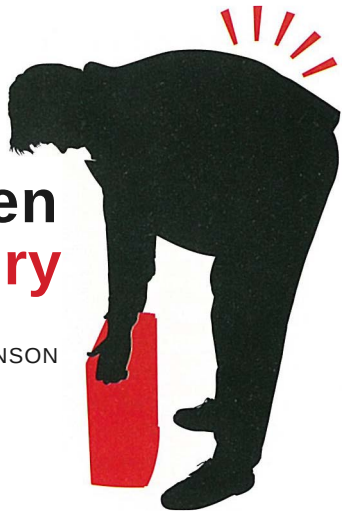
A Mistaken Understanding of Injury



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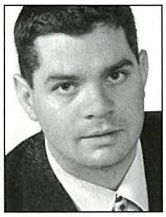

We have all heard the expression the straw that broke the camels back. For biomechanists, it is a simple way to describe a minor event, which results in an unexpected injury. Unfortunately, the concept of a trivial event being responsible for an unexpected injury has been accepted by far too many intelligent people and has led to poor determinations of cause and effect in the insurance and legal industries. However, with a basic understanding of injury, there is some valuable knowledge contained within this expreSSiOn.

An injury occurs when the forces within a tissue (muscle, bone, ligament, etc.) reach a level that is greater than that tissue can handle. Certainly, no one would expect a straw to apply sufficient force to break the back of a camel, or any animal for that matter, would they?

What if the camel had been working, day after day, for many years, walking the same path while carrying the same heavy burden? Like all structures, the body changes with time. With the right amount of physical activity and rest, the body can strengthen, becoming more capable of meeting our demands. However, without adequate rest, the body can weaken, becoming increasingly less resistant to the same demands.

This progressive weakening is the basis for a fatigue related injury. Using the example of the camel, its spine was weakening as a result of too much work and not enough rest. This weakening became so great that the camel was unable to resist even the slightest load. Looking at the repeated demands placed upon the poor camel, the camel's broken back should not have been unexpected. In fact, it was predictable. Just like any other structure, the tissues of our body fail in known patterns. We only need to understand the form and function of the body to appreciate why certain areas are more susceptible to fatigue and injury.

Kiss of death for baseball greats

Take a rotator cuff injury, for example. This is an injury that reportedly precipitated the retirement of baseball greats Curt Schilling and Randy Johnson. This small, deeply seated group of muscles functions to keep the upper arm in place within the socket of the shoulder blade. As a result of their location and purpose, they are active when we move our arms, and when we work with our hands at or above shoulder level. Individuals who experience these demands and positions (like baseball pitchers or some assembly line workers) are required to use the rotator cuff muscles for a large portion of their time.

When active, the force within the muscle can limit blood flow, resulting in damage to the cells of the muscle and subsequent tearing. If inadequate rest is provided, the muscles can break down over time, becoming painful and losing functionality - the "kiss of death" for a major league pitcher. Interestingly, this fatigue injury can happen with little or no change in the other tissues of the shoulder joint. As a result, an athlete or person working a physically demanding job may attempt an ordinary task that they have successfully completed hundreds of thousands of times before and suddenly experience pain. Like the camel, knowing the required demands of a pitcher or industrial laborer makes these injuries predictable.

Discs gone bad

Similarly, disc herniations within the spine are also fatigue-related injuries.[1] Everyone has heard stories of someone bending down to tie their shoe when all of a sudden back pain renders them unable to stand upright. Is it logical that the act of tying your shoes generates significant loads to injure an otherwise healthy back? Not really, otherwise this same individual would have hurt their spine previously.

Like the rotator cuff, the intervertebral discs can be injured by repetitive motion, particularly bending forward or twisting. These movements subject certain areas of the disc to higher stresses than others. If the movements are repeated over and over, these stresses can force the material in the middle of the disc out beyond the edges (herniation). Interestingly, there is evidence only the outer layers of the intervertebral disc contain nerves, which explains why individuals suffering from disc herniations may not report pain or discomfort until there is substantial

progression of the injury. When a person feels back pain while tying their shoe, it is not the incident task that exclusively led to the injury. If so, throwing a baseball or tying a shoe should be viewed as injurious events. In actuality, it is a gradual decrease in the tolerance of the tissue (fatigue) that was responsible for the outcome, not the event itself - just like the camel.

Also, like the camel, these injuries are predictable. If an individual is reporting a torn rotator cuff or intervertebral disc herniation as a result of a motor vehicle collision, it is critically important to determine what their job demands were or what they did outside of work. It may be that the involved person had a history of physically demanding work that required use of the hands at or above shoulder level, or that they were required to do frequent lifting that would require bending and twisting. Often, these demands reflect the correct injury mechanism, where the forces and occupant movement resulting from a motor vehicle collision do not.

Accompanying damage

This is not to say that traumatic rotator cuff tears and disc herniations do not occur. However, when these injuries are traumatic they tend to be accompanied by damage to other tissues in the area. The presence of bone fractures, joint dislocations or ligament tears in such circumstances, is a telltale sign of significant loading in the region.

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One remaining question, which is more legal than biomechanical, concerns the understanding of fatigue-related injuries in the context of the "crumbling skull" consideration. Individuals who are in the process of advancing rotator cuff tears or disc herniations are in an unstable state, as these injuries will continue to progress unless the person seeks intervention or their demands change. However, the time course of these injuries is variable and a single medical imaging study is not sufficient to determine the course of such an injury. For this reason, a thorough understanding of the mechanisms of injury, including fatigue, is required to establish the likelihood a specific event caused an injury.

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1. Referring to disc he1'l1iations not resulting from age related degeneration