Spring 5-10-2017

Efficacy of Electromyography and the Dead Bug Exercise

Taylor M. Scavo
Chapman University, scavo102@mail.chapman.edu

Rachel C. Cooklin
Chapman University, cookl100@mail.chapman.edu

Erika N. Faria
Chapman University, faria105@mail.chapman.edu

Madeline L. Johnson
Chapman University, johns527@mail.chapman.edu

Eric Sternlicht
Chapman University

Efficacy of Electromyography and the Dead Bug Exercise

Scavo, T. M., Cooklin, R. C., Faria, E. N., Johnson, M. L. and E. Sternlicht

Crean College of Health and Behavioral Sciences, Chapman University, Orange, CA, United States
Email scavo102@mail.chapman.edu, sternlic@chapman.edu

Abstract

The Dead Bug exercise is performed in physical therapy clinics to restore lumbar spine stability and core strength in patients with lower back pain (LBP). The aim of this study was to evaluate the efficacy of using electromyography (EMG) feedback to enhance proper mechanics during the Dead Bug exercise. Sixteen healthy, college age students volunteered as subjects for the study. Subjects performed the Dead Bug (Fig. 1a.) with and without visual EMG cues and were given instructions on how to execute the exercise. Data was recorded using a BTS FREEEMG Analyzer and signal processed and data analyzed using the BTS SEMGanalyzer software (BTS Bioengineering, Brooklyn, NY). Electrodes were placed on the right rectus abdominis (RA) and right rectus femoris (RF) of each subject of the agonist and antagonist muscle of the movement, respectively. Subjects performed two trials of the exercise on two test days with two weeks in between testing. EMG data were normalized using subjects' maximum voluntary contraction. Students' paired t-tests were used for statistical analysis with a $p \leq 0.05$ used for significance. The averages of the normalized EMG data (ND) between both visual trials for RA and RF, mean ± standard deviation, were 0.302 ± 0.158 and 0.118 ± 0.094, respectively. The averages of the normalized EMG data between both nonvisual trials for RA and RF were 0.284 ± 0.146 and 0.084 ± 0.049, respectively. No significant differences were found for visual and nonvisual trials for agonist and antagonist muscles (Table 2). After evaluation of the study, the study protocol was determined to not be identical to a typical physical therapy setting which utilizes continuous feedback to the patient. Therefore, pilot testing of two subjects was performed on the Dying Bug exercise (Fig. 1b&c.) with continuous visual, biomechanical, palpation, and verbal feedback. As anticipated, a positive trend was shown in mean visual values relative to nonvisual values for the targeted muscles (Table 1).

Testing Exercise Execution

Figure 1.

