Portuguese Journal of Sport Sciences
11 (Suppl. 2), 2011

THE EFFECTS OF WEARING SPANDEX WEAR WITH COMPRESSION BAND ON MUSCLE ACTIVITY DURING A GOLF SWING

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The purpose of this study was to determine how spandex wear with compressive band affects muscle activities during a golf swing. This study showed that average and maximum nEMG (normalized EMG) values of left AO (external abdominal oblique) were less in EG (experimental group) compared with CG (control group) during back swing, whereas those of left PM (pectoralis major) in EG were greater than CG. It is more likely that EG performed effectively golf swing without excess muscle activity. Thus, the spandex wear with compressive band played an important role in improving swing performance with injury prevention. This has led to suggestions of the need for further kinetic and kinematic analyses to evaluate its function.

KEY WORDS: golf swing, spandex wear with compressive band, electromyography

INTRODUCTION: Many studies have focused on the development of swing mechanism and training to prevent the golf injury. Wadsworth (2007) proposed that excessive muscle activity or exercise could be one reason for causing injury of elite golf players. Kim (2008) reported that beginners generate high muscle activity in lattissimus dorsi during down swing phase. Stockard (2001) reported that ineffective muscle recruitment may increase the possibility of injury. Doan et al. (2003) found that wearing compressive pants reduced muscle oscillation and concluded that this may reduce tissue injury. Thus, if wearing spandex clothing with compressive band may tune the muscles to minimize vibration, there may be specific adjustment made to change muscle activity during golf swing. Since actual effect of wearing spandex clothing with compressive band on muscle activity has not been established, the purpose of this study was to determine how spandex wear with compressive band affects muscle activities during a golf swing.

METHODS: Nine male golf players (22.9±2.2 yrs, 177.0±4.4 cm, 773.0±94.6 N), each with at least 6 years golf experience (handy 4.5±5.4), were recruited as the participants. Eight pairs of surface electrodes (QEMG8, Laxtha Korea, gain = 1,000, input impedance $>$ 1012 Ω, CMMR $>$ 100 dB) were attached to the left and right side of the body to monitor the pectoralis major (PM), external abdominal oblique (AO), erector spinae (ES), and vastus lateralis (VL) (McHardy & Pollard, 2005). Each participant performed a full swing three times with driver (head: Srixon W-505, shaft: Fujikura Rombax 7X07) for the two conditions (CG: control group, EG: experimental group, wearing Techfit Powerweb, Adidas) in random order. Eight phases were analysed by using digital camcorder (Visol Inc., MotionMaster100, 200 Hz) during each golf swing. The average and maximum normalized EMG (nEMG) based on Dynamic Movement Cycle (EMG_{trial}/EMG_{DMC}) was computed for each trial. For each dependent variable, a paired *t*-test was performed to test between two groups (α=0.05).

RESULTS: Average and maximum nEMG value from left AO in EG were significantly less than the corresponding values in CG during the phases from address (AD) to middle of back swing (MB), from take away (TA) to top of back swing (TB). During the phase from AD to MB, maximum nEMG values of left PM were also reduced significantly in EG (Table 1, 2).

Table 1
Normalized EMG (nEMG) from address (AD) to middle of back swing (MB) (unit: %DMC)

	Average			Maximum		
	CG	EG	*p*	CG	EG	*p*
L. PM	3.9(2.0)	2.5(1.3)	.057	23.4(20.8)*	13.6(12.8)*	.032
R. PM	1.6(0.6)	1.7(0.9)	.622	7.9(2.9)	9.2(5.1)	.507
L. AO	9.1(6.9)*	3.7(2.5)*	.014	43.4(28.6)*	19.0(13.0)*	.019
R. AO	1.7(0.8)	1.3(1.0)	.266	8.5(3.8)	6.7(5.1)	.368
L. ES	4.8(2.5)	3.4(1.3)	.118	22.6(10.5)	16.9(7.6)	.112
R. ES	5.5(3.1)	4.6(2.3)	.327	26.6(16.0)	23.5(12.8)	.405
L. VL	2.1(1.5)	1.5(0.9)	.165	10.2(5.2)	7.8(4.4)	.181
R. VL	3.0(1.5)	3.9(3.5)	.276	15.2(8.7)	18.6(15.5)	.211

