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GAIT AND BALANCE ANALYSIS IN PEOPLE WITH MENISCAL TEAR

Ionel Şerban
Transylvania University, Brasov, Romania, serban_ionel1984@yahoo.com

Abstract: *The purpose of this paper is to determine the influence of meniscal tear, after surgery, on gait locomotion and balance in different situation. The experiment took into consideration 4 types of activities: normal locomotion, locomotion with a weight (bottle with water 5L) in the right hand, standing still (for 30 seconds) with a weight (bottle with water 5L) in the right hand and standing still (for 90 seconds) with a weight (bottle with water 5L) in the right hand. For each activity were performed three measurements. The weight was placed in the right hand considering that the meniscal tear took place in the right leg offering an extra stress on the right leg. There was one subject, aged 25, that approved to take part in this research, which had suffered from meniscal tear surgery and had been fully recovered, according to his consideration and medical records.*
Keywords: *gait analysis, balance, meniscal tear, Kistler*

1. INTRODUCTION

This research along with many others are needed in order to evaluate and determine the effects of recovery from meniscal tear surgery and many other interventions that affect the integrity of the human body. From all the interventions that take effect on the leg the one that correct the meniscus injuries are very often met. The particularity of the knee recovery in physical therapy lies in close interdependence between joint function and functional anatomy value (age of subject). Timely intervention by a specialist in physical therapy plays an important role in the subsequent operation of the knee.
The knee is considered very important because it is an important part between the segment of the leg with great influence in the distribution of internal and external forces. [1, 2]
The gait and balance analysis plays an important role in the recovery of the subject because it realizes the benefits of the surgery not only feels them. [3]
This paper was meant to highlight differences in force between the left and right leg (the one with meniscal tear). We used Kistler platform to measure gait and balance forces [4], then additional weight (bottle with water 5L) was added to subjects. We performed three measurements for each case to remove small perturbations that might take place due to the subjectivism of the subject or any other factor. Their mean score was performed and the obtained data was analyzed through graphics in Microsoft Excel 2013.

2. EXPERIMENTAL METHOD

It was used a Kistler platform to analyze gait and balance of the subject in the above mentioned cases. Subject, aged 25, gave its consent to participate to the experiment knowing that there will be nothing that might affect its integrity or health as it will be asked to perform normal activities. The subject had a previous meniscal tear in the right knee. Three dynamic and static measurements were conducted to see the difference of force between the legs. The data obtained will be compared graphically to see the difference.

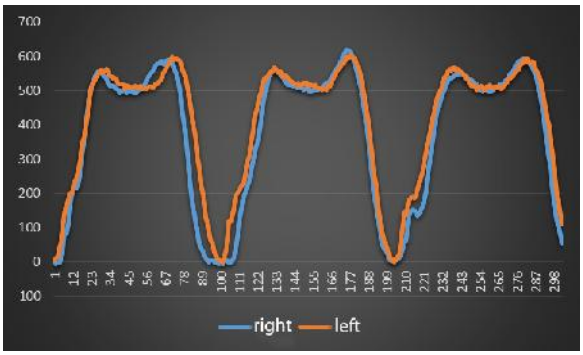
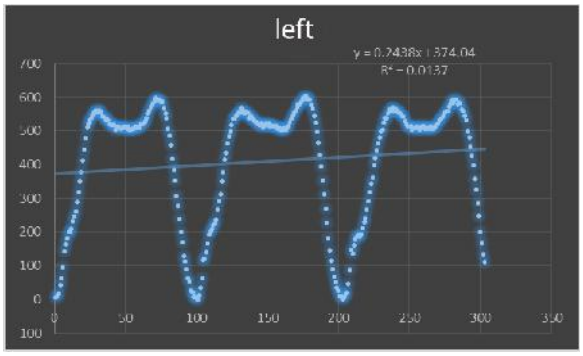
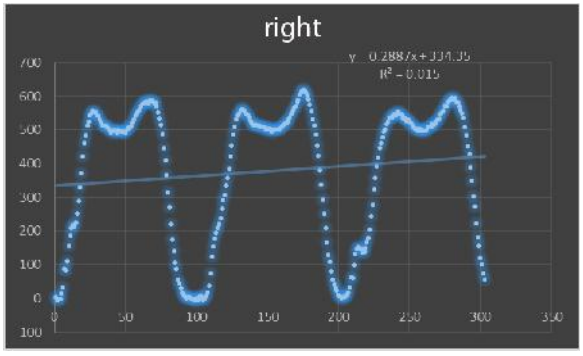


Figure 1: Vertical forces differences between left and right leg, in locomotion.



a)



b)

Figure 2: Vertical forces for a) left leg; b) right leg.

Differences, in vertical force, between left and right leg (figure 1, figure 2 a) and b)) are very low (1-2%). This first measurement doesn't show any important difference between the two knees.

The second type of measurement is also a dynamic measurement that compares the strength of right leg before and after adding an extra weight in the subject's right hand (figure 3) in order to observe any impact on the right leg.

