

Innovative Methods to Reduce Musculoskeletal Injuries in the Workplace

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Introduction

Musculoskeletal injuries (MSDs, CTDs, RSIs, RMIs) tend to be challenging for employers in any industry. In today's corporate environment virtually every employer has or will soon have an aging workforce. Soft tissue conditions alone can be a significant problem but adding the potential challenges of a growing aging workforce and we have a bit more to contend with these days.

Over the last 18 years, the author and his colleagues have worked in clinical settings, in training rooms with collegiate and professional athletes and in 255 manufacturing or service related industrial facilities, designing and implementing unique initiatives to reduce soft tissue strains and repetitive stress injuries. Listening and learning from employees in the trenches, working with health and safety professionals, ergonomists, benefits and HR managers, health-care professionals and government agencies has proven essential in developing effective musculoskeletal initiatives that render positive results while being mindful of governmental rules and regulations.

Participants of this presentation shall understand the nature and causation of soft tissue disorders, while realizing cost effective mechanisms through which to halt and reverse the process. Learn how a multitude of small to large employers have succeeded in their efforts in reducing recordable injury rates, lost time and associated medical expenses, by implementing muscle and joint wellness and first aid programs that professional athletes and teams have known about for years.

Prior to proceeding, I would like to preface this writing with an opinion statement, that a quality ergonomics program should be the cornerstone of preventing workplace musculoskeletal injuries. The programs and initiatives discussed in this paper should be viewed as a compliment to an ergonomics program.

Why Soft Tissue Injuries Are So Misunderstood

Strains, sprains, and repetitive stress injuries tend to all fall into a single classification in the Health and Safety community and are collectively referred to as MSD's or musculoskeletal disorders or injuries. The term, "soft tissue injuries" is often used to address such conditions as well. Regardless of the name or the mechanism in which such injuries occur, the end result, which impacts the individual employee, is pain. Pain may come in the form of tingling, numbness, shooting, stabbing, throbbing, aching or a combination of them. There are many levels of pain that an individual may face. The first challenge in dealing with issues involving pain is that pain is subjective and only the individual experiencing it really knows that it is there and how severe it is. The second challenge is actually discovering the internal source of the pain. Fibrosis or scar tissue formation on or in between muscles (or other soft tissues) is often a primary culprit in many MSD's seen in industry.

There are particular tests commonly used by healthcare professionals to recreate classic symptoms. Let's take carpal tunnel syndrome as an example: "In the Tinel test, the doctor taps on or presses on the median nerve in the patient's wrist. The test is positive when tingling in the fingers or a resultant shock-like sensation occurs. The Phalen, or wrist-flexion, test involves having the patient hold his or her forearms upright by pointing the fingers down and pressing the backs of the hands together. The presence of carpal tunnel syndrome is suggested if one or more symptoms, such as tingling or increasing numbness, is felt in the fingers within 1 minute. Doctors may also ask patients to try to make a movement that brings on symptoms." (NINDS 2012) When conditions escalate to more severe levels, most payer entities (insurance companies) will require a more objective validation that a nerve entrapment or compromise exists. This is done with an electro-diagnostic test or nerve conduction velocity (NCV) test. Although this is a respected form of evaluation, both false positive and false negative results can occur.

X-rays are more relevant for fractures and in determining if arthritis exists. Particular types of Ultrasound machines can demonstrate nerve movement but the reality is that most doctors' offices do not possess such sophisticated ultrasound devices. MRI reveals the anatomy of a region but has not proven to be effective in determining the exact location of particular entrapments. Some practitioners believe this to be due to scar tissue having very similar water density to the structures around it. So two muscles or even a nerve may be entrapped by an adhesion, comprised of scar tissue, yet the MRI depicts this as part of the muscles.

So what all of this means is that demonstrating that scar tissue or an impingement exists is not easy. Fortunately today, manual soft tissue therapies have become much more main stream and accepted both in clinical and corporate settings. In fact OSHA recognizes massage as a component of it's permitted forms of first aid (OSHA 2001).

Over the past 20 years particular providers of soft tissue therapies have raised the bar and developed in-depth hands-on soft tissue palpatory evaluations in which tissue textures are taken into consideration, in conjunction with traditional evaluation processes. The common trend reported by such therapists is that scar tissue has a unique texture that can be felt, by an individual with a well-developed sense of touch. So, what doesn't always appear on an imaging device may be identified via a hands-on evaluation involving palpation.

Understanding the Causation of Common MSDs

Both the Law of Repetitive Motion and the Cumulative Injury Cycle are effective tools to explain how muscle and soft tissues can become compromised with scar tissue, leading to impingements and pain.

