MoreNova- MSDs

A Compendium of Research Articles and
on the Integration of MoreNova into orthopedics pain treatment

MORENOVA

Table of Contents

Learn from Leading Practitioners

This compendium lists selected publication references, synthesizing the knowledge and experiences from leading practitioners, and documenting a range of applications and models for implementing MoreNova in routine practice.

- We hold ourselves to a high standard when it comes to accumulating clinical evidence
- We are committed to extending research opportunities to medical professionals worldwide
- We strive to engage the professional community to explore existing guidelines in order to reach knowledge-based consensus recommendation for change, while recognizing the valued relationship between physiotherapists and industry

To learn more about how MoreNova can benefit you and your patients, please contact us at:

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MoreNova at a Glance

MoreNova is a new-generation shockwave-based no invasive treatment designed to alleviate orthopedic pain, restore joint and tendon function, and support natural tissue repair across all age groups.
MoreNova is equipped with an innovative hands-free arm that enhances patient comfort while optimizing clinician workflow.
Its proprietary shockwave technology combines broad tissue coverage with deep penetration, providing fast and effective outcomes for orthopedic conditions, including those with deep-seated sources of pain.

Clinical Indications for Utilizing MoreNova

Indications in MSDs:

- Tendinitis (e.g., Achilles tendinitis, rotator cuff tendinitis)
- Myofascial pain syndrome
- Chronic pain (e.g., lower back, neck)
- Osteoarthritis-related pain
- Plantar fasciitis
- Post-injury rehabilitation

Clinical benefits:

- Low- to zero-risk, no heating, no ablation, no side effects
- High safety and efficacy across various indications/ages
- Clinically validated regenerative effect
- Multiple health indications
- Non-surgical, non-pharmacological
- Improved patient compliance
- Low interoperator variability
- Durable results

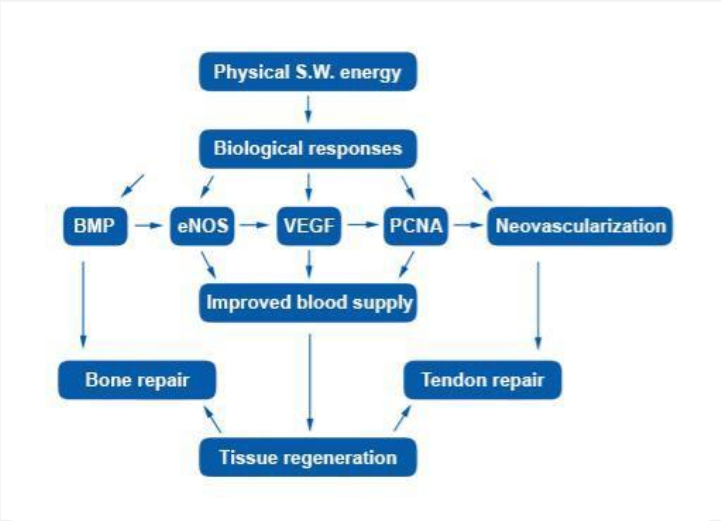
Features and highlights

- Proprietary Large-Area Shockwave Technology (LAST) electromagnetic technology
- Optimal comfort: outpatient setting, anesthetic-free, quick and painless
- Time efficient: no preparations, no downtime, no recovery time
- Fits in standard workflow, requires no additional equipment
- Noticeable results directly after the first few sessions
- Exclusive hands-free application
- Straight-forward procedure

Molecular Mechanism of Action

Shockwaves are characterized by jump change in pressure, high energy peak, high amplitude and non-periodicity. The energy is transferred to the transmitter at the end of the applicator and further into the tissue.

Our bodies have a remarkable capacity to heal themselves. Low Intensity Shockwave Therapy (LISWT) augments the body's natural cellular repair mechanisms, using acoustic pressure waves which carry low-intensity energy to tissues. The cascade of biological actions that follows LISWT leads to accelerated tissue regeneration and cell growth, and is able to restore, improve, and even normalize tissue form and function.



