KINEMATIC COMPARISON OF TETHERED, STATIONARY UNDERWATER RUNNING AND TREADMILL RUNNING

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INTRODUCTION: It is estimated that up to 70% of Americans who engage in running or jogging as a regular form of exercise will experience a running related injury (Butts, Tucker & Greening, 1991). There has been much interest in deep water running as a method for maintaining or improving fitness when recovering from an injury. Very little research has been done to compare the mechanics of the two training modes. The purpose of this study was to compare specific kinematic variables associated with tethered, stationary underwater running and treadmill running under both controlled heart rate and controlled cadence conditions.

METHODS: Five females were chosen to participate based on their experience with both treadmill and underwater running. During the water session the subjects' heart rate was kept constant for three minutes while the video recording was taking place (220 - (age + 10) x 80% as per the recommendations set forth by Quinn, Sedory and Fisher (1994) for assessing heart rate during water exercise). The constant heart rate was achieved by starting the runners at a warm-up cadence of 80 beats per minute (BPM) for three minutes with cadence increasing in twenty beat intervals every two minutes until the desired heart rate was reached. Heart rate was taken for the last fifteen seconds of each two minute interval. For the constant cadence condition the participants began with a warm-up of 48 cycles per minute (CPM) for four minutes (one cycle equal to two steps). Cadence was increased to 66 CPM for two minutes then increased by 12 CPM for each of the four two-minute stages to a maximum of 108 CPM. The performance was then videotaped for two minutes. During land based running, the performance was taped while heart rate was kept constant at 80% of age determined max HR for three minutes. To get the HR to this level a modified Astrand was used (Quinn, Sedory & Fisher, 1994). Participants began jogging at 5 MPH for five minutes followed by a 2.5% increase in grade every two minutes until the desired heart rate was reached. Recording followed for two minutes. Cadence on the treadmill began at the participants' most comfortable jogging pace and was increased by 0.5MPH every two minutes until the desired speed of 5.5 MPH was reached. Recording followed for two minutes. The data was sampled at 60 Hz using the Peak Motus Analysis System and smoothed using a Butterworth optimal digital filter. The angular displacement and velocity of the knees, hips, shoulders and elbows, as well as the degree of trunk lean were measured throughout two strides. In addition, stride frequency relative to heart rate was determined.

DISCUSSION AND IMPLICATIONS: Descriptive statistics for all kinematic data were generated. Differences between the timing and range of motion were highlighted in this study. Future research will examine EMG differences.

REFERENCES:

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