ELELECTROMYOGRAPHIC LINEAR ENVELOPE ANALYSIS OF GOLF SWING FOR TRUNK MOTION IN ASIAN PLAYERS: A CASE STUDY

Chia-Nen Chan[1] and Wen-Tzu Tang[2]
[11]Chang-Gang University, Taoyuan, Taiwan, and[2]National College of Physical Education and Sports, Taoyuan, Taiwan
email: wttang@mail.ncpes.edu.tw

INTRODUCTION

Despite the significant prevalence of back pain among golfers at all levels of ability, the current literature does not fully address specific mechanisms responsible for this injury. The approach of studying trunk motion includes motion analysis and EMG measurements. Some studies show differences in trunk motion with kinematic variables for two groups with non-back pain and back pain, respectively [1]. Most EMG studies have measured EMG amplitude in each phase to understand general on/off activation of trunk muscles in different phases. However, little work evaluates back muscle activation patterns with the EMG envelope, which provides information on the the timing and duration of the burst, and also detail smuscle activation characteristics integrated with kinematics variables. Moreover, most studies have recruited western players as participants who usually have higher anthropometric scores. Recently, Asian professional golf players have successful performances in American and Europe, albeit with lower anthropometric scores. . Investigation of trunk muscle activation pattern in an elite Asian player without pain history may provide useful information to explore the optimal swing for back loading. Therefore, this study identifies reproducible patterns of trunk muscle activity through use of the EMG envelope integrated the kinematic variables. We analyze the swing of a golfer who won a Gold Medal in 2002 Busan Asian Games. The participant had a low anthropometric anthropometry score relative to western players.

METHODS

One male Gold Medal winner in 2002 Busan Asian game aged 25 yearswith height 160 cm and weight 65 kg, with 15 years of training, participated in this study. The subject is a typical right-handed player. Surface EMG data at sampling rate of 1200 Hz were collected by Biovision EMG System (Wehrheim, Germany). The muscles of abdominal oblique, erectus spinae, latissimus dorsi, and upper rectus abdominis in both right and left sides were studied. The distance of the interelectrode was 20 mm, and the placement of electrode was as described by Zipp (1982). A JVC 9800 digital camera at a sampling rate of 120 Hz captured the subject's swing with a #7 iron via markers on club, shoulder, elbow, wrist, ilium, and knee. EMG and video data were synchronized with a simple circuit that simultaneously lit an LED and sent a voltage signal to the Biovision input box. Kinematic data were analyzed by the Kwon3D Software. The swing was divided into five phases: Phase I, upswing; Phase II, forward swing; Phase III, acceleration; Phase IV, early follow through; Phase V, late follow through [2]. The subject was asked to perform 10 swings after a proper warm-up. The four best and most consistent strokes were chosen by the subject for later data analysis. The EMG signal was band-pass filtered at 4 to 500 Hz (Butterworth digital fliter), full-wave rectified, and low-pass filtered at 8 Hz by DasyLab 6.0 System to derive the EMG linear envelope.

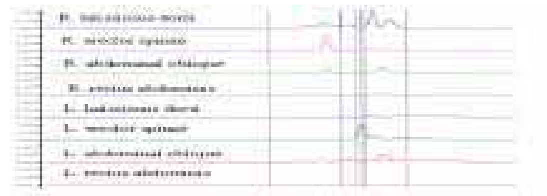

Figure 1: EMG activity patterns of shoulder and trunk muscles on left and right sides during five swing phases

RESULTS AND DISCUSSION

To analyze the timing and duration of the firing pattern of back and shoulder muscles of the participant, the EMG linear envelope as shown in Figure 1 was studied for each muscle. In the early phase of the takeaway, all muscles presented extremely low activation. However, the latissimus dorsi on both sides started to activate during the tak-away. In particular, the latissimus dorsi on the right side continued activation until the top point of the takeaway phase. This muscle presented a similar pattern in the forward swing phase. Comparing the two sides, the left latissimus dorsi presented less activation, and the latissimus of both sides were silent until the end portion of the late follow through. The left and right erect spinae and right obdominal oblique presented significant activation until the top point of the take away, then decline. Overall, the forward and acceleration phases muscles on the upper torso did not showed burst activbity except for the left erect spinae in acceleration phases. Other studies have demonstrated greater activation levels on the forward swing and acceleration relative to the upswing and follow through, as characterized by MVC percentage. The burst peak may be reduced in MVC percentage because of the long duration of the upswing and follow through phase. Furthermore, not many trunk muscle groups in our study exhibited a burst in the forward and acceleration phases, and it is possible that other deep trunk muscles not involved in this study may play an important role for these two phases, which should be further investigated for back pain research.

CONCLUSIONS

From previous studies using EMG amplitude analysis for different swing phases, information is available on the general roles of each muscle in different phases. However, this work demonstrates dilution of the burst which may associate with back pain because of repetitive and cumulative acute motion. Also, reduced burst activation in the forward swing and acceleration which may imply the relevance of exploring deep muscles during the forward swing and acceleration.

REFERENCES

1. Lindsay D et. al., *J Sports Sci*, **20**, 599-605,2002.
2. Pink M et. al., *Am J Sports Med*, **18**, 137-140,1990.