

Muscle Tonus Report

The following report is an analysis of the muscle load test performed at Plux on 26/09/2016 by Sandro Freitas, Hugo Gamboa and Daniel Osório

The EMG electrodes were placed using the posterior superior iliac spine as an anatomical marker. Figure 1 shows the placement over the *multifidus* and the *erector spinae* muscles on both sides of the spine.



Figure 1 - Position of the EMG leads

Procedure

Six different tests were recorded:

- Rest: Data recorded with the test subject laying down on a table, with their back facing up;
- Arms extension: Same position as the rest test, but with the test subject arms extended forwards, parallel with their head;
- MVC: In order to record the maximum voluntary contraction, the test subject was positioned with only their legs on the table and a force was exerted on their shoulder;
- Two feet stance: Data recorded with the subject standing up and their eyes closed;
- Uni-lateral stance: Data recorded with the subject standing on the right and then their left foot.

Data-Processing

All datasets were averaged out before using the RMS. A window of 0.5 seconds was chosen for performing the RMS.

After all datasets were converted to their RMS values, they were normalized using the maximum of the MVC test as a global maximum for each muscle. Figure 2 show the results obtained.

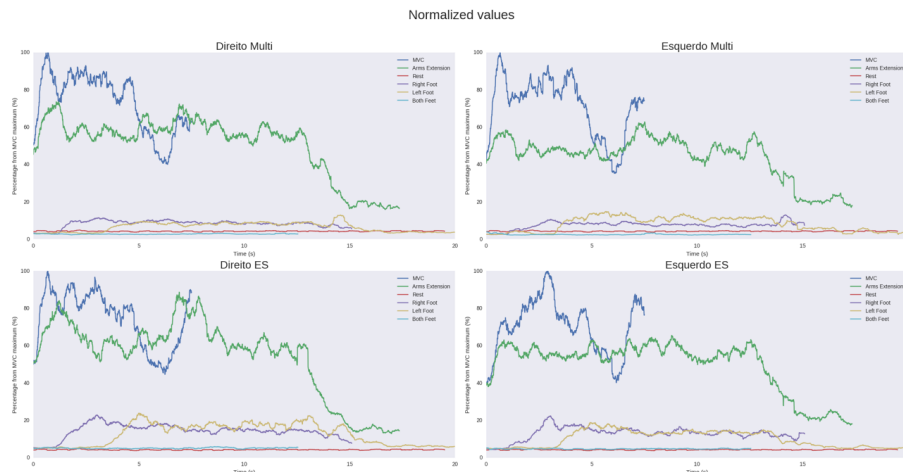


Figure 2 – RMS values normalized using the maximum of the MVC test for each muscle

When resting and standing on two feet, there is low to none muscle activity when compared to the MVC, while when extending the arms there is significant muscle activity.

When standing on each foot, there is an increase compared to standing on both of them. Figure 3 shows the difference in activation between the two situations.