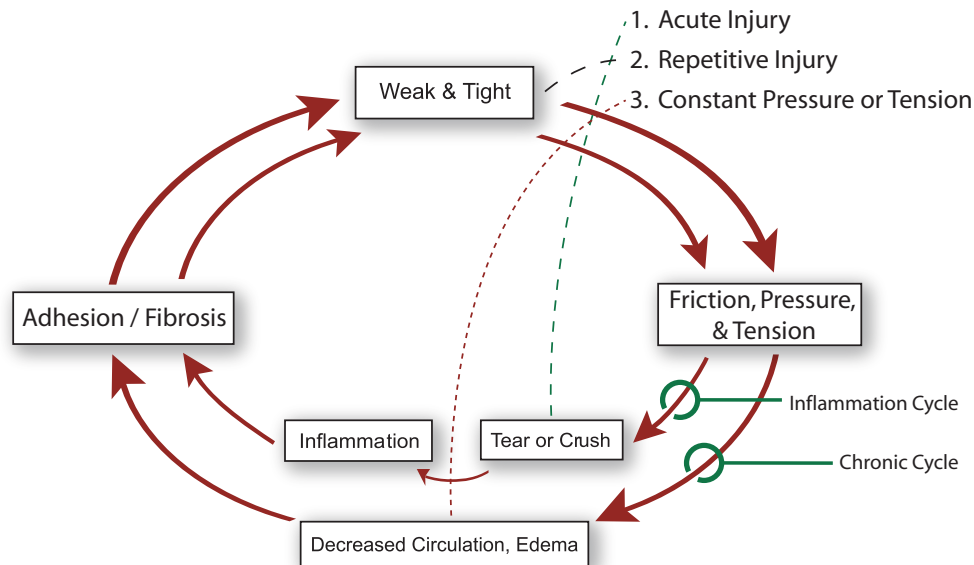


Exhibit 1. The Cumulative Injury Cycle: How RSI's and strain/sprain injuries occur. (Leahy 2008)

The diagram shown in Exhibit 1 demonstrates how scar tissue develops via repetitive stress or strain/sprain. With repetitive stress the individual is usually performing a repetitive task in a compromised position. The muscles and soft tissues are **under increased friction, tension, and pressure** for extended periods of time. When certain areas of the body are under such prolonged compression and stresses, there is a decrease in the blood circulation to the area, resulting in a decrease in Oxygen delivery. When this occurs at a particular pressure level, a series of chemical reactions takes place, resulting in the development of scar tissue adhesions (fibrosis). The fibrotic tissues cause muscles to become compromised, tight, and weak. The cycle continues and tends to become worse with time.

When an individual suffers a true strain or sprain, this cycle begins with the tearing or crushing of the tissues, followed by inflammation. Once the condition enters the healing process, the scar tissue begins to develop and the cycle continues, as with a repetitive stress condition. The only way to stop the cycle is to effectively release or remove the adhesion with an effective intervention.

$$I \approx \frac{NF}{AR}$$

I: insult to tissue

N: number of repetitions

F: force required to perform a repetition

R: relaxation or rest between repetitions

Exhibit 2. The Law of Repetitive Motion.

(Leahy 2008)

The Law of Repetitive Motion, as shown in Exhibit 2, details the four primary factors that contribute to the development of an injury or “Insult” to the tissues.

In an industrial setting a health and safety professional and/or ergonomist will strive to manipulate these factors to reduce the “I”. The “N”, or number of repetitions performed by an employee is not always easily reduced, without negatively impacting production, but it is commonly advised to rotate jobs so that the “N” can be lessened. Reductions of the “F” (Force) may be accomplished with ergonomic modification, when possible. Some companies, such as General Electric in Arkansas City, KS, have developed strengthening programs for employees to fortify particular joints and increase the employees’ ability to render the needed Force, more easily. The “A” for amplitude, is a factor that can be challenging to modify. Smaller repetitive movements tend to yield more repetitive stress conditions, where large movement (greater amplitude) yields fewer. The Amplitude can be manipulated with ergonomic improvements, when possible. The “R”, which stands for rest, tends to be the simplest and most cost-effective factor to manipulate. Rest does not necessarily mean being passive. An effective form of Rest can be accomplished via, micro-break stretches, designed specifically for muscle groups, used by the employee during a repetitive task/job. By placing muscle groups in opposite, or simply different positions, it is believed that muscles and joints stay loose and an improved supply of Oxygen rich blood will reach the region, decreasing the likelihood of scar tissue formation. (Johnson 2011)

