RESEARCH ARTICLE

EFFECTS OF ULTRASOUND THERAPY VERSUS TRANSVERSE FRICTION MASSAGE ALONG WITH ECCENTRIC EXERCISE PROGRAM ON CHRONIC ACHILLES TENDINOPATHY

1. Lecturer, University of Lahore, Lahore Pakistan
2. Senior Lecturer, Riphah International University, Lahore Campus. Madar-e-Millat Road, Quaid e Azam Industrial Estate, Lahore, Punjab, Pakistan
3. Khalidunia institute of Technology and Applied Sciences, Islamabad. Pakistan
4. Assistant Professor Riphah International University, Lahore Campus. Madar-e-Millat Road, Quaid e Azam Industrial Estate, Lahore, Punjab, Pakistan
5. Professor Riphah International University, Lahore Campus. Madar-e-Millat Road, Quaid e Azam Industrial Estate, Lahore, Punjab, Pakistan

Correspondence
Muhammad Sanaullah
Senior Lecturer, Riphah International University Lahore Campus. Madar-e-Millat Road, Quaid e Azam Industrial Estate, Lahore, Punjab, Pakistan
E-mail:drmuhammadsanaullah@gmail.com

Received on: 08-12-2021
Revision on: 10-05-2022
Published on: 30-06-2022

Citation
Kousar R, Sanaullah M, Ikram M, Aleem A, Memon AG, Rehman SS Effects of ultrasound therapy versus transverse friction massage along with eccentric exercise program on chronic achilles tendinopathy T Rehabili. J. 2022:06(02):333-337
soi: 21-2017/re-trjvol06iss02p333
doi: https://doi.org/10.52567/trj.v6i02.110

Raheela Kousar[1]: Conception, data collection, writing; Revised and accountable for all aspects
Muhammad Sanaullah[2]: Analysis & interpretation of data, Revised and accountable for all aspects
Mehwish Ikram[2]: Revised and accountable for all aspects
Asma Aleem[3]: Interpretation of data, Revised and accountable for all aspects
Aamir Gul Memon[4]: Revised and accountable for all aspects
Syed Shakil ur Rehman[5]: interpretation of data, Revised and accountable for all aspects

ABSTRACT

Background: Achilles tendinopathy is highly prevalent and caused by intrinsic or extrinsic factors. The multiple minor traumas can lead to achilles tendinopathy. Physical therapy treatment includes soft tissue mobilization and exercises. Objective: To compare ultrasound and transverse friction massage in chronic Achilles tendinopathy. Methodology: The study was a randomized control trial from 1st March 2019 to 15th August 2019. The non-probability convenient sampling technique was used to include n=76 patients having pain and activity limitation of Achilles tendon and randomly allocated into groups A and B by lottery method. The outcome measuring tools were numeric pain rating scale (NPRS) for pain, the Victorian Institute of Sports Assessment- Achilles questionnaire (VISA-A) for severity and goniometry for ROM. The Group A was treated with transverse friction massage and the group B was treated with ultrasound therapy. Both groups also performed eccentric exercises. The assessment was done at the baseline on the 1st session, at end of the 9th and 18th session. The data was analysed by SPSS 23 using independent t-test and repeated measures ANOVA. Results: The results of RM-ANOVA with pairwise comparison showed that both groups improve significantly ($p<0.05$) throughout the treatment duration with large effect size for all variables. While comparing the groups with independent t-test, TFM group showed more improvement in all variables as compared to UST group ($p<0.05$) after 3rd week as well as after 6th week of intervention. Conclusion: The Transverse friction massage (TFM) was more effective than ultrasound therapy (UST) when combined with eccentric exercises in improving pain severity of tendinopathy and ROM of ankle.

Keywords: Achilles tendon, eccentric exercises, pain stretching, myofascial release, ultrasonic therapy, tendinopathy.