Note. * significant difference between CG and EG

Table 2
Normalized EMG (nEMG) from take away (TA) to top of back swing (TB) (unit: %DMC)

	Average			Maximum		
	CG	EG	*P*	CG	EG	*p*
L. PM	4.6(3.9)	4.1(6.7)	.874	29.7(35.1)	17.8(26.5)	.461
R. PM	2.1(1.2)	2.0(1.0)	.867	8.9(4.1)	13.6(10.2)	.219
L. AO	19.8(10.0)*	8.4(5.0)*	.004	72.5(36.6)*	35.2(27.7)*	.013
R. AO	3.2(1.6)	2.8(1.6)	.587	15.2(11.1)	10.9(6.6)	.389
L. ES	2.8(0.9)	2.4(0.9)	.313	14.3(7.2)	10.7(4.7)	.202
R. ES	6.0(3.1)	5.6(2.5)	.680	26.8(14.2)	27.1(13.1)	.936
L. VL	3.4(1.7)	3.3(1.4)	.786	17.8(8.0)	16.8(6.3)	.679
R. VL	4.1(2.9)	4.8(3.5)	.370	16.5(8.4)	31.1(30.3)	.132

Note. * significant difference between CG and EG

During the phase from ball impact (BI) to middle of follow through (MF), average and maximum nEMG values of left PM were significantly higher in EG. Maximum nEMG values of left ES in CG were significantly greater than corresponding value in EG (Table 3).

Table 3
Normalized EMG (nEMG) from ball impact (BI) to middle of follow through (MF) (unit: %DMC)

	Average			Maximum		
	CG	EG	*P*	CG	EG	*p*
L. PM	23.5(8.0)*	30.9(12.8)*	.037	62.9(20.3)*	79.8(20.0)*	.002
R. PM	26.8(11.7)	21.5(7.0)	.085	74.6(23.3)	64.8(26.7)	.103
L. AO	18.5(7.5)	16.2(11.7)	.625	51.8(23.9)	37.8(19.1)	.186
R. AO	23.4(11.7)	23.6(14.5)	.962	65.2(26.2)	56.9(31.8)	.541
L. ES	24.4(7.8)	20.5(10.8)	.194	77.0(27.7)*	55.3(28.5)*	.040
R. ES	18.4(10.8)	16.1(5.6)	.589	53.8(24.0)	53.4(29.5)	.961
L. VL	17.1(8.5)	19.4(8.8)	.307	56.2(27.3)	58.9(25.4)	.719
R. VL	24.3(13.7)	21.2(12.7)	.611	70.3(26.3)	63.6(24.0)	.516

Note. * significant difference between CG and EG

DISCUSSION: For the back swing, nEMG values of left AO and PM in EG were less than corresponding value in CG. McHardy and Pollard (2005) reported that the abdominal oblique on left side is the most active muscle for back swing in right handed golfers. Many of golf injuries are soft tissue injuries and occur as the result of incorrect golf swing mechanics

before the ball impact. Moreover, abdominal oblique usually contracts to stabilize the trunk rotation during the back swing. This indicates that less muscle activity in EG is resulted from the spandex wear with compressive band and it may reduce possibility of golf injuries by preventing excess muscle activity.
In contrast to the back swing, greater muscle activity is needed for the rapid down swing and better performance. Pectoralis major on the left side is the most active muscle during the acceleration phase which is the most active during the full golf swing and the early follow through phase from BI to MF (McHardy & Pollard, 2005). In this study, muscle activity of pectoralis major in EG was greater than the corresponding value in CG during acceleration and early follow through phases. This showed that the spandex wear with compressive band may be assist in improving swing performance for delivering more power to the shot.

CONCLUSION: This study showed that average and maximum nEMG values of left AO were less in EG compared with CG during back swing, whereas those of left PM in EG were greater than CG. Results show that the EG performed a more effective golf swing without excessive muscle activity. Thus, the spandex wear with compressive band played an important role in improving swing performance with injury prevention. In the future, further kinetic and kinematic analyses is needed to evaluate its function.

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