J. appl. health sci. 2023; 9(2): 221-231

The effectiveness of Extracorporeal Shockwave Therapy in the treatment of chronic low back pain: A Systematic Review

[1,2] Iva Lončarić Kelečić

[1] University Hospital Centre Zagreb, Clinic for rheumatic diseases, Croatia
[2] Alma Mater Europea – AMEU, Maribor, Slovenia

Abstract

Introduction: Low back pain is the most prevalent chronic pain syndrome in clinical practice. Due to safer benefits, nonpharmacological, exercise-based treatments represent the first choice for chronic low back pain (CLBP). Recently, Extracorporeal Shockwave Therapy (ESWT) has been suggested as a new treatment option for CLBP. The aim was to provide an overview of the effectiveness of ESWT in combination with exercise versus exercise alone in pain and disability reduction in CLBP through a systematic review of published randomised control trials (RCTs).

Methods: Original RCTs related to the use of ESWT in CLBP were searched in PubMed, Cochrane's library and the Physiotherapy Evidence Database back ten years from January 2023. The recommendations of the Preferred Reporting Items for Systematic Review and Meta-Analysis statement and The Prisma in Exercise, Rehabilitation, Sport Medicine and SporTs scientific guidance were followed. Data on study information, Population characteristics, Intervention treatment, Control or comparators, and Outcomes were extracted. Outcomes of primary interest were pain and disability, observed before and after treatments. The results are presented systematically and narratively.

Results and Discussion: Two eligible RCTs were included from the initial 30 identified. Despite the evident reduction in pain and disability in the ESWT groups, the significance of the outcome versus the control groups in the short and long-term periods is conflicting between studies.

Conclusion: In treating CLBP, ESWT combined with exercises is to some extent clinically superior to exercises alone; however, evidence should be used with caution due to the lack of studies and existing confrontations.

Keywords: chronic pain, extracorporeal shockwave therapy, low back pain, physical therapy modalities, systematic review

Article received: 15.5.2023.

Article accepted: 1.10.2023.

https://doi.org/10.24141/1/9/2/11

Corresponding author:
Iva Lončarić Kelečić
A: University Hospital Centre Zagreb, Clinic for Rheumatic Diseases, Physical Therapy Department , Božidarevićeva 11, Zagreb 10 000, Croatia
T: +385 1 236 79 15
E-mail: iva.loncaric.kelecic@gmail.com

Introduction

Low back pain (LBP) is clinical practice's most prevalent chronic pain syndrome.[1] Because of years spent with disabilities[2] and reduced quality of life[3] of adults in their otherwise productive age, low back pain represents both individual and societal burden.[4] In treating and preventing the consequences of low back pain, it is essential to make treatment decisions based on evidence, safety and efficacy. For chronic low back pain (CLBP) management, strong recommendations are given for choosing nonpharmacologic treatments[5] - exercises in the first line.[6] Nonpharmacological interventions provide safer benefits than pharmacological or invasive interventions in treating CLBP.[7]

A widely propagated nonpharmacologic and noninvasive therapeutic modality in the treatment of numerous musculoskeletal disorders is Extracorporeal Shockwave Therapy (ESWT)[8], and two types of technical principles usually included in it, focused ESWT (F-ESWT) and radial pressure waves (RPW).[9] The physiologic effects of ESWT have been widely investigated, with observations that different energy forms affect the musculoskeletal system[10] by augmenting pain relief, neovascularisation, protein biosynthesis, cell proliferation, neuro and chondroprotection, and destruction of calcium deposits in musculoskeletal structures.[8] Increasing evidence suggests ESWT is a safe and effective treatment[9], leading to tissue regeneration, significant alleviation of pain, and improved functional outcomes.[8]

To date, ESWT has shown great potential as a proper regenerative technique for treating numerous musculoskeletal disorders[8], including soft and hard tissue[11], with most evidence of effectiveness in chronic tendinopathies[9] but also recently suggested as a new treatment option in CLBP.[12] ESWT proved effective alone or combined treatment in augmenting pain relief and functional outcomes in patients with CLBP.[13,14] However, only several studies investigated its effectiveness[12], meaning further research is needed. The only two reviews, simultaneous meta-analyses, highlight the heterogeneity between studies due to clinically diverse aetiology, duration of pain, ESWT treatment features, various unimodal or multimodal comparators, and outcome measures observed.[13,14] They also emphasise that randomised controlled studies (RCTs) of adequate quality should be conducted to produce high-quality evidence of ESWT effectiveness and safety in CLBP and promote the application of ESWT in clinical practice.

Additional areas for improvement in the existing body of knowledge, and of particular importance for physiotherapy, is the effectiveness of the application of ESWT in combination with exercise compared to the application of exercise alone. Defining such a research problem by extracting exercises from the pool of physiotherapy interventions is based on the fact that exercise alone is the first line of treatment for CLBP, and ESWT can potentially augment patient outcomes. In addition to the knowledge of EWST effectiveness concerning patient outcomes, this effect must be investigated and visible in pain, disability, and quality of life – core outcomes in patients with CLBP.[15]

Considering the existing body of knowledge, the aim is to provide an overview of the effectiveness of ESWT in combination with exercise in comparison to exercise alone on CLBP patient outcomes of pain and disability through a systematic review of published RTCs. This systematic review will have a scientific and practical contribution, given that it will provide insight into the current evidence and, therefore, the justification to some extent for applying ESWT in physiotherapy in patients with CLBP.