INTRODUCTION

Achilles tendinopathy (AT) is an intra-tendinous inflammatory process and degeneration of the tendon[1]. The AT most commonly occurs due to dysfunction or prolonged standing in a sportsperson or person having a physical activity like running, jogging etc[2, 3]. The AT can be caused by intrinsic factors like microtrauma or it can be caused by extrinsic factors like external impact. There is a positive association between obesity, age, hypertension and use of steroids with AT[4, 5]. In the general population, the incidence of AT was 1.85/1000 patients and 2.35 in the adult population[6].In elite athletes, the middle distance runner had higher prevalence (83%) of Achilles tendinopathy than other athletes[7]. In the Dutch population for AT the prevalence rate was 2.35/1000 and the incidence rate was 2016/1000[8]. The treatment options include medicine, invasive procedure, conservative treatment and physiotherapy. The purpose of all treatments is re-vascularization, fibrotic adhesion removal and cell stimulation to start inflammation[9,10,11,12]. The ultrasound is a commonly used modality for tendinosis[10]. It Improves microcirculation, migration and synthesis of collagen fibers to the achilles tendon[11, 12]. A study compared ultrasound (US) with friction massage and both techniques were effective in tendinitis[13]. Eccentric exercises improve range of motion, functional activity, decrease pain and also effect on the rapid recovery of Achilles tendinosis[14, 15].In a study when soft tissue treatment was added with eccentric exercises there was the better effect on function and pain in achilles tendinosis.[16] Transverse friction massage (TFM) is one of the Cyrix approaches, the direction of massage must be transverse from direction of fibers of affected structure. It improves pain and mobility by breaking the adhesion and releasing the scar in muscle and tendon[17,18,19].

The Ultrasound, transverse friction massage and eccentric exercises had effects on achilles tendinopathy but there was no comparison of ultrasound with transverse friction massage when eccentric exercises are baseline treatment. This study aimed to compare transverse friction massage

and ultrasound therapy incorporated with eccentric exercises in the treatment of Achilles tendinopathy.

METHODOLOGY

A randomized control trial was conducted at City Hospital Jalal Pur Jattan, Gujrat. The duration of the study was from 1st March 2019 to 15th August 2019. The study was started after approval from research and ethical committee (RCR&AHS/REC/MS-OMPT/022). The non-probability convenient sampling technique was used for sample collection and patients were randomly allocated in groups by lottery method. A total of n=76 patients were included in the study who were 18 to 65 years of age, had pain on achilles tendon palpation, the VISA-A scale score of >20 and <80 points and had activity limited due to symptoms for the last 6 months. The exclusion criteria were patients having AT surgery previously, intra-articular injection for the past 6 months, having rheumatoid arthritis; and primary and secondary osteoarthritis.

The Group A was treated with transverse friction massage (TFM) along with eccentric exercises (EE) and the group B was treated with ultrasound therapy (UST) along with eccentric exercises (EE). A total of n=73 patients from n=76 samples were included in the data analysis, as the one patient dropped out from the TFM group (n=36) and two patients from the UST group (n=37). (Figure 1)

