



Comparison between capacitive and resistive electronic transfer therapy and high-intensity laser therapy in pain conditions related to musculoskeletal disorders

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ABSTRACT

Introduction: Musculoskeletal disorders (MSDs) imply damage to muscular or skeletal systems, which usually develop due to strenuous, repetitive activity, or an inflammation process. The therapy with capacitive and resistive electronic transfer (CRet) and high-intensity laser therapy (HILT) have mainly been applied for pain relief in these conditions. This paper aims to provide an overview of the efficient results of CRet therapy and HILT in managing pain associated with musculoskeletal disorders found in the available literature.

Methods: Articles related to musculoskeletal disorders were searched through electronic databases, such as PubMed, Web of Knowledge, Lilacs, Cochrane, Research Gate, and available website search tools. After excluding records that are not clinical trials and studies (such as review articles, patient information, and Ph.D. papers) and articles which did not deal with pain in musculoskeletal disorders, 61 articles met our criteria and were included in the overview.

Results: By reviewing the selected articles related to CRet therapy and HILT effects on pain in musculoskeletal disorders, it was found that both therapies have a favorable effect on pain reduction.

Conclusion: The selected papers showed that both therapies are powerful tools for pain reduction. Although there are no specific protocols, including the number and frequency of therapies applied and other parameters, in both therapy modalities, pain alleviation occurs during or immediately after a therapy cycle application.

Keywords: Capacitive and resistive electronic transfer; TECAR; musculoskeletal disorders; pain; analgesic effects, high-intensity laser therapy; physical therapy; quality of life

INTRODUCTION

Musculoskeletal disorders (MSDs) imply damage to muscular or skeletal systems, which usually develop due to strenuous, repetitive activity, or an inflammation process. Musculoskeletal disorders may affect parts of the human body such as bones, muscles, joints, cartilages, ligaments, tendons, and other soft tissues. Symptoms include mild-to-severe aches, numbness, tingling, atrophy, swelling, redness, and weakness (1).

Considering their various manifestations, from fractures to irreparable and degenerative chronic diseases, musculoskeletal conditions may develop at any age, and many risk factors vary from those related to everyday activities to those related to the natural processes of an organism (2).

Musculoskeletal disorders are treated under various medical specialties, including orthopedics, sports medicine,

emergency medicine, and rheumatology (1). Some conditions require the administration of medications, but wherever possible, physical treatment should be administered, given its proven benefits and the fact that it commonly stimulates natural human processes in the body. Whether in hospital settings or in some specialized rehabilitation center, nowadays, various physical rehabilitation modalities are widely used to reduce pain, improve mobility and flexibility, and improve our performance in activities of daily living (ADL) and hence the quality of life (3). Among these, there are capacitive and resistive electronic transfer (CRet) therapy and high-intensity laser therapy (HILT), which are rather different by their nature, but similar in effectiveness (4,5). Compared to many other treatment devices used in the field of physical medicine, these two modalities are not sufficiently exploited given their immediate effects and the fact that there are almost no side effects. Based on our practical experience, where we have been using numerous equipment and settings, other than CRet and HILT, these two gained our attention for their effectiveness on

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pain, particularly, and we wanted these two to find more significant applications.

CRet therapy – background and effect mechanism

The capacitive and resistive electronic transfer (also known as TECAR – the acronym for the French name of this treatment – *Transfert Electrique Capacitif Résistif*) therapy, being a type of endogenous thermal treatment, has been used for heating both the surface and deep tissues, resulting in tissue reconstruction and pain relief. It was developed by Jacques Arsene d'Arsonval, a well-known French physician, and his associate researchers and physicians in the 1920s (4). Since then, this non-invasive physical modality has further developed and advanced, finding its application in treating various musculoskeletal conditions (4).

CRet therapy is rated to be a special form of energy. With non-invasive high-frequency energy, it stimulates the body's natural ability to regenerate itself. Natural physiological and metabolic tissue processes are stimulated by transferring energy without radiation coming from outside. A device used for the administration of CRet therapy includes two electrodes: A movable electrode managed by a therapist, treating the affected area and a fixed electrode used as a conductor being in contact with the skin of a patient (6). This device may be used at low-energy levels, which is one of its major properties. In this way, it is possible to treat either acute or subacute conditions without worsening an inflammatory process developed due to the increased tissue temperature (7). CRet therapy has two manners for transferring electrical charge: Capacitive and resistive. Reactions produced by the capacitive system through capacitive electrode are focused on tissues having more electrolytes, such as soft tissues and muscles, unlike the resistive system, which focuses on greater and more resistant tissues such as tendons, bones, and joints. These two ways of transferring energy enable the therapy to intensify vasodilation and oxygenation, improving microcirculation and causing a rise in internal temperature (8). With electrical currents in the frequency range between 0.45 and 0.60 MHz (9), CRet therapy offers a unique spectrum of treatments for chronic and acute musculoskeletal diseases, with only a few contraindications: Pacemaker, pregnancy, and sensitivity to high temperatures (10).

High-intensity laser therapy – background and effect mechanism

Light has always been considered a source of life, so it has motivated scientists to study it in various ways. Its therapeutic properties have been analyzed since the 6th century B.C., and finally, in 1960, the first laser was developed (10). Now, it is successfully applied worldwide depending on approved protocols and experience.

