REVIEW ARTICLE

Effects Of Physical Therapy Treatment for Rotator Cuff Tendinopathy: A Systematic Review

Rimsha Anwar[1], Atif Sohail[2], Azka Zahoor[3], Iqra Ijaz[4], Fatima Shahid[5]
The University of Lahore

Received: February 15, 2022 Accepted: June 27, 2022

Abstract

Objective: To conduct a systematic literature review on the efficacy of physical therapy treatment for rotator cuff tendinopathy.

Methods: From the oldest record through 2020, a systematic review stayed undertaken via scanning PubMed, The Cochrane library, Google Scholar, and Pedro. Randomized controlled trials evaluate the efficacy of physical therapy treatment for rotator cuff tendinopathy. The Pedro scale was used to appraise the quality of the involved trials.

Results: The search found 19,100 titles, of which 15 Randomized Controlled Trials were included. Articles that score on the PEDro scale of more than six are included. Physiotherapy is beneficial for declining strength, ROM, pain, and disability in patients with rotator cuff tendinopathy, corresponding data of moderate quality.

Conclusion: The current literature supports the effectiveness of physical therapy treatment; however, more research is required because of the unavailability of research and accompanying constraints.

Keywords: "Rotator Cuff Tendinopathy," "Shoulder Pain," "physical therapy," "physiotherapy," "exercises," "Rehabilitation,".

Contact: +92 315 4500051

Introduction

Rotator cuff tendinopathy is a diverse collection of shoulder conditions affecting subacromial structures, including Biceps Tendinopathy, subacromial Bursitis, and Shoulder Impingement Syndrome[1]

***Corresponding Author: Rimsha Anwar,** The University of Lahore
Email: Rimsha123Anwar@gmail.com

Tendinopathy has been interconnected to anomalous shoulder biomechanics, which

Rotator cuff Tendinopathy is diagnosed in 2/3 of people who experience shoulder aches. Rotator Cuff Tendinopathy frequently causes decreased function, poorer well-being, living standard, poor sleep quality, and occupational absenteeism[2]. Rotator Cuff

can cause severe squeezing or intrusion of soft tissues (Tendons and Bursae)

underneath the Acromion within the movement of the shoulder[3]. Stiff Posterior Shoulder joints, stiff Pectoral Muscles, Glenohumeral Internal Rotation deficiency (GIRD), poor Scapular stabilizing m/s, rigid Pelvic Girdle m/s, Age, degenerative tendon modifications, overused activities, and Chronic conditions are Risk factors[4]. Painful arc during elevation decreased ROM of the shoulder, and a reduction in arm and shoulder power are all clinical signs of RC tendinopathy. Patients who suffer from Rotator Cuff Tendinopathy seek physiotherapy treatment. Typically, rehabilitation includes active interventions like exercise and electrophysical modalities[5]. The clinical signs of Rotator Cuff Tendinopathy last further than three months. In marked contrast to other cases of 'subacromial impingement,' which can include constant pain and significant limitation of motion[6]. Different Exercises and interventions are used as treatment options for Rotator Cuff Tendinopathy, i.e., According to Bialosky et al., Manipulative force application causes biomechanics and Neurophysiological effects. Increased ROM (Range of motion) or gradual alterations in joint dynamics are biomechanical responses. Motor neuron excitability modifications & electromyography modulation index are all examples of neurophysiologic responses[7]. Some evidence-based treatments for Rotator Cuff Tendinopathy include arthroscopic acromioplasty, posterior shoulder extension, corticosteroid infusion, Neuromuscular Re-Education, Strengthening, and or Joint mobilization. Many randomized clinical trials demonstrated the effectiveness of Joint mobilization, combining treatments including Strengthening, Stretching, and Neuromuscular Re-Education, enhancing the prognosis of individuals suffering from some forms of shoulder discomfort[7]. An adequate load promotes restoration, while an insufficient use load will worsen Tendon architecture[8]. Joint Mobilization is a type of Manual Treatment that entails limited Passive movements around the Joint ROM[9]. Isometric Exercise program They are comprised of strength contractions followed by recovery time[10]. TENS, which uses Low-f, High-Amplitude stimulation, has been shown to increase endorphin levels in spinal fluid[11]. The capacity of Low-Intensity Laser to generate Athermic, Non-destructive Photo biological phenomena distinguishes it[12]. The goal of this study is to find & synthesize available evaluation findings on Physical Therapy Exercises & Interventions for Rotator Cuff Tendinopathy Treatment. By comparing both various concurrent variables and prescribing characteristics of the Exercise programs. The review aims to appraise the efficacy of therapeutic remedies in rotator Cuff Tendinopathy.

