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Original Research Article

A Study to Compare the Efficacy Of Ultrasound with Cryokinetics & Ultrasound with Soft Tissue Massage (Deep Transverse Friction Massage) in Achilles Tendinopathy

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ABSTRACT

Background
Achilles Tendinopathy (AT) is a common cause of disability. Despite the economic and social relevance of the problem, the causes and mechanisms of Achilles Tendinopathy remain unclear. Tendon vascularity, gastrocnemius-soleus dysfunction, age, sex, body weight and height, pes cavus, and lateral ankle instability are considered common intrinsic factors. Achilles tendinopathy is essentially a failed healing response characterized by random tenocyte growth, some tendon cell degeneration, disruption of collagen fibres, and an increase in non-collagenous matrix. Tendinopathic tendons undergo a higher rate of matrix remodelling, which makes them less mechanically stable and more prone to injury.

Methods
Ninety subjects who has been diagnosed as Achilles Tendinopathy were taken as subject in this study. All subjects were randomly divided into two group, A & B, with forty-five subjects in each group. Group A underwent received ultrasound therapy (UST) with cryokinetics & Group B underwent treatment of received ultrasound therapy with soft tissue massage (Deep Transverse Friction Massage).

Outcome Measures
The outcome was measured by using Visual Analogue Score (VAS) to assess the pain & functional improvement was assessed by using Achilles questionnaire The Victorian Institute of Sport Assessment- Achilles (VISA-A).

Results
The study result showed more statistically significant improvement in functional status of ankle

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joint & reduced pain in Achilles Tendinopathy in both Group A & B. But there is statistical greater improvement in Group B, in which subjects were received ultrasound therapy with soft tissue massage (deep transverse friction massage).

Conclusions

It is concluded that, there is statistically significant improvement in functional status of ankle joint & reduced pain in Achilles Tendinopathy, in both Group A & B. But there is statistical greater improvement in Group B, in which subjects were received ultrasound therapy with soft tissue massage (Deep Transverse Friction Massage).

Keywords: Achilles Tendinopathy (AT), Ultrasound Therapy (UST), Cryokinetics, Deep Transverse Friction Massage (DTFM)

INTRODUCTION

A clinical disorder called Achilles tendinopathy is defined by discomfort and swelling in and around the tendon. It is primarily caused by overuse, however middle-aged overweight patients without a history of increasing physical activity frequently present with this condition[1], because the Achilles tendon (AT) is subjected to continuous, strong functional demands for extended periods of time. The prevalence of Achilles tendinopathy has increased over the last three decades due to an increase in both recreational and competitive sports activity. Compared to age-matched controls, runners have been found to have an increase in AT injuries of up to 10 times[2]. Expert runners have a lifetime incidence of Achilles tendinopathy estimated at 7% to 9%. Athletes that compete in volleyball, soccer, track and field, and racquet sports are also prone to Achilles tendinopathy[3-7]. Achilles tendinopathy affects more than just athletes; non-athletes can also be impacted, accounting for up to one-third of cases. This can result in missed work days and have a substantial financial impact on society[8]. Based on anatomical location. Achilles tendinopathy can be divided into two primary categories: insertional tendinopathy, which occurs at the Calcaneus-Achilles tendon junction, and non-insertional tendinopathy, which occurs 2 to 6 cm proximal to the Achilles tendon's insertion into the calcaneus[9].

Pathophysiology

The cells in a normal Achilles Tendon are well organized. Tenocytes and tenoblasts form up to 95% of the cellular element of the tendon[10]. Specialized fibroblasts, the tenocytes, appear in transverse sections as stellate cells, possibly owing to the uniform centrifugal secretion of collagen. Tenoblasts have variable shapes and sizes, and are arranged in long parallelchains[10]. Collagen constitutes about 90% of tendons protein, or approximately 70% of the dry weight of a tendon[11]. The collagen fibres are tightly packed in parallel bundles. Type I collagen is the commonest; it forms 95% of tendon collagen, and is held in parallel bundles by small proteoglycan molecules[4]. Elastin accounts for only about 2% of the dry mass of tendon[11] and can undergo up to 200% strain before failure.

