

## AN ELECTROMYOGRAPHIC ANALYSIS OF WINDMILL SOFTBALL PITCH

Sheng-Weng Shih, Hwai-Ting Lin\*, and Lin-Hwa Wang\*\*

Institute of Physical Education, University of Tainan, Tainan, Taiwan

\*Faculty of Sports Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

\*\* Institute of Physical Education, Health &amp; Leisure, Cheng Kung University, Tainan, Taiwan

**KEY WORDS:** Windmill, EMG, Softball.

**INTRODUCTION:** Windmill softball pitching is a highly skilled sport combined with coordination and explosive force. Besides many kinematic and kinetic analyses relative to it, its mechanics can also be understood through the EMG analysis of a pitcher's leading foot and throwing arm. The purpose of this study was to investigate how the activated throwing arm and leading foot of a pitcher contribute to his strength while pitching.

**METHOD:** The six subjects of the experiment were female fast softball pitchers. Before their exercise we measured the maximal voluntary contraction (MVC), and subsequently the activation of ten main muscles of the throwing arm and leading foot by the surface EMG sensor when they started pitching.

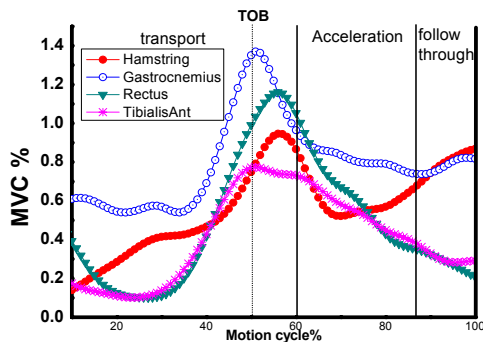
**RESULTS:**

Figure1 leading foot activation level(%MVC)

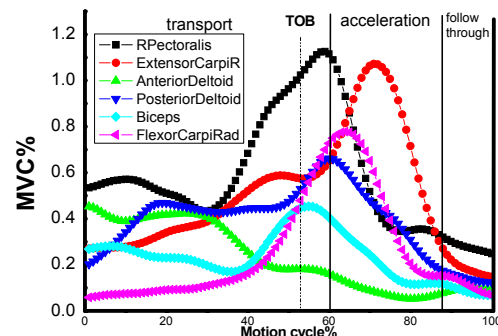


Figure2 throwing arm activation level(%MVC)

**DISCUSSION:** Muscles of leading foot & throwing arm activation level (%MVC) are shown in figure1&2. The acute activation of the muscles of leading foot appears before pitching, during the period of top of backswing (TOB). In the leading foot, the maximal activation happened at biceps and gastrocnemius, about 1.4 times the degree of MVC, when the minimal activation to tibia, approximately 0.8 times (figure1). In throwing arm, the peak activation of most muscles occurred even later compared with the leading foot. The maximal activation happened at the extensor carpi radialis, with the most average activation degree reaching 1 time of MVC.

**CONCLUSION:** The large amount of activation of the leading foot muscles occurred during the striding period. In biceps and gastrocnemius the sequence of activated muscles of throwing arm accords with the kinetic chain. Its maximum usually appears during the accelerating period when the leading foot is planted, with the most activation in extensor carpi radialis.

**REFERENCES:**

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