Successful MSD Halting Interventions

In 2006 an EH&S professional, Mary Betsch, was working at a manufacturing facility, Trane, in Pueblo Colorado. At the time this facility employed approximately 700 individuals. The nature of the work was physical, heavy and considerably repetitive. This facility did strive to improve by investing significant dollars, time, and efforts in ergonomic improvements but were still challenged with higher OSHA recordable injury rates, and approximately \$800,000 in workers’ compensation claims in a single year with the majority attributed to MSD’s. At Trane the employees that performed the more physically demanding jobs were often referred to as “industrial athletes”. So when the traditional interventions simply weren’t delivering the desired outcomes Betsch chose to bring in an on-site musculoskeletal program that had demonstrated effectiveness at other facilities in CO. Mary sought out approvals from her facility upper level management and from local OSHA representatives and moved forward with designing and implementing a preventative program, which incorporated very specific soft tissue massage to maintain the muscle and joint systems of her workforce. Rather than solely reacting to injuries

Trane utilized soft tissue therapies to prevent injuries. Employees were educated about the type of therapy that was made available and encouraged to utilize the service periodically from a joint and muscle “Well-check” standpoint. Employees would visit the soft tissue provider and explain about the regions of the body they utilize regularly throughout the day. The providers also visited the jobs sites and witnessed the movements and the muscle groups that were required, which gave them an improved understanding of the employees’ physical challenges. Then during a very brief preventative therapy session the provider would work on the joints and specific muscle groups that the employees utilized the most, while on the job. The soft tissue providers were viewed as maintenance technicians, but for the employees muscular and joint systems. A significant amount of the program was preventive and employees were even encouraged to utilize the soft tissue program for non-work related discomforts that arose from posture, sleeping positions, sports, or hobbies, since these activities can cross over into the work-place impacting performance, productivity or may become a work related condition. This form of massage was also offered as a first aid care option to employees with minor, early in onset, tolerable discomforts that had not crossed the OSHA recordable injury threshold. In having this care-option available to employees it became simple and comfortable for employees to report discomforts early and frequently, such cases were prevented from escalating to more significant levels. Because data was captured on every employee case, Betsch was able to focus on continued ergonomic improvements at a more specific level. Preventative micro-break stretching programs, to promote circulation were also implemented. This facility realized greater than 75% reduction in both MSD related soft tissue recordable injuries and expenditures from a workers’ compensation claim standpoint.

Important Notes Regarding Preventative Soft Tissue Programs And Exercise-based Initiatives

Prevention is the ideal.

- Put emphasis on utilizing your soft tissue provider to keep your workforce’s muscular and joint systems well.
- When using a soft tissue therapy, from a reactive standpoint as a first aid offering, make sure the type of soft tissue therapy, is an accepted form of “massage,” by the Department of Labor. If the employee’s condition is mild and tolerable and has not exceeded the OSHA recordable threshold then the massage may be used as a first aid option.
- Exercise in the form of stretching programs and or strengthening should be preventative in nature. OSHA interpretations state that if either stretching (OSHA 2011) or strengthening (OSHA 2010) is taught, coached, or instructed to employees in response to a work-related musculoskeletal discomfort, injury, or occurrence it is considered a form of therapeutic exercise and therefore physical therapy which would result in an OSHA recordable injury.

To Stretch or Not to Stretch

Why stretch pre-work or pre-sport? This is a surely a debated topic. Opinions on both sides of the fence exist but little to no good research exists indicating that stretching prevents injuries. Private companies exist throughout North America, that deploy on-site stretching programs and have reported injury reductions and cost savings, but attributing cost savings can be challenging since most employers also have other initiative in place such as ergonomics programs and related wellness offerings. So do we just do stretches to make employees flexible and hope it keeps them

injury free? The author feels there are merits to stretching but a logical reason and plan must exist.

The goal of a stretching program is almost always the same...to prevent strains and repetitive stress.

We often only think of stretching as an activity to help prevent a pulled muscle. There is actually a lot more that can be achieved by stretching but a departure from the traditional 10 - minute group stretch program may be necessary.

We discussed the Law of Repetitive Motion and the Cumulative Injury Cycle earlier in this paper and established or noted that when/if a person keeps a muscle or region tight, for a prolonged period of time, a reduction of blood flow may occur. The reduction in Oxygen rich blood delivery to a targeted site causes a stress at a cellular level. Over 20 years ago, a group of histologists, in Great Britain, determined that when a particular internal pressure is achieved, a series of chemical reactions takes place with an end product being fibrinogen, which is a technical word for scar tissue formation. So this educates us regarding how an individual can simply keep a muscle tight (possibly working, playing a sport with poor biomechanics, or due to posture) and, over time such stress could lead to injury. The Cumulative Injury Cycle explains how a strain/sprain occurs, but also how a strain that was never fully resolved can worsen, accumulate more scar tissue and then strain again and/or can cross over and become an over-use or repetitive stress condition. It is the opinion of the author that stretching, done correctly, can very much so assist in preventing MSD's from occurring.