The essence of tendinopathy is a failed healing response, with haphazard proliferation of tenocytes, some evidence of degeneration in tendon cells and disruption of collagen fibres, and subsequent increase in non- collagenous matrix[1,11,12-14]. Tendinopathic lesions affect both collagen matrix and tenocytes[13,15]. The parallel orientation of collagen fibres is lost, there is a decrease in collagen fibre diameter and in the overall density of collagen. Collagen micro tears may also occur, and may be surrounded by erythrocytes, fibrin, and fibronectin deposits. Normally collagen fibres in tendons are tightly bundled in a parallel fashion. In tendinopathic samples, there is unequal and irregular crimping, loosening and increased waviness of collagen fibres, with an increase in type III (reparative) collagen[15-17]. At electron microscopy, various types of degeneration have been described, namely (a) hypoxic degeneration, (b) hyaline degeneration, (c) mucoid or myxoid degeneration, (d) fibrinoid degeneration, (e)

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lipoid degeneration, (f) calcification, and (g) fibro cartilaginous and bony metaplasia[18-20]. All can coexist, depending on the anatomic site and the nature of their causal insult. Therefore, tendinopathy can be considered the end result of a number of etiologic processes with a relatively narrow spectrum of histopathologic features[1,20,21]. Degeneration of the Achilles Tendon (AT) is usually either ‘‘mucoid’’ or ‘‘lipoid’’. Collagen fibres that are thinner than normal, and large interfibrillarmucoid patches and vacuoles are seen. There is an increase in the Alcian-blue-staining ground substance. The characteristic hierarchical structure is also lost[22].

Aetiology

The aetiology of Achilles tendinopathy remains unclear, and many factors have been implicated-

1. Tendon vascularity, gastrocnemius-soleus dysfunction, age, sex, bodyweight and height, pes cavus, and lateral ankle instability are common intrinsic factors[23].
2. Excessive motion of the hind foot in the frontal plane, especially a lateral heel strike with excessive compensatory pronation, is thought to cause a ‘‘whipping action’’ on the AT, and predispose it to tendinopathy.
3. Changes in training pattern, poor technique, previous injuries, footwear, and environmental factors such as training on hard, slippery or slanting surfaces are extrinsic factors, which may predispose the athlete to Achilles tendinopathy.
4. Degenerative tendinopathy is the most common histologic finding in spontaneous tendon ruptures. Tendon degeneration may lead to reduced tensile strength and a predisposition to rupture. Indeed, ruptured ATs have more advanced intratendinous changes than tendinopathic tendons[24].

Clinical Aspects

The diagnosis of Achilles tendinopathy is mainly based on a careful history and detailed clinical examination. Both legs are exposed from above the knees and the patient was examined during standing and prone. The foot and the heel should be inspected for any malalignment, deformity, obvious asymmetry in the tendons size, localized thickening, Haglund heel and any previous scars. The AT should be palpated for tenderness, heat, thickening, nodule, andcrepitation6. The tendons excursion is estimated to determine any tightness. The ‘‘painful arc’’ sign helps to distinguish between tendon and paratenon lesions. In para-tendinopathy, the area of maximum thickening and tenderness remains fixed in relation to the malleoli from full dorsiflexion to plantarflexion, whereas lesions within the tendon move with ankle motion. There is often a discrete nodule, whose tenderness significantly decreases or disappears when the tendon is put under tension[25].

Royal London Hospital Test

Once the tester has elicited local tenderness by palpating the tendon with the ankle in neutral position (Fig. 1A) or slightly plantar flexed, the patient is asked to actively dorsiflex the ankle and to actively plantar flex it. With the ankle in maximum dorsiflexion and in maximum plantarflexion, the portion of the tendon originally found to be tender is palpated again (Fig. 1B). Results are classified as tenderness present on dorsiflexion or absent. In asymptomatic tendons, the test is performed selecting an area in the tendon 3 cm proximal to its calcaneal insertion when the ankle is held in neutral[26].

