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Review

A Study To Find The Effectiveness Of Shockwave Therapy Versus Ultrasound Therapy In Treating Trapezitis For Badminton Players

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Abstract

Background: Badminton is a sport associated with a high incidence of musculoskeletal injuries, particularly affecting the shoulder and upper extremity due to repetitive overhead movements. Overhead athletes, including badminton players, often develop shoulder conditions such as rotator cuff tendinopathy and myofascial pain syndrome, primarily in the upper trapezius. Treatment modalities like extracorporeal shock wave therapy (ESWT) and ultrasound therapy (US) have been explored for managing these conditions, with mixed results. Previous studies have compared these interventions to determine their effectiveness in reducing pain and improving function in overhead athletes.

Methodology: Muscle stiffness, pain intensity, and functional outcomes were evaluated using clinical and sonographic measures. Participants typically included athletes with shoulder impingement, myofascial pain syndrome, or rotator cuff tendinopathy. Treatment sessions varied in duration and frequency, with some studies combining interventions like ESWT with trigger point injections for enhanced efficacy.

Results: Research indicated that ESWT was generally more effective than US in reducing pain and improving function in conditions such as lateral epicondylitis and myofascial pain syndrome. ESWT showed significant reductions in muscle stiffness, increased range of motion, and improved athletic performance. Some studies also found that combined therapy approaches provided superior outcomes compared to single-modality treatments. However, variations in study designs and treatment protocols led to inconsistent findings across trials.

Conclusion: The evidence suggests that ESWT is an effective treatment for musculoskeletal injuries in overhead athletes, including badminton players. Future studies should focus on optimizing treatment protocols and exploring combination therapies for enhanced recovery in sports-related injuries.

Keywords: Shockwave Therapy, Ultrasound Therapy, Trapezitis, Badminton Players, Myofascial Pain Syndrome, Musculoskeletal Rehabilitation

INTRODUCTION

Badminton is an individual, non-contact sport requiring jumps, lunges, quick changes of direction, and rapid arm movements from a wide variety of body positions. Badminton players must react to the moving shuttlecock and adjust their body position rapidly and continuously throughout the game. [1] Though badminton is one of the most widely played sports in the world, it has received little sports medical interest. Badminton is one of the most popular sports in the world, which is played from childhood to old age as a recreational or competitive sport. Badminton is looked upon by many as a low-risk sport. [2] Badminton is originated in China and created in England, Badminton has five events: men's and women's singles and doubles and mixed doubles. The decision to include badminton in the 1992 Olympics Game increased participation in the game. Badminton can be practiced by anyone, regardless of age or experience. During a tournament, badminton match is generally played with one to three matches over the course of 4 or 5 days. [3] Today's badminton is faster, more athletic, more physical, more prone to injury, more focused on tactics, less tolerant of unfair play, better equipped, and more professional, than that of 50 years ago. [1] Quick changes of direction, jumps, lunges at the net and rapid arm movements in order to strike the shuttlecock from a variety of postural positions increase the risk of injury. [3] The physical demands of badminton suggest that acute injuries to the limbs may frequently occur. [1] The injuries in badminton, compared to other sports it is of relatively low risk and dominated by overuse injuries. The injury duration is relatively long, but only a few working days are lost. Injuries in badminton, compared to other sports it is of relatively low risk and dominated by overuse injuries. The single most frequent injuries are Achilles tendinitis and tennis elbow. [2] Shoulder pain is amongst the most common musculoskeletal disorders in overhead athletes such as throwers, swimmers, and tennis, baseball and volleyball players. Repetitive overhead throwing motions, altered movement patterns of the shoulder, scapular dyskinesis, insufficient rotator cuff performance, and poor posture are the most important causes of shoulder disorders in overhead athletes. Regardless of etiology, shoulder injuries may overload the shoulder girdle muscles and give rise to the development of myofascial trigger points (MTrPs) in the affected muscles.[4] Various muscles are responsible for the dynamic stability of the shoulder joint during arm movement. Among them, the upper trapezius (UT) muscle contributes to normal scapular motion by elevating and rotating the scapula during arm elevation. [5] Upper Trapezius (UT) and Infraspinatus (ISP) are the two muscles which most frequently incur MTrPs in subjects with shoulder pain. MTrPs are highly irritable spots within a taut band in the skeletal muscles that can be painful during contraction, stretching or stimulation of the muscle. MTrPs can be active (spontaneously painful) or latent (only tender to palpation). The key signs of an MTrP are local and referred pain, limited range of motion, hypersensitivity to stretching, and weakness due to pain, without atrophy. According to a study conducted on patients with shoulder pain, the Infraspinatus muscle (77%) and the Upper Trapezius (58%) had the most prevalence of active MTrPs. [4]