Methods

In developing this review, an effort was made to follow the recommendations of the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement[16] and The Prisma in Exercise, Rehabilitation, Sport Medicine and SporTs Science (PERSiST) guidance.[17]

Information sources and search strategy

Original RCTs related to the ESWT in CLBP were sought in PubMed, Cochrane's Library and Physiotherapy Evidence Database (PEDro). Grey literature, secondary sources or popular articles were not of search interest.

PubMed database search consisted of Mesh terms "Extracorporeal Shockwave Therapy" AND "Low Back Pain", with publication date filters January 2013-2023 and RCTs only. Since all studies were in English, no language filter was used.

The search of the Cochrane Register of Trials consisted of the terms “Extracorporeal Shockwave Therapy”, “Low Back Pain”, and “Randomised Controlled Trial” in the keywords, title and abstract search engine with publication date filters 2013-2023, with no language filter since all studies were on English.

In the PEDro database, the search consisted of the terms “Extracorporeal Shockwave Therapy” AND “Low Back Pain” in the title and abstract with publication date filters 2013-2023 and clinical trials only.

Eligibility criteria

The eligibility criteria were set according to the Patient Intervention Comparison Outcome (PICO)[18] framework. The PICO research question was: “In chronic low back pain (P), is there a difference between extracorporeal shock wave therapy in combination with exercise (I) and exercise alone (C) in reducing pain and disability (O)?”.

RCTs were considered eligible if they examined the PICO elements of interest. RCTs conducted outside the clinical or laboratory setting were deemed ineligible. Studies in which participants were <18 years old and had acute low back pain or comorbidities other than CLBP were considered ineligible. Intervention and comparator treatment combined with any other treatment (i.e., manual therapy, electrotherapy, analgesics or anti-inflammatory drug use, surgery and similar) was considered ineligible, except sham ESWT in the control group. Regarding the outcome measures, studies were not considered eligible if they did not address both outcome measures, the outcome of pain and disability, regarding the biopsychosocial interaction of pain[19] and the disability rate of over 80% in CLBP.[20]

Selection process

The selection of studies was a several-step process, and the reviewer evaluated identified sources manually and by reading without a computer program. After records had been identified from databases, evaluated duplicate titles were removed. By scanning individual titles and associated abstracts, articles irrelevant or ineligible to the research question were removed. The full text was searched for relevant titles and abstracts, which included a search of various sources emphasising their scientific and academic integrity. Titles for which the full text was not found were excluded. After reviewing and evaluating the content of the complete texts, eligible studies were defined for inclusion in the report.

Data extraction and qualitative analysis

Data on study information, Population characteristics, Intervention treatment, control or comparators, and Outcomes (PICO) were extracted. Outcome measures of primary interest were pain and disability and, optionally, quality of life observed before and after the intervention/comparison treatment and in follow-up. The mean values, standard deviations and the significance of the difference between the ESWT and the control group were observed, analysed, and presented narratively and with studies quantitative data.

Quality Assessment

A possible already-existing assessment of the methodological quality of the works included in the review was investigated in the PEDro database. The PEDro scale[21] assessment was intended for the absence of an existing evaluation of methodological quality.

Results

Study inclusion

A total of 30 studies were identified through the initial search. After removing duplicates, 20 records were placed, 16 of which were excluded for being irrelevant or ineligible to the PICO research question or criteria. Of the following 4, full texts were found for only two studies corresponding to our PICO question. The remaining two were included in the review and qualitatively analysed due to their full eligibility. The PRISMA flow diagram of the study selection procedure is shown in Figure 1.

Characteristics of the included studies

The included two RCTs in the review were of recent date representing Poland and the same research setting, and were prospectively registered. Radial[22] and focused[23] types of ESWT were used in the studies. Extracted data on study information, Population characteristics, Intervention treatment, control or comparators, and Outcomes (PICO) are contained in Table 1. Below is a brief overview of the studies’ key and summarised features.

