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Effectiveness of Physiotherapy Interventions on Achilles Tendinopathy

Dewa Ayu Made Dhyana Pradnyan Paramita[1,*], M. Widnyana[2]

[1]Bachelor and Professional Program of Physical Therapy, College of Medicine, Universitas Udayana, Bali, Indonesia
[2]Physical Therapy Department, College of Medicine, Universitas Udayana, Bali, Indonesia

ABSTRACT

Background: Achilles tendinopathy is a clinical condition characterized by local pain, swelling in and around the Achilles tendon, and impaired function due to overuse or intrinsic factors such as being overweight. This disorder is often found in individuals who participate in physical activities such as running and jumping. Pain is felt during activity and subsides after rest, but if this continues, the pain may persist even at rest resulting in further decreased performance. Physiotherapy interventions for managing Achilles tendinopathy are quite varied, starting from the application of modalities and exercise and manual therapy.

Objective: To determine the effectiveness of physiotherapy intervention in Achilles tendinopathy.

Methods: The method in this study is a literature review or literature review using secondary data in the form of a review of research articles related to the effectiveness of physiotherapy interventions in Achilles tendinopathy through the search engines google scholar, PubMed, and Science Direct.

Results: Several studies have shown that physiotherapy interventions, except for low-level laser therapy (LLLT), effectively reduce symptoms of Achilles tendinopathy.

Conclusion: Physiotherapy interventions such as eccentric exercise and a combination of eccentric exercise with soft tissue treatment, pressure massage, and ESWT are effective in reducing symptoms in patients with Achilles tendinopathy.

Keywords: Achilles tendinopathy; physical therapy; rehabilitation

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***Corresponding author:** Dewa Ayu Made Dhyana Pradnyan Paramita, Bachelor and Professional Program of Physical Therapy, College of Medicine, Universitas Udayana; Email: dhyana.pradnyanp@gmail.com

Background

Achilles tendinopathy is a clinical condition characterized by localized pain, swelling in and around the Achilles tendon, and impaired function due to overuse or intrinsic factors such as being overweight.[1,2,3] According to its anatomical location, Achilles tendinopathy can be divided into insertion tendinopathy (at the calcaneus-Achilles tendon junction) and noninsertional tendinopathy (2 to 6 cm proximal to the insertion of the Achilles tendon into the calcaneus).[3] The risk factors for Achilles tendinopathy can be classified into intrinsic factors (including anatomical factors, age, sex, metabolic dysfunction, and muscle weakness) and extrinsic factors (including mechanical overload, obesity, drugs, and inadequate warm-up or stretching, and direct trauma).[4]

In the last 3 decades, Achilles tendinopathy has increased due to greater participation in recreational and competitive sports.[1] This disorder is often found in individuals who participate in physical activities such as running and jumping.[3] The prevalence of running-related injuries is between 11% and 85%, or 2.5 to 59 injuries per 1000 running hours. Although runners are the group with the most Achilles tendinopathy, this can also occur in other athletes and sedentary individuals.[5] Individuals with Achilles tendinopathy generally complain of pain, swelling, and stiffness in the Achilles tendon area to impaired lower extremity function.[2,4] Pain is felt during activity and subsides after rest, but if this continues, the pain may persist even at rest resulting in further decreased performance.[2]

Physiotherapy interventions in cases of Achilles tendinopathy are quite varied, starting from the application of modalities in the form of low-energy extracorporeal shockwave therapy (ESWT) and low-level laser therapy (LLLT), exercise therapy such as eccentric, concentric exercise, and stretching, and manual therapy by physiotherapists such as soft tissue. Treatment (Astym) and pressure massage.[5,6,7,8,9]

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Considering the many physiotherapy interventions that can be applied to Achilles tendinopathy cases, the author is interested in further reviewing the effectiveness of physiotherapy interventions in Achilles tendinopathy.

Methods

The method in this study is a literature review or literature review study using secondary data in the form of a review of research articles related to the effectiveness of physiotherapy interventions in Achilles tendinopathy through the search engines google scholar, PubMed, and science direct.