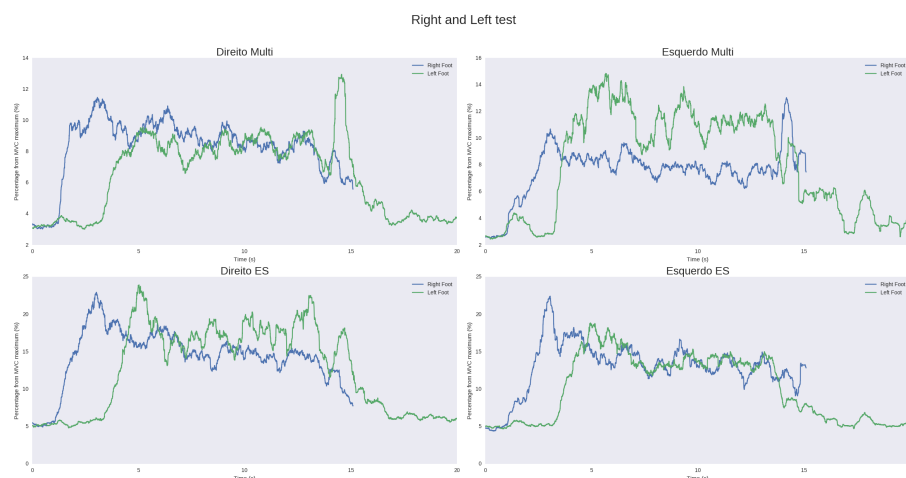


Figure 3 - Right and left stance normalized RMS

The muscle activity is very similar on both situations, although there is an increase of muscle activity when standing on the left foot, possibly due to fact that its not the dominant foot.

Figure 4 shows the maximum normalized RMS value for each dataset for each muscle.

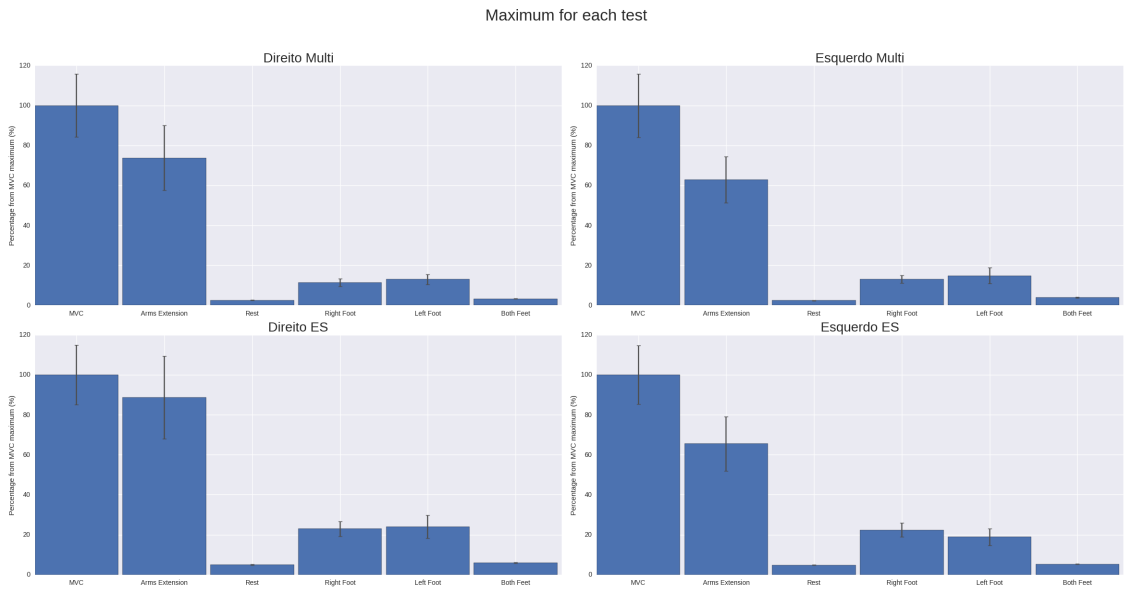


Figure 4 - Maximum normalized RMS value for each dataset for each muscle

As mentioned before, there is little to none activity when resting of standing on both feet.

In a unilateral stance there is an increase of activity, but still very tenuous.

Figure 5 show the mean values for the normalized RMS value for each dataset for each muscle.

