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# Influence of Anterior Cruciate Ligament Surgery with Semitendinous and Gracilis Graft on Static Postural Balance at 3 Months Postoperatively: Randomized Controlled Study

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## ABSTRACT

**Background:** The Anterior Cruciate Ligament (ACL) tear is the most common sports injury. Surgery is often proposed, but single-leg and double-leg static postural disorders have been discovered several months after surgery. Our aims are to compare postural disorders after ligament reconstruction by hamstring tendon graft in the three months after surgery to those caused by aging.

Methods: 2 groups of subjects underwent bilateral and unilateral postural tests. An analysis of the center of pressure's displacement is carried out for each test.

**Results:** Comparison of the two groups shows no significant difference for the injured leg on the unilateral and bilateral tests only (p-value>0.05).

*Conclusion:* Postural alteration after an ACL reconstruction on the injured leg and bilateral posture can be compared to postural disorders caused by age.

Key words: Anterior cruciate ligament; Stabilometry; Force plateform; Postural balance

### Introduction

The rupture of the ACL is often traumatic and will cause a disturbance in the stability of the knee, highly requested articulation during the activities of the daily life and during the sport practice. In 2012, 41,000 surgeries were performed in France, mainly affecting young sporting adults and more particularly women, therefore making the rupture of the ACL, the most frequent sports pathology [1,2]. In 2011, a poll found that 26.7% to 43.2% of injuries takeplace in football and 13.2% to 17.4% during winter sports [3].

Following a rupture, it is recommended to perform a surgical treatment with the objective of restoring the bundles in order to restore the function of the knee by minimizing the symptoms and the risk of complications [4]. The most performed surgery in the world is that of the Gracilis and Semi tendinous graft also called STG [5,6]. 87% of ACL surgery are uncomplicated but it is possible to find joint, muscle, neuromuscular or proprioceptive [7]. These changes will have an impact in the regulation of bipedal posture and unipodal statically and/or dynamically [8,9]. The sports recovery is generally done around six months postoperatively through subjective criteria (answers to questionnaires, absence of feeling of instability) and unspecific [10]. Today, 75.3% of people who have had surgery return to sport at the same level as before the injury instability. Nowadays, life expectancy continues to increase. The scientific literature agrees that physiological aging and a certain percentage did not recover after one year due to lack of confidence, fear of recidivism, or by a feeling of is associated with impaired postural control, caused by impairment of the various balance-regulating systems, with an increase in potentially deleterious falls in 50% to 60% cases in this population with a state of "fragility". These consequences are one of the main causes of the reduction of activities of

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daily living and the quality of life of the elderly. Stabilometric assessment is the study of pressure center displacement (COP) on a force platform by means of static and/or dynamic measurements. This evaluation and its follow-up seem necessary and represent a certain social and economic stake to allow to refine the reeducation with the objective of resuming a sport activity identical to the previous stage in the subjects having benefited from an ACL surgery but also among the aging people in preventing the risk of falls. However, the use of such material is not common practice and would require a large database of healthy patients to best analyze patient outcomes. The literature has shown the existence of postural disorders after ACL surgery with STG and physiological aging. This study aims to compare this disorder, of different origin, presentin these two types of population, and determine if they are assimilated through the use of a platform of force.

#### **Material and Methods**

The study was conducted between July 2018 and November 2018. It was submitted to the ethics committee of the center which validated it under reference PCE-06.18-038. The participants are informed of the progress of the measures through an explanatory document acting as informed consent after signature. The data obtained during the study are anonymous. No feedback on the data and protocol was made to the subjects. Two groups of subjects participated in the study; a first of eleven asymptomatic subjects presenting no involvement in the lower limb and a second of seven subjects who had undergone ACL surgery with STG after isolated rupture of the ACL at three months postoperatively. To integrate the study, the subjects of the test group had to meet the following inclusion criteria: having benefited from ACL surgery with STG after isolated rupture, be at least 15 years old, understand French, be at three months post-operative at the time of the assessment and maintain unipodal support eyes open and closed for at least ten seconds [8,10]. Men and women are included in this study. Older subjects should have a BMI less than 35 kg/m<sup>2</sup> and be able to perform unipodal support for at least 10 seconds. In order to have objective, analyzable and comparable results, the following exclusion criteriaare added for the selection of the two populations: presenting central or

An AMTI Accu Gait® force platform (Advanced Mechanical Technology Inc., Watertown, MA, USA) associated with the software Balance Clinic® (version 1.4.2) was used in this study.

#### **Statistical Analysis**

Statistical analyzes were performed on R® software (R Development Core Team 2011, Bell Laboratories, Murray Hill, NJ, USA) after exporting the data to Excel®. The confidence level is predefined such that C=95% and the level of significance is  $\alpha$ =0.05. Since the number of participants in the study is less than 15 in the test and control group, it is accepted that the values obtained do not follow a normal distribution. Mann-Whitney tests were performed to allow comparison of the results obtained.

#### Results

The age and test groups did not show a statistically significant difference for the height, weight, body mass index and sex variables (p-value>0.05). For the age variable, both groups have a statistically significant difference (p-value<0.05). An absence of a statistically significant difference (p-value>0.05) is found between the two populations for all the variables studied when during the bipodal tests. A statistically significant absence of difference (p-value>0.05) is found when comparing the two lower limbs in the control population. Randomly, it was decided to compare unipodal support on the injured side to the unipodal right support of the elderly group and to compare the unipodal support on the healthy side of the ACL group to the left unipodal support of the elderly group.

#### Discussion

Static postural balance and its study tend to develop today with the appearance and improvement of new tools such as force platforms. The purpose of the study was to compare the postural alteration present after ACL surgery with STG at 3 months postoperatively to that caused by physiological aging. The objective of this study is therefore not to evaluate the quality of the ACL surgery with STG on the postural parameter but to allow the reeducators to acquire information on the possible postural imbalances present after surgery and to be able to compare them with another population also presenting balance disorders.

This study used a customized support base compared to selected studies that use a standardized support base. In their study, Mouzat demonstrated that the increase in the spacing of the opening angle of the feet is correlated with an improvement of the static equilibrium. The use of a personalized support base is therefore sensible to allow subjects to place themselves in a position where they feel stable rather than constrain them in a potentially unbalanced position. The results obtained will focus more precisely on the personal and functional characteristics of each Individual.

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#### Conclusion

The analysis of bipodal and unipodal test results highlights major results. The postural alteration found in unipodal support on the injured side for the ACL group is similar to that of an elderly population whereas for unipodal support on the healthy side the postural alteration appears lower. A lack of significant differences is found in the analysis of bipodal tests between the two populations that may indicate an absence or insufficient compensation by the ACL group during these tests.

The integration of a postural assessment associated with a muscular evaluation, of the walk and the laxity of the transplant at different stages of the reeducation would make it possible to adapt it for a fast sports recovery and to avoid the appearance of complications but also to evaluate its effectiveness in post-surgery management.

The ACL lesion is mainly found in athletes and, in view of the growing interest in stabilometry, it would be wise to evaluate postural disorders in dynamics.

#### **Competing Interests and Ethics**

The authors declare that they have no competing interests. The application of the research protocol has been approved by an ethics committee.

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