Material & methods:

Thorough research was conducted from March 2021 to August 2021, utilizing a search technique established for several databases such as The Cochrane Library, PubMed, MEDLINE, Google Scholar, Pedro, and EMBASE. The search strategy for each database was created by combining keywords with Boolean operators, such as AND, OR, and NOT, that were suitable for the study objectives. Encoding keywords, synonyms, and phrases in PICO format were utilized, and filtering whole text, RCT. The PICO technique was used to determine eligibility

criteria. Electronic databases were searched for studies conducted on treatment protocols, including Physical therapy Exercises, Electrotherapy Manual, and Therapy for Rotator Cuff Tendinopathy. Only those articles that score on the Pedro scale more than six are included.

Results

Study Selection

Inclusion Criteria Studies having	Exclusion Criteria Studies having
Rotator cuff Disease (shoulder impingement)	Less than 18 years of Age
18-65 years of Age	RC Tear, Calcified Tendinopathy, Capsulitis
Both Male, Female gender	Osteoporotic Women, Postmenopsal Women
Exercise & intervention treatment	Cervical radiculopathy
Outcomes (Pain, strength, ROM, Function	Systemic disease
Study Design (RCTs)	Any previous surgery

Study characteristic

The computerized search yielded a total of 19,100 records. After removing duplication and screening, fifteen studies were made part of our research. All researches belong to Randomized Controlled trials and describe the Physical therapy treatment, including different Exercise and Treatments for Tendinopathy of the Rotator Cuff. Table 1 summarizes the main features of every research, such as research objective, Participants (Gender, Age range, and Sample size), Intervention, Duration, and frequency, Mean Standard deviation, P value, effect size, and Interpretation.

Interventions

Electromagnetic transduction therapy and shock wave therapy improves Rotator cuff tendinopathy symptoms. RCEx and RCEx+coactivation do not have a beneficial effect on RC tendinopathy. Standardized manual therapy and home exercise programs show no immediate effect on pain & function, whereas they are beneficial at follow-up. Eccentric training appears to elect more helpful in releasing RC tendinopathy signs than routine physiotherapy. An isolated eccentric exercise program proves to be more effective in improving shoulder pain and function among patients with RC tendinopathy—no greater benefit from Progressive High Load exercise over Traditional Low Load exercises in reducing RC Tendinopathy Symptoms. Joint mobilization and comprehensive treatment are beneficial for relieving pain but not improving function and mobility. The Neuromuscular training program and usual One on One physical therapy treat symptoms. Exercise programs (Open Chain, Closed Chain, ROM) proved beneficial for treating RC tendinopathy symptoms.

Self-managed single Exercise and usual Physical Therapy show no benefit. Glenohumeral mobilization and MWM combined with Supervised Exercise program relief symptoms. Gradual reloading exercise and Cryotherapy both reduce pain and improve function. Microwave Diathermy improves symptoms similar to that with corticosteroid injection. The addition of heavy-loading eccentric training to rehab

shows improvement in strength but not treating pain and function. Manual therapy shows improvement with a combination of Exercises rather than alone.

Discussion

The findings of fifteen types of research are summarized in this Systematic Review. The primary goal of the research was to assess the benefits of Physical Therapy Treatment incorporating various Exercises and interventions for rotator cuff tendinopathy. Alteration of results of the Systematic Review compared to others is its most precise eligible participants in terms of Study participants, i.e., Rotator Cuff Tendinopathy, subacromial impingement. Study Type, e.g., Randomized Controlled Trials (RCTs), decreases the risk of biases.

F. Desmeules et al. in 2015 stated that Transcutaneous Electrical Nerve Stimulation (TENS) provided immediate aches and improved shoulder ROM but had greater biasness13. Self-Managed Single Exercise program against common Physiotherapy Treatment for Rotator Cuff Tendinopathy implies no difference in outcomes due to Lack of blinding and follow-up conducted in 2015 by Chris Littlewood et al. 14. Christopher Clifford et al. concluded in 2020 that isometric exercise of the shoulder causes Pain reduction, increase in Strength, ROM. However, it is not superior to isotonic exercise and is based on the least evidence15. Bernhardsson et al. in 2014 investigated. The eccentric exercise shows the benefit that it does cause pain reduction, function improvement related to rotator cuff tendinopathy symptoms, and get rid of the surgical procedure, but it lacks effect on shoulder kinematics and muscle activity8. Matthew J Page et al. concluded in 2016 that there were no therapeutically distinct changes with Manual Therapy based on low-quality evidence16. George Lewis et al. concluded in 2013 that Self-applied therapeutic Ultrasound utensils indicate greater Pain reduction and Health improvement. It provides supportive evidence17. In 2014 ALESSIA RABIN et al. said that Localized Microwave Diathermy has improved symptoms and is the best alternative therapy for sub-acromial corticosteroid injection18. In 2016 Sibel Kibar et al. said that Laser Acupuncture relieves symptoms19. Ariel Desjardins-Charbonneau, in 2015 evaluated that taping, either NET or KT, shows effectiveness in relieving Pain and Improving function. Due to the high risk of bias, this effect is unclear20. Chris Littlewood et al. in 2015 assessed the Efficacy of Therapeutic Exercise for Rotator Cuff Tendinopathy. He concluded that Resistance Exercise emerges as an essential element of the Exercise Programme, but it is uncertain if the pain will be induced or minimized21. Kim Gordon Ingwersen et al. 2017 evaluated the effectiveness of (PHLE) vs. Low-Load Exercise (LLE) on individuals suffering from Rotator Cuff Tendinopathy. Due to the Lack of power study was unable to conclude the effectiveness22. Alyssa Conte da. Silva et al. in 2016 reported that Spinal Manipulation had been shown to improve shoulder discomfort & ROM. It also supports alterations caused by

