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The Economy of Motion

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Introduction

The economy of motion is a term we may not relate with Repetitive Strain Injury (RSI). The Oxford English Dictionary defines economy as "Sparing or careful use of something" [1] and motion as "The action or process of moving or being moved" [1]. Whereas RSI is a general term used to describe the pain felt in muscles, nerves, and tendons caused by repetitive movement and overuse [2]. One can quickly see the two terms possess the words 'movement' and 'motion' in their definitions, which are synonymous. On the other hand, the words 'economy' and 'repetitive,' which are respectively incorporated into both definitions, are not interchangeable. Closer introspection leads one to see that economy denotes sparing and repetitive indicates often. This is where the two terms differ: in their frequency. Yet, economy can also refer to careful, which does not connote frequency.

However, the economy of motion does have some relationship with Repetitive Strain Injury. In ergonomics, we often seek out those motions that are repetitive (frequent or constant use) and tend to view them as harmful to soft tissue structures. We neglect to acknowledge that motions can be repetitive yet "careful," as the above definition states.

As evidence of this, there are some common physiological motions that occur at very high frequencies throughout life, yet very little incidence of RSI occurs. The first is the quadriceps' pull on the patellar tendon during ambulation on level ground. The second is the scapular muscles maintaining the position of the glenoid fossa (to reduce rotator cuff impingement with their attachment on the humeral head against the under surface of the acromion) with arm motion in which shoulder elevation is below 90 degrees. Lastly, the wrist extensors maintaining the wrist in neutral for activities, such as, keyboarding and other manual dexterity activities, to reduce the force requirements on the finger flexors.

At the muscle fiber level there is economy as well. There are slow (red) and fast (white) muscles in the human body and for the purpose of this discussion we will define slow muscles. In general, slow muscles are used more for sustained periods of work. Their fibers are generally smaller than fast and are surrounded by more blood capillaries. Additionally, they have many more mitochondria (the powerhouse of the cell) than fast and contain a large amount of myoglobin in the sarcoplasm. Myoglobin can combine with oxygen and store the oxygen inside the muscle cell until it is needed by the mitochondria. They are also called "red" muscle due to the reddish tint caused by the myoglobin and the copious amount of red blood cells in the capillaries [3].

We must be mindful that not all repetitive motion is harmful. The skeletal system is a system of levers [4] and the muscles and their associated tendons do work to use leverage advantageously, in order to decrease the work necessary for a particular activity. Here is where the body visibly demonstrates this economy of motion. As ergonomic professionals, we need to keep this in mind with each analysis or observation and cease working against this economy. Working against this economy may lead to musculoskeletal trauma, certainly not what we set out to accomplish.

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