Wang CJ, Wang FS, Yang KD,
Biological mechanism of musculoskeletal shockwaves
ISMST Newsletter 2006, 1 (I), 5-11

During and after treatment, LISWT delivers pulse waves, stimulating the following regenerative and reparative processes simultaneously:

- ANGIOGENESIS AND NEOVASCULARIZATION

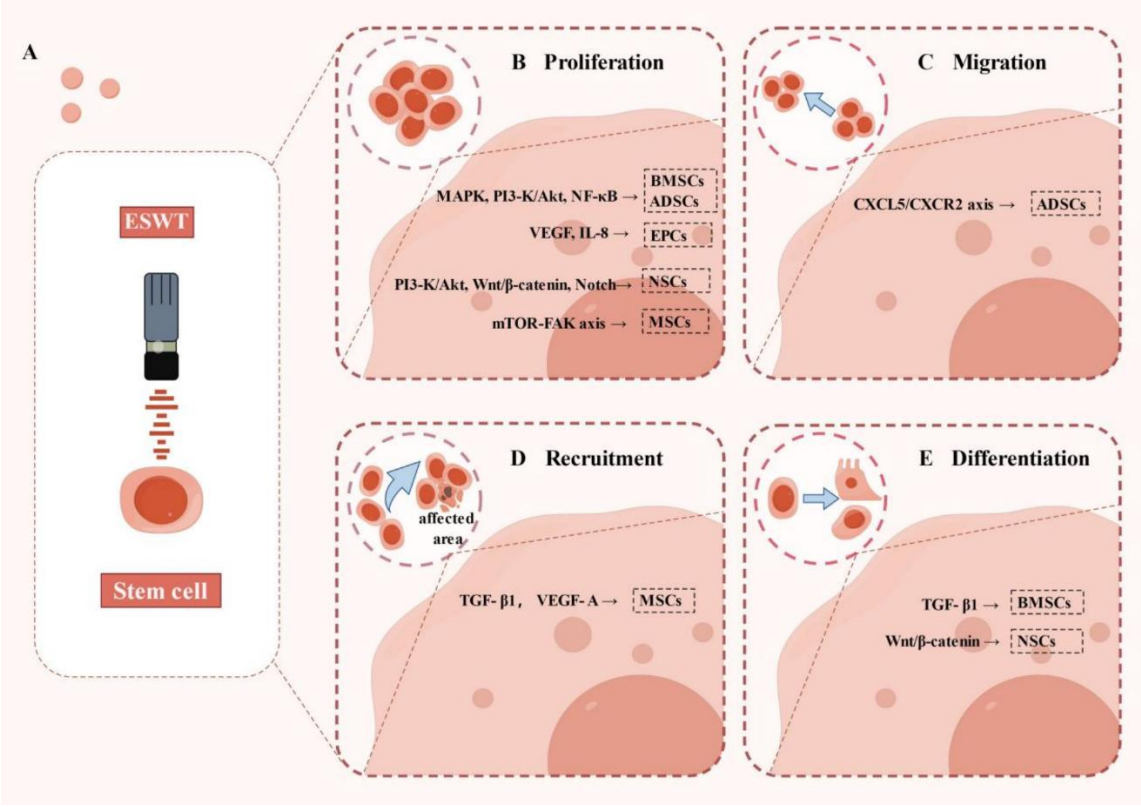
  Nutrient blood supply and tissue oxygenation are vital to initiate and maintain the healing processes of damaged tissue structures. By causing capillary microruptures in the tissue, LISWT stimulates the recruitment of platelets and the subsequent increased expression of growth factors, which in turn activate the propagation and formation of new blood vessels.

- RECRUITMENT AND ACTIVATION OF MESENCHYMAL STEM CELLS (MSCs)

  ESWT stimulates stem cells within the body and enhances their ability to repair damaged tissue. This is achieved by activating several key biological processes:

- Proliferation - the shockwaves encourage stem cells to multiply, increasing the number of cells available for tissue repair.
- Differentiation - stem cells are guided to transform into specific types of musculoskeletal cells, such as tendon cells, bone cells, or cartilage cells, depending on the area being treated.
- Migration and Recruitment - ESWT signals stem cells to move toward the injured tissue, where they accumulate and initiate regeneration.

These effects are mediated through activation of cellular signaling pathways, such as MAPK, PI3K/Akt, and NF-κB, which are known to regulate tissue healing and regeneration.



♦ DECALCIFICATION OF PLAQUES AND ARTERIAL REMODELLING

Vascular and fibrocellular tissue calcification commonly result from repetitive stress, microtrauma and aging. Calcium build-up can lead to histologic and structural changes, reduce tissue elasticity and impact vessel hemodynamics. LISWT-induced shear stress breaks up fibrosis and existing calcifications, leading to fragmentation of calcium deposits into granular particles, which are then removed by the lymphatic system.