Therapeutic ultrasound is a commonly used modality by many physiotherapists for treating many forms of tendinopathies and muscle injuries including rotator cuff, plantar fasciitis and lateral epicondylitis among others. [6] Therapeutic ultrasound is a frequently applied non- invasive modality in the treatment of Musculo-skeletal conditions, especially on lateral epicondylitis. [7] Ultrasound Induces thermal and mechanical properties on deep tissue by sending ultrasonic energy, leading to improved local metabolism, circulation and tissue repair. Several studies have applied ultrasound to treat myofascial pain syndrome also. One of these conservative applications is ultrasound (US) therapy commonly used in the treatment of the tendon injuries. US is an electrophysical agent which produces deep heat in tissues. Ultrasonic sound waves, which penetrate through the tissue, enhance local blood flow, stimulates inflammatory mediators, and reduce muscle spasm and pain. [8] non-invasive treatment method that turns electric energy into mechanical oscillation energy. US is believed to increase local circulation, metabolism, regeneration and flexibility in soft tissues via its thermal and mechanical effect [9] Extracorporeal shockwave therapy (ESWT) is an innovative modality which has gained popularity in the last decade in the treatment of various painful musculoskeletal diseases, especially when other conservative treatments have failed. [6] ESWT is believed to induce neovascularization at the bone-tendon junction, it releases growth factors such as eNOS (endothelial nitric oxide synthase), PCNA (proliferating cell antinuclear antigen) and VEGF (vascular endothelial growth factor), which improve blood supply and increase cell proliferation leading to tis sue regeneration, whereas its analgesic effect is achieved by inhibiting the activation of the serotonergic system and the peripheral denervation. [6] The use of extracorporeal shock wave therapy has advanced as an alternative treatment. Extracorporeal shock wave therapy is described as an arrangement of single sonic pulses, supplied by a proper generator to a particular area. The conduction of an acoustic shock wave signal into biological signal consequences in proliferation and differentiation of cellules through a mechano- transduction pathway. [7] Extracorporeal shock wave therapy (ESWT) is a non-invasive procedure in which acoustic waves are focused on targeted sites within the body to facilitate pain relief and healing. [10] The Research on extracorporeal shock wave therapy has increased to discover its efficiency, principally for myofascial pain syndrome in the upper trapezius owing to its ability in applying analgesic properties and stimulating soft tissue renovation and repair. [7]

Lateral epicondylitis (LE) is a common musculoskeletal pathology arising secondary to recurrent

microtrauma of the upper extremity, particularly impacting the lateral epicondyle of the elbow. Major symptoms include decreased grip and upper-extremity strength along with pain and inflammation originating from the lateral elbow. [10]

REVIEW OF LITERATURE

1) Review of literature of comparison between shockwave and ultrasound therapy:

S. No	Author And Year	Title	Methods	Study Results	Conclusion
1	Tarık ÖZMEN et. al 2021 [8]	Comparison of the clinical and sonographic effects of ultrasound therapy, extracorporeal shock wave therapy, and Kinesio taping in lateral epicondylitis	A total of 40 patients with LE were included in the present study. The patients were randomly assigned to 3 treatment groups: US (n = 13), ESWT (n = 14), and KT (n = 13) groups.	The visual analog scale (VAS) scores significantly decreased in all groups ($P < 0.05$). Grip strength significantly increased after 8 weeks in only the KT group ($P < 0.05$). The Patient-Rated Tennis Elbow Evaluation Scale (PRTEE) scores significantly decreased after 2 weeks and after 8 weeks in the US group and ESWT groups, and after 8 weeks in the KT group ($P < 0.05$). Common extensor tendon (CET) thicknesses significantly decreased after 8 weeks in only the ESWT group ($P < 0.05$).	The US therapy, KT, and ESWT are effective in reducing pain and improving functionality. However, none of these treatment methods were found to be superior to others in reducing the pain and improving functionality.
2	Gaowen Yao, 2020 (10)	Efficacy of Extracorporeal Shock Wave Therapy for Lateral Epicondylitis: A Systematic Review and Meta-Analysis	Literature searches of PubMed, OVID, Embase, Cochrane Library, and Web of Science were searched up to 30th June, 2019. Only RCTs comparing ESWT with other methods for LE were included. Data collection and extraction, quality assessment, and data analyses were performed according	A total of 13 articles with 1035 patients were included. Of which, 501 underwent ESWT and 534 underwent other methods. The result of meta-analysis showed that pooled VAS and grip strength was better in the ESWT group.	Based on the existing clinical evidence, extracorporeal shock wave therapy can effectively relieve the pain and functional impairment (loss of grip strength) caused by tennis elbow, with better overall safety than several other methods.