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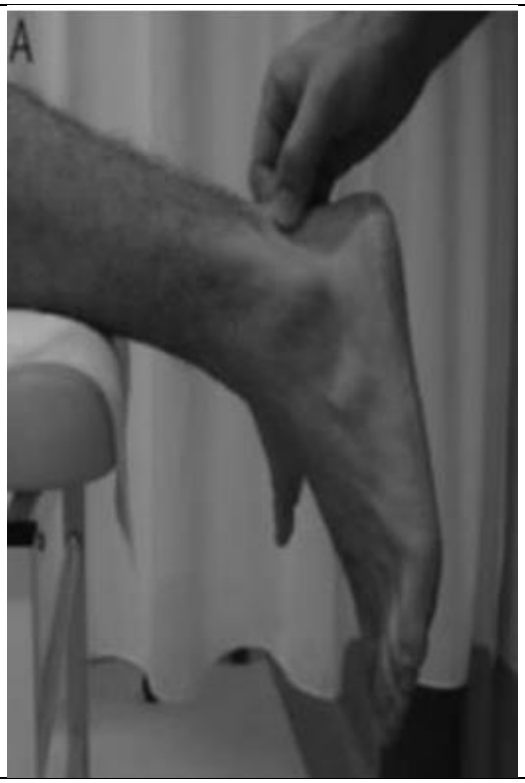

Fig. 1A

Fig. 1B

AIMS & OBJECTIVES

To compare the efficacy of ultrasound with cryokinetics & ultrasound with soft tissue massage (deep transverse friction massage) in achilles tendinopathy

MATERIALS & METHODS

The study was conducted in the out-patient department of Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospitals, in West Bengal, India, from October 2023 to May 2024.

Inclusion Criteria

- Achilles Tendinopathy
- Side: Unilateral
- Age: 18-60 years (to exclude immature, young tendons & fragile tendons in the elderly)
- BMI (kg/m2): 23.9-28
- Positive Royal London Hospital Test & Painful Arc Sign.
- No supplemental treatment of the Achilles Tendinopathy during the study.
- No increase in training intensity during the study.

For this study, 90 patients who met the inclusion criteria, were included. After the assessment of the participants by the physiotherapist, they were randomized in a 1:1 ratio and assigned either to Group A (Ultrasound with Cryokinetics) or Group B (Ultrasound with Soft Tissue Massage) through computer-generated random numbers. A statistician prepared a computer-generated random number list allocated to group A and group B. The allocated numbers were put inside the envelope by the statistician. The data enumerator opened the sealed envelope consecutively, with no exception. According to the information provided inside the envelope, participants were allocated either to Group A or Group B. Upon confirmation of a participant's

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eligibility, the next envelope in the sequence was opened, and the treatment allocation was entered on a randomization list.

Intervention

The patients diagnosed with plantar Achilles Tendinitis by clinicians were randomized either into the Group A (Ultrasound with Cryokinetics) or Group B (Ultrasound with Soft Tissue Massage) group by the principal author and intervened by other research team members.

Every patient participated in the 6-week study, which was done three times a week. Authorization was signed by the patient to give consent. Pre-intervention variables of pain & functional status were measured & recorded, along with demographic information (table 1).
For eighteen sessions, the Group A received Ultrasound Therapy with Cryokinetics. For eighteen sessions, the Group B received Ultrasound Therapy with Soft Tissue Massage (Deep Transverse Friction Massage). After that measurements & documentation of their post-intervention discomfort & functional performance were made by using VAS scale & VISA-A questionnaire. Regarding their measurement, data analysis was done.

