
# SUPPORTING WORKER PERFORMANCE & PRODUCTIVITY

*with Ergonomic Glove Design*

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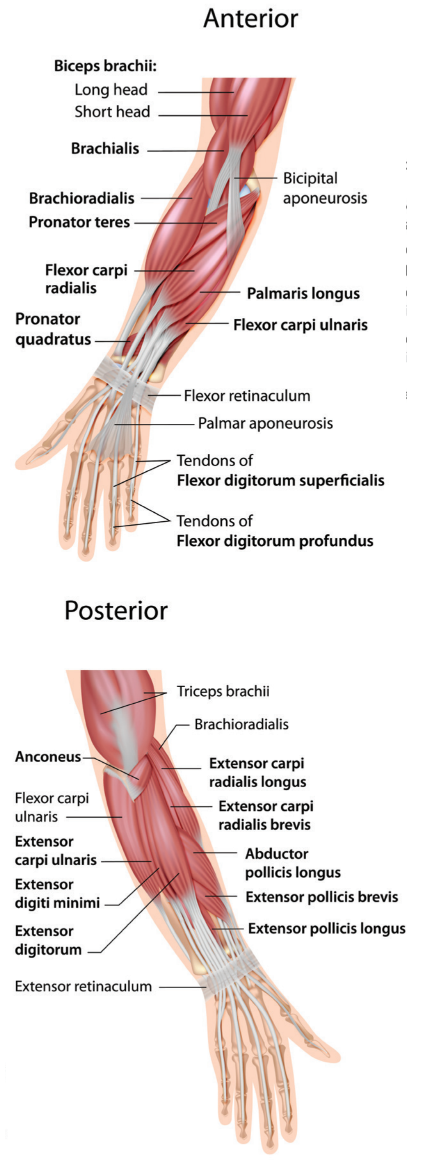
In every industry, from life sciences to manufacturing, workers rely on their hands. And when performing a variety of different tasks, individuals must wear gloves to protect either themselves or the products they work with. The glove a worker wears is important, and can support his or her comfort, performance and productivity by providing the dexterity, grip, tactility and muscle control vital to getting the job done right.

Not all gloves are created equally though, and selecting the glove best suited for the environment as well as the specific application can have a measurable impact on worker health and productivity. This article looks at key considerations for selecting single-use gloves that minimize muscle effort and reduce the risk of ergonomic injury, thereby bolstering worker safety and improving the employer's bottom line.

## ANATOMY OF THE HAND

The human hand is a complex and delicate structure. Comprised of approximately 24 small bones called carpals, metacarpals and phalanges, it also consists of more than 120 ligaments, 48 nerves and 30 arteries.[1] The two bones of the lower arm, the radius and the ulna, meet at the hand to form the wrist, and the median and ulnar nerves run the length of the arm to transmit electrical impulses to and from the brain to create movement and sensation.[2] It is estimated that roughly 25 percent of the motor cortex in the human brain (the part that controls all movement in the body) is devoted to the muscles of the hands.[3] Because the musculoskeletal systems in the hand, wrist and forearm work together as an intricate unit, the dysfunction of a single part often requires consideration of the whole.[4]




*Muscles of the Forearm (right arm)*

## THE ROLE OF ERGONOMICS IN HAND PROTECTION

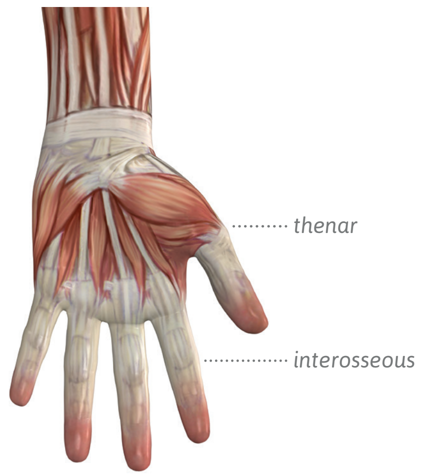
Ergonomics refers to the interaction between a human's musculoskeletal system and his or her workspace. Various job functions expose workers to risk factors for musculoskeletal disorders (MSDs), such as those conducted at awkward angles or overhead, involving pushing and pulling heavy objects or performed repetitively. With increased knowledge of ergonomic best practices, personal protective equipment manufacturers are able to develop products that protect workers from the risk of MSDs and injury.