Scapular biomechanics and Shoulder Muscle strength23. Julie Bury et al. 2016 evaluate the Efficacy of Scapula-Focused techniques. It supports improvement in pain, and disability, altering Scapula Biomechanics. Outcomes on the influence of Scapula Focused Approach on the scapula position movement are ambiguous, and current research is contradictory24. Juan G. Dominguez-Romero et al. reported in 2021 that only Physical Exercise Muscle-Development regimes effectively reduce shoulder pain and improve shoulder function in Rotator Cuff Tendinopathy25. Frédérique Dupuis et al. in 2018 concluded quick benefits of two weeks Gradual Reloading Exercises Programme along with Cryotherapy upon signs and performance for Acute Rotator Cuff Tendinopathy26 Ultrasound is supposed to produce Thermal & Mechanical impact upon Target Tissue and improve circulation27. Imperio Lombardi Jr. et al. in 2008 concluded that Progressive Resistive Shoulder Muscle Training benefits reducing pain and improving strength28. Lisandra V Martins et al. in 2012 assessed the effectiveness of Stretching and Strengthening exercises with and without Proprioceptive Training. He cannot conclude the result as there is no significant difference within groups29. Aimie F. Kachingwe et al. in 2013 concluded that Glenohumeral Mobilization, MWM combined with a Supervised Exercise Program relieves symptoms but lacks evidence due to a small sample size30.

Conclusion

The Systematic Review provides additional guidance on contextual factors and prescription variables to develop the most effective exercise routines for rotator cuff tendinopathy. Unknown are the optimum strength and environment in which the therapeutic workout program is administered and whether other therapies may be beneficial. It is impossible to determine which exercise program is superior to others.

Limitation

Small sample sizes and inappropriate data may risk biases in the study design.

Due to the Lack of blinding, treatment comparison, and outcome measures, studies have low evidence.

Results are generated after short-term follow-up.

Recommendation:

Further studies should be conducted on a larger sample size.

A meta-analysis should be performed to prove it statistically.

Well-designed RCTs with long-term follow-ups are needed.