- STIMULATION OF COLLAGEN PRODUCTION AND RESTRUCTURING

  Collagen plays an important role in maintaining the integrity of myoskeletal and ligamentous structures. LISWT accelerates collagen synthesis and deposition, forming denser and stiffer fibers, and creating a firmer structure.

- REVERSAL OF CHRONIC INFLAMMATION

  Mast cells are the foundation of inflammatory response, wound healing and defence against pathogens. LISWT increases Mast cell activation, followed by the production of chemokines and cytokines. initially enhancing the inflammatory process, these pro-inflammatory compounds ultimately allow for halting of chronic inflammation conditions and associated pain.

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Journal of
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and Kinesiology

Analgesic Effect of Extracorporeal Shock-Wave Therapy in Individuals with Lateral Epicondylitis: A Randomized Controlled Trial[1]

Salameh Aldajah, Anas R. Alashram, Giuseppe Annino, Cristian Romagnoli and Elvira Padua

Objective: This study was conducted to investigate the effect of extracorporeal shock-wave therapy (ESWT) on pain, grip strength, and upper-extremity function in lateral epicondylitis.

Methods: A sample of 40 patients with LE (21 males) was randomly allocated to either the ESWT experimental (n = 20) or the conventional-physiotherapy control group (n = 20). All patients received five sessions during the treatment program. The outcome measures used were the Visual Analog Scale (VAS), the Taiwan version of the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, and a dynamometer (maximal grip strength).

Results: Forty participants completed the study. Participants in both groups improved significantly after treatment in terms of VAS (pain reduced), maximal grip strength, and DASH scores. However, the pain was reduced and upper-extremity function and maximal grip strength were more significantly improved after ESWT in the experimental group.

Conclusion: ESWT has a superior effect in reducing pain and improving upper-extremity function and grip strength in people with lateral epicondylitis. It seems that five sessions of ESWT are optimal to produce a significant difference. Further studies are strongly needed to verify our findings.

BMC Sports Science, Medicine and Rehabilitation

RESEARCH Open Access

The effect of extracorporeal shock-wave therapy on pain in patients with various tendinopathies: a systematic review and meta-analysis of randomized control trials[4]

Lobat Majidi1, Sorour Khateri1, Nikta Nikbakht1, Yousef Moradi2 and Mohammad Reza Nikoo

Objectives Tendinopathy is a common condition that affects the body's tendon structures, causing discomfort, restricted movement, and reduced functionality. In this study, we looked at how extracorporeal shock wave therapy (ESWT) affected pain levels in individuals with various forms of tendinopathy around the world.

Design This study is a comprehensive review and meta-analysis of previously published randomized controlled trials. To gather relevant data, the researchers performed keyword searches in international databases, including PubMed (Medline), Scopus, Web of Sciences, Cochrane Central Register of Controlled Trials (CENTRAL), Research Registers of ongoing trials (ClinicalTrials.gov), as well as Embase. The search was conducted up until March 2023. The quality of the selected articles was assessed using the Cochrane risk-of-bias method for randomized trials (RoB2).

Results Based on the results of the meta-analysis, which included 45 clinical studies, the use of ESWT was found to have a significant impact on reducing pain in various conditions. The standardized mean difference (SMD) in patients with plantar fasciitis (PF) was reduced by 1.63 (SMD: -1.63, 95% CI: -3.04, -0.21; I2: 77.36%; P heterogeneity: 0.0001). For lateral epicondylitis (LE), the SMD was 0.63 (SMD: -0.63, 95% CI: -1.11, -0.16; I2: 67.50%; P heterogeneity: 0.003). In the case of chronic Achilles tendinopathy, the SMD was 1.38 (SMD: -1.38, 95% CI: -1.66, -1.10; I2: 96.44%; P heterogeneity: 0.0001). Additionally, in individuals with rotator cuff tendinopathy, the SMD for pain reduction was 2.37 units (SMD: -2.37, 95% CI: -3.58, -1.15; I2: 98.46%; P heterogeneity: 0.0001).