Table1: Demographic characteristics & clinical parameters of participants-

Variables	**Total no. of sample (n= 90)** n (%)	**Group A (n=45)** n (%)	**Group B (n=45)** n (%)
Sex a. Male b. Female	a. 76 (84.4) b. 14 (15.6)	a. 39 (51.3) b. 6 (42.8)	a. 37 (48.7) b. 8 (57.2)
Age Categories a. 18-30 b. 31-50	a. 35 (40.2) b. 52 (59.8)	a. 20 (54.1) b. 25 (47.2)	a. 15 (45.9) b. 27 (52.8)
Age in Years (mean ± SD)	43.8 ± 10.9	42.9 ± 10.3	44.7 ± 11.6
Involved Side a. Left b. Right	a. 37 (41.1) b. 53 (58.9)	a. 18 (48.6) b. 27 (50.9)	a. 19 (51.3) b. 26 (49.1)

Study Variables (Outcome Variable)

The primary outcomes were the functional mobility and pain of the participants. The Visual Analogue Scale (VAS) &The Victorian Institute of Sport Assessment- Achilles (VISA-A) Scale was used to analyse the intensity of pain & functional mobility in the clinical setting before intervention (baseline) & after intervention (end line) at six weeks' follow-up. VISA-A Scale aims to evaluate the clinical severity for patient with Achilles Tendinopathy. It is an easily self-administered questionnaire that evaluate symptoms & their effect on physical activity. The questionnaire contains eight questions, covering three necessary domains: pain, functional status & activity (= three significant domains of dysfunction). The maximum score that can be achieved on the question is 100, & would be the score of person who is completely asymptomatic.

A lower score indicates more symptoms & greater limitation of physical activity. This scale had a good test- retest (r=0.93), intrarater (three test, r=0.90), & interrater (r=0.90) reliability as well as good stability when compared one week apart (r=0.81). There is no difference in scores whether the test-retest questionnaires are completed at the first visit or at the second visit (p=0.58). Reliability data were analysed by Pearson 'r, as these data were normally distributed[27].

Procedure

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1. Ultrasound Therapy (UST)

UST Refers to mechanical vibrations which are essentially the same as sound waves but of a higher frequency. Such waves are beyond the range of human hearing and therefore also called as ultrasonic. Thixotropic substances are gels that become fluid on vibration and thus make ideal couplants for ultrasound[28].

Before the start of the treatment, the patients were instructed of the use and the harmful effects of ultrasound. The patient was also instructed about the time of application and the duration of treatment. The patient part to be treated was exposed & the patient should be in comfortable position & in prone lying. The therapist should stand at the bottom of the treatment table. Skin and transducer were coated with acoustic gel. The applicator is moved in small concentric circular movements.

The transducer head was applied to the therapy region at right angle to ensure maximum absorption. The Ultrasound settings were pulse 20% duty cycle 8ms interval/2ms emission, 2ms burst of 1.0 MHz sinewaves repeating at 100Hz, 0.5 w/cm² of intensity. The intensity was gradually increased based on patient's response, however, not exceeding 1.5W/cm2.

Fig. 2a: Therapist giving Therapeutic Ultrasound

2. Cryokinetics

It is a systemic combination of cold application to numb the injured body part and graded progressive, active exercises. Cryokinetics referring to combination of cold and exercise. Ice used to anesthetize the injured part; this took 3 to 20 minutes and was ceased when patient reported numbness. Once numbed the body part was exercised with active movements, if any discomfort recurred the ice was reapplied[29].

Cryotherapy is thought to decrease oedema formation via induced vasoconstriction. Reduce secondary hypoxic damage by lowering the metabolic demand of the injured. Exercises increases blood flow to the injured area vital in healing. Exercise re- establishes neuromuscular function. With this technique exercise is possible much earlier than normal. Swelling is reduced dramatically through the combination of cooling and exercises. If the exercise during cryokinetics becomes so vigorous that further damage may result, the body

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responds with a pain sensation. Thus, cryokinetics has a built-in safety value[29].

In this group, pre application precautions were given to all the patients. Patients were instructed not to consciously attempt to overcome the pain. The patients were explained about the types of the pain that they would be experience during the treatment. An insulating layer should be used between the cold pack and patient's skin. Placing a towel between the skin and the cold packs, as many recommended, insulates the skin against the cold, decreasing the effectiveness of cold pack. Some types of cold packs are too cold to be applied to the skin. This is too much too cold for the skin and often results in tissue damage.