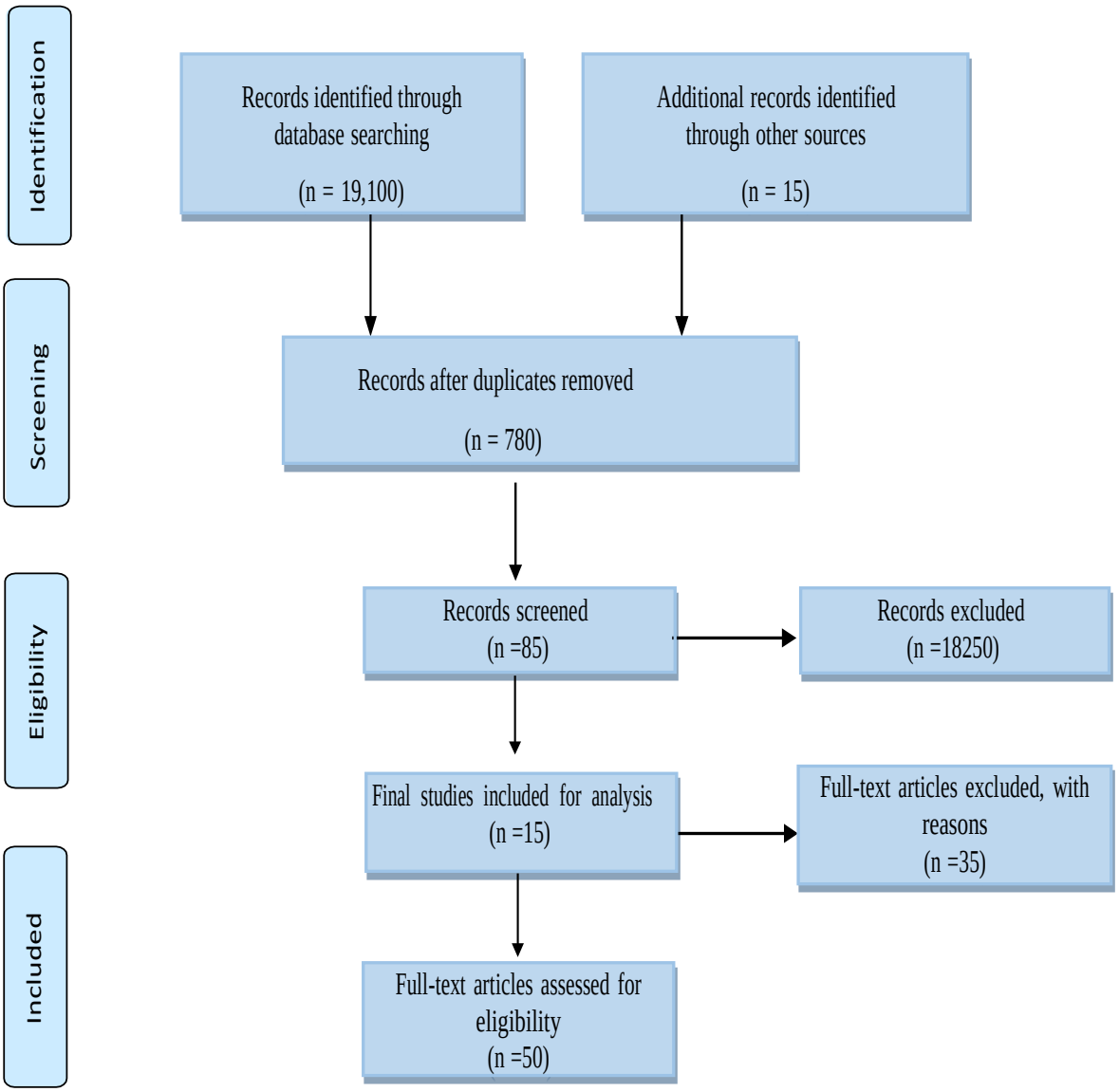
Author Contributions

Conception and design: *Rimsha Anwar*
Collection and assembly of data: *Atif Sohail*
Analysis and interpretation of the data: *Azka Zahoor*
Drafting of the article: *Iqra Ijaz*
Critical revision of article for intellectual content: *Fatima Shahid*
Statistical expertise: *Atif Sohail*
Final approval and guarantor of the article: *Rimsha Anwar*
Conflict of Interest: *None declared*

Abbreviations

RCT= Rotator Cuff Tendinopathy
GIRD= Glenohumeral Internal rotation deficiency
ROM= Range of Motion
PROM= Passive Range of Motion AROM= Active Range of Motion MT= Manual Therapy
US= Ultrasound
TENS= Transcutaneous Electrical Nerve Stimulation MWM= Mobilization with movement
TSM= Thoracic Spinal Manipulation
EMTT= Electromagnetic transduction therapy
ESWT= Extracorporeal shock wave therapy
RCEx= Rotator Cuff Exercise
CMS= Constant-Murley score VAS= Visual Analogue scale
DASH= Disabilities of arm, shoulder, and hand
WORC= Western Ontario Rotator Cuff SPADI= Shoulder Pain and Disability Index QoL= Quality of Life
PHLE=Progressive High-Load Exercise LLE= Low-Load exercise
Abd= Abduction
Ext rot= External rotation Int rot= internal rotation
MVIC= Muscle voluntary isometric contraction
UPEx-NTP= Upper Extremity Neuromuscular Training Program HEP= Home exercise program
UPC= usual Physical therapy care OC= open chain
CC= Closed chain