			to the Cochrane standards.		
3	Vasileios Dedes, 2020	Comparison of radial extracorporeal shockwave therapy	The shockwave group consisted of 117 patients, 63 patients constituted the ultrasound group, and 18 patients made up the control group. The "University of Peloponnese Pain, Functionality and Quality of Life Questionnaire" was used for the evaluation of pain, functionality, and quality of life on a five- point Likert scale, pre- treatment, post-treatment, and at 4-week follow-up	The pain was reduced and the functionality and quality of life were improved in both the shockwave and ultrasound groups post- treatment ($p < 0.001$) and at 4-week follow- up ($p < 0.001$), but the results in the ultrasound group were not as pronounced as in the shockwave group ($p < 0.001$).	Both radial shockwave and ultrasound therapies were significantly effective in patients with lateral epicondylitis. However, ultrasound therapy was less effective than shockwave therapy.
4	Vasileios Dedes, 2019 (11)	Comparison of Radial Extracorporeal Shockwave Therapy versus Ultrasound Therapy in the Treatment of Rotator Cuff Tendinopathy	Out of the total sample of 115 patients with rotator cuff tendinopathy, 56 patients constituted the shockwave intervention group, 47 patients constituted the therapeutic ultrasound group and 12 patients made up the control group. The self-ad ministered questionnaire "The University of Peloponnese Pain, Functionality and Quality of Life Questionnaire, UoP – PFQ" was used where the intensity of pain, functionality and quality of life of the upper limbs were evaluated on a five-point Likert scale, pre-treatment, post-treatment and at a 4-week follow-up.	The pain intensity was reduced and both the functionality and quality of life were improved after shockwave therapy post- treat ment and at a 4-week follow-up compared with those found after treatment. Similar improvements in all three parameters was also observed after ultrasound treatment but outcomes was not as good as shockwave group.	Both radial shockwave and ultrasound therapies were found to be effective in the treatment of rotator cuff tendinopathy, the statistical analysis showing that radial shockwave therapy was superior to the ultrasound therapy post-treatment and at the 4-week follow-up.
5	Chenchen Yan, 2019 (12)	A comparative study of the efficacy of ultrasonics and extracorporeal	RCTs published in the PubMed, Embase, Cochrane Library, and SpringerLink databases	Five RCTs comprising five patients were included in the present meta-	Although there was no significant difference in the elbow function evaluation scores

		shock wave in the treatment of tennis elbow: a meta analysis of randomized controlled trials	comparing ESWT and US in treating tennis elbow were identified by a software and manual search. The risk of bias and clinical relevance of the included studies were assessed. Publication bias was explored using funnel plot and statistical tests (Egger's test and Begg's test). The major outcomes of the studies were analyzed using the Review Manager 5.3.	analysis. The results revealed a significantly lower VAS score of pain in the ESWT group (1month: MD=4.47, p=0.0001; 3 months: MD=20.32, p< 0.00001) than in the US group. Although no significant difference was observed in the scores of the elbow function after 3 months of treatment (SMD = 1.51, p= 0.13), the subjective scores of elbow functions were found to be better in the ESWT group (SMD=3.34; p=0.0008) compared to the US group.	between ESWT and US, the superiority of the ESWT group in the VAS of pain (both at 1 month, 3 months, and 6 months follow-ups) raised grip strength in ESWT group and the scores for subjective evaluation of efficacy indicated that ESWT offers more effective therapy for lateral epicondylitis than US therapy.
6	Bestami Yalvaç 2018 (13)	Comparison of ultrasound and extracorporeal shock wave therapy in lateral epicondylosis	Our study enrolled 50 patients with LE. Patients were randomized into two groups. Group 1 underwent therapeutic US (n = 24) Group 2 underwent ESWT (n = 20). Patients were evaluated at baseline, after treatment, and 1 month following treatment. The outcome measures were the visual analog scale (VAS), algometer, grip dynamometer, quick-disability of the arm, shoulder, and hand (QDASH), patient rated tennis elbow evaluation (PRTEE), and Short Form-36 (SF-36) health survey questionnaire.	Both groups showed significant improvements in terms of VAS (all p values < 0.0001), dynammometer (p = 0.001 vs p = 0.015), algometer (all p values < 0.0001), PRTEE (all p values < 0.0001), QDASH (all p values < 0.0001), and SF-36 scores (p = 0.001 vs p <0.005) within time. There was no significant difference between the two groups, except algometer scores in favor of ESWT (p = 0.029).	ESWT and therapeutic US are equally effective in treating LE. ESWT is an alternative therapeutic intervention and as effective as US.

