CAN MUSCLE ACTIVATION BE INCREASED WHEN MODIFYING THE DUMBBELL CHEST PRESS? AN ELECTROMYOGRAPHIC COMPARISON

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INTRODUCTION: The development of core stability is an important part of the athlete strength and conditioning process. Research has shown that when traditional resistance exercise is performed on a stability ball, core muscle surface electromyography (sEMG) is increased (Anderson & Behm, 2005). However, investigators have also demonstrated this can lead to a considerable reduction in agonist muscle sEMG (Behm & Anderson, 2006). It has been suggested that by replacing traditional bilateral resistance exercises with unilateral variations the reduction in agonist muscle sEMG associated with stability ball resistance exercise can be avoided (Behm & Anderson, 2006). However, this theory has not been tested on the chest press. Therefore, the aim of this study was to compare core and agonist sEMG during chest press performance to establish whether unilateral chest press exercise would increase core sEMG without compromising agonist sEMG.

METHODS: After gaining university ethical approval, six recreationally resistance trained males (mean ± SD age: 23 ± 1 years; mass: 79.8 ± 9.7 kg; height: 1.8 ± 0.01 m) were recruited and provided informed consent.
Two testing sessions were conducted. During the first, bilateral bench dumbbell chest press (Figure 1) maximal strength (one repetition maximum-1RM) was established using the methods proposed and used by Bompa and Cornacchia (1998). Seven days later subjects performed two sets of five repetitions with 60% 1RM in the four dumbbell chest press variations that are shown in Figure 1.

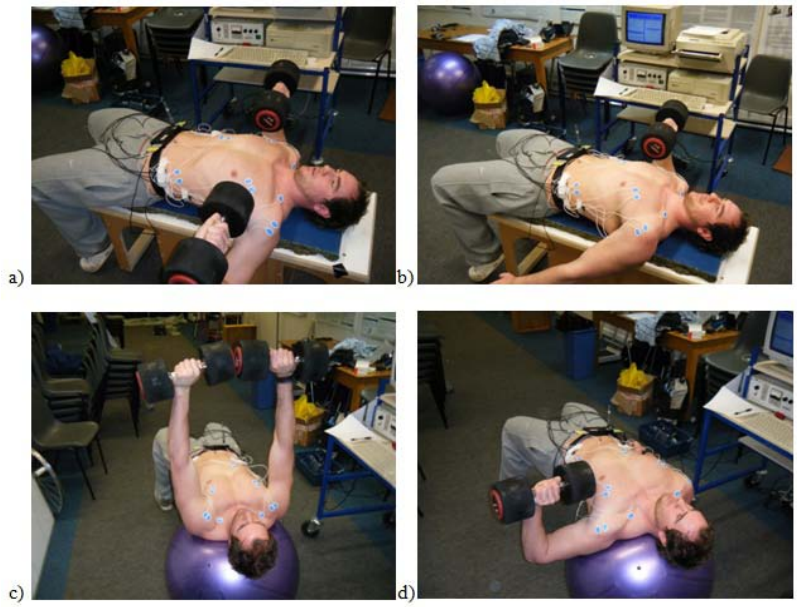

Figure 1. Demonstrations of the chest press variations that were studied: a) bilateral and b) unilateral bench chest press (CP) (L and R), and c) bilateral and d) unilateral ball CP (L and R).

All subjects rested for 3 minutes between each set and 10 minutes between each exercise. The sEMG of seven muscles (agonist: left and right anterior deltoid, pectoralis major; core: left and right oblique, and rectus abdominis were recorded at 500 Hz using a radio telemetry system (MIE Medical Research Ltd., Leeds, UK). Following skin preparation, AgAgCl surface electrodes were

placed in accordance with (Cram et al., 1998; Figure 1), with a maximal voluntary contraction (MVC) recorded against manual resistance for each muscle under investigation. Mean concentric phase muscle activity for each muscle during each repetition was calculated by summing integrated sEMG data. Repetition data was then averaged for further analysis.
All data were presented as mean (± SD). Differences between the different exercise core and angonist sEMG were established using repeated measures ANOVA and planned comparisons on SPSS version 16 for Windows (SPSS Inc., Chicago, USA). An alpha value of $p \leq 0.05$ set to establish statistical significance.

RESULTS AND DISCUSSION: Descriptive statistics are presented in Table 1. Exercise type significantly affected the right oblique sEMG ($p<0.05$, Table 1), but not the left oblique ($p = 0.414$), left ($p = 0.402$) and right ($p = 0.255$) deltoid, left ($p = 0.188$) and right ($p = 0.214$) pectoralis major, or rectus abdominis ($p = 0.343$, Table 1).

Table 1. Mean (± SD) sEMG (% MVC) during the different variations of the dumbbell chest press.

	Bench Bilateral	Bench Right	Bench Left	Ball Bilateral	Ball Right	Ball Left
Right deltoid	58 (12)	60 (12)	66 (5)	65 (10)	64 (12)	57 (3)
Left deltoid	52 (14)	58 (6)	61 (13)	56 (13)	60 (7)	61 (7)
Right pectoralis	58 (7)	57 (9)	38 (4)	47 (3)	57 (9)	51 (31)
Left pectoral	58 (6)	38 (8)	67 (9)	52 (8)	35 (.4)	61 (1)
Right oblique	59 (8)[a]	58 (3)	60 (20)	63 (8)[b]	53 (6)	77 (3)
Left oblique	58 (11)	60 (8)	61 (10)	52 (23)	60 (17)	78 (10)
Rec ab	36 (9)	40 (15)	40 (4)	33 (6)	45 (14)	41 (3)

Rec ab = rectus abdominis; a = 10.2% greater than unilateral ball exercise ($p < 0.05$); b = 15.9 % greater than unilateral ball exercise ($p < 0.05$).

Unilateral bench exercise did not elicit significantly greater sEMG than the unilateral ball equivalent. However, unilateral bench exercise demands on the rectus abdominis were between 10% (for bench exercise) and 23% (for ball exercise) greater than the bilateral equivalent, indicating that a considerable component of the core musculature had a greater demand made of it when performed unilaterally, especially when a stability ball was used. Further, unilateral bench exercise offered no clear benefit over the ball equivalent for the obliques. Although right oblique activity was 8.6% greater, left oblique activity was 28% less (Table 1). This is further supported when the agonist sEMG is reviewed. Deltoid activity tended to be greater during stability ball exercise. However these differences, in addition to the differences between the stability ball and bench exercise pectoralis activity were minimal. This suggests that unilateral stability ball chest press exercise places a greater demand on a considerable portion of the core musculature with little affect on the agonist musculature.

CONCLUSION: The results of this study refute the contention that unilateral variations of traditional chest press exercise elicit greater demands on core and agonist sEMG. Greater demands are placed on these muscle groups during unilateral stability ball chest press exercise.

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