Figure#1 Prisma Flow Diagram



Figure#1 Prisma Flow Diagram

Author Name	Participants (Gender, Age range, Sample Size)	Intervention / Control or comparison group	Duration and frequency	Outcome measures (Scales)	Result (Mean, SD, P value
Tim Klüter, 2018 (31)	Female 22,23 49.2 ±7,3 50.2±8,5 N=44	ESWT and sham-EMTT combination of ESWT and EMTT	Total of 3 sessions at 2-week intervals with f= 4 (Hz). EMTT administered twice per week for a total of 8 session	(CMS) (VAS).	3.5 ± 0.18 P < 0.025 η2=60%
Nicolas Boudreau 2019 (32)	Female 13, 9 Male 8, 12 49.6±13.2,50±10.9 N=42	Rcex rcex+coactivation	Three sets of 10 repetitions seven days a week, six weeks.	Functional limitations/symptoms DASH WORC VAS	DASH -2(-10.4-6.4)-44.4(-11.82.9) P=0.74 η2=0.014,0.079 WORC 10.7(-3.7-25.2) 14.1(5.3-22) P=0.754η2=0.132,0.398 VAS rest 7.7(-3.5-18.9)1.3(-7.5-11.2) P=0.244 η2=0.142,0.003 movement-24.3(-37.6-1)-15(-30-0.5) P=0.417 η2= 0.378,0.221 SD=14%
Kim Bennell 2010 (33)	M 34 (58) 30 (49) 59.3(10.1)60.8 (12.4) N=60	Active treatment (manual therapy and home ex program), the placebo treatment, inactive ultrasound therapy)	Twice weekly for the first fortnight, once a week for the next four weeks, then once a fortnight in the last four weeks (10 visits, 30-45 minutes each).	SPADI, function Pain on movement, at restAbd Ext rot, Int rot strength(kg)	SPADI total 20.9,28.3 Pain on movement 2.4,3.3 SPADI pain 23,31 SPADI function 14.1,22,2 Pain at rest 1.0,1. Abd strength 8.3,6.5 Ext rot strength 8.4,7.0 Int rot strength 12.2,10.2 SD=21 P=0.79
Arooj Fatima 2017 (34)	51.8±11.53, 50.92±7.91 N=50	Group-A routine physiotherapy treatment. Group-B eccentric loading exercise+routine physiotherapy Treatment.	Traditional training of rotator Cuff done for 12 weeks at home, along with nine physical therapy sessions	(VAS) (DASH)	VAS A=4.8000B=4.8400 A=(SD=2.32737), B=(SD=2.0952) p=0.001 DASH A=43.28, B=27.48 A=(SD=10.1879) B= (SD=13.115) P=0.000
Beate Dejaco 2016 (35)	Women 10 ,7 Age 50.2 ± 10.848. 6 ± 12.3 N=28	Isolated eccentric exercise (EE) group or a conventional exercise (CG) group	12-week daily HEX program received the total amount of 9 treatment sessions, one session/week during the first six weeks and 3 sessions during the last six weeks, 26- Week follow-up	CM VAS	Cm=86.9±16.8 88.8 ± 8.1 p < 0.001 Vas= 19.1±24.5 19.8±18.5 p <0.0001
Kim Gordon Ingwersen 2017 (22)	Women 19(38.9) 27(52.9) Age 45.7±10.6 46.5±10 N= 100	Progressive High-Load Exercise PHLE (intervention) Traditional Low-Load Strength Training LLE (comparator)	Instruction (60 min) in week one and supervised exercise sessions (30 min) in weeks 2-4, 6, and 9 and home-based ex 3x per week PHLE 15-rep max in week one 6-rep maxi weeks 9 -12 LLE 20- to 25-rep max Weeks 1 -12	DASH VAS ROM	DASH p=0.773.2 (_2.8-9.2) 3.4 (_1.3-8.3) VAS on Rest p=0.61 1.5 (_2-5)1.02 (_1.63.7) Ext rot p=0.85 0.03(0.02-0.05)0.04(0.02-0.06) Int rot p=0.71 0.07 (0.04-0.09)0.07(0.05- 0.10) PROM Scaption p=0.41 2.8(_0.9-6.6)3.86(0.6-7.09) AROM Scaption p=0.83 7.4(2.2-12.6)3.5(_0.8-7.88)
Douglas E.Conroy, 2014 (36)	Male8 Female=6 Mean Age 52.9 years N=14	The experimental group (joint mobilization& comprehensive treatment (hot packs, AROM stretching, strengthening soft tissue mobilization, and patient education) control Group comprehensive treatment	3times per week for three weeks, hot packs were administered for 15 minutes	VAS AROM (shoulder abduction elevation, int rot, ext rot)	24-hour pain 12.50, 45.86 SD=14.9,33.26P=0.005,0.8 Abduction 129.79 SD=26.31 p=0.0005Elevation 144.93 SD=17.35 P=0.0015Internal Rot 47.21 SD=14.13 P=0.0005External Rot 78.43 SD=17.32 P=0.0095
Amanda L. Ager 2018 (3)	M16, 14 F 0,1 Age 33.4 ± 9.5 36.9 ± 7.1 N=31	Supervised neuromuscular training program (upex-NTP) or one-on-one usual physiotherapy care (UPC)	Upex-NTP35–45 min 3x/week for six weeks 18 treatments of 9-10hours) UPC 2-3 PT treatment (30min/week in clinic total of 12 treatments (HEP) of 30min2–3x/week. 6 hours of UPC3–4 hours HEP total of 9–10 hours Over six weeks.	DASH, WORC EXT rot and Abd muscles	DASH Δ−13.7 (±10.5) p< 0.0001 η2 0.26 WORC Δ+28.4 (±19.9) p<0.0001 η2 0.36 EXT rot 36.8 ± 8.5 32.8±11.7 η2 0.05, 0.087 p ≥ 0.1