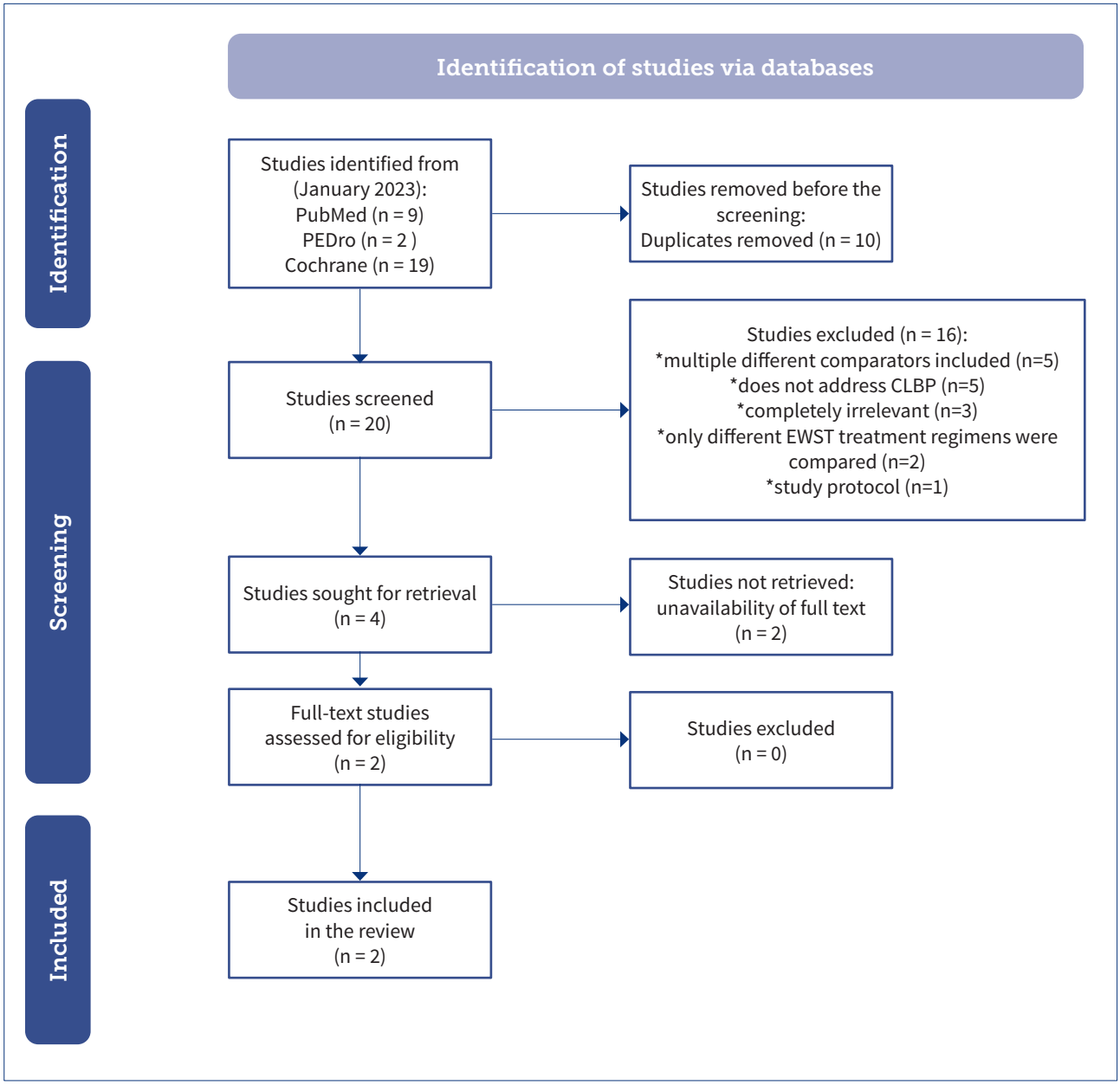

Figure 1. **PRISMA flow diagram**

The total number of active participants in these two studies was 80, 40 per study, and equally randomised in intervention and comparison groups. The age of the participants ranged from 42,3 to 55,8 years. On average, there were more women than men (61,25% vs 26,25%). The participants reported average pain at baseline from 4,7 to 7,3 out of 10 on the Visual Analogue Scale (VAS) and the Laitinen Pain Scale (LPS) from 6,2 to 8,8 out of 16. The reported average disease duration was from 57,5 to 117,6 months, with an Oswestry Disability Index (ODI) score ranging from 16,1 to 33,4 out of 50. Health-related quality of life was not measured in either of these two studies.

Both studies included stabilisation training in intervention and comparison groups (45 mins, once daily, five days a week). In the intervention groups, real ESWT was applied on lumbosacral soft tissue twice a week, a total of 10 treatments with an average flux density of 0.125 mJ/mm2, 1500 pulses and 4,5 Hz frequency. The control group received sham ESWT. Subjects were blinded to the form of ESWT they were receiving.

