Kinestetik : Jurnal Ilmiah Pendidikan Jasmani 7 (4) (2023)
Kinestetik : Jurnal Ilmiah Pendidikan Jasmani
https://ejournal.unib.ac.id/index.php/kinestetik/index
DOI : 10.33369/jk.v7i4.30165

Physiotherapy Management for Cases of Achilles Tendinopathy in Indonesian Para Athletics Athletes : Case Report

Muhammad Raihan Maulidan *[1], Suryo Saputra Perdana[2], Amalia Nur Azizah[3]
[1,2] Physiotherapy Study Program, Universitas Muhammadiyah Surakarta, Indonesia
[3] Physiotherapy Profession, National Paralympic Committee Clinic, Indonesia

Article Info

Article History :

Received : September 2023
Revised : December 2023
Accepted : December 2023

Keywords:

Achilles Tendinopathy, ESWT, Eccentric Exercises, Para Athletics, Physiotherapy,

Abstract

Achilles tendinopathy is a degenerative process due to excessive and cumulative use of microtrauma with internal and external risk factor. Approximately 52% of runners experience an Achilles tendinopathy (AT) injury during their lifetime. Achilles Tendinopathy can limit Indonesia's athletic performance due to pain on the side of the knee during running, walking and jumping. The aim of this study was to evaluate the physiotherapy management for Achilles Tendinopathy cases in Indonesian para-athletics. This research is a descriptive case studyinvolving one client with participatory observation. The physiotherapy intervention involved modality intervention using Eccentric exercises, ESWT, Stretching, Muscle release, Electrical Stimulation, and Cryotheraphy. The subject of the study was An. B, a 28 year old para athlete with height 182 cm, weight 77 kg, and BMI 23.3 in the ideal category. The patient came to the physiotherapy clinic of NPC Indonesia on 20 August 2023 with complaints of pain and burning in the left leg. Physical examination showed normal results except for pain examination using Numeric Rating Scale (NRS), where silent pain 0/10, tenderness 9/10, and motion pain 7/10 were found. The diagnosis of Achilles Tendinopathy sinistra was confirmed through specific examination. After four physiotherapy sessions Based on the results of studies that have been carried out, ESWT and Eccentric exercise can reduce pain, increase joint range of motion, increase muscle strength, increase ankle stability and improve functional abilities in Achilles tendinopathy patients.

*Corresponding email : j120200077@student.ums.ac.id
ISSN 2685-6514 (Online)
ISSN 2477-331X (Print)

INTRODUCTION

Sport opportunities for disabled-bodied individuals have significantly increased in recent decades, including increasing opportunities for enhanced training and competition. Research on the psychosocial aspects of disability sport participation has a relatively short history and disabled-bodied athletes have only begun to receive attention in the last 20 years (Vanlandewijck & Thompson, 2011). The competing athletes will have a wide range of disabilities, though the International Paralympic Council (IPC) classify 10 specific categories of impairment that are eligible for participation: impaired muscle power, impaired passive range of movement, limb deficiency, leg length difference, short stature, hypertonia, ataxia, athetosis, vision impairment, and intellectual impairment (International Paralympic Committee, 2015) With the growing profile of the Paralympic Games and the wide-ranging investment that is made in Paralympic athletes to attend these competitions, it is becoming increasingly important to understand how these diverse athletes perform to the best of their abilities, invoking a holistic account of both biomechanical and psychosocial attributes. The prevalence and incidence were 16.6 and 7.9 per 1.000 registered patients. Plantar heel pain was the most common tendinopathy, accounting for 39% of lower limb tendinopathies. Patients with tendinopathy were significantly older than all included patients (46.0 years (95% CI: 43.3, 48.7) vs.38.8 years (95% CI: 38.4, 39.3)) (Riel et al., 2019).

Tendinopathy is a complex and diverse tendon pathology characterized by pain, decreased function and decreased exercise tolerance (Millar N, Silbernagel K, 2021). Achilles tendinopathy is a common injury among athletes. Approximately 52% of runners experience an Achilles tendinopathy (AT) injury during their lifetime (Myhrvold et al., 2022). Achilles tendinopathy is a degenerative process due to excessive and cumulative use of microtrauma with internal and external risk factor (Maffulli et al., 2020). Some of the signs and symptoms of Achilles tendinopathy include pain, swelling, and impaired function, especially when walking and sports with a lot of impact (Maffulli et al., 2020). Intrinsic risk factors include patient demographics, such as older age, male gender, poor vascularity poor vascularization, hyperpronation and other biomechanical factors, as well as systemic diseases including metabolic disorders and rheumatology (Maffulli et al., 2020)(van Sterkenburg & van Dijk, 2011). Extrinsic risk factors include overuse, training errors (rapid increase in training volume), and certain medications that may predispose to tendon injury (van Sterkenburg & van Dijk, 2011).