The subject is in comfortable prone lying position. Cryo pack is applied around the involved Achilles Tendon covering superior to posterior, superior to anterior aspects. Treatment was given 20 minutes following which active exercises were given for 5-7 minutes. Again, cryo pack was applied for 5 minutes then another set of active exercises were given. Exercises include active exercises like planter-flexion, dorsi-flexion, inversion & eversion.

Fig. 2b: Application of Cryopacks

3. Soft Tissue Massage (Deep Transverse Friction Massage)

It is a technique popularized by Dr. James Cyriax for pain and inflammation relief in musculoskeletal conditions. Deep friction massage is a technique that attempts to reduce abnormal fibrous adhesions and make scar tissue more mobile in acute, sub- acute and chronic inflammatory conditions by realigning the normal soft tissue fibres.

This is carried out by fingertip or by the thumb. Recent study suggests the rise of fabricating material in administrating deep friction massage for better effect and to overcome the fatigue to therapist. Friction massage produces local vasodilatation and also mobilizes the structures in the area. It is an effective means for treating conditions like sprains, strains, tendinitis etc. According to Cyriax Deep Transverse Friction Massage cause s traumatic hyperaemia which results in increased blood flow and decrease in pain. It also increases tissue perfusion and stimulates mechanoreceptors. When we talk about the effect of deep friction massage in Achilles Tendinopathy, it stimulates circulation, which overcomes the congestion within the tendon, reduces/ prevents adhesion formation[30].

Before friction massage can be performed successfully, the correct structure must be found through proper evaluation procedures. The distinction must be made between contractile structures such as the muscle belly, musculotendinous junction, tendon, and tendon-periosteal

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junction and non-contractile structures such as the joint capsule, bursae, fascia, dura mater, and ligament. In addition to finding the right spot, the massage must also be given the most effective way by following these basic principles.

1. The proper location must be found through proper evaluation procedures and palpation of the specific tendon, ligament, or muscle.
2. Friction massage must be given across the affected fibres. The thicker and stronger a normal structure, the more important friction is given strictly across the grain.
3. The therapist's fingers and patient's skin must move as one, otherwise moving subcutaneous fascia against muscle or ligament could lead to blister formation or subcutaneous bruising.
4. The friction massage must have sufficient sweep and be deep enough.
5. The patient must be in a comfortable position[31,32].

The frequency & duration of the treatment varies with the severity & type of the injury. In a recent injury, i.e., ligament sprain, start daily with gentle massage, only for 1-2 minutes to keep mobility. However, it may well take several minutes to be able to get the therapist's fingers on the structure depending on the severity of pain. With DFM, the treatment will last 10-15 minutes. The intensity of pressure applied during DFM is important to reduce the pain. Mean pressure used by physiotherapists have been estimated to be 2.3kg/cm2.

Deep Transverse Friction Massage is a common technique to treat Achilles Tendinopathy by rubbing across the tendon fibres to reduce pain & stimulate healing.

Patient Position: The patient should be in comfortable prone lying position. The therapist should be at the bottom of the table & bend the patient's knee slightly, stretch the Achilles Tendon & stabilize the foot against the torso.

Palpate: Therapist should use his/her thumbs to feel the most tender spot on the Achilles Tendon.

Friction: Roll the thumbs back & forth over the tender spots against the surface of the tendon sheath or body for 30 seconds to a minute. Therapist can use their finger pads instead of thumbs.

Pressure: The intensity of the pressure applied is important for pain relief. Physiotherapist typically use a pressure of around 2.3kg/cm2.

Duration: The treatment can last for 10-15 minutes. If the discomfort does not subside after one or two minutes, stop the treatment & try again later.

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Fig. 2c: Administration of Soft Tissue Massage

Data management and analysis

The collected data were entered in Epi-Data version 3.2and analysed based on the intention-to-treat (ITT) principle using Stata/MP version 14.1 (StataCorp LP, College Station, Texas). The normality of data was assessed using Shapiro–Wilk test. Socio-demographic data were analysed using descriptive analysis. Since the data were normally distributed, the mean and standard deviation (SD)were calculated. Comparisons were made using the Student's two-sample t-test. All values less than 0.05 were considered statistically significant.