Table 1. **Summary and characteristics of RCTs included in the review**

Study information, Population characteristics, Intervention treatment, control or comparators, and Outcomes (PICO)							
	Patients		Intervention	Comparison	Outcomes		Authors' Conclusion
Author and Year	ESWT vs control: randomised (completed); mean age (years); gender; disease duration (months)	Eligibility criteria	ESWT group: device; parameters; sessions; adjuvant therapy	Control group: comparison therapies	Pain ESWT vs control (significance)	Disability ESWT vs control (significance)	
Walewicz et al., 2019[22]	N: 20 (20) vs 20 (17) 51,1 ± 8,4 vs 55,8 ± 9,3 Gender: female/ male; 14/6 vs 15/5 Disease duration: 117,6 ± 61,2 vs 108,0 ± 49,2	Inclusion: age >18 years; CLBP of L5-S1 discopathy; CLBP history > 3 months Exclusion: acute spinal pain; different level spine discopathy; no pain; reduced mobility in the lumbosacral segment; specific spinal diseases; pregnancy; pacemaker; cardiovascular diseases; blood coagulation disorders; metal implants; mental disorders; cancer; skin lesions; infections; spinal surgery; drug use	ESWT Device: Radial, Cosmogamma, Indonesia Parameters: 2,5 bars; 5 Hz; 2000 pulses; 0,1 mJ/ mm^2; 7 min Sessions: twice a week for five-week training: in the form of stabilization and functional exercises, relaxation and proper breathing: 45 min, once a day, five days a week	Sham ESWT: polyethene applicator cap that prevents the actual procedure to have a therapeutic effect Training: in the form of stabilization and functional exercises, relaxation and proper breathing: 45 min, once a day, five days a week	VAS Baseline: 4,7 ± 1,9 vs 4,7 ± 1,4 (p>0,05) After: 4,4 ± 1,8 vs 3,1 ± 1,4 (p=0,039) 1-month FU: 2,7 ± 1,7 vs 3,5 ± 1,1 (p>0,05) 3-month FU: 2,0 ± 2,0 vs 4,4 ± 1,2 (p<0,0001) LPS Baseline: 6,3 ± 2,0 vs 6,2 ± 2,8 (p>0,05) After: 5,7 ± 2,4 vs 4,3 ± 2,1 (p>0,05) 1-month FU: 3,9 ± 1,8 vs 5,2 ± 2,2 (p=0,043) 3-month FU: 2,2 ± 2 vs 6,4 ± 2,6 (p<0,0001)	ODI Baseline: 16,1 ± 5,2 vs 16,1 ± 8,0 (p>0,05) After: 13,6 ± 5,6 vs 12,3 ± 8,4 (p>0,05) 1-month FU: 9,3 ± 7,1 vs 14,6 ± 7,3 (p=0,033) 3-month FU: 9,3 ± 8,7 vs 17,8 ± 7,2 (p=0,004)	ESWT is effective both in the short and long-term, substantially influencing pain reduction and improving functional state versus conventional exercise program
Rajfur et al., 2022[23]	N: 20 (19) vs 20 (18) Age: 42,3 ± 13,1 vs 45,4 ± 14,0 Gender: female/ male; 10/10 vs 10/10 Disease duration: 57,5 ± 50,9 vs 61,8 ± 53,1	Inclusion: age >18 years; CLBP of L5-S1 discopathy; CLBP history > 3 months; no spinal surgery Exclusion: no pain; reduced mobility in the lumbosacral segment; specific spinal conditions; pregnancy or ovulation; neurological deficits, cardiac pacemaker; blood coagulation disorders; application site metal implants; sensory disturbances; mental disorders; cancer; skin lesions; infections; drug use	ESWT Device: focused, Storz Medical, Switzerland Parameters: 2,5 bars; 4 Hz; 1000 pulses; 0,15 mJ/ mm^2 Sessions: twice a week for five weeks Training: in the form of stabilization and functional exercises, relaxation and proper breathing; 45 min, once a day, five days a week	Sham ESWT: polyethene applicator cap that prevents the actual procedure to have a therapeutic effect Training: in the form of stabilization and functional exercises, relaxation and proper breathing; 45 min, once a day, five days a week	VAS Baseline: 7,2 ± 1,9 vs 7,3 ± 1,7 (p=0,857) After: 1,5 ± 0,6 vs 2,9 ± 1,3 (p<0,001) 1-month FU: 1,7 ± 1,1 vs 3,1 ± 1,7 (p=0,004) 3-month FU: 2,0 ± 1,2 vs 3,3 ± 1,9 (p=0,014) LPS Baseline: 8,8 ± 3,2 vs 7,1 ± 2,6 (p=0,050) After: 1,9 ± 1,5 vs. 3,1 ± 2,0 (p=0,048) 1-month FU: 2,4 ± 2,2 vs 3,3 ± 2,1 (p=0,163) 3-month FU: 2,8 ± 2,0 vs 3,7 ± 2,4 (p=0,304)	ODI Baseline: 33,4 ± 6,3 vs 32,5 ± 8,6 (p=0,221) After: 18,3 ± 7,5 vs 19, 5 ± 6,5 (p=0,664) 1-month FU: 17,3 ± 7,1 vs 18,7 ± 6,6 (p=0,480) 3-month FU: 18,3 ± 6,8 vs 19,9 ± 7,4 (p=0,578)	ESWT in conjunction with exercise can be effective, both in short and long-term pain reduction, although it does not seem to improve a patient's functional state significantly

N- number of respondents, ESWT- extracorporeal shock wave therapy, CLBP- chronic low back pain, VAS- visual analogue scale, LPS- Laitinen Pain Scale, FU- follow-up

In both studies, a smaller number of dropouts was recorded, but considering that it is within the permitted percentage calculated in the initial number of randomised, it is considered insignificant. Outcomes were measured before, after, and in follow-ups and for all comparisons made, a significance level of α=0,05 was used.

Reduction in pain intensity and interference

Observing the results between the compared groups and studies (Table 1), particular diversities were noticed despite the similarities. In both studies, the compared groups were homogeneous regarding baseline pain intensity and interference. Associated with short-term pain reduction, measured on the VAS scale, one study reported a statistically significant advantage of control over the ESWT group (4,4 ± 1,8 vs 3,1 ± 1,4 points on the VAS; p=0,039) after the treatment, while the other reported significant advantage of ESWT compared to control treatment (1,5 ± 0,6 vs 2,9 ± 1,3 on the VAS; p<0,001). In one month follow-up, one study reported superiority of ESWT over control (1,7 ± 1,1 vs 3,1 ± 1,7; p=0,004) while the other reported no significat findings (2,7 ± 1,7 vs 3,5 ± 1,1 on VAS; p>0.05). At three months follow up, studies reported either significant pain reduction (2,0 ± 2,0 vs 4,4 ± 1,2 on VAS; p<0,0001) or maintenance of the achieved improvement and in favor of ESWT (2,0 ± 1,2. vs 3,3 ± 1,9 on VAS; p=0,014).