Efficacy reviews - 204 studies provided evidence that exercise therapy is safe and beneficial, and that patients are generally satisfied with treatment outcome and perceive the improvement to be substantial(Cooper, 2023). Exercise therapy is an effort to reduce complaints in people with Achilles tendinopathy Research shows that exercise therapy is one of the best treatments for Achilles tendinopathy. Exercise therapy can increase flexibility, strengthen the heart and increase blood flow, maintain body weight, and improve general physical fitness (Nuraini, 2018). Interventions for Achilles tendinopathy have been increasingly researched, with seven systematic reviews assessing the evidence of effectiveness of different treatment options (Silbernagel & Crossley, 2015).

Eccentric exercise is an exercise method that can be used to increase strength and increase muscle flexibility and increase joint mobility (Olagbegi et al., 2017). K Eccentric contractions create greater stimulation to tendon cells, thereby increasing collagen cross-linking (Yoon et al., 2021). Many previous studies have combined eccentric exercise with other conventional adjunctive treatment combinations such as ultrasound, brace, ice, or massage, making it difficult to isolate the effects of eccentric exercise (Yoon et al., 2021).

The purpose of writing this case report journal is to educate para-athletes and the public about Achilles tendinopathy as a common health problem in athletes. Better knowledge of the symptoms, causes, and treatment of Achilles tendinopathy may help the public recognize early signs and take appropriate precautions. This study may contribute to the development of more effective physiotherapy methods to address Achilles tendinopathy. By understanding the most effective physiotherapy interventions, healthcare practitioners and physiotherapists can improve the services they offer to their patients, not only athletes, but also the general public who experience similar problems.

METHODS

This type of research is a descriptive case study using observation and participation methods to evaluate physiotherapy management of Achilles Tendinopathy cases in Indonesian para-athletics.

Participants

The subject in this study was a man An. B is a national para athletic athlete who is 28 years old. The NPC Indonesia Clinic is the place for this research. Jl. Sugiyopranoto No.20, Kp. Baru, Kec. Ps. Kliwon, Surakarta City, Central Java

Sampling Procedures

Data collection methods by means of subjective examination, objective examination, motion examination, cognitive ability examination, personal and interpersonal skills, functional examination and activity environment, and specific examination in 1 sample of Achilles tendinopathy cases in Indonesian Para athletics athletes.

Materials and Apparatus

Measurement, examination and intervention tests used in data collection techniques, including (i) BMI measurement using body weight (scales) and height (meter). (ii) general examination; blood pressure & pulse (electric tension meter), body temperature (thermometer), breathing pattern (inspection). (iii) physical examination; joint motion scope (goneometer), muscle mass (midline), muscle strength (mmt), pain (NRS). (iv) specific examination; Royal London Hospital (RLS) test, Thompson test, and Aplley's. (v) functional examination using VISA-A. (vi) modality intervention using Eccentric exercises, ESWT, Stretching, Muscle release, Electrical Stimulation, and Cryotheraphy.

Procedures

The procedures used in this study are as follows: (i) researchers first measured and examined the subjects. (ii) the researcher classifies and categorizes the data. (iii) testing was carried out at the NPC Indonesia Clinic. Sugiyopranoto Street No.20, Kp. Baru, Kec. Ps. Kliwon, Surakarta City, Central Java

Design or Data Analysis

Data analysis techniques using interviews, observations, and case studies to obtain conclusions from the research.

RESULT

The subject in this study was a man An. B is a 28-year-old para athletic athlete by profession. The patient's height is 182 cm and body weight is 77 kg with a BMI of 23.3 which is included in the ideal category. The patient came to physiotherapy in 20 August 2023 with complaints of pain and burning in the left leg. The pain was felt for the first time in 2018 during national training and until now the pain feels fluctuating along with the exercise program given at national training. The patient revealed that the pain was felt to increase in the morning with stiffness and when the patient exercised with high intensity, walked on uneven surfaces and up and down stairs. Pain decreases when the patient rests with a relaxed leg position. Patients do physiotherapy treatment and take painkillers. Daily activities as a male para-athletic athlete with the T45/46/57 class force the patient to always do field training so that it worsens the patient's condition which should have time to rest. However, the patient still wants to participate in the Asian Para Games 2018.

