

SPORT EQUIPMENT - ENERGY AND PERFORMANCE

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THREE MAIN CONCEPTS: Energy is the ability to do work. The more energy an athlete or piece of equipment has the more work an athlete can do. Increased work results in an increase in performance, for example a higher jump or a longer throw. From a performance perspective, it is very important to optimize the energy transfer between athlete and equipment. This is generally achieved by:

- maximizing the (conservative) energy which is returned,
- minimizing the (non-conservative) energy which is lost and/or
- optimizing the musculoskeletal system.

ENERGY RETURN IN SPORTS EQUIPMENT: There are many examples of energy storage and return in sports equipment. Vaulting poles, diving boards, trampolines, ice hockey sticks, tennis racquets and other pieces of equipment are successful examples of energy storage and return. In all of these cases, performance in the sport is highly dependent on the energy stored in the equipment. The extra energy returned by the diving board increases a diver's height and flight time allowing the diver to perform more complex dives. The extra energy stored in a hockey stick allows the athlete to shoot the puck faster. In these sports, the objective is to maximize the energy returned, to ensure it occurs in the right location, at the right time and with the right frequency.

ENERGY LOSS IN SPORTS EQUIPMENT: The concept of minimizing the loss of energy attempts to minimize the use of energy, which is not related to performance but would be available to enhance performance if it would not have been spent unnecessarily. Many athletic activities like swimming and skating can be characterized as physical endeavors to overcome external resistance forces. Energy is used to overcome these resistive forces. If the magnitudes of these external resistive forces can be reduced, the amount of energy that is lost combating these forces can be decreased. The net result is that an athlete can perform a given task while expending less energy or use the saved energy to enhance performance. Some examples of such energy loss can include loss due to friction, drag and energy dissipation in materials.

OPTIMIZING THE MUSCULOSKELETAL SYSTEM WITH SPORTS EQUIPMENT: Optimizing the musculoskeletal system utilizes the inherent properties of muscle to maximize performance. By placing muscles into favorable positions where force or power output are maximized, performance can be increased. Subtle changes in equipment can lead to large differences in muscle output and the resulting performance. The position of an athlete on a bicycle, for example, can be adjusted in order to optimize the range in which muscles work to maximize power output

SUMMARY: Over the past 30 years, sport scientists and sport equipment manufacturers have investigated ways of improving athletic equipment to enhance performance. The result is equipment that is stronger, lighter, more durable and more pleasant to use. Consequently, sport performances are faster, higher, longer and more accurate than they used to be. In fact every world record in sport which was set before 1980 has been broken an indication for the recent developments in athletic ability and improvements in athletic equipment.