Particular findings can also be seen in changes in pain interference measured with the LPS. In addition to short-term changes, one study reported higher pain interference in the ESWT group compared to the control (6,3 ± 2,0 vs 6,2 ± 2,8 on the LPS; p>,05). The other reported the contrary (1,9 ± 1,5 vs 3,1 ± 2,0 on the LPS; p=0,048) and in favour of ESWT. In the study that reported greater short-term efficacy in favour of control, the situation changes in turn of ESWT at one month (3,9 ± 1,8 vs 5,2 ± 2,2 on the LPS; p=0,043) and three months after (2,2 ± 2 vs 6,4 ± 2,6 on the LPS; p<0,0001). In the other study, although the advantage of ESWT was maintained, it was not reported as statistically significant compared to the control at a one-month follow-up (2,4 ± 2,2 vs 3,3 ± 2,1 on the LPS; p=0,163) or three months (2,8 ± 2,0 vs 3,7 ± 2,4 on LPS; p=0,304). Despite the evident reduction in pain intensity and interference in the ESWT groups, the significance of the outcome versus the control groups in the short and long-term periods is conflicting between studies.

Reduction in disability

Despite the evident improvement in functional status in the ESWT groups, the significance of the outcome versus the control groups in the short and long-term periods is conflicting between studies. In both studies, the compared groups were homogeneous in terms of disability. One study reported no differences between the compared groups after treatment (13,6 ± 5,6 vs 12,3 ± 8,4 on the ODI; p>0.05) but noticed a significant difference in favour of ESWT versus control in one month (9,3 ± 7,1 vs 14,6 ± 7,3 on the ODI; p=0,033) and at a three-month follow-up (9,3 ± 8,7 vs 17,8 ± 7,2; p=0,004). The other reported no significant difference between compared groups after (18,3 ± 7,5 vs 19,5 ± 6,5 on the ODI; p=0,664), in one month (17,3 ± 7,1 vs 18,7 ± 6,6 on the ODI; p=0,480) nor at a three-month follow-up (18,3 ± 6,8 vs 19,9 ± 7,4 on the ODI; p=0,578) after treatment cessation.

Methodological Quality

Table 2 shows the methodological quality of the studies included in the review. Methodological quality assessment was found for both studies[24,25] in the PEDro database.

Discussion

Summary of evidence

The reviewed studies included 80 subjects with CLBP, a middle age group generally associated with a higher incidence of musculoskeletal disorders. Most of the respondents were women. In addition to female dominance, research on CLBP indicates that prevalence and degree of disability are more significant in females[26], apropos their biopsychosocial characteristics. The chronic pain among the subjects is considered moderate[27], and the disability moderate to severe[28]. For comparison, one group of subjects were treated with ESWT twice a week, a total of ten treatments combined with stabilisation exercises. The other had only stabilisation exercises, considering that sham ESWT was used.

The RCTs included in this review are considered “good” and provide level-1 evidence[29], although minor im-

Table 2. **The methodological quality of RCTs included in the review**

PEDro scale	Author and Year	
Criteria	Walewicz et al., 2019[22]	Rajfur et al., 2022[23]
	PEDro score[24]	PEDro score[25]
Random allocation	+	+
Concealed allocation	-	-
Baseline similarity of the groups	+	+
Blinding of all subjects	+	+
Blinding of all therapists	-	-
Blinding of all assessors	-	+
Adequate follow-up	+	+
Intention-to-treat analysis	+	+
Between-group statistical comparisons	+	+
Point estimates and variability	+	+
Total of 10	7/10	8/10

provements in them would ensure their excellence. Although methodologically correct and similar, the results of these studies are different. Despite the evident reduction in pain intensity, interference, and disability in the ESWT groups, the significance of the outcome versus the control groups in the short and long-term periods is conflicting between studies.

In short-term pain intensity reduction, measured with VAS, Walewicz et al.[22] reported a statistically significant advantage of control over the ESWT group. In contrast, Rajfur et al.[23] reported a significant benefit of ESWT compared to the control treatment. In the first month follow-up, Walewicz et al.[22] reported no significant reduction in pain, while Rajfur et al.[23] reported significant pain reduction and superiority of ESWT over control in one month. At three months of follow up, the studies reported either significant pain reduction[22] or maintenance of the achieved improvement and in favor of ESWT[23]. Particular findings were also seen in changes in pain interference measured with the LPS. In addition to short-term changes, Walewicz et al.[22] reported higher pain interference in the ESWT group compared to the control. In contrast, Rajfur et al.[23] reported the contrary and favoured ESWT. In the study that reported greater short-term efficacy in favour of control, the situation changed in favour of ESWT at both follow-ups.[22] In the other study, despite the advantage of ESWT being maintained, it was not reported as statistically significant compared to the control in none of the follow-ups.[23] The findings of previous meta-analyses have shown that ESWT led to a significantly more reduction in pain in the first month[13,14] compared with comparator therapies. However, pooled results at the third-month follow-up were different; there was a significant reduction in pain intensity after ESWT compared to control[14] and no statistically significant difference between ESWT and control groups.[13] Here, observing certain discrepancies in the findings is also possible. However, it is necessary also to emphasise that both studies mentioned above included different unimodal or multimodal comparator therapies. In contrast, we extracted and reviewed studies that only had ESWT in combination with exercise as a comparator to exercises (and sham ESWT) alone.

