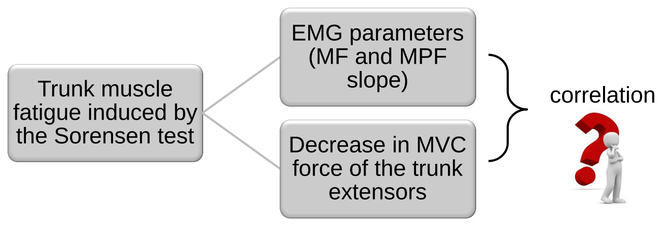
ARE FATIGUE-RELATED EMG PARAMETERS CORRELATED TO TRUNK EXTENSOR MUSCLES FATIGUE INDUCED BY THE SORENSEN TEST ?

Demoulin Christophe[1,2], George Florian[1], Matheve Thomas[3], Jidovtseff Boris[1,4], Vanderthommen Marc[1,2]

[1] Department of Sport and Rehabilitation Sciences (University of Liege, Belgium); [2] Department of Physical Medicine and Rehabilitation (CHU Liege, Belgium); [3] Rehabilitation Research Center (REVAL) (Uhasselt, Belgium)

I. INTRODUCTION

The Sorensen test has been extensively studied and is a rapid, simple, and reproducible evaluation of the trunk extensor muscles [1]. It is often considered as a fatigue test because fatigue-related electromyographic (EMG) parameters change throughout the test [2]; however, only recently it has been confirmed that this test induces a decrease of trunk extensor force during a maximal voluntary contraction (MVC) [3], which best characterises muscle fatigue.
The main aim of this study was to investigate the correlation between the decrease in MVC torque of the trunk extensors induced by the Sorensen test and the changes in fatigue-related EMG.



II. METHODS

Population :

Twenty participants (students; mean age: 22.1 years; 10 males) without a history of low back pain were included in the present study.

Experimental procedures :

Two to three days after a familiarization session (including the Sorensen test and an isometric MVC test of the trunk extensors), participants successively performed the MVC test (pre-fatigue test: Pre-MVC) and the Sorensen test which was immediately followed by the MVC test again (post-fatigue test: Post-MVC). The relative peak torque (in Newton.Kg^{-1}) was calculated.

The EMG activity of various trunk extensor muscles (i.e, multifidus, longissimus and iliocostalis lumborum, gluteus maximus, semitendinosus, and biceps femoris) was recorded with surface electrodes (**Fig. 1**). From this data, the decrease in median frequency (MF) (**Fig. 2**) and in mean power frequency (MPF) was calculated for the first 60 seconds and the total holding time of the Sorensen test.

