

ERGONOMICS FOR THE SAFETY PROFESSIONAL

Upper Extremity – Arms & Shoulders (Part 4 of 6)

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In order to truly understand the importance of ergonomics related to the upper extremities, it is vital to appreciate how it is uniquely formed and thus how it is used. The evolution of arms and shoulders is just one of the amazing reasons for humans' rise to the top of the food chain. Anthropologist, Susan Larson, at Stony Brook University Center described the change in the shoulder's position beginning some two million years ago as human left the comfort of trees and began to stand upright. The shoulder's collar bone (clavicle) and shoulder blade (scapula) transitioned from a more upward and frontal orientation to one that is more horizontal and out to the sides of our bodies. This affords greater joint flexibility and range of motion to move our arms and hands much further around us. That would include the use more tools and ability to throw things with more speed and accuracy. An early wooden spear used for hunting found in Europe dates back to 400,000 years. However, early humans were probably throwing rocks and other items for a much longer period.



When considering ergonomics of the modern-day shoulder, there is a need to balance stability with all that shoulder mobility. Since the evolutionary direction of the shoulder went for extra mobility, the structures of the shoulder are now inherently unstable. This is observed when comparing the shoulder ball and socket design with that of the hip. In the shoulder, the ball is at least three times bigger than the pair-like shallow shape socket unlike the very stable deep socket of the hip joint. The suspended shoulder is now horizontal and out to our sides, the clavicle and scapula need the support of many more muscles to maximize its overall function. There are 14 muscles surrounding the shoulder and 4 muscles holding the ball and socket together.

A key component to keep in mind from an ergonomic perspective is that the scapula contains the shoulder socket. In using our arms and shoulders for work, the shoulder blade constantly changes position letting the socket orientation to be move up or down and backward or forward



motions for added interaction during tasks. For example, lifting one's hand overhead is possible because the scapula now tilts upward resulting in the socket facing upward. The 14 muscles controlling the scapula and the 4 muscles that control surface contact between the ball and socket rely on those muscles to provide critical stability to complete those functional activities. Also, it is quite amazing that 7 of those muscles anchor off the vertebral spines from the lumbar region and all the way up to the base of the skull.

Since the shoulder and arm extend to our sides, another critical job of those muscles is to hold up the weight of the upper extremity. The body will compensate by overusing the upper and middle trapezius along with the other muscles to support the weight. This causes a strain in the neck, most commonly misdiagnosed for a pinched nerve in the neck. This may also lead to impingement syndrome and compression of the four rotator cuff muscles. Ergonomics needs to pay close attention to unsupported arms, particularly in the office setting or where workers will be sitting for long periods, such as piece work and manufacturing areas. If reaching a lot, consider a good pair of insoles to reduce the potential balance issues as your center of mass shifts forward.



The elbow also has a particularity to its structure referenced as the “carrying angle”. Extending one’s arm out and looking along the humerus, one will notice a slight bend at the elbow to the outside. The bend is smaller in males but greater in females. It permits the ability to carry objects without hitting your legs, thus the “carrying angle”. The greater angles in females have been associated with their smaller shoulders and larger hips than the average male population.

The image on the left shows the many wrist and finger flexor muscles used for gripping items that anchor off of the humerus above the inside of the elbow. Continuous grasping and gripping motions will create tighter muscles that need more attention to stretching throughout the workday. Since the muscles attach above the elbow, the fingers and wrist stretching should be performed with the elbows in the extended position.

Three ergonomics elements for the upper extremities are: 1. Unload or support the weight of the arms whenever possible, 2. Keep work or tasks performed within the primary zone (elbows by your side to finger tips), and 3. Consider stretching to the upper extremities throughout the day, breaks and lunch time included.

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