Results

We found five studies that are suitable to answer the study objective. Research from McCormack et al. compared Eccentric Exercise Versus Eccentric Exercise and Soft Tissue Treatment for Achilles Tendinopathy.[5] This study used the soft tissue treatment, eccentric exercise (intervention), and the eccentric exercise (control) group. The eccentric exercise was given 3 sets of 15 repetitions per session and 2 sessions per day for 12 weeks. Suppose the subject was unable to complete 3 sets of 15 repetitions. In that case, the subject was instructed to start with a lower number of repetitions and sets (minimum 2 sets of 10) and progress to the full number according to ability. Soft tissue treatment was given twice a week for 12 visits. During each treatment session, the instrument progresses through a decrease in the surface contact area. Each treatment session lasts approximately 20 to 30 minutes.

Yu et al. examined the effects of eccentric and concentric strengthening on pain, muscle strength, endurance, and functional fitness factors in men with Achilles tendinopathy.[6] Eccentric strengthening is carried out through the Curwin and Stanish method and the Alfredson method, while concentric strengthening is carried out through the Mafi method. Eccentric strengthening was performed with the subject tying a bag containing dumbbells (the weight of which was determined according to the subject's weight) on their back, according to a weekly program. If subjects experienced pain during exercise, they were asked to return to the previous week's program. Whereas concentric strengthening is done using an elastic band, resistance is increased by changing to a stronger tension band in the pain-free range. The two research assistants arranged all exercises to prevent eccentric strengthening movements. In addition, the subject also performed two types of stretching exercises: knee extension and knee flexion for 10 seconds each, five times on each side. The exercise began with a warm-up and ended with a cool-down on a bicycle for 10 minutes with an HRmax of 40%. All movements are performed in 10 seconds, 3 sets of 15 repetitions, and a 30-second pause between sets.

Abdelkader et al. compared short- and intermediate-term results of extracorporeal shockwave therapy for non-insertional Achilles tendinopathy.[7] In his study, the intervention group was given ESWT, eccentric training, and stretching, and the control group was given sham ESWT, eccentric training, and stretching. ESWT was performed 4 sessions per week. Each session consisted of 2000 pulses with a pressure of 3 bar and a frequency of 8 pulses/s. Sham ESWT was performed 4 sessions/week. The engine settings were adjusted to produce zero energy while producing the same sound effect. Calf muscle eccentric training was performed for 5 seconds with 3 sets of 15 repetitions (1-minute rest between sets), 2 times a day (morning and evening), 7 days/week for 4 weeks. Stretching gastrocnemius, soleus, and hamstring were performed 2 times a day with 3 repetitions (30 seconds hold and 30 seconds rest), 7 times/week for 4 weeks.

Stefan et al. used pressure massage for Achilles tendinopathy.[8] There were three groups of interventions. The first group was given eccentric exercises using Alfredson's method. The second group was given pressure massage, and the third group was given both eccentric exercise and pressure massage. Eccentric exercise performed 3 sets of 15 repetitions. Pressure massage was performed 2 times per week (2 or 3 days interval between treatments) for 6 weeks and once weekly for 6 weeks.

Tumilty et al. examined the effectiveness of low-level laser therapy (LLLT) as an adjunct to eccentric exercise for the treatment of Achilles tendinopathy.[9] The intervention group was given LLLT and eccentric exercise, while the comparison group was given LLLT placebo and eccentric exercise. LLLT was performed 3 times per week for 4 weeks. Laser probes were applied to three standard points on both sides of the Achilles tendon (at the lesion site, 2 cm proximal, and 2 cm distal) for 30 seconds, delivering doses of 3J per point (18J per session). The dose for placebo LLLT was the same, but the laser was not turned on during treatment. Eccentric exercises were performed in 6 sets of 15 repetitions, 2 times/day, 7 days/week for 12 weeks.