RESULT

At baseline, a total of 90 participants were included in this study (45 participants in the Group A & 45 participants in the Group B). However, after 6 weeks of follow-up, a total of 87 participants completed the study (42 participants in the Group A & 45 participants in the Group B), whereas 3 participants lost follow in the Group A, & none of the participants discontinued the treatment in the Group B.

An evaluation chart is used to document the progression of the treatment. By using the statistical tools & with the help of the evaluation chart, t-test, standard deviation & p-value is calculated to check whether the treatment procedures are statistically significant or not.

The study's findings demonstrate a statistically significant reduction in pain over The Achilles Tendon & improve functional status or mobility of the ankle joint in patients with Achilles Tendinopathy, in both Group A & B. However, in Group B- where the patients undergone ultrasound therapy with soft tissue massage (Deep Transverse Friction Massage) - shows better statistical significant improvement than Group A- where the patient undergone ultrasound therapy with cryokinetics treatment protocol.

Table 2: Comparison of VAS score between Group A & Group B:

Variables	Group A (n=42) Mean (SD)	Group B (n=45) Mean (SD)	p- Value*
Pre- Treatment	4.77 (0.95)	5.22 (1.34)	0.073
Post- Treatment	2.71 (0.94)	1.97 (1.13)	0.001

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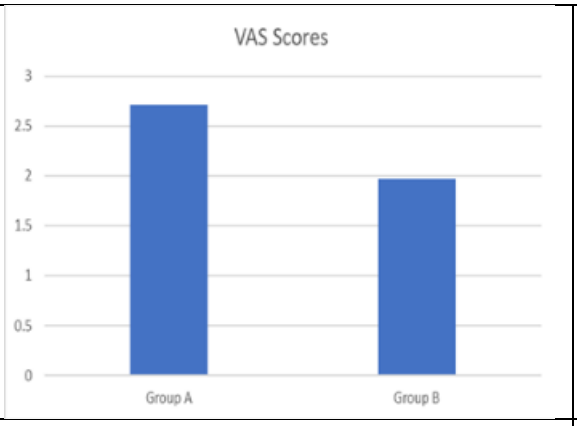
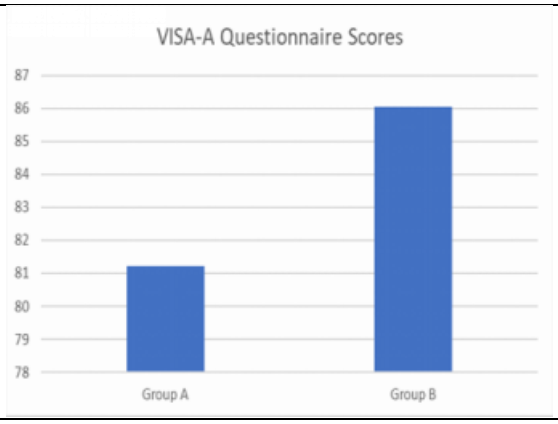
Table 3: Comparison of VISA- A questionnaire score between Group A & Group B

Variables	Group A (n=42) Mean (SD)	Group B (n=45) Mean (SD)	p- Value*
Pre- Treatment	58.14 (11.47)	52.53 (14.87)	0.005
Post- Treatment	81.23 (9.60)	86.04 (7.45)	0.011

***Statistically significant at p<0.05.**



Graph 1



Graph 2

Comparison of post-value of VAS & VISA-A score between Group A & B in Graph 1 & 2

DISCUSSION

Achilles Tendon problems are very common among athletes as well as the general population[11,16]. The terminology used to describe the painful condition of the Achilles Tendon is superfluous, confusing, & most often does not reflect the underlying abnormality. Additional terms such as Achilles tendinopathy, tenopathy, tendinosis, partial rupture, paratenonitis, tenosynovitis, tenovaginitis, peritendinitis, & achillodynia have been used to describe the problems of non-insertional pain associated with this tendon. For the patients, the most common problem of Achilles Tendinopathy is the pain induced limitation in sports & sports related activities. While the activities of daily living are also affected but relatively lesser than the previous one. The goal of treatment is to return the patient to the desired level of physical activity without residual pain. In athletes, an additional demand is that the recovery time should be as short as possible.