Conclusion This study suggests that ESWT can be a highly effective therapy option for relieving pain in people with tendinopathy. Nonetheless, it is encouraged to make additional recommendations based on high-quality clinical research and more accurate information in order to define the optimal therapeutic options for each type of tendinopathy.

INTERNATIONAL JOURNAL OF SURGERY

Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial[5]

Tomas Nedelka, Jakub Katolicky, Jiri Nedelka, Paul Hobrough and Karsten Knobloch

Objective: Lumbar facet joints (FJs) are a common source of chronic low back pain (LBP). Focused extracorporeal shock wave therapy (ESWT) has demonstrated potential in the treatment of musculoskeletal disorders due to its deeper tissue penetration and safety profile. This study aimed to evaluate the efficacy and safety of ESWT in the management of lumbar facet joint pain.

Methods: A prospective, randomized, sham-controlled trial was conducted in 128 patients with chronic lumbar facet syndrome confirmed by medial branch block. Patients were randomized to receive either focused ESWT (Group A, n = 64; 0.35 mJ/mm2, 1200 shocks/session = 600 shocks per segment, 5 weekly sessions) or sham therapy (Group B, n = 64). Pain intensity (VAS), disability (ODI), and neuropathic pain features (PainDETECT questionnaire) were assessed at 2, 6, and 12 months. Lumbar spine MRI was performed at baseline and 6 months post-treatment.

Results: Group A showed significant reductions in VAS scores at 6 and 12 months (mean 64.4% reduction at 12 months, $P<0.01$), with an effect size (Cohen's d = 1.12). ODI decreased by 42.3% in Group A compared to 12.5% in the sham group. Neuropathic pain symptoms improved significantly only in Group A (PD-Q reduction from 18.3 ± 2.4 to 10.2 ± 1.9; $P<0.01$). MRI follow-up demonstrated resolution of bone marrow edema in 58.8% of ESWT-treated patients versus none in the control group. No adverse effects were reported.

Conclusions: High-energy focused ESWT is a safe and effective non-invasive therapy for chronic lumbar facet joint pain, showing sustained improvements in pain, function, and neuropathic symptoms. MRI findings support its biological effect on joint-related bone marrow edema. ESWT represents a promising alternative to interventional pain procedures.

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Efficacy of Focused Extracorporeal Shock Wave Therapy in Chronic Low Back Pain: A Prospective Randomized 3-Month Follow-Up Study[6]

Katarzyna Rajfur, Joanna Rajfur, Tomasz Matusz, Karolina Walewicz, Robert Dymarek, Kuba Ptaszkowski, Jakub Taradaj

Objective: Extracorporeal shock wave therapy (ESWT) is a modern physiotherapeutic method that is useful for treating musculoskeletal conditions. There are still limited data from well-designed studies evaluating the clinical efficiency of ESWT in low back pain (LBP). Therefore, this study aimed to assess the effectiveness of the focused ESWT (fESWT) in reducing pain and improving the functional status of patients with chronic LBP.

Methods: The study involved 40 patients with L5-S1 discopathy with chronic LBP pain who were randomized into 2 groups: group A (n=20, mean age of 42.3±13.1 years) and group B (n=20, mean age of 45.4±14 years). Group A was an experimental group treated with an fESWT at the lumbar and sacral spine (0.15 mJ/mm^2, 1000 pulses, 4 Hz). Group B was a control group, treated with a sham fESWT. The treatment protocol in both groups included identical stabilization training (45 minutes, once a day, 5 days a week). Study outcomes included subjective pain with a visual analog scale (VAS) and Laitinen Pain Scale (LPS), and functional status using the Oswestry Disability Index (ODI). Measurements were made before and after treatments, as well as follow-up observations at 1 and 3 months following ESWT. The study was prospectively registered at the ISRCTN registry platform (no. ISRCTN13785224).

Results: There was a significant analgesic effect (VAS and LPS) in both groups; however, it was significantly greater in the experimental group compared to the sham group ($P<0.05$). A more significant decrease in the perceived pain (VAS and LPS) was observed immediately after the active fESWT therapy. In follow-up observations (after 1 and 3 months), there were no significant between-group differences ($P>0.05$). Also, there was a significant effect in terms of functional state (ODI) for both groups ($P<0.05$); however, between-group comparisons revealed no statistically significant differences ($P>0.05$).