Implementing a Micro-break Stretching/Movement Program

Improving circulation to regions of the body kept tight throughout the day seems to be the logical step. Much of this can be improved with ergonomics and job rotations, but placing the region of the body in opposite positions from what a job requires or simply performing a dynamic movement in a different manner may speed up the circulation to the targeted body part. This increased circulation should, theoretically reduce the propensity for the pressure to increase internally and therefore prevent the individual from developing a repetitive stress injury. But an employee's job traditionally last 8 to 10 hours. Most employees, if at all, only stretch once per day, and such stretches tend to be performed in a very general manner.

The author, based on working with over 250 employers, feels that performing multiple micro-break stretching routines should have a more profound influence on the promotion of circulation. By promoting circulation (and oxygen delivery) to regions of the body, kept tight during the workday there should be a reduction in overuse injuries. Stretches should be specific, brief (so as to not take away from productivity) and performed multiple times, during natural breaks in the work process. Stretches do not all have to be static, as dynamic (movement based) can surely promote circulation too.

Tips for a Micro-break Stretching/Movement Program

1. Have each job description analyzed by a healthcare professional trained in biomechanics (exercise physiologist, PT, chiropractor).
2. They should ask the employees detailed questions about performing the job such as, “specifically where do you get sore from doing this task.”
3. If permitted, ask the therapist if he would like to try doing the job for a given amount of time, so that he can experience the physicality first hand.
4. The trainer should then design brief micro-break stretches that are specific to the musculature the employees use while on a particular job-task. The stretches must be realistic for employees to perform during moments of downtime. No more than 3 stretches per job-task with each stretch taking no more than 10 seconds. You will likely not be using stretches where employees have to sit or lay on the floor, so all stretches should be able to be done standing or sitting.
5. When employees job-rotate their stretches should change with each job, if different sets of muscles are being used.
6. Have the exercise professional utilize enough variety so that stretching doesn't become boring.
7. Develop stretching flyers with pictures of each job description and its associated stretches being performed by an actual employee. The employees can put these flyers up in their workstations.
8. Produce stretching DVD's that can be looped or played somewhat regularly on break room TV's. These should have actual employees working and stopping, during a natural break, and performing their micro-break stretching series.
9. Form a stretching leadership team or committee. Recruit employees that are charismatic and respected by all. Have the exercise professional teach all of the people on this team how to perform the stretches correctly. Team members should set the trend and commit to performing their stretches throughout the day. The intent is to lead by example. When employees see others, who they like and respect, performing the stretches regularly, they will be more inclined to copy them.
10. If you are involved with opening a new facility build stretching into each job description from day 1. It will be much easier for the employees to perform and for management to support when stretching is built into the process.
11. Prior to starting a stretching program provide the employees with an educational session on why stretching is important, with a focus on circulation. Allow employees to report if they possess any health issues that may not allow them to perform stretches. This should be reported to your company nurse (if applicable) or to a health and safety professional.
12. Have a healthcare professional screen the participating individuals prior to start and make sure your legal department provides proper liability forms to participants.
13. On a health and safety day(s) have the exercise professional teach all of the employees the appropriate manner in which to perform each stretch.
14. Stretching leaders are to set the trend and lead by example.
15. If possible have healthcare providers capture baseline data inclusive of joint ranges of motion. This data can be compared to normative data.
16. Provide and collect feedback questionnaires. Employees will let you know how much they appreciate such offerings and such feedback can be helpful in continuing and even

increasing such programs in the future. Improvement or changes can also be addressed from this feedback.

IMPORTANT: Stretching programs managed in the manner above should only be done from a prevention and wellness standpoint. Teaching, requiring, coaching and employee in particular stretches, in response to a particular soft-tissue symptom or complaint will trigger an OSHA recordable injury, as it will be construed as physical therapy. Only allow licensed healthcare providers to manage the therapy for such cases.

Functional Assessments – Not Just for Return to Work

Functional capacity evaluations have existed for many years and have often been utilized to objectively demonstrate a person's abilities or inabilities to perform particular job functions, activities of daily living and even sports performance capabilities. Companies and insurance carriers rely on this data to make safe decisions about employees return to work. These tests can provide guidance for ergonomic and or workload modifications as well as disability ratings and pension eligibilities.

