INTRODUCTION

Speed skating has seen many innovations in the last five years. The most note worthy is the klapskate. The klapskate permits the shoe to rotate on a hinge relative to the blade. Therefore, allowing plantar flexion with the blade remaining flat, gliding on the ice. When the klapskate was re-engineered in 1985 it was not known where to position the hinge of the klap mechanism, which will be referred to as the pivot point (PP), so it was arbitrarily placed just behind the first phalangeal joint. Since the klapskate became commercially available, in 1997, different manufacturers have made the PP placement adjustable, but there is still no scientific reasoning as to where an individual should put the PP to attain optimal performance. A few experimental studies have tried to quantify an optimal PP placement, but they all found inconsistent results and pronounced individual differences (Allinger & Motl, 2000; Houdijk et al., 2002). This lead to two speculations: either every individual has their own optimal PP placement, or there is one optimal spot for everyone and the sensitivity of the experimental design needs to be increased.

The purpose of this study was to determine if moving the PP had a generic effect on the total push energy (TE), and on the individual energies produced at the ankle, knee, and hip, throughout the explosive push phase of the speed skating push. This study assumes a higher TE indicates a more optimal PP placement.

METHODS

Ten speed skaters participated in the study; all had personal best 500 meter times within 110% of the World Record. Four pivot point (PP) conditions were tested on each subject, at the following four locations: 55%, 62.5%, 70%, and 77.5% of the total foot length, horizontally in the sagittal plane, extending from the ankle joint center to the PP. A similar method of PP placement was used by Houdijk (2002), except the range was smaller (57% to 73%). Subjects performed 10 trials with each condition, kinematic and kinetic data were collected, in the lab, on a modified slide board apparatus (Van Horne & Stefanyshyn, 2002). Each trial consisted of one maximal speed skating push on the modified slide board. Inverse dynamics was used to quantify the joint energetics. The sum of the ankle, knee, and hip energy was defined as the total push energy (TE). A one-way repeated measures ANOVA was used to compare the change in joint energy between the different PP conditions, and the change in TE between the different conditions. Post hoc, paired t-tests were used to determine significance between conditions (α=0.05).

RESULTS AND DISCUSSION

As the pivot point (PP) was moved anterior from the 62.5% condition to the 70% condition the average total energy of the explosive push phase (TE) decreased significantly by 5.1%. No difference was found between the 55% and 62.5% condition. At the ankle joint a significant, almost linear, increase in average joint energy was found as the PP was moved anterior. At the knee joint a significant, almost linear, decrease in average joint energy was found as the PP was moved anterior.

REFERENCES

Houdijk, H., et al. (2002). J of Applied Biomechanics, 18, 292-305