Conclusions: Focused ESWT with an exercise program can be effective in patients with chronic LBP. ESWT allows reducing pain, although it does not seem to significantly improve a patient's functional state.

Clinical Trial/Experimental Study

Medicine

Clinical evaluation of the efficacy of focused extracorporeal shock-wave therapy in patients with cervical spondylosis. A randomized control trial[7]

Shuangyue Li, Jie Liu, Yan Wang, Chan Zhu, Yahong Tang, Minghong Gu

Objective: Extracorporeal shock wave therapy (ESWT) has emerged as a contemporary modality in physiotherapy, demonstrating efficacy in addressing musculoskeletal disorders. Despite its potential, the clinical efficacy of ESWT in the context of cervical spondylosis remains understudied, with a dearth of robust empirical evidence. To bridge this gap, the present study was designed to evaluate the therapeutic impact of focused ESWT (fESWT) on pain alleviation and functional improvement in individuals afflicted with cervical spondylosis.

Method: A multicenter, randomized controlled clinical study was conducted, collecting data from 5 clinical studies on the treatment of cervical spondylosis with fESWT from June 2021 to March 2024. The inclusion criteria were patients diagnosed with cervical spondylosis, aged 20 to 70, without severe underlying diseases such as heart disease, hypertension, diabetes, etc. The exclusion criteria included pregnant women, nursing women, patients with bleeding tendencies, or those with cardiac pacemakers. The control group underwent a sham fESWT, while the experimental group received fESWT. The main observation indicators included the Visual Analogue Scale (VAS) for pain scoring, Neck Disability Index (NDI) scoring, cervical range of motion (ROM) scoring, and the Short Form-36 (SF-36) quality of life survey scoring.

Results: A total of 320 subjects were included in the study, with 160 in the experimental group and 160 in the control group. Post-treatment, the VAS and NDI scores in the experimental group were significantly lower than those in the control group ($P < .05$), while the cervical range of motion (ROM) and SF-36 scores were significantly higher than in the control group ($P < .05$). The overall treatment efficacy rate in the experimental group exceeded 90%, markedly higher than the approximately 70% rate in the control group ($P < .05$). There was no significant difference in the incidence of adverse reactions between the 2 groups.

Conclusion: The fESWT has shown promising therapeutic effects in the treatment of cervical spondylosis. It effectively reduces patient pain, improves cervical function, and enhances the quality of life, making it worthy of clinical promotion and application.

Contents lists available at ScienceDirect

Complementary Therapies in Medicine

journal homepage: www.elsevier.com/locate/ctim

Therapeutic effect of focused-extracorporeal shockwave therapy on muscular and adjacent tissue stiffness and pain changes in myofascial pain syndrome: A randomized controlled trial study[8]

Pijakkana Vasvit, Kultida Klarod, Oranat Sukkho, Sirirat Kiatkulanusorn, Phurichaya Werasirirat, Xue-Qiang Wang, Yong-Hui Zhang, Juntip Namsawang, Pornpimol Muanjai, Nongnuch Luangpon

Objective: Focused-extracorporeal shockwave therapy (fESWT) has recently been applied in the management of chronic pain. However, its effectiveness in reducing muscular stiffness and pain among office workers has not been extensively studied. This study aimed to investigate the effectiveness of fESWT and sham-fESWT in alleviating muscular stiffness, pain, and functional disability.

Methods: Sixty-four office workers (mean age 31.4 ± 9.5 years) with myofascial pain syndrome of the upper trapezius were randomly and equally assigned to receive either the fESWT or sham-fESWT. The interventions were administered once a week for 4 weeks, with 4 Hz frequency and a total energy of 0.1–0.232 mJ/mm^2. Measurements were recorded at baseline, immediately after treatment, at two weeks, and at four weeks, assessing shear modulus (tissue stiffness), visual analogue scale (VAS), and the neck disability index (NDI).

Results: The result demonstrated a significant acute decrease in shear modulus at the trigger point (–6.1 kPa, $p = 0.009$) and a delayed reduction in muscle stiffness of the lower aponeurosis (–5.3 kPa, $p = 0.004$) following 4 weeks. Additionally, VAS scores decreased at all time points following fESWT ($p < 0.05$), while the shamfESWT group also demonstrated reductions during the final two weeks. NDI showed a decrease in both groups after four sessions ($p < 0.05$), with no group effect.