After obtaining consent from the patient and permission from the supervisor, a physical examination was carried out. On general examination, the patient was conscious, cooperative, no cognitive impairment and able to understand communication with the physiotherapist and felt comfortable in a relaxed sitting position. The patient's blood pressure on examination was 140/70, pulse 75x/min, with a normal breathing pattern of 20x/min and a temperature of 36.3˚c. On inspection, the patient appeared to be in pain when standing and had an antalgic gait. The patient's left lower arm is absent or amputated. Palpation examination was carried out with the patient in a supine sleeping position and the results obtained were no edema but an increase in local temperature and tenderness in the left Achilles tendon area. In the active motion examination, it was found that the LGS was not full in plantar flexion. Full joint motion scope and physiological end feel were obtained on passive motion examination, but there was still pain throughout the examination, but on isometric motion examination the patient was able to withstand maximum weight. After basic motion function examination, followed by pain examination, joint range of motion examination and muscle examination. From the pain examination carried out with the Numeric Ratting Scale (NRS), it was found that there was silent pain 0/10, tenderness 9/10 and motion pain 7/10. Furthermore, the results of muscle examination with Manual Muscle Testing (MMT) showed a decrease in flexion muscle strength.

Table 1. Examination Result

Physical Movement Examination				
Regio	**Motion**	**LGS**		**Pain**
Ankle Sinistra	Plantar Fleksi	Not Full ROM		+
	Dorso fleksi	Not Full ROM		+
Passive Motion Examination				
Regio	**Motion**	**LGS**	**Pain**	**End Fell**
Ankle Sinistra	Plantar Fleksi	Full	+	Hard
	Dorso fleksi	Full	+	Elastik
Isometric Movement Check				

Regio	Motion	Pain	Loud
Ankle Sinistra	Plantar Fleksi	+	Maximum
	Dorso fleksi	+	Maximum
Numeric Rating Scale			
NRS		**Result**	
Silent pain		0	
Tenderness		9	
Movement pain		7	
Goneometer			
LGS	**Sinistra**	**Dekstra**	**Normal LGS**
Active LGS	S: 15°- 0°-30°	S: 20°- 0°-35°	S: 20°- 0°-35°
Manual Muscle Test			
Motion of Knee	**Sinistra**		**Dekstra**
Fleksor	4		5
Ekstensor	4		5

When coming to physiotherapy, the patient did not bring the results of the supporting examination. Signs and symptoms of Achilles tendinopathy were revealed during history taking with the patient. To further confirm the condition, the physiotherapist performed a specific examination and obtained the results of the Royal London Hospital (RLS)

Test (+), Aplley's Test (+) medial side, Thompson Test (-) After these tests were carried out, to determine the patient's functional ability, a functional scale test using the VISA-A (Table. 2) scale and obtained a score of 86% with an interpretation below 60% of patients still experiencing problems in the Achilles tendon so it can be concluded that the patient has Achilles Tendinopathy Sinistra with physiotherapy diagnoses. The prognosis regarding the patient's. recovery from the best prognosis reported in the available literature is a return to full activity within 12 weeks, regardless of the therapeutic intervention, the response to treatment in the patient presented is very important. The patient obtained almost complete resolution of symptoms and returned to full physical activity after a total of nine therapy sessions over an eight-week period. After follow-up, seven months later, the patient continued to have positive therapeutic outcomes. And the patient returned to sport.

Table 2. Specific Examination & Comparative Diagnosis

Test	Result
Royal London Hospital	+
Thompson test	-
Apley’s	+ (med)

The interventions given to patients are tailored to short-term and long-term physiotherapy goals, where the short-term goals are to reduce pain, reduce tightness & increase muscle flexibility, increase joint range of motion and increase muscle strength then proceed to the long-term goal of improving and optimizing the patient's functional abilities.

The exercise program is carried out for 4 meetings in 2 weeks with a time of -+ 1 hour each session by considering the patient's condition. The exercise program performed, Patellar Tendon exercises, Eccenttric Achilles Tendon Loading Exercises, lower extremity stretching, Electrical Stimulation, ESWT, Muscle release, Cryotherapy with a predetermined dose.

