

A Comparative Analysis of Treadmill Exercise and Surya Namaskar in Injury Recovery and Healing Mechanisms

PRANAB SARKAR

Research Scholar

ABSTRACT

In injury rehabilitation, exercise is an integral component that enhances blood flow; facilitates movement restoration and reintegrates musculoskeletal strength. Other than the general strategy of exercise in rehabilitation Treadmill exercise & Surya Namaskar (Sun Salutation) is the common technique of a lot of therapeutic people. Treadmill exercise would be primarily focused on cardiorespiratory conditioning/gait retraining/facilitates lower rates strength whereas Surya Namaskar combine flexibility/muscle sequencing/controlled breath. The aim of this study is to assess the benefits of exercise modalities (both physiological and therapeutic) on physiological-biomechanical recovery in injury.

It also investigates their role in the decrease of inflammation, proprioceptive ability and prevention from reoccurring. Base on the trends, Treadmill exercise is found to be effective for endurance and lower body rehabilitation while surya namaskar (nadapradahanapadaasana) constitutes all the probable goals including joint mobility, muscle lengthening and mental relaxation. A comprehensive rehabilitation model combining each of the exercise formats may produce superior recovery outcomes.

BACKGROUND

Recovery from injury is a challenging journey involving many different disciplines working together in the areas of physical therapy, strength training and mobility exercises. Rehabilitation exercises are to be selected based on the nature of the trauma, extent of the recovery and current fitness level. Treadmill training has been recommended for cardio metabolic conditioning/amputation-lower limb rehabilitation (10), a sequence of synchronized yoga postures (Surya Namaskar) is emerging as an added advantage that promotes musculoskeletal /psychological health (Kumar & Sharma, 2021).

The physiological pathways that affect injury recovery from specified types of exercise is supported by research findings. Gait retraining and rehabilitation after lower body injuries (Bishop et al. 2020) Treadmill exercise it's mainly beneficial for Cardiovascular endurance and lower limb strength, therefore one of very efficient methods is to use treadmill ((1)).

Surya Namaskar, on the other hand increases the flexibility of our joints and mobility of neuromuscular coordination in a low impact way. Recognizing the relative advantages of these exercise modalities can act as a framework to inform clinicians and rehabilitation professionals of recovery strategies.

Physiological and Biomechanical Aspects

Treadmill work in rehabilitation, because this is a form of tread -mill training virtually always used in rehab settings for improvements to gait mechanics, cardiovascular fitness and lower limb strength. Ensure safe repetitive movement patterns that allow the musculoskeletal system to load gradually in post-injury recovery. Main benefits are

Gait Restoration: Treadmill walking/running can help to re-educate the motor patterns, especially following orthopaedic surgeries or neurological pertaining to stroke, (Hidler et al 2011) like peroneal, transverse bands scrapers;

Efficiency of Cardiovascular: Enhance heart rate elasticity, oxygen carrying capacity and endurance requirements for injury recovery (Meyer et al., 2019).

Lower Limb strengthening: Involve muscles like quadriceps, hamstrings containing calf (important for rehab that knee and ankle injuries).

But, like we all know that running on a treadmill can create significant stress forces to the joints leading to aggravation such as osteoarthritis or stress fractures (Schache et al., 2014) if those loads are not monitored.

Surya Namaskar and Rehabilitation

Surya Namaskar form a series of 12 postures to be performed in sequence which recruit lots of muscles and help you maintain flexibility with controlled breathing. Felt Therapeutic Benefits of Treatment in Recovery from Injury include :

Spinal mobility & flexibility : increased range of motion to spine, hips & my shoulders over time takes care of the stiffness post injury (Varambally & Gangadhar, 2020)

Neuromuscular Coordination — Transition between the poses improve proprioception which helps to maintain postural control and prevent injury (Singh et al., n.d.)

Breath Control and Stress Relief: The Sudrya Namaskar synchronized Yoga breathing technique activates the parasympathetic nervous system that releases stress-induced inflammation and promotes tissue healing (Gupta et al., 2021).