Discussions

Exercise is the treatment with the highest evidence level for managing Achilles tendinopathy. The purpose of the exercise is to provide a mechanical load on the tendon to encourage the remodelling process, reduce pain, and increase calf muscle endurance, strength and lower extremity function.[2] Commonly used exercise programs in the management of Achilles tendinopathy are concentric and eccentric exercises, where eccentric exercise is the most recommended by several literatures.[5, 6, 7, 8, 9] Eccentric exercise is an exercise that is done by lengthening the muscle when it contracts. A study by Yu et al. comparing the effectiveness of concentric and eccentric strengthening exercises proved that eccentric strengthening is better in reducing pain and improving function in patients with Achilles tendinopathy. Similar results were also obtained by previous studies comparing concentric and eccentric strengthening. This is related to the release of opioids in the brain so that pain can be reduced after doing eccentric strengthening.[6]

Yu et al. also explained that there was a significant increase in knee extension muscle strength and ankle plantarflexion/dorsiflexion in patients after eccentric

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strengthening, but not in the group of patients who did concentric exercise. However, the differences between the groups observed were not significant. Eccentric strengthening positively affects the repair of the abnormal morphological changes in damaged Achilles tendons, so simultaneous improvements are achieved in variables such as muscle strength and endurance. The risk of additional damage caused by concentric strengthening can also be reduced by using eccentric strengthening.[6]

Mechanisms of tendon tissue remodelling secondary to eccentric exercise include the tenocyte response to stretch, resulting in adaptations such as increased collagen synthesis and normalized collagen morphology. This adaptation can be facilitated through post-exercise upregulation of transforming growth factor-β-1 (TGF-β-1), insulin growth factor-1Ea (IGF-1Ea), and mechano growth factor (MGF), as well as type 1 and type 3 collagen. Elements of eccentric exercise prescription, such as slower movement speed and relatively high workload, can affect the magnitude of post-exercise tendon tissue adaptation. Tendon tissue adaptation to eccentric exercise stimulation is proportional to the workload and tension. In addition, it has been observed that exercise regimens involving relatively low workloads are comparatively less effective in inducing tendon tissue adaptation than routines incorporating higher workloads.[10]

Eccentric strengthening is more effective in improving balance ability. Patients with Achilles tendinopathy have decreased neuromuscular activity due to pain that causes the kinematics to change movement function, such as walking and running. Pain interferes with proprioceptive mechanisms leading to sensory-motor dysfunction, decreased sensitivity to joint position, and resulted in the loss of balance. High-frequency oscillations occur significantly more frequently during eccentric strengthening than during concentric strengthening; the oscillations can be a stimulus for tendon remodelling. The group that did eccentric strengthening showed an increase in their balance ability due to this mechanism. The results of this study also showed that agility and agility increased in the eccentric strengthening group compared to the concentric strengthening group. This effect can be caused by pain reduction and high-frequency oscillation.[6]

Some literature explains that eccentric exercise can be combined with other interventions such as soft tissue treatment, pressure massage, ESWT, and LLLT to produce a better effect in the management of Achilles tendinopathy.[5,7,8,9] Astym is a special soft tissue treatment that uses handheld instruments to transfer pressure and shear stress to the underlying soft tissue. Astym treatment can induce soft tissue regeneration and remodelling through fibroblast activation by releasing endogenous cellular mediators and growth factors. Increased recruitment and activation of fibroblasts, as well as fibronectin production, have been demonstrated by Astym treatment of rat tendons, but these have not been studied in humans. Since Astym and eccentric exercise can affect tendon healing, combining these two treatments can give better results than eccentric exercise alone. This is evidenced by the results of a study by McCormack et al. in patients with insertion tendinopathy, who explained that the combination of soft tissue treatment and eccentric exercise was more effective than eccentric exercise alone in reducing the severity of Achilles tendinopathy over 12 weeks. This difference also occurred in the follow-up period of 26 and 52 weeks.[5]