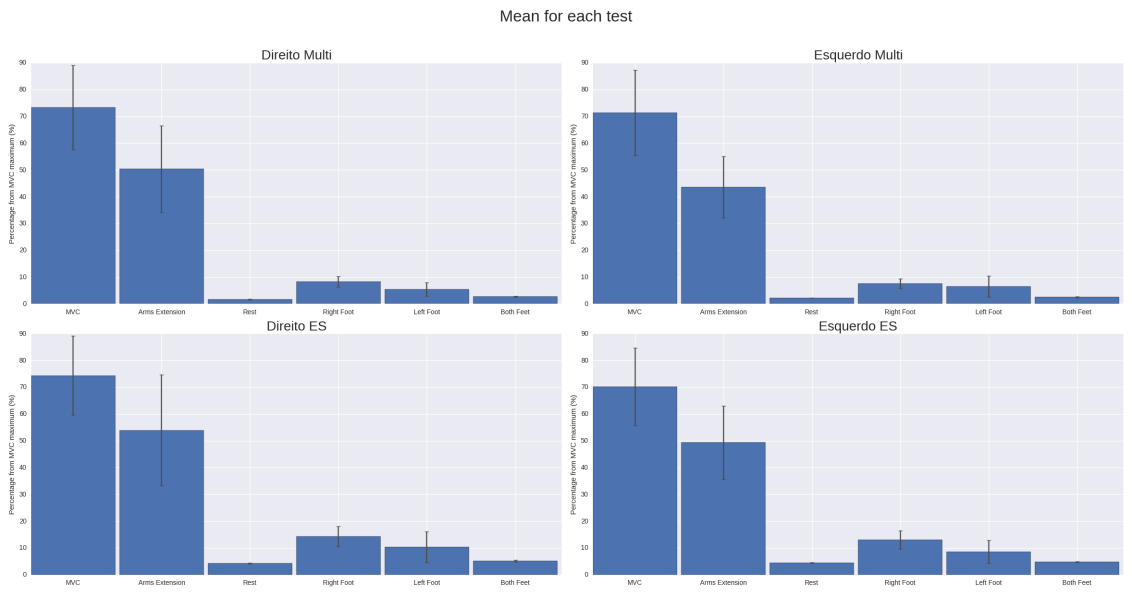


Figure 5 - Mean normalized RMS value for each dataset for each muscle

The values obtained in this figure show that although there is a slight difference between the right and left foot, they are inside the standard deviation. Table 1 is a summary of the data shown above.

MAXIMUM	MVC	Arms extension	Rest	Right foot	Left foot	Both feet
Right <i>Multifidus</i>	100 ± 15.79 %	73.75 ± 16.18%	2.60 ± 0.15%	11.47 ± 1.93%	12.95 ± 2.54%	3.28 ± 0.18%
Left <i>Multifidus</i>	100 ± 15.88 %	62,82 ± 11.46%	2,39 ± 0.06%	13,03 ± 1.86%	14,85 ± 3.95%	3,93 ± 0.29%
Right <i>Erector Spinae</i>	100 ± 14.81 %	88,71 ± 20.69%	4,92 ± 0.21%	22,93 ± 3.75%	23,92 ± 5.74%	5,95 ± 0.28%
Left <i>Erector Spinae</i>	100 ± 14.57 %	65,50 ± 13.66%	4,86 ± 0.13%	22,42 ± 3.42%	18,83 ± 4.28%	5,33 ± 0.19%
MEAN	MVC	Arms extension	Rest	Right foot	Left foot	Both feet
Right <i>Multifidus</i>	73,30 ± 15.79 %	50,36 ± 16.18%	1,74 ± 0.15%	8,30 ± 1.93%	5,50 ± 2.54%	2,79 ± 0.18%
Left <i>Multifidus</i>	71,37 ± 15.88 %	43,62 ± 11.46%	2,21 ± 0.06%	7,59 ± 1.86%	6,52 ± 3.95%	2,53 ± 0.29%
Right <i>Erector Spinae</i>	74,37 ± 14.81 %	53,88 ± 20.69%	4,28 ± 0.21%	14,33 ± 3.75%	10,43 ± 5.74%	5,14 ± 0.28%
Left <i>Erector Spinae</i>	70,19 ± 14.57 %	49,31 ± 13.66%	4,48 ± 0.13%	12,99 ± 3.42%	8,59 ± 4.28%	4,77 ± 0.19%

Table 1 - Summary of the maximum and mean RMS values and the standard deviation for each dataset and each muscle