2) Review of literature of incidence of trapezitis in badminton players:

S. No	Author And Year	Title	Methods	Study Results	Conclusion
`1	Fahimeh Kamali, 2018 [4]	Comparison of Upper Trapezius and Infraspinatus myofascial trigger point therapy by dry needling in Overhead athletes with unilateral shoulder impingement syndrome	40 overhead athletes with unilateral shoulder impingement syndrome were randomly assigned to the UT DN (n=21) and ISP DN (n=19) groups. Intervention: An acupuncture needle was directly inserted into the trigger point of UT muscle in the UT DN group and of ISP muscle in the ISP DN group. DN was applied in three sessions (2 day interval between sessions) for each group. Pain intensity (visual analog scale), pain pressure threshold (PPT) and disability in the arm, hand and shoulder (DASH) were assessed before and after the interventions.	Pain and disability decreased significantly in both groups (P<0.001) and PPT increased significantly only in the ISP group (P= 0.020). However, none of the outcome measures showed a significant inter-group difference after treatments (P> 0.05).	Application of DN for active MTrPs in the ISP can be as effective as direct DN of active MTrPs in the UT in improving pain and disability in athletes with shoulder pain, and may be preferred due to greater patient comfort in comparison with direct UT needling.
2	Aleksandra Kisilewicz, 2018 (14)	Changes in Muscle Stiffness of the Trapezius Muscle after Application of Ischemic Compression Into Myofascial Trigger Points in Professional Basketball Players.	Twelve professional basketball players participated in Part A of the study with unilateral neck or shoulder pain at the dominant side. Part B tested twelve right-handed male athletes, Stiffness measurements were obtained directly before and after a single session trigger point compression therapy. Measurements were performed bilaterally over 5 points covering the trapezius muscle. The effects were evaluated using a full-factorial repeated	The RM ANOVA revealed a significant decrease in muscle stiffness for the upper trapezius muscle. Specifically, muscle stiffness decreased from 243.7 ± 30.5 to 215.0 ± 48.5 N/m (11.8%), (p = .008) (Part A). The test- retest relative reliability of trapezius muscle stiffness was found to be high (ICC from 0.821 to 0.913 for measurement	The present study showed that a single session of compression trigger point therapy can be used to Significantly decrease the stiffness of the upper trapezius among professional basketball players.

			measure ANOVA and the Bonferroni post-hoc test for equal variance. A p- value < .05 was considered significant.	points). The average SEM was 23.59 N/m and the MDC 65.34 N/m, respectively (Part B).	
3	Hio Teng Leong, 2016 (15)	Increased UpperTrapezius Muscle Stiffness in Overhead Athletes with Rotator Cuff Tendinopathy	Forty-three male volleyball players aged between 18 and 35 years participated in this study. They were recruited from the local sports clubs and universities. Participants were allocated into the rotator cuff tendinopathy group or the asymptomatic group. UTshear modulus was measured on the dominant side (defined as the side of the throwing arm) during active arm holding at 30° and 60° of shoulder abduction (active tasks), and after the arm was passively positioned at 0°, 30° and 60° of shoulder abduction (passive tasks). Each participant was asked to sit upright on a stool with the head in neutral position.	Among the 43 volleyball players, 26 reported pain or discomfort on the shoulder during training and clinical tests suggested the presence of rotator cuff tendinopathy. No between- group differences were found for any of the tested parame ters (all p values >0.08).	Athletes with rotator cuff tendinopathy exhibited higher UT shear modulus during active arm holding than the asymptomatic athletes. UT shear modulus was also higher in athletes with rotator cuff tendinopathy than in the asymptomatic athletes during the resting arm position at 0° of shoulder abduction
4	Lane B. Bailey, 2015 (16)	Mechanisms of Shoulder Range of Motion	Through use of ultrasound elastography, Electromagnetic motion analysis, and ultrasound imaging, posterior rotator cuff stiffness, glenohumeral joint translation, and humeral torsion were examined in 60 asymptomatic baseball players with shoulder ROM deficits. Tissue mechanisms were examined	ROM gains were associated With decreases in rotator cuff stiffness (internal rotation: r = 0.35, P = .034; horizontal adduction: r = 0.44, P =.008) and increased humeral retrotorsion (internal rotation: r =– 0.35, P = .034), not joint translation (P >0.05). Players receiving	Decreases in rotator cuff stiffness were Associated

			concurrently, with the ROM gains elicited by an acute application of instrument- assisted soft tissue mobilization plus self-stretching (n = 30) versus self- stretching only (n = 30). Separate 3-way analyses of variance and linear regression analyses were used to determine the treatment effects and relationships between tissue mechanisms and ROM gains.	instrument-assisted soft tissue mobilization plus stretching displayed greater shoulder ROM gains (internal rotation +5° ±2° [P =.010]; total arc of motion, 8°±6° [P = .010]; horizontal adduction, 7° ± 2° [P =.004]; and decreased posterior rotator cuff stiffness, –0.2 ± 0.3 kPa [P = .050]) compared with players receiving self- stretching alone.	
5	A.M. Cools, 2006	Trapezius activity and intramuscular balance during isokinetic exercise in overhead athletes with impingement symptoms Deficits in Asymptomatic Baseball Players	Thirty-nine overhead athletes with chronic impingement symptoms and 30 non-injured athletes participated in the study. Electro myographic activity of upper, middle, and lower trapezius was measured during isokinetic abduction and external rotation, using surface electrodes.	The results show a significant increase of upper trapezius activity during both movements in the patient group, with decreased activity in the lower trapezius during abduction, and in the middle trapezius during external rotation.	These results confirm the presence of scapular muscle imbalances in patients with impingement symptoms and emphasize the relevance of restoration of scapular muscle balance in shoulder rehabilitation. with acute ROM gains in baseball players. The study results show that changes in rotator cuff stiffness, not glenohumeral joint mobility or humeral torsion, are most likely associated with the ROM deficits observed in adolescent baseball players.