In the early phases of Achilles Tendinopathy, various forms of conservative treatment are normally used[33]. Operative treatment is recommended for patients who do not respond adequately to a 3-6 months' trial of appropriate conservative protocol. In recent eight years' follow-up study, non-operative treatment was unsuccessful in 29% of 83 patients with acute to subacute Achilles Tendinopathy[34]. Most of the cases are treated conservatively with NSAIDs, rest & through physiotherapy.

In this study the majority, 76 (84.4%), were male & 14 (15.6%), were female. The mean ± SD age of the participant was 43.8 ± 10.9 years (42.9 ± 10.3 in Group A & 44.7 ± 11.6 in Group A). Most of the participants (58.9%) had the problem of Achilles Tendinopathy on the right leg, & only 41.1% had the occurrence on the left side.

According to study, therapeutic ultrasound is effective in treating tendinopathy. The effectiveness of therapeutic ultrasound depends upon the intensity, frequency, & duration of the treatment. The dose of the ultrasound therapy in this study was chosen from evidence available in literature. Pulsed Ultrasound Therapy was used. It is preferred for soft tissue repair with the pulse ratio 1:4 as per Dyson M. The high intensity can be potentially damaging, so the dose of 0.5-1W/cm2.

Therapeutic ultrasound has been used widely for more than 40 years in the treatment

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of musculoskeletal injuries. Therapeutic ultrasound converts electrical energy into acoustic wave forms which is converted into heat as it passes through tissues of varying resistance. Therapeutic ultrasound can be used as thermal agents to increase the temperature of deep tissues. Raising the tissue temperature accelerates the metabolic processes including increasing enzymes activity, increasing the rate of ion exchange, increasing the rate & volume of diffusion across cell membrane. Thus therapeutic ultrasound decreases pain & stiffness.

On the other hand, cryokinetics is a systematic combination of cold application to numb the injured body part & graded progressive active exercise. This is the most effective form of cryo therapy for the rehabilitation of ligament sprain & muscle injuries. The success of cryokinetics was due to early exercise & that the role of cold was only to decrease the pain & thereby allow earlier recovery. Cryokinetics is significantly more efficient in reducing pain. These results are consistent with those of Moore et al (1967) who presented a case study on athletic rehabilitation with cryokinetics & discussed possible mechanics for a quicker rehabilitation, & with those of Grant & Hayden (1964) who discussed benefits of cryokinetics.

Soft tissue massage or Deep Friction Massage is an another important treatment protocol, commonly used to treat different kinds of tendinopathy. Friction massage prevents the formation of adhesion as well as helps to break down of the adhesion that limit the motion & improves local blood supply. Thus it helps in healing & improves the condition. According to results of deep transverse friction massage, we can state that soft tissue massage is highly effective in treating Achilles Tendinitis. These findings support the study done by Guler UF et al (2004) & Gimblett PA et al (1999) who stated that deep transverse friction massage is an effective means of treating with soft tissue lesions.

But these results were contraindicating to the findings of Brosseau et al (2002) who stated that soft tissue massage is not effective for controlling pain in tendinitis because it showed significant improvement in VAS score.

These results of the study also got strong evidence from the study done by Shamshi Sharick (2013) who has done a comparative study of effectiveness of ultrasound & massage alone in treatment of acute supraspinatus tendinitis. The result of the study suggests that ultrasound & deep friction massage improves pain symptoms of supraspinatus tendinitis. Deep friction massage alone improved the pain symptoms but too small to reach. That's why combination of ultrasound therapy with deep friction massage is much more effective in treating conditions like tendinitis.