Regarding disability reduction, that is, functional status augmentation, Walewicz et al.[22] reported no differences between the compared groups immediately after treatment. However, they did note a significant difference in favour of ESWT versus control in one and three-month

follow-up. Rajfur et al.[23] reported no immediate considerable difference between the groups nor in one month or three months after treatment cessation. Comparing other active comparators, Yue et al.[14] showed that ESWT trended toward more pronounced disability improvement at one and three months of follow-up. The results of the study by Li et al.[13] are equal to the previous one and ultimately the most similar to the findings of Walewicz et al. in terms of the longer-term effectiveness of ESWT on functional status.[22]

This study provided an overview of the effectiveness of ESWT in general, as has been done in previous reviews. In studies included in this review, different types of ESWT technical principles were used; radial[22] and focused.[23] In practice, it is not easy to objectively asses and analyse the clinical effectiveness of such treatments, including recommendations regarding doses, treatment parameters and duration, and other relevant aspects of the treatment protocol; ultimately, it is unclear how to evaluate radial vs focused techniques.[23] Considering that the aim of this review was not to compare the effectiveness of different principles of ESWT in CLBP, we leave this research problem as a proposal for future research. Although ESWT has been recommended as a new treatment option in CLBP, its clinical application must be fully justified. Evidence should be used cautiously due to the need for studies and confrontations between current evidence.

Limitations

Although the studies used in this review were of good quality, the number of studies in future reviews must be increased to reach firmer conclusions. It is a fact that the availability of full texts is limited. As a potential solution for increasing the number of studies, it is possible to use secondary sources, for example, research from existing and discussed meta-analyses. Still, this was not applied since this review condition was the availability of the full text of primary sources for a detailed review. As an addition to possible weaknesses, we note the fact of only one reviewer. However, given that the guidelines were followed and the studies used are verifiable, this deficiency could be considered a partial limitation.

Conclusion

Considering the outcomes of this review, the need for a new and more significant number of RCTs and their open access is evident. Despite more serious reviews with meta-analyses, this review has its additional value, considering that it is the first, by the objective, to address the problem of the effectiveness of ESWT in combination with exercises versus exercises alone as a primary nonpharmacological treatment of CLBP. It can be concluded that ESWT, in combination with exercises, is, to a certain extent, clinically superior to exercises alone. However, although ESWT has been recommended as a new treatment option in CLBP, its clinical application must be fully justified. Findings should be used cautiously due to the need for studies and confrontations between current evidence.