Table 3. Physiotherapy Interventions

Meeting	Intervention	Objective	Dosage
1,2,3,4	Patellar Tendon exercises	Improves knee muscle mobility and strength	F : 2x / week I: 12 reps 4 set T : 3-5 minutes T : Exercise
1,2,3,4	Stretching Lower Extremity	Relaxation & improve muscle flexibility	F : 2x / week I : 8 reps 3set T : 5-8 minutes T : Exercise
1,2,3,4	Eccenttric Achilles Tendon Loading Exrcises	Increase lower limb muscle strength	F : 2x / week I : 1 set T : 5 minutes T : Exercise
1,2,3,4	Electrical Stimulation	Increase muscle activation & Block pain with gate control theory	F : 2x / week I : 100 µs T : 10 minutes T : Russian Stimulation
1,2,3,4	ESWT	Decrease pain & Muscle activation	F : 2x / week I : 1,3 Barr, 25 HZ, 2000 shock T :10 minutes T : Focused
2,3,4	Muscle release	Relaxation	F : 2x / week I : Gentle pressure T : 5-8 minutes T : Massage
1,2,3,4	Cryotherapy	Reducing pain with vasocontriction techniques	F : 2x / week I : target suhu jaringan 12^0 T : 3 minutes T : spray and stretch

2. Case Study Results

After the intervention was given for 4 meetings in 2 weeks, the patient was followed up again to evaluate the patient's condition after the intervention. In general, the patient's condition looked better and there were no additional complaints after the intervention. The component that was evaluated was pain evaluation with the Numeric Rating Scale (NRS). NRS is an 11-point horizontal scale consisting of items that are given to the patient with the numbers 0 and 10. 0 means "not tired" and 10 means "as bad as you imagine. " Patients are asked to rate "your fatigue (malaise, tiredness)" by selecting the number that represents the worst level of fatigue in the past 24 hours (Gladman et al., 2020). The first evaluation (T1) was carried out on September 1, 2023, followed by the second evaluation (T2) on September 8, 2023, then the third evaluation (T3) on September 11, 2023 and the last evaluation (T4) on September 16, 2023 obtained the following results:

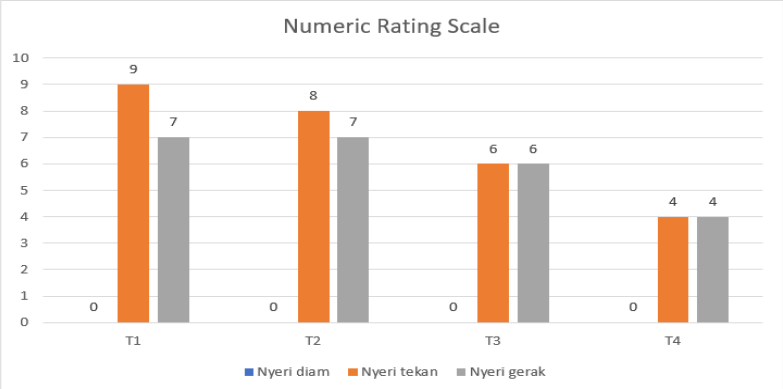

Fig 1. Result of NRS (Pain) Examination

The pain evaluation chart shows the results of a gradual decrease in pain at each meeting. At the first meeting, the patient felt motion pain with a score of 7 (severe pain controlled) and gradually decreased until the last meeting to score 4 (moderate pain). In addition to silent pain, the patient felt tenderness with a score of 9 (severe pain controlled) at the first meeting, then decreased to a score of 8 (severe pain controlled) at the second meeting, then decreased again at the meeting. The third meeting became score 6 (moderate pain) and at the fourth meeting became score 4 (moderate pain). Pain evaluation is carried out at each therapy session which aims to determine the short-term effects of Eccentric exercises and ESWT.

Manual muscle testing (MMT) is a diagnostic tool used worldwide.

It has a wide range of applications including neurology, intensive care medicine, physical therapy, osteopathy, and sports medicine (Garcia et al., 2021). The muscle strength evaluation chart using Manual Muscle Testing shows that the patient has decreased muscle strength in the ankle flexors and extensors with a muscle strength value of 4 at the time of examination, after being given Eccentric exercise the strength value of the ankle flexor increases to a value of 5 at the second meeting and the ankle extensor increases to a value of 5 at the third meeting.