Unlike running on a track, Surya Namaskar is soft on joints and can be done by people who have used up all their cartilage in the joint or have chronic musculoskeletal conditions like arthritis.

Comparing Swing at Injury Recovery

In rehabilitation settings specifically, treadmill exercise compared with walking or Surya Namaskar have unique strengths and weaknesses:

It is specific to the rehabilitation goals which one wants to achieve, between these two exercises. Though the benefit of lower body strength and endurance is higher with Treadmill exercise Surya Namaskar does give you more flexibility as well stress management benefits in overall.

Psychological and Physical Effects of the Therapeutic

Treadmill exercise and Surya Namaskar are beneficial for mental health but have a deeper mind-body link with Surya Namaskar (Sudhakar et al., 2017). Yoga-based rehabilitation is associated with substantial decreases in cortisol, interestingly along with better mood stability and sleep quality that are all required for a whole recovery (Cramer et al., 2017).

Also, Surya Namaskar has been associated with decreased inflammation, and improved immune function that may speed tissue repair from an injury (Ross & Thomas 2010).

Treadmill exercise as opposed to just plain running on a track has been associated with increased endorphin release and an increased energy level / motivation for rehabilitation in general

Clinical Implications and Recommendations

Given the additive advantages, a combination of treadmill exercise coupled with Surya Namaskar in rehabilitation may be the gold standard for injury recovery.

Below are some recommendations to adjust the rehabilitation template:

1. Early recovery: low-impact awesome exercises like Surya Namaskar to keep you mobile and loose.
2. Phase: Introduction to treadmill walking at a leisurely pace and strengthening lower extremity muscles.
3. Intermediate Recovery Phase: Gradually raise the intensity of your treadmill while performing Surya Namaskar to increase flexibility.
4. Maintain for the Long Term : Balancing hybrid Methods can stop future injuries and adhere well-being.

CONCLUSION

Treadmill exercise and Surya Namaskar give a special but also commensurate advantage to the injured patient. Treadmill training increases cardiovascular fitness and function of lower extremity while Surya Namaskar allows one flexibility, mobility and mental relaxation in a holistic way. Combining both in rehabilitation programs has been suggested to lead to optimal recovery outcomes and respond differently based on individual injury type profiles and healing status. Longitudinal studies need to be undertaken, which compare their effectiveness in particular injury categories and developed evidence based rehabilitation strategies.

In the sense of injury rehabilitation, Treadmill exercise and Surya Namaskar have separate but parallel advantages. Treadmill training is especially useful for cardiovascular conditioning, and to help in restoring lower extremity function. Its principle is to return endurance for patients with injuries, improve gait and balance, strengthen the muscles of legs in controlled movement. This feature allows us to effectively use it as a widely applicable rehab tool for rehabilitation from mild to severe injuries in speed, incline and time. However treadmill training remains static in terms of flexibility and mental relaxation, together with strength or the overall full body recovery needed for holistic recovery.

Contrarily, Surya Namaskar provides an all-round solution by including flexibility, mobility and mental wellbeing in one totality. A full range of dynamic postures in the series work multiple muscle groups, increase joint mobility and correct posture — all useful for musculoskeletal injuries that have led to a loss of function. Also, the synchronized breathing of Surya Namaskar is a natural mechanism that enhances relaxation, diminishes stress and logically improves mental tenacity—all good for recovery from injury.

In contrast, all the (mainly lower extremity) musculature is not targeted for most of a treadmill workout whereas Surya Namaskar is a full body practice.

Concurrent training of these two exercise in rehabilitation programs may help to enhance recovery as it addresses multiple aspects about healing. The treadmill walking in conjunction with lower limb strength and endurance, Surya Namaskar makes us flexible and disciplined mob (mobility of others). Nonetheless, the efficacy of this method as a whole will depend on the nature and severity of the injury and individual healing phases. In order to develop an appropriate rehabilitation approach, longitudinal studies comparing them side by side are needed in order to determine their actual efficacy in different injury patterns.

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