References

1. Baron R, Binder A, Attal N, Casale R, Dickenson AH, Treede RD. Neuropathic low back pain in clinical practice. Eur J Pain. 2016 Jul;20(6):861-73. doi: 10.1002/ejp.838. Epub 2016 Mar 2. PMID: 26935254; PMCID: PMC5069616.
2. Driscoll T, Jacklyn G, Orchard J, Passmore E, Vos T, Freedman G, Lim S, Punnett L. The global burden of occupationally related low back pain: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis. 2014 Jun;73(6):975-81. doi: 10.1136/annrheumdis-2013-204631. Epub 2014 Mar 24. PMID: 24665117.
3. Lubkowska W, Krzepota J. Quality of life and health behaviours of patients with low back pain. Phys Act Rev 2019; 7: 182–192.
4. Breivik H, Eisenberg E, O'Brien T; OPENMinds. The individual and societal burden of chronic pain in Europe: the case for strategic prioritisation and action to improve knowledge and availability of appropriate care. BMC Public Health. 2013 Dec 24;13:1229. doi: 10.1186/1471-2458-13-1229. PMID: 24365383; PMCID: PMC3878786.
5. Qaseem A, Wilt TJ, McLean RM, Forciea MA; Clinical Guidelines Committee of the American College of Physicians; Denberg TD, Barry MJ, Boyd C, Chow RD, Fitterman N, Harris RP, Humphrey LL, Vijan S. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. Ann Intern Med. 2017 Apr 4;166(7):514-530. doi: 10.7326/M16-2367. Epub 2017 Feb 14. PMID: 28192789.
6. Shipton EA. Physical Therapy Approaches in the Treatment of Low Back Pain. Pain Ther. 2018 Dec;7(2):127-137. doi: 10.1007/s40122-018-0105-x. Epub 2018 Sep 18. PMID: 30229473; PMCID: PMC6251828.
7. Feise RJ, Mathieson S, Kessler RS, Witenko C, Zaina F, Brown BT. Benefits and harms of treatments for chronic nonspecific low back pain without radiculopathy: systematic review and meta-analysis. Spine J. 2023 May;23(5):629-641. doi: 10.1016/j.spinee.2022.11.003. Epub 2022 Nov 17. PMID: 36400393.
8. Simplicio CL, Purita J, Murrell W, Santos GS, Dos Santos RG, Lana JFSD. Extracorporeal shock wave therapy mechanisms in musculoskeletal regenerative medicine. J Clin Orthop Trauma. 2020 May;11(Suppl 3):S309-S318. doi: 10.1016/j.jcot.2020.02.004. Epub 2020 Feb 12. PMID: 32523286; PMCID: PMC7275282.
9. Moya D, Ramón S, Schaden W, Wang CJ, Guiloff L, Cheng JH. The Role of Extracorporeal Shockwave Treatment in Musculoskeletal Disorders. J Bone Joint Surg Am. 2018 Feb 7;100(3):251-263. doi: 10.2106/JBJS.17.00661. PMID: 29406349.
10. Tenforde AS, Borgstrom HE, DeLuca S, McCormack M, Singh M, Hoo JS, Yun PH. Best practices for extracorporeal shockwave therapy in musculoskeletal medicine: Clinical application and training consideration. PM R. 2022 May;14(5):611-619. doi: 10.1002/pmrj.12790. Epub 2022 Apr 14. PMID: 35187851; PMCID: PMC9321712.
11. Cheng JH, Wang CJ. Biological mechanism of shockwave in bone. Int J Surg. 2015 Dec;24(Pt B):143-6. doi: 10.1016/j.ijsu.2015.06.059. Epub 2015 Jun 25. PMID: 26118613.
12. Çelik A, Altan L, Ökmen BM. The Effects Of Extracorporeal Shock Wave Therapy On Pain, Disability And Life Quality Of Chronic Low Back Pain Patients. Altern Ther Health Med. 2020 Mar;26(2):54-60. PMID: 31221949.
13. Li C, Xiao Z, Chen L, Pan S. Efficacy and safety of extracorporeal shock wave on low back pain: A systematic review and meta-analysis. Medicine (Baltimore). 2022 Dec 30;101(52):e32053. doi: 10.1097/MD.0000000000032053. PMID: 36595991; PMCID: PMC9803516.
14. Yue L, Sun MS, Chen H, Mu GZ, Sun HL. Extracorporeal Shockwave Therapy for Treating Chronic Low Back Pain: A Systematic Review and Meta-analysis of Randomized Controlled Trials. Biomed Res Int. 2021 Nov 15;2021:5937250. doi: 10.1155/2021/5937250. PMID: 34840977; PMCID: PMC8617566.
15. Chiarotto A, Boers M, Deyo RA, Buchbinder R, Corbin TP, Costa LOP, Foster NE, Grotle M, Koes BW, Kovacs FM, Lin CC, Maher CG, Pearson AM, Peul WC, Schoene ML, Turk DC, van Tulder MW, Terwee CB, Ostelo RW. Core outcome measurement instruments for clinical trials in nonspecific low back pain. Pain. 2018 Mar;159(3):481-495. doi: 10.1097/j.pain.0000000000001117. PMID: 29194127; PMCID: PMC5828378.
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021 Mar 29;372:n71. doi: 10.1136/bmj.n71. PMID: 33782057; PMCID: PMC8005924.
17. Ardern CL, Büttner F, Andrade R, Weir A, Ashe MC, Holden S, Impellizzeri FM, Delahunt E, Dijkstra HP, Mathieson S, Rathleff MS, Reurink G, Sherrington C, Stamatakis E, Vicenzino B, Whittaker JL, Wright AA, Clarke M, Moher D, Page MJ, Khan KM, Winters M. Implementing the 27 PRISMA 2020 Statement items for systematic reviews in the sport and exercise medicine, musculoskeletal rehabilitation and sports science fields: the PERSiST (implementing Prisma in Exercise, Rehabilitation, Sport medicine and SporTs science) guidance. Br J Sports Med. 2022 Feb;56(4):175-195. doi: 10.1136/bjsports-2021-103987. Epub 2021 Oct 8. PMID: 34625401; PMCID: PMC8862073.
18. Frandsen TF, Bruun Nielsen MF, Lindhardt CL, Eriksen MB. Using the full PICO model as a search tool for systematic reviews resulted in lower recall for some PICO elements. J Clin Epidemiol. 2020 Nov;127:69-75. doi: 10.1016/j.jclinepi.2020.07.005. Epub 2020 Jul 15. PMID: 32679315.
19. Meints SM, Edwards RR. Evaluating psychosocial contributions to chronic pain outcomes. Prog Neuropsychop-

harmacol Biol Psychiatry. 2018 Dec 20;87(Pt B):168-182. doi: 10.1016/j.pnpbp.2018.01.017. Epub 2018 Jan 31. PMID: 29408484; PMCID: PMC6067990.