When considering the role of ergonomics in hand and glove use, four main muscle groups are involved. **The two primary muscle groups required for hand and finger exertions include the powerful forearm flexor muscles, located at the top of the forearm, and the extensor muscles[5], located in the back of the forearm.**

More than 14 extrinsic flexor and extensor muscles span the length of the forearm, originating at the elbow and inserting at the hand.[6] Together, these large-muscle groups deliver grip strength and general range of motion – essentially all gross motor skills conducted with the hands. Examples of forearm flexor and extensor muscle use in the workplace include lifting or moving heavy objects, manipulating large equipment or climbing ladders.

The smaller-sized primary hand muscles, the interosseous and thenar muscles, originate and insert within the structure of the hand.[7]

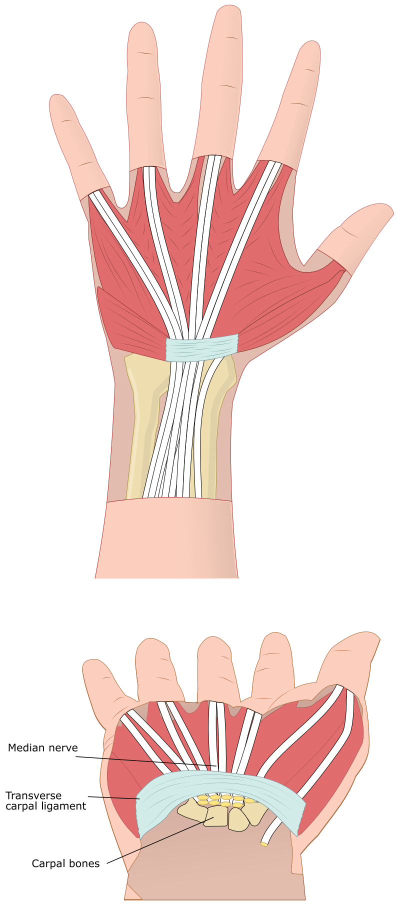
The interosseous muscles lie between the metacarpal bones in the hand and are important in moving individual fingers, while the thenar muscles are located at the base of the thumb, in the fleshy muscular area on the palm side of the hand. Together, these muscle groups are responsible for enabling pinching and gripping tasks conducted by any of the fingers and/or thumb. Most susceptible to fatigue, these small muscles are employed in a multitude of tasks requiring fine motor skills and dexterity across a wide variety of applications, such as the manipulation of small vials, test




*Muscles of the Hand*

tubes and instruments such as pipettes in laboratory settings; manipulation of handpieces conducted in dentistry; handling small hardware, wires and wiring harnesses in automotive applications; and even daily writing and typing tasks performed across industries.

Also important in the hand's anatomy as it relates to ergonomics is the carpal tunnel, a narrow passageway of ligament and bones at the base of the hand.[8] The median nerve and tendons housed there are involved in nearly every aspect of hand movement, and are therefore especially prone to strain and injury.




*Carpal Tunnel*

## EFFECTS OF HAND FATIGUE

When workers carry out demanding, tedious or repetitive job functions, the muscles, nerves and tendons in their hands, wrists and arms are susceptible to strain. Such strain can result from either bare-handed or gloved operations, but can be exacerbated by glove use when the gloves are thick, rigid, slippery, ill-fitting or otherwise uncomfortable. In fact, **when a person wears a glove that restricts movement, he or she must exert more muscle effort to perform tasks, thus increasing the risk of strain.**

Over time, strain caused by repetitive motion or prolonged exertion can lead to muscle fatigue, pain and even injury.