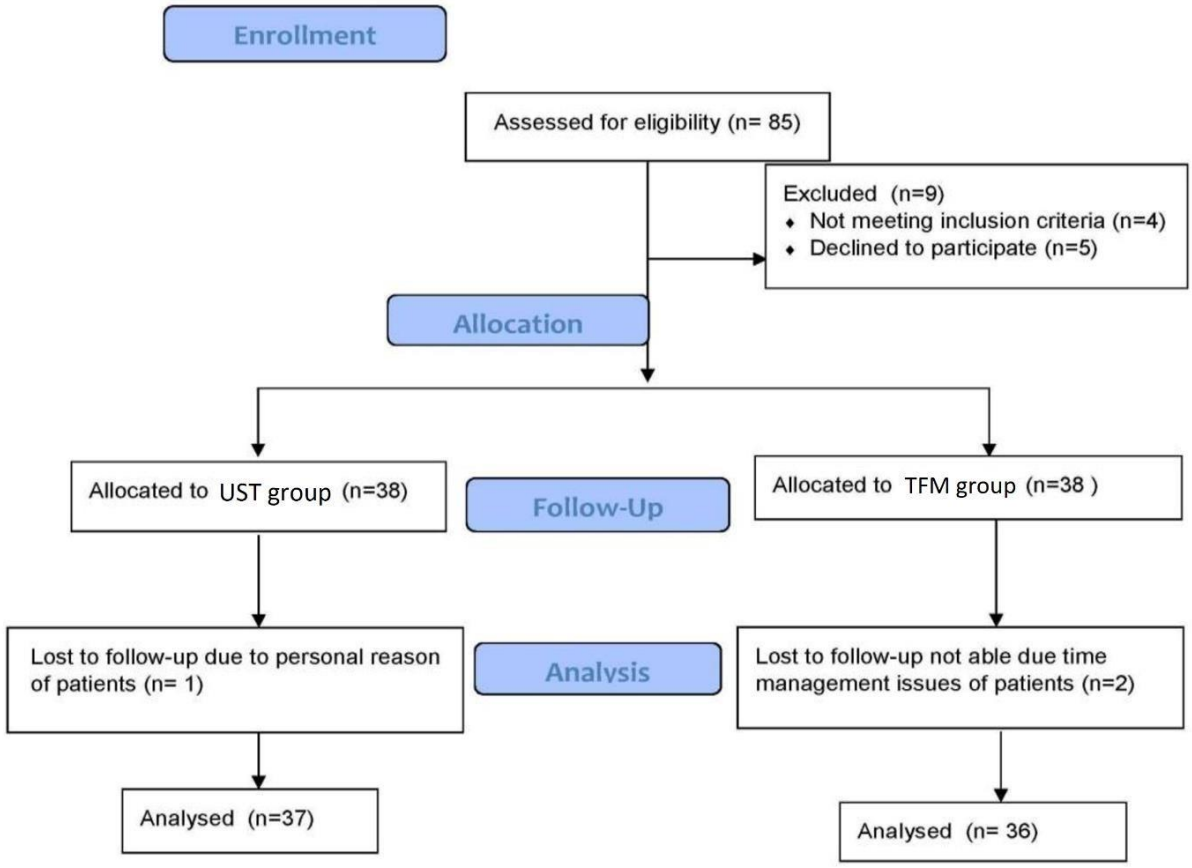

Figure 1: Consort diagram

The Eccentric exercises of plantar flexion were performed while standing on the step with 6 sets of 15 repetitions. The gastrocnemius and soleus were targeted by 3 sets of plantarflexion while knee in extension and 3 sets while knee in slight flexion.

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. Transverse friction massage was performed by thumb for 3 min over 3cm-5cm area. The duration of treatment was 6 weeks with 3 sessions per week The assessment was done at the baseline on the 1st session, at end of the 9th and 18th session. The Numeric pain rating scale (NPRS), a valid and reliable scale (ICC=0.63)[21]. To measure the severity of Achilles tendinopathy, self-administered, The Victorian institute of sports assessment–achilles

questionnaire (r=0.90-0.93) was used [22]. The universal goniometry was used for planter flexion, dorsiflexion, inversion and eversion. The demographic data was presented as mean±Sd and n(%) for age and gender respectively. As the assumptions of the parametric test were met so RMANOVA with Bonferroni correction was applied for with-in group changes and to compare the group independent t-test was applied. The partial eta squared (ηp^2) and Cohen's d was also calculated to determine the effect size for RMANOVA and independent t-test respectively. The level of significance was set at p<0.05 and SPSS ver 23 was used for data analysis.

RESULTS

The mean age of the participants in the group A was 42.67±5.50 years and in the group B was 42.52±5.29 years. A total of n=28 males and n=9 females were in the group A and the remaining n=25 male and n=11 females were in the group B.

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated (p<0.05), and therefore, a Greenhouse-Geisser correction was used. It showed that both groups improve significantly (p<0.05) throughout the treatment duration with large effect size for all variables. (Table 1)