3) Review of literature of how it is impacted in badminton players:

S. No	Author and Year	Title	Methods	Study Results	Conclusion
1	Ana Marchena-Rodrigueza, 2020 [1]	Incidence of injuries among amateur badminton players A cross- sectional study.	A cross- sectional study, composed of 150 players drawn from the 2018 BWF European Senior Championships, was analyzed. The definitions and types of injury included in the study are based on those published in previous epidemiology studies.	322 injuries were recorded, of which 22.44% were to the knee, followed by 18.3% to the leg. In the upper extremities, the shoulder was most frequently affected (11.8%).	study findings reveal differences in the incidence of injury according to the players' sex and age. By type of injury, those to the muscles are the most frequent, and by location, those to the knee (in the lower limb) and the shoulder (in the upper limb).
2	M. Phomsoupha, 2020 [3]	Injuries in badminton: A review	conducted a literature search for English language and non-English language papers on the following databases: PubMed, EBSCOhost, PsycINFO, ScienceDirect, Cairn and Web of Science. An additional search was performed on the Internet using Google Scholar and ResearchGate.	Eye injury occurs when shuttlecock impact from an opponent's stroke. Wearing glasses can considerably reduce the risk of eye injury. Injuries to the arm and shoulder are due to faulty technique, while leg and back injuries are caused mainly by a lack of strength or mobility. The contribution of the trunk to the prevention of lower limb injuries suggests that specific attention should be paid to this area.	This review takes a global approach to badminton-related injuries related to the eyes, and upper and lower limbs. Each of these factors may play an important role in the pre vention of injuries to badminton players.
3	K. Hoy, 1994	Badminton injuries-a prospective epidemiological and socioeconomic study	The study consisted of 100 badminton injuries registered during 1 year in the casualty ward, Department of Orthopedic Surgery, Randers city hospital, Denmark. The trauma mechanism was investigated according to	The incidence of injuries among players younger than 18 years old was 28 per 1000 per year. Players between 18 to 25 years had an injury incidence of 45 per 1000 per year and foe those over 25	Sprains were the injury most commonly diagnosed (56%), fractures accounted for 5%, tom ankle ligaments were found in 10%, and 13% had ruptures to the Achilles tendon. Overall, 21% were admitted to hospital.

			circumstances: during a tournament; while training or warming up; previous injuries; training condition. The injuries were followed up at 1 week, 2 months and 2 years and 89% completed follow-up questionnaires. Data were analysed using a computer. Statistical analysis was carried out using the X2 and t tests. Probability values less than 0.05 were considered to be statistically significant.	years had 42 per 1000 per year.	None of the patients treated as inpatients was kept in hospital for more than 7 days. The injury caused 56% of players to be absent from work of whom 23% were absent for more than 3 weeks. After the injury 12% of the players gave up their sport, and only 4% restarted their training/spo rt within 1 week. As many as 28% had to avoid training and playing in matches for 8 weeks or more.
4	Uffe Jorgensen, 1990 (19)	Injuries in Badminton	Review of existing studies on badminton injuries. They Used prospective self-registration of injuries where players reported: Injuries that occurred during training or matches, Injuries causing pain during play, Injuries requiring special treatment, Injuries that made play impossible. And Comparative analysis with injury rates in other sports	Injury Incidence: 0.85 injuries per year or 2.9 injuries per 1000 hours of badminton, Lower injury rate compared to soccer, handball, ice hockey, and volleyball. Only 0.4 serious injuries requiring hospital treatment per 100 participants. Injury Patterns: 74% were overuse injuries, 12% strain injuries, 11% sprains, 1.5% fractures, 1.5% contusions. Anatomical Distribution: 58% lower extremity injuries, 31% upper extremity injuries, 11% back injuries. Risk Factors: Men had higher injury risk than women,	Badminton is a relatively low-risk sport dominated by overuse injuries, Injury duration is typically long (48 days) but results in few lost working days (2.4 days), Preventive measures suggested are: Improved badminton shoe design with higher heel and better shock absorption, Better friction adjustment between shoe soles and playing surfaces, Specific training including stretching and strengthenin g of key muscle groups.

				Recreational players had higher injury risk than elite players when accounting for exposure time, Unlike other sports, higher injury risk during training than competition.	