Another study using a different soft tissue treatment method, namely the application of pressure massage in non-insertional tendinopathy patients, explained that there was a significant improvement in pain variables measured using the VISA-A-IS scale in the pressure massage group compared to the eccentric exercise group at week 4. Pressure massage is a treatment in which pressure is applied to a stiff and painful area in the calf muscle and held until the muscle relaxes. Patients with Achilles tendinopathy usually experience stiffness in the calf muscles, so relaxing the calf muscles through pressure massage can reduce the pull on the tendons and promote the healing process. Previous studies regarding the stretch reflex in the calf have shown that the reflex appears to be hyperactive in patients with Achilles tendinopathy and diminishes with osteopathic manipulative treatment. The patient showed clinical improvement in pain, stiffness, and swelling. This supports the importance of treating the calf muscle complex in patients with Achilles tendinopathy. The pressure massage study by Stefansson et al. found a significant increase in ROM with knee flexion in patients with Achilles tendinopathy. This can be a sign of decreased stiffness in the inner calf muscle (soleus), which can play a role in the development of Achilles tendinopathy. A stiff muscle (or part of a muscle) will pull more on the tendon (or part of the tendon). Muscle relaxation reduces resting tension or may equalize the distribution of forces across the tendon, promoting recovery. Palpation pain in the Achilles tendon is one of the symptoms of Achilles tendinopathy as measured by the pressure pain threshold (PPT). In the study by Stefansson et al., PPT values did not change for 24 weeks in either group. Patients tend to be almost pain-free, as evidenced by the score on VISA-A-IS (90 is considered normal), although the tendons are still painful to palpation as before the treatment. This occurs because the pain during activity does not originate from the damaged tendon but is referred from the calf muscle by the trigger point. Trigger points in the posterior tibialis or soleus muscle can cause pain referred to the area of the Achilles tendon. Pain reduction on VISA-A-IS with pressure massage treatment can be due to relaxation of the calf muscles, although the tendons still feel painful when palpated.[8]

A study by Abdelkader et al. that compared a combination of ESWT and conventional exercise (eccentric exercise followed by stretching exercise) with sham ESWT and conventional exercise (eccentric exercise followed by stretching exercise) proved that patients who received low energy ESWT in addition to conventional exercise had significantly better results at reducing pain and improving function than those receiving conservative physiotherapy

treatment/conventional exercise alone. ESWT is a safe and well-tolerated modality which can be used as an alternative or in combination with exercise.[7] Transmission of shockwaves or pressure waves causes tissue effects. The transformation of physical energy into a biological response is similar to a cascade process. First, the attachment of the cell skeleton is activated, which leads to the release of mRNA from the cell nucleus. This is followed by the activation of cellular organs such as mitochondria and endoplasmic reticulum and cell vesicles, which release specific proteins from the healing process. In addition, ESWT can also trigger and strengthen the cell regeneration process.[11]

Another modality besides ESWT that can be combined with eccentric exercise in patients with Achilles tendinopathy is LLLT. LLLT, also known as Photobiomodulation (PBM), is a low-intensity light therapy. The effect is photochemical, not thermal. Light triggers biochemical changes in cells and can be compared with the process of photosynthesis in plants, where photons are absorbed by cellular photoreceptors and trigger chemical changes.[12] In contrast to previous theories and research, the study by Tumilty et al. discussed the effectiveness of adding LLLT to eccentric exercise as a treatment for Achilles tendinopathy and showed that there was no significant difference between the experimental and placebo groups. This can be caused by differences in laser application from previous studies. In the present study, tendons were irradiated at 6 points with 3J per point from an 810-nm, 100-mW probe and a power density of 100mW/cm^2, compared with irradiation at 6 points with 0.9J per point from an 820-nm, 30-mW probe and a power density of 60mW/cm^2.[9]

Conclusion

Physiotherapy interventions such as eccentric exercise and a combination of eccentric exercise with soft tissue treatment, pressure massage, and ESWT are effective in reducing symptoms in patients with Achilles tendinopathy.

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