Occupational musculoskeletal disorders (MSDs), such as Carpal Tunnel Syndrome and tendinitis, are a leading cause of lost workday injury and illness.[9] In fact, MSD cases accounted for 33 percent of all worker injury and illness cases in 2013, according to the U.S. Bureau of Labor Statistics.[10]

In the case of Carpal Tunnel Syndrome, repetitive stress causes swelling and inflammation of tendons, creating pressure on the nerves. Symptoms typically start gradually, with burning, tingling or numbness in the palm and fingers.

As symptoms worsen, individuals may experience decreased grip strength, making it difficult to carry out basic manual tasks. Left untreated, Carpal Tunnel Syndrome can result in significant, permanent muscle loss at the base of the thumb.[11] In other overuse injuries, swelling of nerves, tendons and ligaments can result in similar sensations of pain, tingling, weakness and numbness in the fingers, hand and wrist, and can even radiate into the arm, making manual work difficult to impossible to conduct.

The combined cost of lost wages and production, medical expenses and worker's compensation resulting from hand injuries results in a sizable financial toll on individuals and employers alike. Therefore, in any environment where the risk of stress-related hand injury exists, an ergonomic process that uses the principles of an Injury and Illness Prevention Program to address MSD hazards should be considered.[12]

## SELECTING A SINGLE-USE GLOVE

Selecting high-performing, single-use gloves with a certified ergonomic design is a trusted method for reducing muscle effort and supporting occupational hand health and productivity. First and foremost, a protective glove style should be selected based on hazard type and functions being performed. Then, selection may vary based on many factors.

### *Glove Strength and Elasticity*

The strength of a single-use glove is of utmost importance to maintaining its protective qualities. However, strength alone can actually work against the ergonomic properties of a glove. Elasticity and modulus are measurements of the glove's ability to stretch and how likely it is to return to its original shape. Taken together these metrics help us understand and quantify how soft or comfortable a glove film may be, as part of a larger equation of overall comfort.

A stiffer glove requires more muscle effort to conduct tasks thereby increasing musculoskeletal pressure, stress and risk of injury. When selecting single-use gloves, look for those that deliver a high level of glove strength, but are constructed of highly pliant materials to ensure both protection and comfort.

### *Fit and Grip*

A glove that is carefully designed to deliver optimum fit ensures superior comfort and maximum range of motion. At the same time, the amount of grip a glove delivers plays a major role in the amount of muscle effort required to securely handle, hold or manipulate objects. Ultimately, innovations in formulation, material type, and texture all contribute to a softer, more comfortable, better fitting and better gripping glove that supports the muscles and the worker alike.

### *Ergonomic Design*

**ERGOFORM™ Ergonomic Design Technology** is a new technology that enables Ansell to design hand protection that supports musculoskeletal health during repetitive tasks and improves worker performance. Ansell is the only disposable glove manufacturer to offer ergonomically certified gloves. Ansell does this by measuring the toll of occupational activities and apply cutting-edge technologies to engineer solutions that maximize the dexterity, comfort and fit of single-use gloves.

Through its ERGOFORM design technology, Ansell applies knowledge of typical muscle use in common tasks and produces gloves that alleviate muscle strain and tension. The strategic design results in an improved fit and feel for workers, and laboratory tests prove that products designed with ERGOFORM technology markedly reduce muscle effort when compared to competitive products. Over time, the use of ERGOFORM designed gloves may lead to less downtime and fewer injuries, and therefore more consistent levels of quality and productivity.