Table 1: With-in group changes pain, severity, and foot ROM

		Group A(TFM)					Group B (UST)				
		Mean	SD	p-value	F(df)	ηp^2	Mean	SD	p-value	F(df)	ηp^2
NPRS	Zero week	8.56	0.50	<0.001^{***a}	982.54(1.34,48.58)	0.96	8.38		<0.001^{***a}	596.72(1.692,59.23)	0.94
	3rd week	5.1	0.75	<0.001^{***b}			6.5	0.64	<0.001^{***b}		
	6th week	1.8	1.01	<0.001^{***c}			4.02	0.77	<0.001^{***c}		
VISA-A	Zero week	27.62	4.70	<0.001^{***a}	1639.35(1.931,69.51)	0.97	27.97		<0.001^{***a}	1506.07(1.91,67.54)	0.97
	3rd week	59.56	3.76	<0.001^{***b}			49.4	2.75	<0.001^{***b}		
	6th week	84.81	4.52	<0.001^{***c}			72.47	3.23	<0.001^{***c}		
Planter Flexion	Zero week	12.54	2.08	<0.001^{***a}	1461.11(1.663,59.85)	0.97	12.44		<0.001^{***a}	1336.35(1.747,61.15)	0.96
	3rd week	22.78	2.89	<0.001^{***b}			18.08	2.52	<0.001^{***b}		
	6th week	31.59	2.94	<0.001^{***c}			23.83	2.19	<0.001^{***c}		
Dorsi Flexion	Zero week	5.27	1.50	<0.001^{***a}	1642.99(1.785,64.24)	0.97	5.41		<0.001^{***a}	543.34(1.648,57.67)	0.93
	3rd week	10.62	1.68	<0.001^{***b}			8.50	1.71	<0.001^{***b}		
	6th week	16.62	1.68	<0.001^{***c}			12.50	1.99	<0.001^{***c}		
Inversion	Zero week	8.40	1.89	<0.001^{***a}	1022.68(1.996,71.84)	0.96	8.33		<0.001^{***a}	868.664(1.58,55.51)	0.96
	3rd week	15.21	2.79	<0.001^{***b}			11.86	1.70	<0.001^{***b}		
	6th week	23.48	2.30	<0.001^{***c}			17.86	1.86	<0.001^{***c}		
Eversion	Zero week	5.40	1.48	<0.001^{***a}	927.647(1.479,53.24)	0.96	5.30		<0.001^{***a}	374.231(1.38,48.37)	0.91
	3rd week	11.00	1.43	<0.001^{***b}			8.72	1.76	<0.001^{***b}		
	6th week	17.08	1.65	<0.001^{***c}			13.22	2.05	<0.001^{***c}		

[a]0 week vs. 3rd week, [b]3rd week vs. 6th week, [c]0 week vs 6th week

Level of significance: p<0.05 p<0.01**, p<0.001****

While comparing the groups with independent t-test, TFM group showed more improvement in all variables as compared to UST group (p<0.05) after 3rd week as well as after 6th week of intervention with large effect size. (Table 2)

Table 2: Between group comparison (TFM & UST)

		Group A(TFM)		Group B (UST)		MD	p-value	Cohen's d
		Mean	SD	Mean	SD			
NPRS	Zero week	8.56	0.50	8.38	0.49	0.18	0.129	0.18
	3rd week	5.1	0.75	6.5	0.64	-1.4	<0.001***	0.75
	6th week	1.8	1.01	4.02	0.77	-2.22	<0.001***	0.81
VISA-A	Zero week	27.62	4.70	27.97	4.30	-0.35	0.761	0.04
	3rd week	59.56	3.76	49.4	2.75	10.16	<0.001***	0.84
	6th week	84.81	4.52	72.47	3.23	12.34	<0.001***	0.82
Planter flexion	Zero week	12.54	2.08	12.44	2.07	0.1	0.885	0.02
	3rd week	22.78	2.89	18.08	2.52	4.7	<0.001***	0.66
	6th week	31.59	2.94	23.83	2.19	7.76	<0.001***	0.84
Dorsi flexion	Zero week	5.27	1.50	5.41	1.22	-0.14	0.722	0.04
	3rd week	10.62	1.68	8.50	1.71	2.12	<0.001***	0.53
	6th week	16.62	1.68	12.50	1.99	4.12	<0.001***	0.87
Inversion	Zero week	8.40	1.89	8.33	1.75	0.07	0.871	0.02
	3rd week	15.21	2.79	11.86	1.70	3.35	<0.001***	0.57
	6th week	23.48	2.30	17.86	1.86	5.62	<0.001***	0.81
eversion	Zero week	5.40	1.48	5.30	1.47	0.1	0.808	0.03
	3rd week	11.00	1.43	8.72	1.76	2.28	<0.001***	0.58

Level of significance: p<0.05 p<0.01**, p<0.001****

DISCUSSION

The objective of this study was to compare ultrasound with transverse friction massage in Achilles tendinopathy. Eccentric exercises of planter flexors were common treatment for both groups. NPRS, VISA-A and goniometer were used for pain, functional outcome and range of motion at the ankle joint. There was a significant decrease in pain within and between groups. There was also significant increase in functional status (VISA-A) and range of motion at ankle joint.

