SHOCK ABSORBING CROSS-COUNTRY SKI POLE FOR DRYLAND SKIING

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INTRODUCTION

Some research has gone into the forces that are produced during the pole plant phase of cross-country roller skiing (Street & Frederick, 1995; Komi, 1988; Millet et al., 1998a,b,c). Due to the hard surface (usually asphalt) into which the roller skiers plant their poles there are much higher forces travelling through the pole than with ordinary snow skiing. These high ground reaction forces have been identified as a possible cause of injuries to the wrists, elbows and shoulders of roller skiers.

To date few studies have tried to resolve this problem by inserting a shock absorbing mechanism into the ski pole. In the present experiment pole forces were examined before and after a shock absorbing mechanism (a spring) was inserted into a normal Nordic ski pole. The spring was inserted into the shaft of a carbon fibre cross-country ski pole between the handle and the shaft.

METHODS

To simulate the load created by the arm, a 1.13 kg mass was attached to the handle above the spring. The ski pole was dropped from a support that was set up over a force platform (Kistler). The pole was dropped five times for each of the four pole/height conditions: 20 and 40 cm with and without the modification. The pole was suspended by a fish line and the drop height was measured by an anthropometer to ensure repeatable impulses. The force platform was covered with a steel plate to protect it from the carbide tips of the ski pole. The resonant frequency of the force platform was measured to be approximately 780 Hz.

RESULTS AND DISCUSSION

The peak vertical forces for the 20 cm trials were 458+/-66 N and 404+/-45 N for the standard versus modified poles, respectively. The peak vertical forces for the 40 cm trials were 766+/-49 N and 615+/-64 N for the standard versus modified poles, respectively. Thus, the spring reduced the peak vertical force by 11.8% for the 20 cm drop height and 19.8% for the 40 cm drop height. Figure 1 shows vertical force histories for the normal and modified poles for the 40 cm drop. Notice that the spring dissipates the impact forces by spreading the forces over a longer duration and creating negative vertical forces.

The reduced peak forces are comparable to those reported by Wells (1988) for cross-country skiers on snow. Presumably, the spring has reduced the peak forces low enough to prevent stress related injuries.

SUMMARY

In summary, the trials to test the modified ski pole successfully simulated a standard pole plant on a harder than snow surface. The results showed that the forces were reduced by the shock absorbing system that was installed on the ski pole. While the modified pole was successful in a laboratory environment it is essential to estimate its durability and its functionality in a field setting for its use by the general public and athletes.

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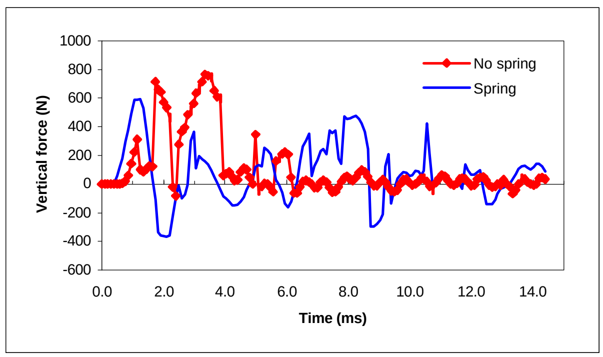

Figure 1: Vertical forces for the 40 cm drop height for modified (spring) and normal (No spring) ski poles.