Fig 2. Result of MMT (Muscle) Examination

DISCUSSION

As illustrated by the above case presentation, patients with chronic Achilles tendinopathy usually present with progressive pain and concentrated dysfunction of the Achilles tendon (Miners & Bougie, 2011). Pain associated with Achilles tendinopathy can range from mild to severe, depending on the stage of injury when symptoms first appear.

Factors associated with the clinical picture may include sudden increases in training volume or intensity, changes in terrain, increased training intervals and high-intensity running (Utomo D.N, 2018). Most sources of information regarding the treatment of chronic Achilles tendonitis recommend conservative treatment as the initial strategy for patient management, however there is little evidence regarding this approach. Conservative treatment methods or modalities are the most effective (Miners & Bougie, 2011). Conservative treatment options include: eccentric strength training, therapeutic modalities, soft tissue mobilization, rest, corticosteroids, cryotherapy, heat, nonsteroidal anti-inflammatory drugs (NSAIDs), deep friction massage, stretching, acupuncture and foot therapy. Of these treatments, eccentric strength training for the calf muscles, alone or in combination with one or more other therapies, has the most favorable evidence (Utomo D.N, 2018).

Achilles tendon strengthening programs have historically consisted of eccentric muscle contractions, but protocols involving isolated concentric or a combination of concentric and eccentric contractions have all been used with positive results (Beyer et al., 2015). Although there is no real evidence, the treatment principles outlined in this review also apply to Achilles tendinopathy. Based on the growing body of evidence that traditional eccentric Alfredson training (excessive training of the ankle) produces poor results, it is recommended to limit ankle compression (and therefore compression) in insertional Achilles tendinopathy (Malliaras, 2022). To increase tendon strength and size, exercises with higher loads and slower contractions are likely to provide the greatest benefit. However, the load on the tendon also increases as the speed of movement increases; therefore, high-speed tolerance also needs to be addressed in the subsequent recovery phase. In summary, any type of muscle contraction can be used to mechanically load the tendon (Silbernagel et al., 2020). According to Shalabi et al. (2004) found that eccentric training of the gastrocnemius-solar complex in chronic Achilles tendinitis resulted in decreased tendon volume and decreased signal within the tendon, as assessed by MRI (Miners & Bougie, 2011). Static gastrocnemius and soleus muscle stretches were included in the management plan to increase ankle range of motion, isometric force production, stretch tolerance, and to increase focused Achilles stress during the tissue remodeling phase caused by soft tissue mobilization (Schepsis et al., 2002). Therefore, it is expected that the tendon extends more under eccentric loading conditions compared to concentric loading.1.90 Eccentric training has the potential to cause high loads and consequent stretching, but this potential is rarely utilized because rehabilitation exercises are rarely performed (Langberg, 2015). Approach a maximum of one concentric repetition.Heel rise to increase Achilles tendon tolerance to rapid loading in preparation for pliometric exercises (Silbernagel et al., 2020).

The initial stage is considered the warm-up phase designed to increase blood flow, ankle range of motion, and tissue compliance. The movements include ankle dorsiflexion and plantarflexion and toe extension and flexion. Three sets of gastrocnemius and soleus stretches for 20 seconds are performed. Other warm-up exercises included walking and heel, one-leg stand. The duration of eccentric training was 6 or 12 weeks and was compared with concentric training (three studies), surgery (one study), wearing a night splint, or combined with a night splint (one study). and four studies did not include a control band. Results showed an average pain reduction of 60% with eccentric load training, compared to 33% in the control group (Kingma et al., 2007). Although the effect of eccentric training is promising in reducing pain in chronic Achilles tendonitis, the degree of effectiveness cannot be determined because the studies lack satisfactory methodological quality. Extracorporeal shock wave therapy (ESWT) has recently been developed to improve the treatment of tendonitis. A series of low-energy shock waves are applied directly to the painful tendon area. Although the evidence regarding how ESWT works is still in question, some believe that it may cause nerve degeneration. Others argue that it causes tenocytes to release growth factors in response to the pulse shock(Giangarra & Manske, 2019). Some authors suggest that a combination of ESWT and eccentric exercise is an effective treatment for insertional Achilles tendinopathy (Stania et al., 2019). The management of patients with Achilles tendinopathy conditions in this study uses several references to determine exercise programs in the hope of obtaining more optimal results. Many choices of exercise methods can be applied such as the use of electrotherapeutic modalities, and injections. From several methods that can be used, the author chose the modality of exercise therapy with consideration of low cost, can be done by patients at home for home programs. However, not all movements in the exercises can be applied to patients, physiotherapists must consider the patient's condition and environment. Education must always be carried out to provide understanding to patients regarding the conditions and risks experienced. In this study process, the author experienced problems in adjusting the language to provide education and instructions to patients. The author is also unable to monitor the success of providing education and home programs, so a contribution from the trainer is needed to increase the patient's enthusiasm.