4) Review of literature of Effectiveness of shockwave and ultrasound in trapezitis:

S. No	Author and Year	Title	Methods	Study Results	Conclusion
1	Nadia Anwar, 2022 (20)	Combined effectiveness of extracorporeal radial shockwave therapy and ultrasound-guided trigger point injection of lidocaine in upper trapezius myofascial pain syndrome	For this purpose, forty-five participants were randomly divided into shockwave (n = 15), shockwave with ultrasound-guided trigger point injection (com bined; n = 15), and control (standard care; n = 15) groups. Participants were assessed at baseline, one week and four weeks by using the visual analog scale, neck disability index, electromyography, infrared thermography, and sonoelastography.	Compared with control group, both shockwave and combined groups showed a statistically significant reduction in pain ($P<0.05$), functional disability ($P<0.05$), skin temperature ($P<0.01$) and elastic stiffness, with greater reduction in the combined group than shockwave group at four weeks. However, no significant difference was found in electrical activity between the groups ($P>0.05$). The combined group also showed significant differences in pain and elastic stiffness compared with shockwave group at four weeks.	The study revealed that extracorporeal radial shockwave therapy combined with trigger point injection of lidocaine was more effective for decreasing pain and elastic stiffness in upper trapezius myofascial pain syndrome at four weeks.
2	Mohammad Rahbar, 2020 (7)	Effectiveness of extracorporeal shock wave therapy versus standard care in the treatment of neck	Participants were randomly allocated into shock wave group (n = 24), standard care (ultrasound + hot	Shock wave and ultrasound improved visual analogue scale (P = 0.083) and disability index	Extracorporeal shock wave therapy was more effective in controlling of the pain intensity compared to

		and upper back myofascial pain: a single blinded randomised clinical trial	pack + self- stretch-exercises) group (n = 24) and control (self-stretch-exercises) group (n = 24) for four weeks.	(P = 0.495) similarly at first week examinations that were significantly higher than control (P < 0.05). In week 4 measurements, additional improvements were achieved concerning Visual analogue scale and disability index in the shock wave and ultrasound groups. However, visual analogue scale improved more significantly in shock wave group than ultrasound group in fourth week measurements (P = 0.012).	ultrasound one month after treatment. However, it had no superiority over ultrasound in improving neck disability index at this time point.
3	Hye Min Ji, 2012	Extracorporeal Shock Wave Therapy in Myofascial Pain Syndrome of Upper Trapezius	Twenty-two patients diagnosed with myofascial pain syndrome in upper trapezius were selected. They were assigned to treatment and standard care (control) groups balanced by age and sex, with eleven subjects in each group. The treated group had done four sessions of ESWT (0.056 mJ/mm2, 1,000 impulses, semiweekly) while the control group was treated by the same protocol but with different energy levels applied, 0.001 mJ/mm2. The VAS and pressure threshold were measured twice: before and after last	There were two withdrawals and the remaining 20 patients were three men and 17 women. Age was distributed with 11 patients in their twenties and 9 over 30 years old. There was no significant difference of age, sex, pre- VAS and pre- pressure threshold between 2 Groups (p>0.05) found. The VAS significantly decreased from 4.91±1.76 to 2.27±1.27 in the treated group (p<0.05), but there was no significant change in the	ESWT in myofascial pain syndrome of upper trapezius is effective to relieve pain after four times therapies in two weeks. But further study will be required with more patients, a broader age range and more males.

	therapy. They evaluated VAS of patients and measured the pressure threshold by using algometer.	control group.

MATERIALS AND METHODS

The studies reviewed utilized a variety of research designs, including **cross-sectional studies, randomized controlled trials (RCTs), systematic reviews, and meta-analyses**. The methodologies generally included:

- **Study Population**: Participants included **amateur and professional athletes**, particularly those engaged in **badminton, baseball, and other overhead sports**, as well as individuals with musculoskeletal conditions such as **rotator cuff tendinopathy, lateral epicondylitis, and myofascial pain syndrome**.
- **Interventions**: The primary interventions examined were:
  - **Extracorporeal Shock Wave Therapy (ESWT)** (Dedes et al., 2019, 2020; Rahbar et al., 2021; Ji et al., 2012)
  - **Ultrasound Therapy (UST)** (Dedes et al., 2019, 2020; Özmen et al., 2021; Gur et al., 2013)
  - **Kinesio Taping** (Özmen et al., 2021)
  - **Dry Needling for Myofascial Trigger Points** (Kamali et al., 2019)
  - **Ischemic Compression** (Kisilewicz et al., 2018)
  - **Exercise Therapy** (Cools et al., 2007)
  - **Combination Therapy (ESWT + Injection Therapy)** (Anwar et al., 2022)
- **Outcome Measures**:
  - **Pain Assessment** using tools such as the **Visual Analog Scale (VAS)** or **Numeric Pain Rating Scale (NPRS)**.
  - **Muscle Stiffness Measurement** using **elastography and sonographic techniques** (Leong et al., 2016).
  - **Functional Outcomes** assessed through **shoulder range of motion (ROM), grip strength, and specific sport-related functional tests** (Bailey et al., 2015).
  - **Epidemiological Data** collected from badminton players regarding the **incidence and type of injuries** (Marchena-Rodriguez et al., 2020; Høy et al., 1994).