Conclusion: fESWT was effective in reducing muscular pain, stiffness, and functional disability in patients. However, the potential psychological effects of sham-fESWT on VAS and function should be considered. Further research is necessary to determine the optimal treatment sessions and intensity of fESWT to better establish its efficacy

Original Article

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Applying Focused and Radial Shock Wave for Calcific Tendinitis of the Shoulder: Randomized Controlled Study[3]

Jonggun Kima, Changmin Ohb, John Yooc, and Jongeun Yimc

Objective: Extracorporeal shock wave therapy (ESWT) is a nonsurgical treatment alternative to surgery for various musculoskeletal diseases that have traditionally been difficult to treat conservatively, including calcific tendinitis, tennis elbow, and plantar fasciitis. This study evaluated the effect of focused and radial shock wave therapy for calcific tendinitis of the shoulder.
Design: Randomized controlled study
Methods: Forty participants with calcific tendinitis were randomized into focused shock wave therapy (FSWT, n＝20) and radial shock wave therapy (RSWT, n＝20) groups. Patients were examined before and one week after treatment. Pain intensity was subjectively assessed using the visual analogue scale and function was assessed using the Constant-Murley score (CMS) and range of motion (ROM).
Results: The results showed a significant decrease in pain and significant increase in shoulder mobility and function in both groups. However, FSWT was significantly more effective than RSWT, based on CMS and ROM assessment.
Conclusions: Although it is possible to raise the energy intensity of RSWT to increase the depth at which the energy becomes dispersed, higher energy intensity is associated with a greater risk of severe neurovascular damage, and that high-intensity stimulation can cause adverse effects such as pain and petechiae. Therefore, FSWT is considered to be a safe and effective method for treating tendinous lesions while minimizing adverse effects. In conclusion, both FSWT and RSWT can reduce pain and increase mobility and function. FSWT can be considered as an alternative for calcific tendinitis of the shoulder.

BMC Musculoskeletal Disorders

SYSTEMATIC REVIEW Open Access

Effect of extracorporeal shockwave therapy for rotator cuff tendinopathy: a systematic review and meta-analysis[2]

Xiali Xue, Qingfa Song, Xinwei Yang, Amila Kuati, Hao Fu, Yulei Liu, and Guoqing Cui

Objective: Rotator cuff tendinopathy (RCT) is a widespread musculoskeletal disorder and a primary cause of shoulder pain and limited function. The resulting pain and limited functionality have a detrimental impact on the overall quality of life. The purpose of this study was to perform a systematic review of the effects of extracorporeal shock wave therapy (ESWT) for RCT.

Methods: The literature search was conducted on the following databases from inception to February 20, 2024: PubMed, Web of Science, the Cochrane Library, Scopus, MEDLINE, EMBASE, EBSCO, and China National Knowledge Infrastructure (CNKI) were checked to identify the potential studies exploring the effect of ESWT for the treatment of Rotator cuff tendinopathy (Calcification or non-calcification), control group for sham, other treatments (including placebo), without restriction of date, language. Two researchers independently screened literature, extracted data, evaluated the risk of bias in the included studies, and performed meta-analysis using RevMan 5.3 software.

Results: A total of 16 RCTs with 1093 patients were included. The results showed that compared with the control group, ESWT for pain score Visual Analogue Scale/Score (VAS) (SMD = -1.95, 95% CI -2.47, -1.41, $P < 0.00001$), function score Constant-Murley score (CMS) (SMD = 1.30, 95% CI 0.67, 1.92, $P < 0.00001$), University of California Los Angeles score (UCLA) (SMD = 2.69, 95% CI 1.64, 3.74, $P < 0.00001$), American Shoulder and Elbow Surgeons form (ASES) (SMD = 1.29, 95% CI 0.93, 1.65, $P < 0.00001$), Range of motion (ROM) External rotation (SMD = 1.00, 95% CI 0.29, 1.72, $P = 0.02$), Total effective rate (TER) (OR = 3.64, 95% CI 1.85, 7.14, $P = 0.0002$), the differences in the above results were statistically significant. But ROM-Abduction (SMD = 0.72, 95% CI -0.22, 1.66, $P = 0.13$), the difference was not statistically significant.

Conclusion: Currently limited evidence suggests that, compared with the control group, ESWT can provide better pain relief, functional recovery, and maintenance of function in patients with RCT.

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