Stuart R Heron 2016 (37)	M 25,24,22 F 15,16,18 Age49.5,50.4,49.8 N= 72	Open chain resisted band ex (OC) closed chain ex (CC) minimally loaded range of movement Exercise (ROM).	Three sets of 10 reps twice/ day, hold each stretch for 5 sec and perform five reps twice/day. Three appointments over 6weeks	(SPADI) (MCIC)	Mean 12,9,9 SD=15 P value 0.0001, 0.0002, 0.0002 H2 0.56,0.63,0.49
Chris Littlewood 2014 (38)	M 5,7 F 7,5 Age 62.6 ,63.9 N=24	Self-managed loaded exercise. (intervention group) usual physiotherapy treatment (control group)	Three sets of 10 to 15 reps twice per day	SPADI VAS QoL	Spadi 20.9,20.7 sd=19.2,20.3 Sf36 physical function 78.2,73.3 sd=17.7,29.3 bodily pain 61.4,71.8sd=13.4,18.2
AIMIE F. KACHING E2013 (30)	M 17 F 16 Age 46.4 years N=33	Group 1, exercise only; Group 2, exercise and mobilization; Group 3, Exercise And MWM; Group 4, control group	One time a week for six weeks; each session ended with a cold pack for 10–15 Min home exercise program once a day	(VAS) AROM SPADI	VAS P=0.85, η2=0.03 14.4 (119.8) 20.8(112.3)44.2(38.6) 55.2 (31.9) Flexion P<0.33, η2=0.41 42.6(15.8)27.6 (41.7)-15.9(116.6)46.7 (31.9) SPADIP=0.79, η2=0.04 34.2 (58.9) 61.6 (35.9) 56.7 (29.8) 55.5 (20.1)
Frédérique Dupuis 2018 (26)	male 11 ,13 Age, 43±13, 33±7 N=44	The experimental group performed an isometric ex-control group that advised to rest from aggravating activities, apply ice Wraps	Ice wrap application for 15 min 3x/ day. Five reps of gentle, pain-free movement. Strengthening ex every day for the next 4weeks total, six weeks	DASH, WORC, AHD, ROM BPI, Shoulder strength	Exercise group 11.4±7.9 Control group 19.5±13.8 p=0.076 DASH η2=0.485 WORC η2= 0.587 BPI η2= 20.483
ALESSIA RABINI 2012 (18)	Male15,16 Female31,30 Age 56.6 ± 11.6 59.2 ± 7.1 N= 92	Local corticosteroid injections or hyperthermia (local microwave diathermy)	Three local injections (1 every two weeks) Hyperthermia 12 treatment sessions (3 sessions a week for four weeks), lasting 30 min f=434mhz Total 24 week	DASH CMS VAS	Quick DASH score 30.0 ±15.1, 32.0 ±24.6 P=0.583 η2 = 5.39 Constant score 89.9 ±12.6 , 88.1±20.0 p=0.479 η2= 43.72 VAS score 29.0±17.3 , 37.6±30.0 P=0 .131 η2= 3.02
AnneliesG. Maenhout 2012 (39)	Male=15,10 Female= 16,20 Age 39.4 ± 13.1 40.2 ± 12.9 N= 61	Traditional rotator cuff strength training TT group (resisted external and internal strengthening ex) TT combined with heavy load eccentric training (TT+ET) group	Total 12 weeks. 1 PT session a week during the first period of 6 weeks and one every two weeks during the last six weeks TT= 1/ day3 sets of 10 rep.IT+TT= 3sets of 15 rep 2x/ day	SPADI HHD for isometric strength. Abd 0º, Abd 45º Abd 90º Ext rot int rot	SPADI 27(19.5) 25.7(15.8) P<0.001 η2=2.6, 2.3 Isom F Abd 0º 17.3 (38.2), 31.5 (32.2) P< 0.001, =0.005 η2=0.9,1.0 Isom F Abd 45º12.5 (19), 12.8 (16.0) P<0.001, =0.001 η2=1.3,0.9 Isom F Abd 90º 5.1(19.8),14.7 (19.7) P= n.s, p<0.001 η2= 0.6,6.2 Isom F ext. Rot 10.2 (18.6), 13.2 (16.1) P=0.002, <0.001 η2=0.7,1.1 Isom F int rot 7.3 (24.7), 18.1 (24.8) P=0.006, =0.038 η2=0.3,0.4
Michael D. Bang 2018 (40)	Male=30 Female=22 Age 43± 9.1 N=52	The exercise groups Performed supervised flexibility & strengthening exercises. The manual therapy group performed the same program and received MT Treatment	Twice weekly for Three weeks total of 6 visits. . Total treatment is it a one-half hour in length? Stretch for 30 sec perform	VAS Functional assessment questionnaire (FAQ)	Abd strength 147.1,225.3 SD=81.11,111.8 Ext rot strength 101.8,159 SD=42.06 ,77.83 Int rot strength 153.6,191.9 SD=58.63, 82.29 Strength Composite score 402.6, 576.3 SD=162.5,228 Abd AROM pain 37.54 , 16.82 SD=29.0,21.0 Resisted Abd pain32.6,22.7 SD=29.4,26.27 Resisted Ext rot 30.2,15,8 SD=29.7,21.92 Resisted int rot 33.5, 21.04 SD=27.5, 27.9 Functional pain226.7,98.0 SD=194.7.107.3 Pain composite score 360.64,174.4 SD= 272,183 FAQ 33.26, 38.22 SD=7.84 , 4.68

