CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
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Project Number
J0221

Project Title
The Force Absorbed by the Knees and Hips in Ski Jumping

Abstract

Objectives/Goals
Previously I found that landing on the flats in a ski jump can create as much as 23 g's of force at the ankle. The objective in this project was to measure how much of the force of landing was absorbed by the knees and how much was absorbed by the hips.

Methods/Materials
Two accelerometers using a spring and weight sliding on a steel rod attached to a plexiglass plate were constructed. I then attached these accelerometers above and below each of the joints being studied. Wearing appropriate safety gear, I jumped off a variety of ski jumps and noted the force of landing recorded by each of the accelerometers. By subtracting the force recorded above a joint from the force recorded below that joint I calculated the force absorbed by the joint being studied.

Results
On average 75% of the force recorded at the ankle was absorbed by the knee joints, and 52% of the force recorded at the thigh was absorbed by the hips.

Conclusions/Discussion
The majority of the force of landing in ski jumping is absorbed by the knees. A smaller but significant amount of force is absorbed by the hips. Only a small fraction of the total force of landing is felt by the upper body. The knee is the most commonly injured joint in skiing, and this makes sense knowing how much force the knee must absorb.

Summary Statement
I calculated how much force was absorbed by the knees and hips in ski jumping.

Help Received
My mother helped type my report and helped me set up my project board. My father helped me find background information and helped me design and build my accelerometers.