Inclusion and Exclusion Criteria
The studies applied specific criteria to select participants:
Inclusion Criteria

- Athletes or individuals diagnosed with:
  - **Rotator cuff tendinopathy**
  - **Myofascial pain syndrome**
  - **Lateral epicondylitis ("tennis elbow")**
  - **Shoulder impingement syndrome**
- Individuals who **regularly engage in overhead sports** such as **badminton, baseball, or tennis**.
- Age range: **Typically between 18-60 years**, depending on the study.
- Patients experiencing **pain and functional limitations for at least 4-6 weeks**.
- Willingness to **participate in therapy sessions and complete follow-up assessments**.

Exclusion Criteria

- **Recent fractures or surgical interventions** affecting the shoulder or upper limb.
- **Neurological disorders** that could influence muscle function.
- Use of **anti-inflammatory medication or corticosteroid injections** within a specific period before treatment (varies per study).
- History of **systemic inflammatory diseases** (e.g., rheumatoid arthritis).
- Pregnancy or **contraindications to shockwave therapy or ultrasound treatment**

DISCUSSIONS

The comprehensive literature review presented above provides valuable insights into several key areas: the comparison between shockwave and ultrasound therapy, the incidence of trapezitis in athletes (particularly badminton players), the impact of these conditions on badminton players, and the effectiveness of various treatment modalities. This discussion will analyze and synthesize these findings while highlighting their clinical implications and identifying areas for future research.

Comparative Efficacy of Shockwave and Ultrasound Therapy

1) Treatment Outcomes and Pain Management

The literature review reveals a consistent pattern regarding the comparative effectiveness of shockwave therapy (ESWT) and ultrasound therapy (US) in treating various musculoskeletal conditions. Multiple studies demonstrate that both treatment modalities are effective in reducing pain and improving functionality, but with some notable differences in their relative efficacy.

Özmen et al. (2021) found that both ESWT and US were effective in reducing pain and improving functionality in lateral epicondylitis, with neither treatment showing clear superiority. However, this finding is somewhat contrasted by other studies in the review. For instance, Yao (2020) conducted a systematic review and meta-analysis that showed superior outcomes for ESWT in terms of pain relief and grip strength improvement compared to other methods, including ultrasound therapy.

The divergence in findings might be attributed to:

a. Different treatment protocols and parameters used across studies
b. Varying patient populations and severity of conditions
c. Different follow-up periods and assessment methods
d. Methodological differences in study design and execution

2) Long-term Effectiveness and Follow-up Results

A particularly noteworthy aspect emerging from the review is the temporal dimension of treatment effectiveness. Dedes (2020) found that while both ESWT and US showed significant improvements in pain reduction and functionality, the results in the ultrasound group were less pronounced than in the shockwave group, particularly at the 4-week follow-up. This finding suggests that ESWT might offer more sustainable long-term benefits compared to US therapy.

3) Clinical Applications and Treatment Selection

The research indicates several factors that clinicians should consider when choosing between ESWT and US:

1. Patient-specific factors:
   - Severity of condition
   - Previous treatment history
   - Patient preference and comfort
   - Cost considerations
2. Condition-specific factors:
   - Type of tissue involved
   - Acute vs. chronic presentation
   - Presence of calcification or other structural changes
3. Practical considerations:
   - Available equipment
   - Therapist expertise
   - Treatment duration and frequency requirements

Trapezitis in Athletes and Sports-Specific Considerations

Prevalence and Risk Factors

The review highlights the significant prevalence of trapezius-related issues in overhead athletes, including badminton players. Several key factors contribute to this prevalence:

1. Biomechanical Demands:
   - Repetitive overhead movements
   - High-velocity actions
   - Extended periods of sustained muscle activation
2. Training-Related Factors:

- Training volume and intensity
- Recovery time between sessions
- Technical execution quality

3. Individual Factors:
- Previous injury history
- Muscle imbalances
- Postural habits and workplace ergonomics

Sport-Specific Impact on Badminton Players

The literature review reveals several important aspects regarding how trapezitis specifically affects badminton players:

1) Performance Impact:
   - Reduced shot power and accuracy
   - Limited range of motion
   - Decreased endurance during matches
   - Compromised technique execution
2) Risk Factors Specific to Badminton:
   - High frequency of overhead strokes
   - Quick directional changes
   - Extended playing sessions
   - Competitive pressure and inadequate recovery
3) Injury Patterns:
   - Higher prevalence in dominant arm
   - Association with other upper body injuries
   - Correlation with playing experience and level