References

1. Desmeules F, Boudreault J, Dionne CE, Frémont P, Lowry V, MacDermid JC, et al. Efficacy of exercise therapy in workers with rotator cuff tendinopathy: a systematic review. Journal of occupational health. 2016:15-0103-RA.
2. Desjardins-Charbonneau A, Roy J-S, Dionne CE, Frémont P, MacDermid JC, Desmeules F. The Efficacy of Manual Therapy for rotator cuff tendinopathy: a systematic review and meta-analysis. Journal of orthopedic & sports physical Therapy. 2015;45(5):330-50.
3. Ager AL, Roy J-S, Gamache F, Hébert LJ. The effectiveness of an upper extremity neuromuscular training program on the shoulder function of military members with a rotator cuff tendinopathy: a pilot randomized controlled trial. Military medicine. 2019;184(5-6):e385-e93.
4. Rodriguez-Santiago B, Castillo B, Baerga-Varela L, Micheo WF. Rehabilitation management of rotator cuff injuries in the master athlete. Current sports medicine reports. 2019;18(9):330-7.
5. Desmeules F, Boudreault J, Roy J-S, Dionne C, Frémont P, MacDermid JC. The efficacy of therapeutic ultrasound for rotator cuff tendinopathy: A systematic review and meta-analysis. Physical Therapy in Sport. 2015;16(3):276-84.
6. Littlewood C, Ashton J, Chance-Larsen K, May S, Sturrock B. Exercise for rotator cuff tendinopathy: a systematic review. Physiotherapy. 2012;98(2):101-9.
7. Muth S, Barbe MF, Lauer R, McClure P. The effects of thoracic spine manipulation in subjects with signs of rotator cuff tendinopathy. Journal of orthopedic & sports physical Therapy. 2012;42(12):1005-16.
8. Camargo PR, Alburquerque-Sendín F, Salvini TF. Eccentric training as a new approach for rotator cuff tendinopathy: Review and perspectives. World journal of orthopedics. 2014;5(5):634.
9. Di Fabio RP. Efficacy of Manual Therapy. Physical Therapy. 1992;72(12):853-64.
10. Wiley RL, Dunn CL, Cox RH, Hueppchen NA, Scott MS. Isometric exercise training lowers resting blood pressure. Medicine and science in sports and exercise. 1992;24(7):749-54.
11. Deyo RA, Walsh NE, Martin DC, Schoenfeld LS, Ramamurthy S. A controlled trial of transcutaneous electrical nerve stimulation (TENS) and Exercise for chronic low back pain. New England Journal of Medicine. 1990;322(23):1627-34.
12. Schindl A, Schindl M, Pernerstorfer-Schön H, Schindl L. Low-intensity laser therapy: a review. Journal of investigative medicine: the official publication of the American Federation for Clinical Research. 2000;48(5):312-26.
13. Desmeules F, Boudreault J, Roy J, Dionne C, Frémont P, MacDermid J. Efficacy of transcutaneous electrical nerve stimulation for rotator cuff tendinopathy: a systematic review. Physiotherapy. 2016;102(1):41-9.
14. Littlewood C, Bateman M, Brown K, Bury J, Mawson S, May S, et al. A self-managed single exercise program versus usual physiotherapy treatment for rotator cuff tendinopathy: a randomized controlled trial (the SELF-study). Clinical rehabilitation. 2016;30(7):686-96.
15. Clifford C, Challoumas D, Paul L, Syme G, Millar NL. Effectiveness of isometric Exercise in managing Tendinopathy: a systematic review and meta-analysis of randomized trials. BMJ open sport & exercise medicine. 2020;6(1):e000760.
16. Page MJ, Green S, McBain B, Surace SJ, Deitch J, Lyttle N, et al. Manual Therapy and Exercise for rotator cuff disease. Cochrane Database of Systematic Reviews. 2016(6).
17. Lewis G, Hernandez L, Lewis Sr GK, Ortiz R, editors. Wearable long duration of ultrasound therapy pilot study in rotator cuff tendinopathy. Proceedings of Meetings on Acoustics ICA2013; 2013: Acoustical Society of America.
18. Rabini A, Piazzini DB, Bertolini C, Deriu L, Saccomanno MF, Santagada DA, et al. Effects of local microwave diathermy on shoulder pain and function in patients with rotator cuff tendinopathy in comparison to subacromial corticosteroid injections: a single-blind randomized trial. Journal of orthopedic & sports physical Therapy. 2012;42(4):363-70.
19. Kibar S, Konak HE, Evcik D, Ay S. Laser acupuncture treatment improves pain and functional status in patients with subacromial impingement syndrome: a randomized, double-blind, sham-controlled study. Pain Medicine. 2017;18(5):980-7.
20. Desjardins-Charbonneau A, Roy JS, Dionne CE, Desmeules F. The efficacy of taping for rotator cuff tendinopathy: a systematic review and meta-analysis. International journal of sports physical therapy. 2015;10(4):420.
21. Littlewood C, Malliaras P, Chance-Larsen K. Therapeutic exercise for rotator cuff tendinopathy: a systematic review of contextual factors and prescription parameters. International Journal of Rehabilitation Research. 2015;38(2):95-106.
22. Ingwersen KG, Jensen SL, Sørensen L, Jørgensen HR, Christensen R, Søgaard K, et al. Three months of progressive high-load versus traditional low-load strength training among

