Electromyography Analysis of Scapular Muscles During Baseball Pitching

INTRODUCTION:
Scapular muscles play an important role in achieving the appropriate motion and position of the shoulder during baseball pitching. The failure of these muscles to perform this role causes the shoulder to function inefficiently, and this limits the physiological and biomechanical performance of the player.

In the past, shoulder muscle activity during baseball pitching has been examined extensively by many researchers. Among them, many researchers reported the importance of scapular motion and activity. However, little study has been carried out on the electromyography (EMG) activity of scapular muscles, and the role of these muscles during pitching is yet to be fully elucidated.

The purpose of our investigation was to dynamically measure the normalized EMG activity of scapular muscles during baseball pitching.

METHODS:

9 male volunteers with no history of shoulder pain or pathology participated voluntarily in this study. Their physiological parameters (mean ± standard deviation) were as follows: age = 20.5 ± 1.2 years, height = 170.0 ± 7.5 cm, weight = 68.3 ± 4.4 kg, and number of years played = 8.5 ± 2.1. The subjects had to undergo a brief clinical examination (medical history, manual shoulder muscle testing, and range-of-motion measurements). The approval for this study was obtained from the Institutional Review Board of Waseda University, and each subject was required to sign a consent form prior to his participation in the study. All the experiments were carried out under appropriate safety conditions and in the presence of an orthopedic surgeon.

After stretching and warming up, the subjects were asked to throw 10 overhand fastball pitches. The time interval between the pitches was set to 90 s. The pitching phase was recorded using a 210-Hz high-speed digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five digital camera (FX-20, CASIO, Tokyo, Japan). The pitching motion was divided into six phases according to Fleisig et al.2) and the following five.