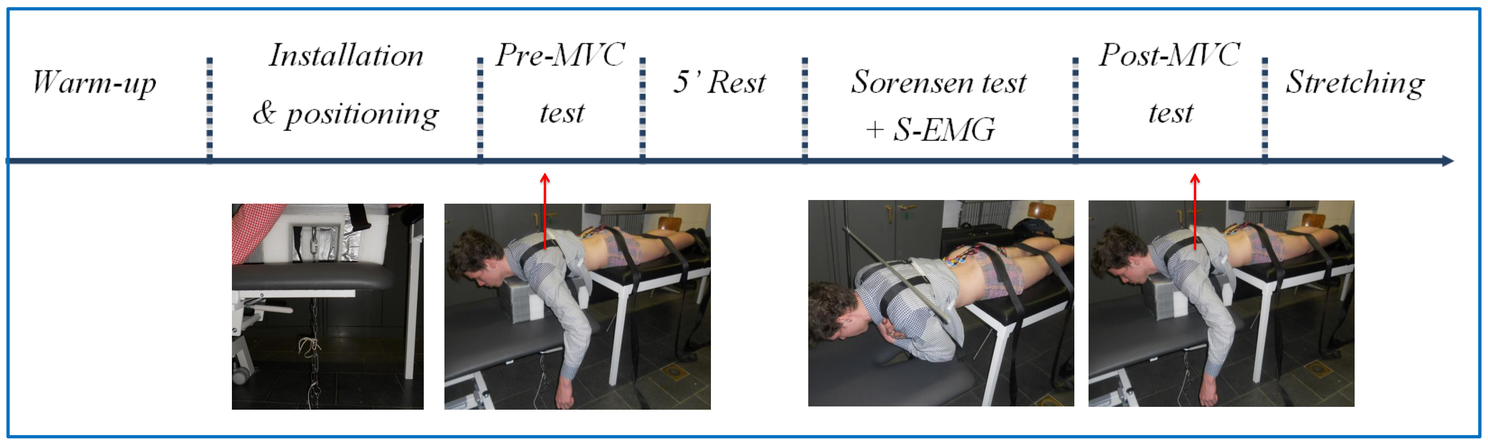


Figure 1: position of EMG electrodes

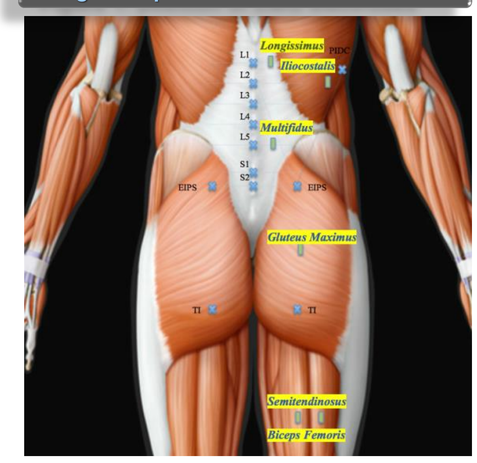
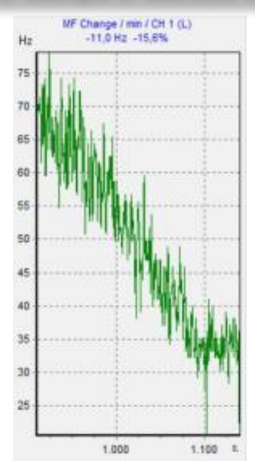


Figure 2: example of decrease in MF



III. RESULTS

The pre- and post-fatigue tests comparison revealed a significant ($p<0.05$) decrease of the maximal relative peak torque (PT) (-17%) (**Fig. 3**). Significant decreases of all EMG parameters were also observed during the first 60s as well as during the whole test (**Fig. 4**). However, there were no significant correlations between the changes in PT and any of these EMG parameters ($p>0.05$) (**Fig. 5**).

Figure 3 : Pre- and Post-MVC relative peak torque

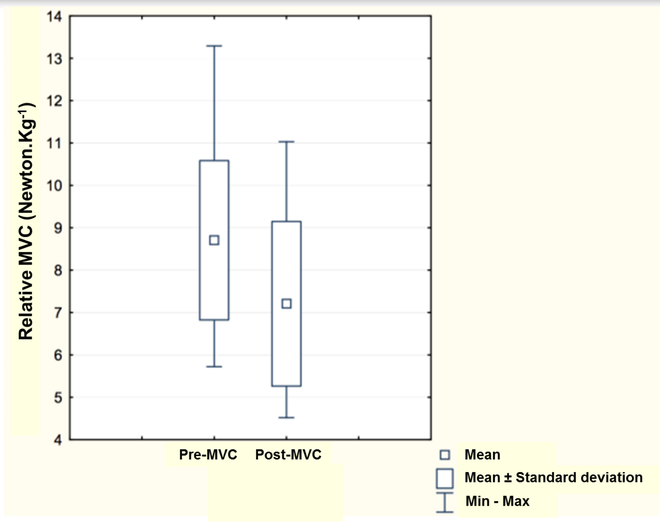


Figure 4 : MF and MPF decreases recorded at the end of the Sorensen test

	MF *%/min*	MPF *%/min*
	Median [P25:P75]	*Median [P25:P75]*
Longissimus	**-19,0 [-25,6:-15,4]**	**-18,3 [-23,1:-16,4]**
Iliocostalis	**-15,7 [-23,0:-12,6]**	**-15,8 [-22,5:-12,9]**
Multifidus	**-14,8 [-22,1:-12,7]**	**-15,7 [-20,4:-12,9]**
Gluteus maximus	**-8,0 [-10,4:-4,8]**	**-8,7 [-11,1:-6,9]**
Semitendinosus	**-11,3 [-14,8:-9,0]**	**-11,1 [-13,8:-8,6]**
Biceps femoris	**-6,3 [-8,7:-3,6]**	**-6,9 [-9,3:-3,4]**

Figure 5 : Correlations between the EMG parameters recorded at the end of the test and the relative PT decrease

		Relative MVC decrease (%)	
	%/min	r	p
Longissumus	**MF**	**0,03**	**0,88**
	MPF	**0,10**	**0,68**
Iliocostalis	**MF**	**-0,02**	**0,92**
	MPF	**-0,01**	**0,96**
Multifidus	**MF**	**-0,03**	**0,90**
	MPF	**-0,01**	**0,98**
Gluteus maximus	**MF**	**-0,08**	**0,53**
	MPF	**0,02**	**0,73**
Semitendinosus	**MF**	**0,20**	**0,41**
	MPF	**0,26**	**0,27**
Biceps fémoris	**MF**	**-0,26**	**0,28**
	MPF	**-0,17**	**0,48**

IV. DISCUSSION AND CONCLUSIONS

This study confirms that the Sorensen test induces fatigue of the trunk extensor muscles in healthy participants. Interestingly, the fatigue-related EMG parameters were not significantly correlated to the change in maximal force of these muscles induced by the test. Although this could be explained by the fact that EMG parameters can only reflect physiological responses linked to fatigue and not fatigue itself [4], the involvement of various trunk muscles and the inter-individual variations regarding the extent of activation of these muscles during the test might also partly explain these results.

REFERENCES

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christophe.demoulin@ulg.ac.be

C. Demoulin, Department of Sport and Rehabilitation Sciences, University of Liege, ISEPK, B21, 4000 Liège, BELGIUM