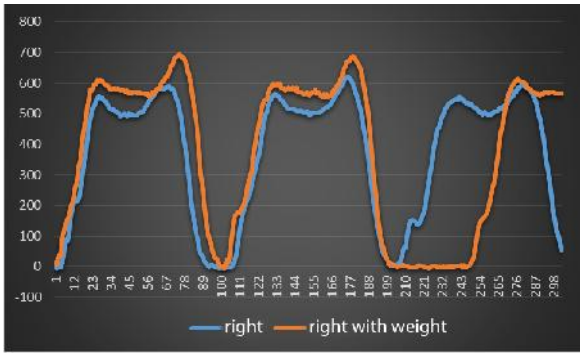


Figure 3: Vertical forces differences in right leg between no weight and weight, in locomotion.

After the data was collected and analyzed it was found that the weight has an influence besides adding another approximately 50N to the right hand.
The following measurements are static (figure 5). The first static measurement lasts for 30 seconds without adding extra weight to the subject (figure 4).

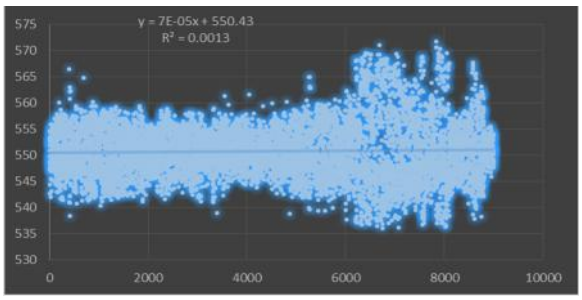


Figure 4: Vertical forces for static analysis of 30 seconds.

The next measurement is static lasting for 30 seconds but additional weight is added to the subject right hand (figure 6). The weight has very little effect (1-1.5 %).

Figure 5: Positioning Kistler platform- subject for static weight measurement.

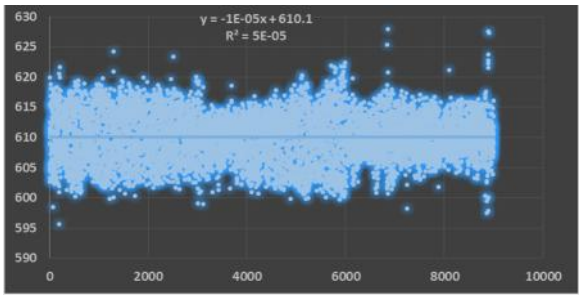


Figure 6: Vertical forces for static analysis of 30 seconds, with weight.

The last measurement (figure 7) is static lasting for 90 seconds with additional weight, to see how the right leg behaves on a longer period.

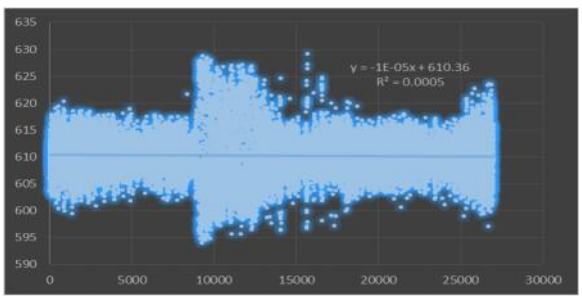


Figure 7: Vertical forces for static analysis of 90 seconds, with weight.

In the graph below (figure 8) it can be observed the differences in average vertical forces for all the above measurement in this order: column 1 represents the average forces exerted by left lower limb measured dynamic, column 2 represents the average forces exerted by right lower limb measured dynamic, column 3 represents the average forces exerted by right lower limb measured dynamic with additional weight, column 4 represents the average forces measured static for 30 seconds, column 5 represents the average forces measured static for 30 seconds with additional weight, column 6 represents the average forces measured static for 90 seconds with additional weight.

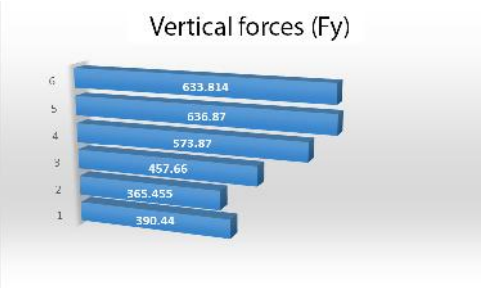


Figure 8: Comparison vertical forces (Fy)

3. CONCLUSION

The experiment was conducted using one subject suffering from meniscal tear in the right leg aged 25. This experiment aimed at highlighting the differences between the left and right leg (the one with meniscal tear). Kistler platform was used to measure static and dynamic forces. Analyzing the dynamic values of the vertical forces it was found a range: from 406 to 374 Nm for the left leg, from 413 to 334 Nm for the right leg and from 464.29 to 448.8 Nm for right leg with weight added; and for the static measurements we have the following ranges: for 30 seconds measurement 587.65- 550.43; for 30 seconds measurement with weight 647.66- 610.11, and for 90 seconds measurement with weight 647.74-587.66.

The main result, as it can be observed (figure 8), is the difference of 1% between the left and the right leg without any additional weight.

The added weight, in dynamic measurement, has an impact on the right leg besides adding another 50 N. This can be seen in the difference (approx. 92N) between column 2 and 3 (figure 8).The extra force might be due to the forces of the muscles exerted in order to protect the affected knee.

In the static measurement there isn't any influence on the average forces. This might be due to the fact the forces are supported by both left and right leg.

Comparing this data and analyzing graphs it was noticed very little difference between the two legs (the healthy and the one with meniscal tear). This is due to the age of the subject which determined a good recovery after surgery with little effect to the gait and balance of the subject in various activities.

4. ACKNOWLEDGMENT

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