A meta-analysis was conducted in 2019 to compare the VISA-A score of eccentric exercises and ultrasound in Achilles tendinopathy. In that meta-analysis, a study compared two groups, group A was treated with deep friction massage (DFM), ultrasound and in group B eccentric exercises were added with deep friction massage, ultrasound. The mean difference of VISA-A for group B was 35±3.00 and for group, A was 22±10.00. In current study, the mean difference of VISA-A for transverse friction massage group was 57.19±0.18 and for the ultrasound group was 44.5±0.96. In the previous study the treatment plan was of 12 weeks with 1week interval. In current study treatment was of 6 weeks but was continuous. That 1 week pause of treatment in previous study can affect the outcomes. Another study in this meta-analysis also uses DFM and ultrasound for AT and there was no significant improvement in VISA-A but in current study, there was a significant improvement in VISA-A score for both groups. In That meta-analysis, deep friction massage showed better improvement in VISA-A as compared with traditional physical therapy. In the current study, ultrasound was compared with transverse friction massage; and eccentric exercises were common in both groups. By comparing the current study with this meta-analysis it can be concluded if eccentric exercise is added with transverse friction massage or ultrasound there will be more significant positive effects on Achilles tendinopathy[23,24].

A 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 exercises. The current study showed better improvement in pain as compared to previous study. because in this study eccentric exercises were common treatment and in previous study, Codman's exercises were common treatment. For ROM, the results in previous and current study both showed significant improvement (p=0.001)[25].

A study analyzed the effect of transverse friction massage on tendinitis. That trial was of 3 weeks with 2 sessions per week. Outcome measuring tools were VAS and VISA-A. They included eccentric exercises with transverse friction massage. In current study the result of NPRS and VISA-A were more significantly better than previous study because the duration of treatment and quantity of sessions in current study were greater in quantity [26].

In current study the BMI, presence of diabetes and information regarding foot wear of participants was not considered, which may affect the progress of the condition even with intervention.

CONCLUSION

The transverse friction massage (TFM) was more effective than ultrasound therapy (UST) when combined with eccentric exercises in improving pain severity of tendinopathy and ROM of ankle.

REFERENCES

1. Lopez RGL, Jung H-G. Achilles tendinosis: treatment options. Clin Orthop Surg. 2015;7(1):1-7.doi.org/10.4055/cios.2015.7.1.1
2. Rio E, Moseley L, Purdam C, Samiric T, Kidgell D, Pearce AJ, et al. The pain of tendinopathy: physiological or pathophysiological? Sports med. 2014;44(1):9-23. doi 10.1007/s40279-013-0096-z
3. Sobhani S, Dekker R, Postema K, Dijkstra PU. Epidemiology of ankle and foot overuse injuries in sports: a systematic review. Scand j med sci sports. 2013;23(6):669-86. doi.org/10.1111/j.1600-0838.2012.01509.x
4. Waldecker U, Hofmann G, Drewitz S. Epidemiologic investigation of 1394 feet: coincidence of hindfoot malalignment and Achilles tendon disorders. Foot Ankle Surg. 2012;18(2):119-23. doi.org/10.1016/j.fas.2011.04.007
5. Franceschi F, Papalia R, Paciotti M, Franceschetti E, Di Martino A, Maffulli N, et al. Obesity as a risk factor for tendinopathy: a systematic review. Int. J. Endocrinol. 2014;2014. doi.org/10.1155/2014/670262
6. De Jonge S, Van den Berg C, de Vos R-J, Van Der Heide H, Weir A, Verhaar J, et al. Incidence of midportion Achilles tendinopathy in the general population. Br. J. Sports Med. 2011;45(13):1026-8. doi.org/10.1136/bjsports-2011-090342
7. Janssen I, van der Worp H, Hensing S, Zwerver J. Investigating Achilles and patellar tendinopathy prevalence in elite athletics. Res Sports Med. 2018;26(1):1-12. doi.org/10.1080/15438627.2017.1393748
8. Albers IS, Zwerver J, Diercks RL, Dekker JH, Van den Akker-Scheek I. Incidence and prevalence of lower extremity tendinopathy in a Dutch general practice population: a cross-sectional study. BMC musculoskelet disord. 2016;17(1):1-6. doi 10.1186/s12891-016-0885-2

