 °/sec, accomplishing five repetitions in each limb. A decrease of the position sense, of the threshold of movement detection was found besides a correlation between the deficit in proprioception of the injured muscle and the decrease of force of the hamstrings and quadriceps muscles. These answers were only found in the test group, while the, control group didn't show alteration. Other authors who have researched this issue, like Beard et al (1993), looked for correlations between ACL and latency of reflex contraction of the hamstrings. Thirty subjects with chronic ACL lesions were evaluated. It was found that the latency of reflex contraction of the hamstrings was

significantly larger in knees with ACL lesion than in the contralateral knee. This is directly related to the functional instability of the knee. It is also possible to verify the effectiveness of the latency of reflex contraction of the hamstrings as an objective form of verifying the proprioception. Unlike the studies mentioned above, the present study could not find as a result statistically significant numbers that reaffirmed the decrease in proprioception in the cases of ACL lesion. Some factors could have contributed to such a result: 1. The method to evaluate the proprioception may not have been the most appropriate or the procedure not sensitive enough to detect the alterations. 2. The individuality concerning anatomical structures, degree of laxity or muscular tonus. 3. The capacity of some subjects to compensate for the proprioceptive deficit with input from the muscular and tendineos receptors; 4. The fact that the subjects of the present study were treated conservatively; 5. Control was just done with the contralateral limb rather than having control groups.

CONCLUSION: In this study, no statistically significant alteration in proprioception was found in subjects with unilateral ACL lesion. The alteration of proprioception by lesions in the knee, in spite of receiving recent attention from some researchers, leads to many questions not yet answered and vital for a better understanding of the structures involved with proprioception of the knee. Thus, new works that approach this subject are necessary for a better understanding of the alterations occurring in subjects with ACL lesions.

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