Another study in 2011 compared ultrasound with deep friction massage in tendinitis. It was an RCT of 10 days' treatment. The baseline treatment was Codman's exercise. The current study showed better improvement in pain as compared to previous study, because in this study ultrasound therapy was the common treatment & cryokinetics & deep friction massage were the additional treatment options with ultrasound therapy, which improved the condition much better than the Codman's exercise.

Studies comparing cryokinetics with deep friction massage for tendinitis often show that friction massage provides superior results in pain reduction & functional improvement[35]. So, it can be said that cryokinetics is useful in the acute phase when significant inflammation & pain are present due to its cooling effect.

In this study ultrasound therapy & soft tissue massage found to be better than ultrasound therapy & cryokinetics. In Group A the mean value of VAS is 4.77 & SD is 0.95 at Day 1 (baseline) & after six-weeks of treatment protocol (end line) the mean value of VAS in Group A is 2.71 & SD is 0.94. In Group B the mean value of VAS at day 1 (baseline) is 5.22 & SD is 1.34, whereas after six-weeks of treatment protocol (end line) in Group B the mean value of VAS is 1.97 & SD is 1.13. Two sample t-test is performed with the post-treatment values of

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VAS score & the p-value is obtained, 0.001, which is less than the 0.05 (level of significance), means statistically significant (table 2).

In Group A the mean value of VISA-A score is 58.14 & SD is 11.47, at day 1 (baseline) & after six-weeks of treatment protocol (end line) the mean value of VISA-A score in Group A is 81.23 & SD is 9.60. In Group B the mean value of VISA-A score is 52.53 & SD is 14.87, at day 1 (baseline) & after six-weeks of treatment protocol (end line) the mean value of VISA-A score in Group B is 86.04 & SD is 7.45. Two sample t-test is performed with the post-treatment values of VISA-A score & the p-value is obtained, 0.011, which is less than the 0.05 (level of significance), means statistically significant (table 3).

This study implies that both ultrasound therapy with cryokinetics & ultrasound therapy with soft tissue massage (deep friction massage) can be used for treating patient with Achilles Tendinopathy, but the ultrasound therapy with soft tissue massage is much more superior than ultrasound therapy with cryokinetics in treating patient with Achilles Tendinopathy.

LIMITATION OF THE STUDY

1. Short duration.
2. No long-term follow-up care has done
3. The study is based on only two variables- pain & functional performance.
4. Patients are selected from limited geographical area.
5. The effects on various sports related to Achilles Tendinopathy, is not included in this study.

RECOMMENDATION

1. The study can be done for longer duration.
2. Geographical area can be increased.

Further Study

Further study can be done only with athletic person suffering from Achilles Tendinopathy

CONCLUSION

In this study, VAS scale & VISA-A questionnaire was used to measure the prognosis of the pain & functional ability in treating Achilles Tendinopathy was determined.

Taking into consideration the parameters of pain using VAS & functional scale for Achilles Tendon injury, therapeutic ultrasound & cryokinetics was compared with therapeutic ultrasound with soft tissue massage (Deep Transverse Friction Massage) in Achilles Tendinopathy.

The study concluded by taking mean scores that therapeutic ultrasound with cryokinetics & therapeutic ultrasound with soft tissue massage are efficient & useful in rehabilitation of patient with Achilles Tendinitis. They improved the functional ability, relieve pain & considerably improve the physical performance of patients in their own aspects.

Hence, therapeutic ultrasound with soft tissue massage (Group B) showed significant improvement than therapeutic ultrasound with cryokinetics (Group A) in reducing pain & enhancing functional performance in patient with Achilles Tendinitis.

AUTHOR CONTRIBUTION

1. Dr. Krishnendu Chakraborty: study design, data analysis, statistical analysis, drafting manuscript.
2. Dr. Sayak Biswas: study design, statistical analysis, drafting manuscript.
3. Dr. Sutanu Goswami: statistical analysis, drafting manuscript, corresponding author.
4. Dr. Jayati Paul: study design, drafting manuscript.
5. Dr. Jitendra Kumar Shriwas: study design, drafting manuscript.

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6. Dr. Manmeet Kaur: study design, drafting manuscript.

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