patients with rotator cuff tendinopathy: primary results from the double-blind, randomized controlled RoCTEx trial. Orthopedic journal of sports medicine. 2017;5(8):2325967117723292.
23. da Silva AC, Padilha JF, Marques JLB, de Godoy Marques CM. Effect of spinal manipulation on shoulder pain and range of motion in individuals with rotator cuff tendinopathy. Manual Therapy, Posturology & Rehabilitation Journal. 2016:1-5.
24. Bury J, West M, Chamorro-Moriana G, Littlewood C. Effectiveness of scapula-focused approaches in patients with rotator cuff related shoulder pain: a systematic review and meta-analysis. Manual Therapy. 2016; 25:35-42.
25. Dominguez-Romero JG, Jiménez-Rejano JJ, Ridao-Fernández C, Chamorro-Moriana G. Exercise-Based Muscle Development Programmes and Their Effectiveness in the Functional Recovery of Rotator Cuff Tendinopathy: A Systematic Review. Diagnostics. 2021;11(3):529.
26. Dupuis F, Barrett E, Dubé M-O, McCreesh KM, Lewis JS, Roy J-S. Cryotherapy or gradual reloading exercises in acute presentations of rotator cuff tendinopathy: a randomized controlled trial. BMJ open sport & exercise medicine. 2018;4(1):e000477.
27. van der Windt DA, van der Heijden GJ, van den Berg SG, ter Riet G, de Winter AF, Bouter LM. Ultrasound therapy for musculoskeletal disorders: a systematic review. Pain. 1999;81(3):257-71.
28. Lombardi Jr I, Magri AG, Fleury AM, Da Silva AC, Natour J. Progressive resistance training in patients with shoulder impingement syndrome: a randomized controlled trial. Arthritis Care & Research: Official Journal of the American College of Rheumatology. 2008;59(5):615- 22.
29. Martins LV, Marziale MH. Assessment of proprioceptive exercises in the treatment of rotator cuff disorders in nursing professionals: a randomized controlled clinical trial. Brazilian Journal of Physical Therapy. 2012; 16:502-9.
30. Kachingwe AF, Phillips B, Sletten E, Plunkett SW. Comparison of manual therapy techniques with therapeutic exercise in treating shoulder impingement: a randomized controlled pilot clinical trial. Journal of manual & manipulative Therapy. 2008;16(4):238-47.
31. Klüter T, Krath A, Stukenberg M, Gollwitzer H, Harasser N, Knobloch K, et al. Electromagnetic transduction therapy and shockwave therapy in 86 patients with rotator cuff Tendinopathy: a prospective randomized controlled trial. Electromagnetic biology and medicine. 2018;37(4):175-83.
32. Boudreau N, Gaudreault N, Roy J-S, Bédard S, Balg F. The addition of glenohumeral adductor coactivation to a rotator cuff exercise program for rotator cuff tendinopathy: a single-blind randomized controlled trial. Journal of orthopedic & sports physical Therapy. 2019;49(3):126-35.
33. Bennell K, Wee E, Coburn S, Green S, Harris A, Staples M, et al. efficacy of standardized manual therapy and home exercise program for chronic rotator cuff disease: a randomized placebo-controlled trial. BMJ. 2010;340.
34. Fatima A, Ahmed A. Effectiveness of Routine Physical Therapy with and without Eccentric Loading Training for the Rehabilitation of Rotator Cuff Tendinopathy. Annals of King Edward Medical University. 2017;23(4):469-73.
35. Dejaco B, Habets B, van Loon C, van Grinsven S, van Cingel R. Eccentric versus conventional exercise therapy in patients with rotator cuff tendinopathy: a randomized, single-blinded, clinical trial. Knee Surgery, Sports Traumatology, Arthroscopy. 2017;25(7):2051-9.
36. Conroy DE, Hayes KW. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. Journal of Orthopaedic & Sports Physical Therapy. 1998;28(1):3-14.
37. Heron SR, Woby SR, Thompson DP. Comparison of three types of exercise in treating rotator cuff tendinopathy/shoulder impingement syndrome: a randomized controlled trial. Physiotherapy. 2017;103(2):167-73.
38. Littlewood C, Malliaras P, Mawson S, May S, Walters SJ. Self-managed loaded exercise versus usual physiotherapy treatment for rotator cuff tendinopathy: a pilot randomized controlled trial. Physiotherapy. 2014;100(1):54-60.
39. Maenhout AG, Mahieu NN, De Muynck M, De Wilde LF, Cools AM. Does adding heavy load eccentric training to the rehabilitation of patients with unilateral subacromial impingement result in better outcomes? A randomized clinical trial. Knee surgery, sports traumatology, arthroscopy. 2013;21(5):1158-67.
40. Bang MD, Deyle GD. Comparison of supervised Exercise with and without manual physical therapy for patients with shoulder impingement syndrome. Journal of Orthopaedic & Sports Physical Therapy. 2000;30(3):126-37.