The effectiveness of cryotherapy as a rehabilitation method is determined by its ability to maintain decreased muscle temperature and treatment time relative to the onset of injury or cessation of exercise (Kwiecien, S.Y., McHugh, 2021). The mechanism behind this pain relief is thought to be due to inflammation and edema, oxidative stress, and decreased nerve conduction velocity in pain fibers. Cryotherapy showed promising results in 4.444 patients with rheumatic diseases such as gouty arthritis, psoriatic arthritis, rheumatoid arthritis, and ankylosing spondylitis. Whole-body cryotherapy has been shown to reduce pain and disease activity, with the best results at temperatures of at least -110°C. Results also suggest that localized cryotherapy may be an effective treatment for pain relief in patients with these diseases (Garcia et al., 2021).

CONCLUSION

Based on the results of studies that have been carried out, ESWT and

Eccentric exercise can reduce pain, increase joint range of motion, increase muscle strength, increase ankle stability and improve functional abilities in Achilles tendinopathy patients.

ACKNOWLEDGEMENT

1. Suggestions for Patients:
    a. Adhere to the therapy plan that has been suggested by the physiotherapist regularly and disciplined.
    b. If you experience any discomfort or have any questions, communicate immediately with your physiotherapist.
    c. Do not hesitate to talk to the physiotherapist about changes in your condition during therapy.
2. Advice for Physiotherapists:
    a. Keep your knowledge updated on the latest developments in physiotherapy, particularly in the use of the latest technology such as ESWT.
    b. Always communicate with patients regarding the progress of their therapy, and provide a clear explanation of the benefits of each type of intervention.
    c. Consider utilizing the latest technology and tools available to improve the effectiveness of therapy.
    d. Establish a good relationship with the patient, provide emotional support, and encourage them to undergo therapy consistently.

With mutual cooperation between patients and physiotherapist, as well as the application of the latest technology, it is hoped that physiotherapy services can continue to be improved and provide maximum benefits for patients with achilles tendinopathy and other conditions.

REFERENCES

Beyer, R., Kongsgaard, M., Hougs Kjær, B., Øhlenschlæger, T., Kjær, M., & Magnusson, S. P. (2015). Heavy Slow Resistance Versus Eccentric Training as Treatment for Achilles Tendinopathy. The American Journal of Sports Medicine, 43(7), 1704–1711. https://doi.org/10.1177/0363546515584760

Cooper, K. (2023). Exercise therapy for tendinopathy: a mixed-methods evidence synthesis exploring feasibility, acceptability and effectiveness. https://doi.org/https://doi.org/10.3310/tfws2748

Garcia, C., Karri, J., & Zacharias, N. A. (2021). Use of Cryotherapy for Managing Chronic Pain : An Evidence-Based Narrative. Pain and Therapy, 10(1), 81–100. https://doi.org/10.1007/s40122-020-00225-w

Giangarra, C., & Manske, R. (2019). Clinical orthopaedic rehabilitation a team approach. In Journal of Chemical Information and Modeling (Vol. 53, Issue 9).

Gladman, D., Nash, P., Goto, H., Birt, J. A., Lin, Y., Orbai, A.-M., & Kvien, T. K. (2020). Fatigue numeric rating scale validity , discrimination and responder definition in patients with psoriatic arthritis. 1–8. https://doi.org/10.1136/rmdopen-2019-000928

International Paralympic Committee. (2015). International Paralympic Committee Athlete Classification Code. November, 21. https://www.paralympic.org/sites/default/files/2020-05/170704160235698_2015_12_17%2BClassification%2BCode_FINAL2_0-1.pdf

Kingma, J. J., de Knikker, R., Wittink, H. M., & Takken, T. (2007). Eccentric overload training in patients with chronic Achilles tendinopathy: a systematic review. British Journal of Sports Medicine, 41(6), e3–e3. https://doi.org/10.1136/bjsm.2006.030916