20. Doualla M, Aminde J, Aminde LN, Lekpa FK, Kwedi FM, Yenshu EV, Chichom AM. Factors influencing disability in patients with chronic low back pain attending a tertiary hospital in sub-Saharan Africa. BMC Musculoskelet Disord. 2019 Jan 15;20(1):25. doi: 10.1186/s12891-019-2403-9. PMID: 30646894; PMCID: PMC6334448.
21. Physiotherapy Evidence Database. PEDro Scale. [Internet] Available at: https://pedro.org.au/english/resources/pedro-scale/ (Accessed 2023 Jan 11)
22. Walewicz K, Taradaj J, Rajfur K, Ptaszkowski K, Kuszewski MT, Sopel M, Dymarek R. The Effectiveness Of Radial Extracorporeal Shock Wave Therapy In Patients With Chronic Low Back Pain: A Prospective, Randomized, Single-Blinded Pilot Study. Clin Interv Aging. 2019 Oct 30;14:1859-1869. doi: 10.2147/CIA.S224001. PMID: 31806944; PMCID: PMC6857735.
23. Rajfur K, Rajfur J, Matusz T, Walewicz K, Dymarek R, Ptaszkowski K, Taradaj J. Efficacy of Focused Extracorporeal Shock Wave Therapy in Chronic Low Back Pain: A Prospective Randomized 3-Month Follow-Up Study. Med Sci Monit. 2022 Jun 11;28:e936614. doi: 10.12659/MSM.936614. PMID: 35689370; PMCID: PMC9199449.
24. Physiotherapy Evidence Database. [Internet] Detailed search results: The Effectiveness Of Radial Extracorporeal Shock Wave Therapy In Patients With Chronic Low Back Pain: A Prospective, Randomised, Single-Blinded Pilot Study. Available at: https://search.pedro.org.au/search-results/record-detail/59356 (Accessed 2023 Jan 14)
25. Physiotherapy Evidence Database. [Internet] Detailed search results: Efficacy of Focused Extracorporeal Shock Wave Therapy in Chronic Low Back Pain: A Prospective Randomised 3-Month Follow-Up Study. Available at: https://search.pedro.org.au/search-results/record-detail/70737 (Accessed 2023 Jan 14)
26. Fehrmann E, Kotulla S, Fischer L, Kienbacher T, Tuechler K, Mair P, Ebenbichler G, Paul B. The impact of age and gender on the ICF-based assessment of chronic low back pain. Disabil Rehabil. 2019 May;41(10):1190-1199. doi: 10.1080/09638288.2018.1424950. Epub 2018 Jan 12. PMID: 29327593.
27. Boonstra AM, Schiphorst Preuper HR, Balk GA, Stewart RE. Cut-off points for mild, moderate, and severe pain on the visual analogue scale for pain in patients with chronic musculoskeletal pain. Pain. 2014 Dec;155(12):2545-2550. doi: 10.1016/j.pain.2014.09.014. Epub 2014 Sep 17. PMID: 25239073.
28. The Oswestry Low Back Pain Questionnaire. [Internet] Available at: https://www.aaos.org/globalassets/quality-and-practice-resources/patient-reported-outcome-measures/spine/oswestry-2.pdf (Accessed 2023 Jan 14)
29. Foley NC, Teasell RW, Bhogal SK, Speechley MR. Stroke Rehabilitation Evidence-Based Review: methodology. Top Stroke Rehabil. 2003 Spring;10(1):1-7. PMID: 12970828.

UČINKOVITOST IZVANTJELESNE TERAPIJE UDARNIM VALOM U LIJEČENJU KRONIČNE KRIŽOBOLJE: SUSTAVNI PREGLED LITERATURE

[1,2] **Iva Lončarić Kelečić**

[1] **KBC Zagreb, Klinika za reumatske bolesti, Hrvatska**
[2] **Alma Mater Europea – AMEU, Maribor, Slovenija**

Sažetak

Uvod: Bol u donjem dijelu leđa najčešći je sindrom kronične boli u kliničkoj praksi. Zbog veće sigurnosti, nefarmakološki tretmani temeljeni na vježbanju predstavljaju prvi izbor u liječenju kronične boli u donjem dijelu leđa (engl. *chronic low back pain*, CLBP). Nedavno je izvantjelesna terapija udarnim valom (engl. *extracorporeal shockwave therapy*, ESWT) predložena kao nova opcija liječenja kronične boli u donjem dijelu leđa. Cilj je rada pružiti pregled učinkovitosti izvantjelesne terapije udarnim valom u kombinaciji s vježbanjem u odnosu na samo vježbanje u smanjenju boli i invaliditeta kod kronične boli u donjem dijelu leđa kroz sustavni pregled objavljenih randomiziranih kontrolnih ispitivanja.

Metode: Izvorna ispitivanja koja se odnose na upotrebu izvantjelesne terapije udarnim valom kod kronične boli u donjem dijelu leđa pretražena su na platformi PubMed, u Cochraneovoj knjižnici i bazi podataka Physiotherapy Evidence Database u posljednjih deset godina do siječnja 2023. Autor se u radu pridržavao smjernica za izvještavanje u preglednim radovima i metaanalizama PRISMA (*Preferred Reporting Items for Systematic Review and Meta-Analysis statement*) i znanstvenih smjernica za tjelovježbu, rehabilitaciju, sportsku medicinu i sporta PERSiST (*The PRISMA in Exercise, Rehabilitation, Sport medicine and Sports science*). Izdvojeni su podaci o ispitivanju, karakteristikama pacijenata, intervenciji, usporedbama i ishodima. Ishodi od primarnog interesa bili su bol i invaliditet, promatrani prije i nakon tretmana. Primijenjen je sustavan i narativan pregled rezultata.

Rezultati i rasprava: Uključena su dva prihvatljiva randomizirana kontrolna ispitivanja od početnih 30 identificiranih. Unatoč evidentnom smanjenju boli i invaliditeta u skupinama liječenima izvantjelesnom terapijom udarnim valom, značaj ishoda u odnosu na kontrolne skupine u kratkoročnim i dugoročnim razdobljima ne podudara se među ispitivanjima.

Zaključak: U liječenju kronične boli u donjem dijelu leđa, izvantjelesna terapija udarnim valom u kombinaciji s vježbama donekle je klinički superiornija od samih vježbi; međutim, dokaze treba koristiti s oprezom zbog nedostatka studija i postojećih oprečnih rezultata.

Ključne riječi: kronična bol, izvantjelesna terapija udarnim valom, bol u donjem dijelu leđa, modaliteti fizikalne terapije, sustavni pregled