9. Maquirriain J. Surgical treatment of chronic achilles tendinopathy: long-term results of the endoscopic technique. J Foot Ankle Surg. 2013;52(4):451-5. doi.org/10.1053/j.jfas.2013.03.031
10. Best TM, Moore B, Jarit P, Moorman CT, Lewis GK. Sustained acoustic medicine: wearable, long-duration ultrasonic therapy for the treatment of tendinopathy. Phys sportsmed. 2015;43(4):366-74. doi.org/10.1080/00913847.2015.1095617
11. Chang Y-P, Chiang H, Shih K-S, Ma H-L, Lin L-C, Hsu W-L, et al. Effects of therapeutic physical agents on achilles tendon microcirculation. J Orthop sports Phys Ther. 2015;45(7):563-9. doi/10.2519/jospt.2015.5681
12. Tsai W-C, Tang S-T, Liang F-C. Effect of therapeutic ultrasound on tendons. Am J Phys Med Rehabil. 2011;90(12):1068-73. doi: 10.1097/PHM.0b013e31821a70be
13. Shivakumar H, Chanappa T, Reddy PK, Dey J. A comparative study between the efficacies of ultrasound therapy with cryokinetics versus ultrasound therapy with soft tissue massage (deep friction massage) in acute supraspinatus tendinitis. J. Evol. Med. Dent Sci. 2014;3(15):3898-908. doi: 10.14260/jemds/2014/2374
14. Habets B, Van Cingel R. Eccentric exercise training in chronic mid-portion A chilles tendinopathy: A systematic review on different protocols. Scand J Med Sci Sports. 2015;25(1):3-1.doi.org/10.1111/sms.12208
15. Miners AL, Bougie TL. Chronic Achilles tendinopathy: a case study of treatment incorporating active and passive tissue warm-up, Graston Technique®, ART®, eccentric exercise, and cryotherapy. J Can Chiropr Assoc. 2011; 551(4): 269–279.
16. Mccormack JR, Underwood FB, Slaven EJ, Cappaert TA. Eccentric exercise versus eccentric exercise and soft tissue treatment (Astym) in the management of insertional Achilles tendinopathy: a randomized controlled trial. Sports health. 2016;8(3):230-7. doi: 10.1177/1941738116631498
17. Hassan SM, Hafez AR, Seif HE, Kachanathu SJ. The effect of deep friction massage versus stretching of wrist extensor muscles in the treatment of patients with tennis elbow. OJTR 2016;4(1):48-54. doi: 10.4236/ojtr.2016.41004
18. Kanwal R, Khan J, Awan WA, Khan R, Malik S. Stretching exercises versus deep friction massage for the management of piriformis syndrome. T Rehabili J. 2018;2(02):65-9
19. Abbas S, Riaz R, Khan A, Javed A, Raza S. Effects of mulligan and cyriax approach in patients with subacute lateral epicondylitis: Soi: 21-2017/re-trjvol03iss02p107. T Rehabili J. 2019;3(02):107-15
20. Kedia M, Williams M, Jain L, Barron M, Bird N, Blackwell B, et al. The effects of conventional physical therapy and eccentric strengthening for insertional Achilles tendinopathy. Int J. Sports Phys. Ther. 2014;9(4):488. PMC4127511
21. Young IA, Cleland JA, Michener LA, Brown C. Reliability, construct validity, and responsiveness of the neck disability index, patient-specific functional scale, and numeric pain rating scale in patients with cervical radiculopathy. Am J Phys Med Rehabil. 2010;89(10):831-9. DOI: 10.1097/PHM.0b013e3181ec98e6
22. Mccormack J, Underwood F, Slaven E, Cappaert T. The Minimum clinically important difference on the visa-a and lefs for patients with insertional achilles tendinopathy. Int J Sports Phys Ther. 2015 ;10(5):639-44.
23. Murphy MC, Travers MJ, Chivers P, Debenham JR, Docking SI, Rio EK, et al. Efficacy of heavy eccentric calf training for treating mid-portion Achilles tendinopathy: a systematic review and meta-analysis. Br. J. Sports med. 2019;53(17):1070-7. Doi:10.1136/ bjsports-2018-099934
24. Jayaseelan DJ, Mischke JJ, Strazzulla RL. Eccentric exercise for Achilles tendinopathy: A narrative review and clinical decision-making considerations. J. Funct. Morphol. Kinesiol. 2019;4(2):34. doi.org/10.3390/jfmk4020034
25. Bansal K, Padamkumar S. A comparative study between the efficacy of therapeutic ultrasound and soft tissue massage (deep friction massage) in supraspinatus tendinitis. Indian J Physiother Occup Ther. 2011;5(2):80-4.
26. Blackwood J, Ghazi F. Can the addition of transverse friction massage to an exercise programme in treatment of infrapatellar tendinopathy reduce pain and improve function? A pilot study. Int. Musculoskelet. Med. 2012;34(3):108-14. doi.org/10.1179/1753615412Y.0000000005

Disclaimer: None to declare.
Conflict of Interest: None to declare.
Funding Sources: None to declare.