The author has noticed a shift by employers in the utilization of related tests, to a much more prevention-driven model. Corporations are utilizing health service suppliers, often in the rehabilitation or occupational medicine arena, to provide a number of functional screenings to employees and new hires prior to the occurrence of injury.

Physical demands evaluations (PDE): This evaluation focuses on essential functions of a particular job. By having a PDE in place for each job an actual screening can be applied with much greater specificity for each applicant.

Post Offer Screens: Makes sure a job candidate is not placed into a roll that may result in injury. This screen provides baseline data on each individual and identifies pre-existing conditions and physical limitations.

Selective Functional Movement Assessment: Is a series of seven full body movement tests designed to assess fundamental patterns of movement such as bending and squatting. Compromise is identified via analyzing the individual's movements. Exercises or manual therapy may be recommended to correct or fortify the individual for their job. This is assessment can be used to prevent poor movement patterns from resulting in injury.

Ground-Up Ergonomic Compliments

A large percentage of manufacturing, service, or construction companies require employees to work on their feet. Much study, interventions and improvement have been put on prevention of slip and falls as well as proper lifting or material handling. New trends in both lifting-training as well as general work-performed-while-standing are focusing on the foundations of our bodies = our feet, ankles, and leg positioning.

A traditional lift involves a shoulder width (or slightly wider) squat which transitions into a standing position. Depending on the awkwardness of the object being lifted, this often leads to the upper body leaning forward, compromising one's center of gravity.

From an engineering standpoint, a wider foundation tends to provide greater stability of a structure. This philosophy has transferred over to material handling. The majority of proper lifting guidance has remained the same with one change. Some call it a "Sumo" stance. It simply involves a wider stance with toes slightly outward. Exercise and biomechanics professionals are finding that such positions allow for more quadriceps, gluteal, and hip involvement with less low back compromise and less forward lean compromise. Various professional groups exist that consult with safety professionals in designing such wide-stance material handling programs, specific to each industry. Although the concept is relatively simple, it is recommended that each job description and the materials being handled, be evaluated to determine appropriateness and the most ideal manner in which to apply a wide stance lift. **Note:** This lifting method is still considered relatively new, so it is not formally recommended by government agencies.

Ankle Alignment and Its Relevancy to Injuries

As health and safety professionals we are often expected to manage ergonomic modifications involving workstation set up, tools, and processes. But what if the employee comes to work with a physiological issue that is so common that we perceive it as normal. What if that issue makes that employee more susceptible to injury? This is actually very common with our feet and ankles.

Before going any further it is important to understand a few terms that describe the shape or tendency of ankles. When looking straight on at the front of your lower legs and feet, with your feet aimed forward if you notice that your ankles bow outward, this is called supination. If the ankle bows inward it is called pronation. If the ankle is relatively straight this is called neutral. When an individual has a pronation or supination it tends to become more significant during a dynamic movement phase such as walking or squatting. Having ankles that pronate is quite common. Ankles that supinate are less common, but still a significant population has this. When an individual possesses either, or a combination of both, this usually is accompanied by foot, knee, hip or low-back pain. This compromise can and does put an employee in a weaker and less than optimal starting point, prior to the workday even beginning. When one bends or squats and their kinetic chain is not well aligned the chances for injury escalates. Improving or correcting this issue is actually fairly simple and affordable. Many companies provide some sort of footwear financial support to employees. Often the thought is solely to provide a durable shoe or boot with particular protections, such as steel toes. Quality insoles now exist that provide support in the form of a raise or lift, to lateral or medial aspects of the heel. This results in correcting of a pronation or supination of the ankles, which often assists in aligning knee movements and leveling the hips. Collectively this allows the individual to stand, walk, climb stairs, or squat in a state of proper (or improved) alignment. This also translates to greater comfort, strength, power and endurance. Note: There are numerous suppliers of such insoles. Some will provide complete evaluations of a workforce as part of their service. Such insoles are not to be confused with orthotics, which are traditionally custom made (with a mold or foot scan) by a health care provider.

Conclusion

Every facility has different challenges from a musculoskeletal standpoint. At some facilities the concern is that the employees are sedentary, while in others, the movements and physical/repetitive demands take their toll on the workforce. Fortunately today there are many fine interventions, wellness programs and ergonomic modifications to choose from to help minimize the exposures and related expenses of soft tissue conditions. The intent of this paper is to share some Health and Safety professional's innovative experiences and outcomes and to enlighten the reader about relatively new concepts that may be applicable to your workplace.

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