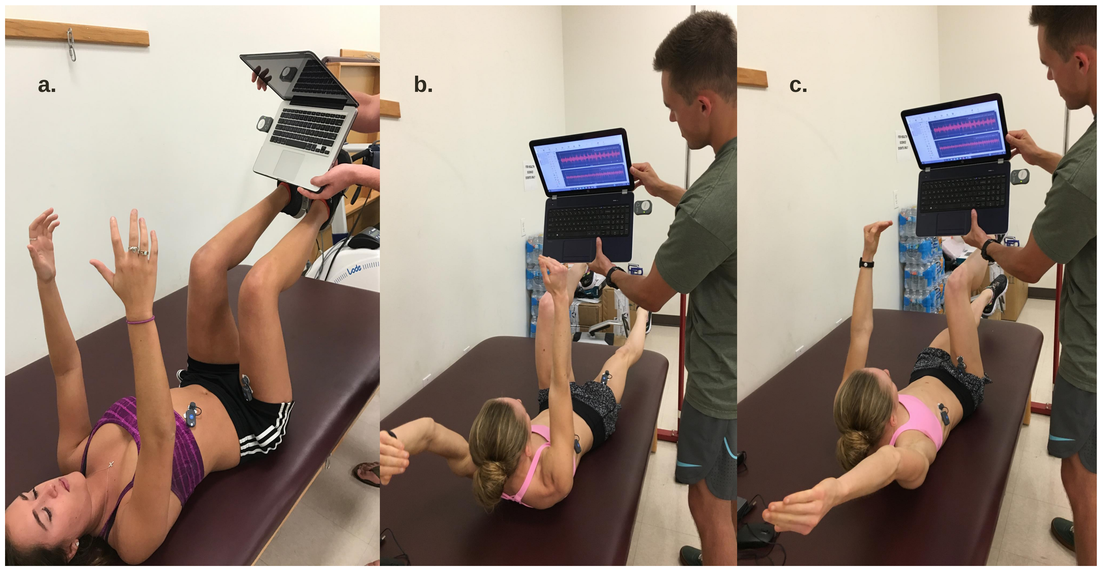

Figure 1a. Subject performing Dead Bug exercise. Electrodes were placed on r. rectus abdominis and r. rectus femoris. Visual EMG cueing trial. **1b.** Subject performing Dying Bug exercise with left arm and right leg extended. Electrodes were placed on r. external oblique and r. rectus femoris. Visual EMG cueing trial. **1c.** Subject performing Dying Bug exercise with right arm and left leg extended. Electrodes were placed on r. external oblique and r. rectus femoris. Visual EMG cueing trial.

Pilot Testing Results

Table 1.

Muscle	Nonvisual ND (mean ± SD)	Visual ND (mean ± SD)	Trend
RO	0.192 ± 0.071	0.395 ± 0.147	↑
RF	0.283 ± 0.113	0.223 ± 0.092	↓

Table 1. Normalized mean ± s.d. EMG data (ND) from the visual and nonvisual trials of pilot testing of the Dying Bug. Averages of the r. external oblique (RO) and r. rectus femoris (RF) for visual and nonvisual trials. A positive trend (↑) between nonvisual and visual trials was seen for the RO, while a negative trend (↓) from visual to nonvisual trials was observed for the RF.

Figure 2.

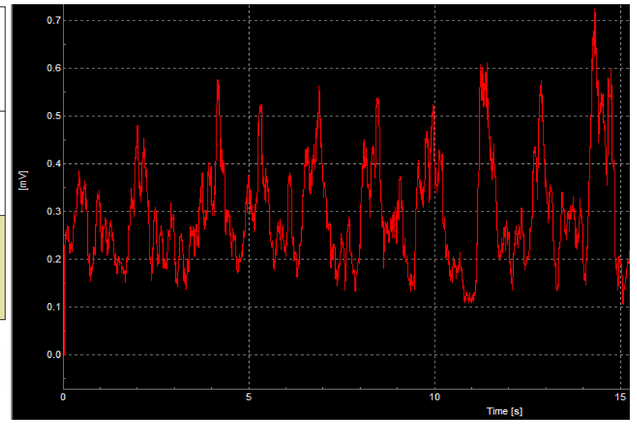

Figure 2. Exemplar data from pilot testing of the Dying Bug exercise with continuous visual, biomechanical, palpation, and verbal feedback.

Study Results

Table 2.

Muscle	Nonvisual ND (mean ± SD)	Visual ND (mean ± SD)	*p*
RA	0.284 ± 0.146	0.302 ± 0.158	0.720
RF	0.084 ± 0.049	0.118 ± 0.094	0.273

Table 2. Normalized mean ± s.d. EMG data (ND) from the visual and nonvisual trials of the Dead Bug exercise study. Averages of the r. rectus abdominis (RA) and r. rectus femoris (RF) for visual and nonvisual trials. There was no significance between nonvisual and visual trials for the RA and RF.

Study Limitations

- Deep muscles of the Dead Bug exercise were unable to be measured with surface EMG
- In the initial study on the Dead Bug exercise, preliminary data analysis was not performed prior to testing of all subjects.
- Unlike in a physical therapy setting, continual instructions were not performed during the primary study on the Dead Bug exercise.

Strengths

- Prior research supports the use of EMG along with continual forms of feedback to patients in the physical therapy setting.
- Following analysis of study results, subsequent pilot testing on two subjects using continual EMG visual, biomechanical, palpation, and verbal feedback supports the use of EMG feedback on patients for proper exercise mechanics.