### *Measuring Ergonomic Toll*

With ERGOFORM design technology, exertion measurements and comparisons are based on specific tasks, such as flexion (opening and closing the hand), pinch grasp (holding a common instrument) or grip friction (completion of a standard precision task). Measurements are evaluated in two ways. The first is by conducting controlled user surveys evaluating comfort and user experience, both before and after tasks are conducted. Survey criteria may include performance, fit, comfort, tactile sensitivity, ability to appropriately don the glove and gripping ability. The second is by taking electromyography measurements which quantify the amount of muscle effort exerted by individual muscles in the hand during assigned tasks.

Once measurement data is collected, it is analyzed to determine how glove performance compares to data collected in bare-hand operations as well as those taken during the wear of comparable products. Based on those findings, Ansell designs products that deliver measurable improvements in user comfort, fit and productivity while reducing the risk factors associated with ergonomic injury.

## SELECTING ERGONOMIC GLOVES

To ensure the selection of single use gloves proven to strategically alleviate joint, tendon and ligament strain and associated injury, look for those marked with Ansell ERGOFORM Ergonomic Design Technology. Only products with these certifications have been tested in state-of-the-art ergonomics laboratories and are proven to provide measurable advantages to user comfort and long-term hand and arm muscle health. Ansell single-use glove products that are currently ERGOFORM certified include:

**Microflex® 93-833**

**Microflex® 73-847**

**TouchNTuff® 73-300**

**TouchNTuff® 73-500**

### *Conclusion*

Workers rely heavily on their hands to conduct tasks of all kinds, but long-term strain and muscle exertion are recognized risk factors that lead to various MSDs and injuries in nearly every occupation. By understanding the key roles different muscle groups play in performing tasks and applying its expertise in safety glove manufacture, Ansell has developed innovative solutions proven to help reduce muscle strain and tension – and even improve muscle performance – in the hand, wrist and arm. When employers supply workers with ergonomically-designed, single-use gloves, they can minimize the risk of injury, support compliance, improve worker safety and increase productivity.

## *For more information on Ansell ERGOFORM Ergonomic Design Technology visit www.ansell.com/ergoform*



1. ASSH (American Society for Surgery of the Hand), “Hand Anatomy”
http://www.assh.org/handcare/hand-arm-anatomy
2. Southern California Orthopedic Institute, “Anatomy of the Hand”
http://www.scoi.com/specialties/anatomy-hand
3. EatonHand.com, The Electronic Textbook of Hand Surgery, “Hand Facts and Trivia”
http://www.eatonhand.com/hw/facts.htm
4. St. Anthony’s Hospital, “Anatomy of the Hand and Wrist”
http://www.orthopedics.stanthonyshouston.com/anatomy-hand-wrist.html
5. Wikipedia, “Extrinsic extensor muscles of the hand”
https://en.wikipedia.org/wiki/Extrinsic_extensor_muscles_of_the_hand
6. Livestrong.com, “Flexor & Extensor Muscles in the Forearm”
http://www.livestrong.com/article/505780-flexor-extensor-muscles-in-the-forearm/
7. Ground Up Strength, “The Intrinsic Muscles of the Hand: Thenar, Hypothenar, Interossei and Lumbricals Muscles”
http://www.gustrength.com/anatomy:intrinsic-hand-muscles
8. National Institute of Neurological Disorders and Stroke, “Carpal Tunnel Syndrome Fact Sheet”
http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm
9. U.S. Occupational Safety & Health Administration, “Prevention of Musculoskeletal Disorders in the Workplace”
https://www.osha.gov/SLTC/ergonomics/index.html
10. U.S. Bureau of Labor Statistics, “Nonfatal Occupational Injuries and Illnesses Requiring Days Away from Work, 2013”
http://www.bls.gov/news.release/osh2.nr0.htm
11. National Institute of Neurological Disorders and Stroke, “Carpal Tunnel Syndrome Fact Sheet”
http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm
12. U.S. Occupational Safety & Health Administration, “Prevention of Musculoskeletal Disorders in the Workplace”
https://www.osha.gov/SLTC/ergonomics/index.html

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