Kwiecien, S.Y., McHugh, M. P. (2021). The cold truth: the role of cryotherapy in the treatment of injury and recovery from exercise. https://doi.org/https://doi.org/10.1007/s00421-021-04683-8

Langberg, H. (2015). Eccentric or Concentric Exercises for the Treatment of Tendinopathies? 45(11), 853–863. https://doi.org/10.2519/jospt.2015.5910

Maffulli, N., Longo, U. G., Kadakia, A., & Spiezia, F. (2020). Achilles tendinopathy. Foot and Ankle Surgery, 26(3), 240–249. https://doi.org/10.1016/j.fas.2019.03.009

Malliaras, P. (2022). Physiotherapy management of Achilles tendinopathy. Journal of Physiotherapy, 68(4), 221–237. https://doi.org/10.1016/j.jphys.2022.09.010

Millar N, Silbernagel K, T. K. et al. (2021). Tendinopathy. https://doi.org/10.1038/s41572-020-00234-1

Miners, A. L., & Bougie, T. L. (2011). Chronic Achilles tendinopathy: a case study of treatment incorporating active and passive tissue warm-up, Graston Technique, ART, eccentric exercise, and cryotherapy. The Journal of the Canadian Chiropractic Association, 55(4), 269–279. http://www.ncbi.nlm.nih.gov/pubmed/22131563%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3222702

Myhrvold, S. B., Brouwer, E. F., Andresen, T. K. M., Rydevik, K., Amundsen, M., Grün, W., Butt, F., Valberg, M., Ulstein, S., & Hoelsbrekken, S. E. (2022). Nonoperative or Surgical Treatment of Acute Achilles' Tendon Rupture. New England Journal of Medicine, 386(15), 1409–1420. https://doi.org/10.1056/nejmoa2108447

Nuraini, Y. N. (2018). Tendinitis Achilles Dextra Dengan Aplikasi Ultra Sound. 1–12.

Olagbegi, O. M., Adegoke, B. O., & Odole, A. C. (2017). Effectiveness of three modes of kinetic-chain exercises on quadriceps muscle strength and thigh girth among individuals with knee osteoarthritis. Archives of Physiotherapy, 7(1), 9. https://doi.org/10.1186/s40945-017-0036-6

Riel, H., Lindstrøm, C. F., Rathleff, M. S., Jensen, M. B., & Olesen, J. L. (2019). Prevalence and incidence rate of lower- extremity tendinopathies in a Danish general practice : a registry-based study. 4–9.

Schepsis, A. A., Jones, H., & Haas, A. L. (2002). Achilles Tendon Disorders in Athletes. The American Journal of Sports Medicine, 30(2), 287–305. https://doi.org/10.1177/03635465020300022501

Silbernagel, K. G., & Crossley, K. M. (2015). A proposed return-to-sport program for patients with midportion achilles tendinopathy: Rationale and implementation. Journal of Orthopaedic and Sports Physical Therapy, 45(11), 876–886. https://doi.org/10.2519/jospt.2015.5885

Silbernagel, K. G., Hanlon, S., & Sprague, A. (2020). Current clinical concepts: Conservative management of achilles tendinopathy. Journal of

Athletic Training, 55(5), 438–447. https://doi.org/10.4085/1062-6050-356-19

Stania, M., Juras, G., Chmielewska, D., Polak, A., Kucio, C., & Król, P. (2019). Extracorporeal Shock Wave Therapy for Achilles Tendinopathy. BioMed Research International, 2019. https://doi.org/10.1155/2019/3086910

Utomo D.N. (2018). Cedera tendon achilles (Issue 1).

van Sterkenburg, M. N., & van Dijk, C. N. (2011). Mid-portion Achilles tendinopathy: why painful? An evidence-based philosophy. Knee Surgery, Sports Traumatology, Arthroscopy, 19(8), 1367–1375. https://doi.org/10.1007/s00167-011-1535-8

Vanlandewijck, Y. C., & Thompson, W. R. (Eds.). (2011). The Paralympic Athlete. Wiley. https://doi.org/10.1002/9781444328356

Yoon, S. Y., Kim, Y. W., Shin, I. S., Kang, S., Moon, H. I., & Lee, S. C. (2021). The beneficial effects of eccentric exercise in the management of lateral elbow tendinopathy: A systematic review and meta-analysis. Journal of Clinical Medicine, 10(17). https://doi.org/10.3390/jcm10173968