Treatment Effectiveness in Trapezitis

Comparative Analysis of Treatment Modalities

The research presents compelling evidence regarding the effectiveness of both ESWT and US in treating trapezitis, with some important distinctions:

1. Immediate Effects:
- Both modalities show significant pain reduction
- ESWT demonstrates superior results in muscle stiffness reduction
- US therapy shows good results in improving tissue elasticity

2. Medium-term Outcomes:
- ESWT maintains better pain relief at 4-week follow-up
- Combined approaches show enhanced effectiveness
- Both treatments improve functional outcomes

3. Long-term Benefits:
- Limited data on long-term outcomes beyond 3 months
- Need for more extended follow-up studies
- Potential role of maintenance treatments

Clinical Implementation Considerations

The review suggests several important factors for clinical implementation:

1. Treatment Protocol Design:
- Optimal frequency and duration of sessions
- Energy levels and application techniques
- Integration with other therapeutic approaches

2. Patient Selection:
- Acute vs. chronic conditions
- Presence of trigger points
- Overall physical condition and activity level

3. Outcome Measurement:
- Standardized assessment tools

- Regular progress monitoring
- Patient-reported outcomes

Implications for Clinical Practice

A) Treatment Protocol Optimization

Based on the reviewed literature, several recommendations can be made for optimizing treatment protocols:

1. Initial Assessment:
   - Comprehensive evaluation of pain patterns
   - Assessment of functional limitations
   - Identification of contributing factors
2. Treatment Planning:
   - Individualized approach based on patient characteristics
   - Integration of multiple treatment modalities when appropriate
   - Regular reassessment and protocol adjustment
3. Progress Monitoring:
   - Use of validated outcome measures
   - Regular documentation of improvements
   - Patient feedback integration

B) Risk Management and Prevention

The research highlights the importance of preventive measures:

1. Training Modifications:
   - Proper warm-up protocols
   - Technique correction
   - Workload management
2. Recovery Strategies:
   - Adequate rest periods
   - Active recovery techniques
   - Supporting exercises
3. Education and Awareness:
   - Player education about risk factors
   - Early intervention strategies
   - Proper body mechanics

Future Research Directions

The literature review reveals several areas requiring further investigation:

A) Methodological Considerations

1. Study Design:
   - Need for larger sample sizes
   - Longer follow-up periods
   - More randomized controlled trials
2. Assessment Methods:
   - Standardization of outcome measures
   - Integration of objective and subjective measures
   - Development of sport-specific assessment tools
3. Treatment Protocols:
   - Optimization of treatment parameters
   - Investigation of combination therapies
   - Cost-effectiveness analysis

B) Specific Research Needs

1. Long-term Outcomes:
   - Extended follow-up studies
   - Investigation of recurrence rates

- Analysis of career longevity impact

2. Prevention Strategies:
   - Development of screening tools
   - Evaluation of preventive protocols
   - Risk factor modification studies
3. Sport-Specific Research:
   - Badminton-specific intervention studies
   - Analysis of playing level influence
   - Investigation of equipment factors

CONCLUSION

The literature review provides substantial evidence supporting the effectiveness of both ESWT and US therapy in treating musculoskeletal conditions, particularly trapezitis in athletes. While both modalities demonstrate positive outcomes, ESWT appears to offer some advantages in terms of long-term pain relief and functional improvement. However, the choice of treatment should be individualized based on various patient-specific factors and practical considerations.

A) The high prevalence of trapezitis in badminton players highlights the need for:
   1. Early intervention strategies
   2. Comprehensive prevention programs
   3. Sport-specific treatment protocols
   4. Regular monitoring and assessment

B) Future research should focus on:
   1. Standardizing treatment protocols
   2. Investigating long-term outcomes
   3. Developing sport-specific interventions
   4. Evaluating combination therapy approaches

The findings underscore the importance of an integrated approach to treatment, considering both immediate symptomatic relief and long-term functional outcomes. Continued research in this field will help refine treatment protocols and improve outcomes for athletes affected by these conditions.

Recommendations for Future Research

Future research should focus on:

1. Longitudinal Studies: Investigating the long-term effects of both therapies on trapezitis recovery.
2. Comparative Effectiveness: Further comparative studies between SWT and UST specifically targeting trapezitis in badminton players.
3. Preventive Strategies: Developing preventive measures aimed at reducing the incidence of trapezitis through improved training techniques and conditioning programs.

Practical Implication

For practitioners working with badminton players or other overhead athletes, incorporating shockwave therapy into rehabilitation protocols may enhance recovery outcomes. Additionally, addressing muscle imbalances through targeted strength training and flexibility exercises could mitigate the risk of developing trapezitis. In summary, understanding the comparative effectiveness of these therapeutic modalities is crucial for optimizing treatment strategies for athletes suffering from trapezitis and enhancing their overall performance on the court.

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