A Biomechanical Analysis of the Weight Training Squat Using Dartfish Motion Analysis Software

Introduction

Wesley Kephart was enrolled in the course Analysis of Movement, KIN 427, and in one of the co-requisite labs, KIN 426L, during the Fall 2019 semester term. His course-long term project, A Biomechanical Analysis of the Weight Training Squat, was completed in the lab portion of the course. This project required the comprehension and utilization of various biomechanical principles, which were learned in the lecture portion of the Analysis of Movement class. The biomechanical principles, which are discussed in his paper, are derived from Newton’s Laws of Motion and assist us to understand the forces that produce and affect movement. This project required the comprehension and utilization of various biomechanical principles, which were learned in the lecture portion of the Analysis of Movement class. The biomechanical principles, which are discussed in his paper, are derived from Newton’s Laws of Motion and assist us to understand the forces that produce and affect movement.

Methods

- A video was created using camera motion analysis software called Dartfish.
- The video was analyzed by using the Dartfish software.
- The performance was first analyzed by using the video tools to create a planar analysis.

Abstract

During the Fall 2019 semester, Dr. Cole and her graduate assistant David Ware supervised students in a term project in which the students analyzed a movement of their choice using the latest computer version of the Dartfish Motion Analysis Software. In this project, a weight training squat was analyzed because it’s considered to be the “king of lifts,” but it’s frequently performed incorrectly.

The biomechanical analysis involved understanding two subjects, the subject performing the lift in the best of their abilities. The subjects were instructed to wear clothing that did not interfere with their skin tone and to have their legs and shoulders seen visible. To ensure accurate measurements, strict standards were followed during videoing. A camera, containing a MiniDV cassette tape, was set up to record the lift and set up in a position where it was perpendicular to the plane of the movement. All of the movements of the squat were recorded and then edited for the final product. Two trials were recorded per subject with a five-second period of recording time before and after the completion of the squat. After the trial was completed, all data were compiled into the Dartfish software.

After a careful review of the data, the two trials of the subjects were selected for an in-depth and thorough movement analysis. Strengths and weaknesses of the movement were analyzed and illustrated by the various tools available within the software. The tools allowed the investigator to both quantify and qualify the correct and incorrect indicated movement patterns. Also, the investigator utilized his knowledge of physics and biomechanics principles to analyze and give comparisons to the various phases of the movement. For clarification of the recommendations, pictures were drawn with the Dartfish software and test was provided to further explain both the corrections and phases.

The investigators conduct a video at the completion of the analysis to present the results and findings in a DVD format. The DVDs made it possible for the subjects to watch their movements with the analysis recommendations, so that they could perform the weight training squat more safely, effectively, and efficiently.

Summary

The Dartfish Motion Analysis Software enabled the investigators to more efficiently view the performer’s movements than with the known “stop-motion” tool and allowed him to evaluate the performance in a much more visible way. It also allowed him to provide more detailed feedback for improvement to the subjects. The above images were used to publish a DVD media book, which was then given to the subjects as a permanent record of the instructions and reasoning of performing the weight training squat in a manner that prevents injury.