From Strain to Tenderness: A Short Communication Navigating Repetitive Strain in Skeletal Muscles

Himanshi[1], Shilpa Jain[2], Charu Chhabra[3]

1. Student Researcher, School of Physiotherapy, Delhi Pharmaceutical Sciences and Research University, Sector- 3, Pushp Vihar, New Delhi
2. Associate Professor, School of Physiotherapy, Delhi Pharmaceutical Sciences and Research University, Sector- 3, Pushp Vihar, New Delhi
3. MPT Student, Department of Physiotherapy, Jamia Hamdard University, New Delhi

Abstract

"Repetitive strain injury," or "RSI," is a broad term for pain and discomfort felt in muscles, nerves, and tendons that often develops with lengthy repeated movement of the same body parts and finally leads in an overuse of those body parts. Sarcomeres are the building blocks of the fiber-shaped fascicles known as myofibrils, which are composed of the muscle fibers (cells) that comprise skeletal muscles. Soreness might develop immediately after intense physical exercise or later. The immediate discomfort may be due to the brief hypoxia caused by muscle ischemia or the metabolic byproducts of metabolism that affect free nerve terminals. Muscle shortening and lack of strength lead to the development of muscle discomfort.This can be lessened to some extent if the proper procedures are followed. It has been shown that the RICE routine, yoga, and stem cell therapy can all speed up the healing process. Receiving the right therapy can help reduce the chance of changes happening again and make it easier to resume regular daily activities.

Keywords: repetitive strain injury, chronic muscle soreness, treatment for repetitive strain injury, skeletal muscle, anatomy pathophysiology

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Introduction

Repetitive strain injury (RSI) is a common health risk that affects people in a variety of vocations in today's fast-paced, technologically-driven environment (Jain et al., 2021; Shuttleworth, 2004). Chronic skeletal muscular pain can result from repetitive actions performed during laborious work, extended screen use, or other activities that cause repetitive strain injuries. In order to shed light on the intricate connections between RSI and chronic muscular soreness, this essay will analyze its causes, symptoms, and recommended courses of action.

Anatomical considerations

Fascicles, which are fiber-shaped bundles containing muscle fibers (cells), make up the anatomy of skeletal muscles. Sarcomeres are the smallest contractile units found inside the myofibrils that make up these muscle fibers. Along the axial orientation of the muscle fibers, fascicles, fibers, and myofibrils are arranged, and myosin and actin filaments overlap within each sarcomere. An active force is produced during muscle activation as a result of cross-bridge interactions between myosin and actin. Passive force increases when a muscle is stretched past its ideal length. The maximal active tension force attained with elongation is the same as optimal length. The extracellular matrix around the muscle fibers produces passive forces (Yujiang Xiang, 2019).

Muscle fibers can change their size or fiber type composition in response to changing demands. Many physical therapy approaches that target improving a patient's power development or endurance are physiologically based on this adaptability (Wayne Scott, November 2001). Skeletal muscle cells are connected to the bone by the extracellular matrix found in tendon tissue, as well as in peri- and intramuscular areas. Tissue maladaptation, injury, and clinical symptoms can result from overloading and extended abuse of musculotendinous tissues (Michael Kjaer, 2003).

Repetitive Strain Injury in Skeletal muscle

Acute skeletal muscle injuries can impair one's capacity to engage in recreational and occupational activities due to severe discomfort and disability. These injuries include contusions, lacerations, strains, ischemia, and full ruptures (Donald T. Kirkendall, November 2002). The phrase "repetitive strain injury" (RSI) refers to aching& discomfort in the tendons, muscles, & nerves as a result of overusing certain body components through lengthy, repetitive movements. The growing use of technology without proper breaks, such as extended computer use or prolonged sitting, has led to an increase in RSI (Mohd Abdullah, 2019). RSI is a condition that primarily affects the upper extremities and neck and is characterized by a variety of symptoms, such as discomfort, tingling, numbness, loss of coordination, and loss of force (Konjinenberg HS et al., 2001).

The muscles in the skeleton are critical to the development of repetitive strain injury (RSI) since they are required for a wide variety of motions and activities. Because human movement is complex and requires coordinated action from multiple muscle groups, it is important to know which specific muscles are impacted by repetitive activity. Because these duties are repetitious in nature, some muscle groups are overworked. For instance, prolonged typing or mouse use can commonly strain the neck, shoulders, and forearms of people who work in offices. On the other hand, people who work with their hands may overuse their back, arm, or leg muscles (Jain, 2021). It is essential to detect these patterns in order to pinpoint high-risk muscle groups and modify preventive actions appropriately(Yassi, 1997).

It's commonly acknowledged that activating a muscle while it's being stretched might result in strain injuries. Since muscular pressures can be larger during lengthening and are conveyed to the muscle through noncontractile connective tissue, eccentric contraction plays a substantial role in these injuries (Donald T. Kirkendall, November 2002). Physical examination results in non-specific discomfort and partial impairment of tiny movements in cases of RSI. Anhedonia and anxiety symptoms could also be present, and discomfort usually goes away over the weekend but comes back when you go back to work. By putting tissues under stresses above their physical limits, heavy lifting can cause injuries to muscles or ligaments or other tissues (Jain & Arora, 2012). This may cause the tissue's length to momentarily vary, which could have an impact on the biomechanics of the structure it supports. According to PS Helliwal et al. (2008), ischemia and an increase in intramuscular pressure can result from submaximal loading as little as 5%.

Mechanism of Chronic Skeletal Muscle Soreness

Repetitive strain injury (RSI) and chronic muscle soreness have a sensitive interaction that stems from a complex physiological mechanism that involves inflammation & microtrauma. Little injuries form inside the muscle fibers when people do repetitive motions that put their muscles under continual strain, which sets off a chain of events (O'Neil et al., 2001).

The microscopic, perhaps imperceptible harm that recurrent stress brings to muscle fibers is referred to as "microtrauma". These microtears are caused by the constant, oftentimes unrelenting forces that repetitive tasks place on the muscles. Microscopic tears in the affected muscle fibers, for instance, may result from severe lifting or frequent keyboard use (Barr & Barbe, 2002). The body's inflammatory reaction to these microtraumas plays a crucial role in the emergence of chronic muscular discomfort. In response to the perceived injury, the body sets off an inflammatory cascade that involves the release of immune cells and the delivery of substances to the site of harm. While inflammation is a natural and necessary part of the healing process, the recurring nature of the strain can result in a permanent and chronic inflammatory state (Barr & Barbe, 2002). When the tension persists over time and causes a persistent inflammatory response, chronic muscle soreness occurs. Chronic muscle soreness is characterized by discomfort, stiffness, and reduced flexibility and often last longer than the immediate post-activity period. This disease has long-term consequences on musculoskeletal health and impairs an individual's ability to do daily duties (Barr & Barbe, 2002; Jain et al., 2018).

Repetitive strain injuries (RSI) have underlying causes that must be addressed in order to prevent and treat recurrent muscle discomfort. Treating the symptoms alone, without addressing the underlying recurrent strain, may temporarily relieve the symptoms, but it does not break the cycle of inflammation and microtrauma. This emphasizes the significance of putting solutions in place to reduce or eliminate repetitive strain, such as ergonomic adjustments, suitable training techniques, and regular breaks from repetitive labor (Jain et al., 2021).

Muscle soreness can develop as a result of excessive physical effort and might appear immediately or later. Pain may be felt right away if there is a brief hypoxia brought on by biochemical metabolic waste products on nerve terminals or muscle ischemia. The pain disappears as the action is halted. On the other hand, delayed onset muscle soreness, or DOMS, is a frequent medical condition that manifests as muscular discomfort and stiffness after new physical activity. M.J. Cleak (2014) states that DOMS often increases over the first 24 hours, peaks between 24 and 72 hours later, and then gradually diminishes after that. In sports, muscle injuries are among the most common injuries, accounting for 10–55% of all injuries. The majority of sports-related injuries are contusions and strains, with muscle abrasions being less common. Muscle injuries are traditionally classified as mild, moderate, or severe based on the degree of clinical disability. Severe strains entail a full rupture over the whole cross-section of the muscle, according to Tero AH Jarvinen (2013). Every grade represents a distinct level of harm (Sharma et al., 2017).

Conclusion

An in-depth comprehension of the specific muscles engaged in an individual's activities is essential for targeted prevention and effective management of RSI. This understanding allows for the development of personalized approaches that address the unique demands placed on each person's musculature. For instance, a professional pianist may require specific exercises and stretches to prevent strain in hand and forearm muscles, while a construction worker might benefit from interventions targeting muscles involved in heavy lifting and repetitive motions.

The findings suggest that immediate and appropriate measures can minimize muscle injuries. The RICE protocol (Rest, Ice, Compression, Elevation) can help prevent further tissue damage by stopping intramuscular bleeding. Angiogenesis, the formation of new blood vessels, is prompted during the first 1-3 days of immobilization at the site of injury. Gradual mobilization, followed by intensified exercise programs.

Emphasizing the need for personalized approaches underscores the importance of individualized assessments. Healthcare professionals, ergonomics experts, or physical therapists can evaluate an individual's work or activity environment, identify specific muscle groups under stress, and provide tailored recommendations. This approach not only helps prevent RSI but also ensures that interventions are precisely aligned with the demands of an individual's lifestyle or occupation.

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