Laser is an acronym for light amplification by stimulated emission of radiation (11). As indicated by the name itself, it is a form of radiation originating from solid, liquid, or gaseous material. The emission occurs after the material is stimulated by the activation source, and the system of mirrors embedded in the optical resonator amplifies the laser light's electromagnetic waves. Three parameters are considered when defining the physical characteristics of a laser:

The wavelength, intensity, and emission mode. The wavelength ranges between 180 and 10,600 nm, and laser penetration power depends on it – the greater wavelength, the greater penetration. The depth of penetration is regulated by the intensity of the laser. By increasing the laser power, the penetration depth is also increased. The emission mode is a way in which the laser is distributed. Therefore, it may be continuous, pulsed, flash, or Q-switched (brief emissions at high peak intensity). With different pulsations and frequencies, we get other effects on the substrate – as frequency decreases, there is more significant interaction with the conduction structures and vice-versa (12).

High-intensity laser therapy (HILT), with a power higher than 500 mW, has been recently introduced in the treatment of musculoskeletal system disorders. It is a laser mode with a 1064 nm wavelength with an analgesic effect and reactive vasodilatation as the primary effect, and these are created by affecting the cutaneous nerve endings (13). Another significant mechanism of action is based on tissue stimulation which develops at various levels: Cell, vascular tissue, interstitial tissue, and immune system level. It enhances regeneration and beta-endorphin release by inducing protein synthesis in synovial fluid, exhibiting analgesic and anti-inflammatory effects (14). HILT provides a quick reduction of inflammation and painful symptoms (15). A particular waveform, including regular peaks of elevated values of amplitude and time distances between them, is used to decrease phenomena of thermal accumulation, and it can rapidly induce photochemical and photothermic effects in the deep tissue that increases cell metabolism, vascular permeability, and blood flow (16).

METHODS

Further to proven benefits and good tolerance to these two therapy modalities, we were interested in investigating papers dealing with these within the scope of musculoskeletal conditions. Based on available resources and records, we prepared this results overview of recent clinical articles published between 2009 and 2021 that include effects of CRet therapy and HILT in musculoskeletal disorders where the pain is a dominant symptom.

The papers related to CRet and HILT were searched through electronic databases, including PubMed, Web of Knowledge, Lilacs, Cochrane, Research Gate, and available website search tools. For better sensitivity of the articles, we used the following keywords related to intervention: Capacitive and resistive electronic transfer, TECAR therapy, pulsed radiofrequency therapy, high-intensity laser therapy, and high-power laser therapy. Within accessible papers, 101 records were identified and screened, either written in English or another language. After excluding records that were not clinical trials and studies (such as review articles, patient information, and Ph.D. papers) and articles which did not deal with pain in musculoskeletal disorders (in total $n = 40$), 61 articles met our criteria. They were included in the overview (Table 1). These were further grouped as per the regions treated for pain with HILT and CRet. There was no disagreement between reviewers regarding the selection of the studies.

TABLE 1. Overview of the selected studies and results

Citation	Author, title, reference number	Aim	Result
1	Stagi P, Paoloni M, Ioppolo F, Palmerini V, Santilli V. Studio clinico randomizzato in doppio cieco tecarterapia versus placebo nel trattamento della lombalgia. (23)	To evaluate the efficacy of TECAR therapy in chronic low back pain.	There was improvement in the pain symptoms in most patients treated with TECAR therapy, while the treatment in the placebo group showed little or no improvement.
2	Paolucci T, Pezzi L, Centra MA, Porreca A, Barbato C, Bellomo RG, Saggini R. Effects of capacitive and resistive electric transfer therapy in patients with painful shoulder impingement syndrome – A comparative study. (24)	To determine the effects of CRet on painful shoulder.	VAS scores in the CRet group improved from 7.23±1.11 at baseline to 2.68±0.99 at follow-up. The placebo group did not report any improvement. Similarly, functional scale scores improved in the CRet group compared with the placebo group.
3	Alguacil-Diego I M, Fernández-Carnero J, Laguarda-Val S, Cano-de-la-Cuerda R, Calvo-Lobo C, Martínez-Piédrola R, et al. Analgesic effects of a capacitive-resistive monopolar radiofrequency in patients with myofascial chronic neck pain – A pilot randomized controlled trial. (25)	To investigate the immediate effect of capacitive resistive monopolar radiofrequency, in comparison with a placebo, on (1) neck pain intensity reduction at myofascial trigger points (MTrP), (2) reducing neck disability, and (3) improving cervical range of motion (CROM).	The Wilcoxon test done for VAS indicates statistically significant differences between baselines, just following the first session and after eight sessions. NDI improved in both groups after eight sessions, but no differences were found between groups.
4	Adua G. Eficàcia de la tecar teràpia en el tractament de les tennis elbow. (26)	To demonstrate the efficiency of the TECAR therapy within the scope of the Tennis elbow's treatment in comparison with the blast waves (shock wave).	TECAR therapy may be used in the treatment of this condition. TECAR therapy benefits may be improved with combination with other therapies. The results of this study may be helpful in investigation of efficiency of TECAR therapy in some other conditions.
5	Kazalakova K. Efficacy Evaluation of Targeted Radio frequency Therapy in Trigger Points and Functional Muscle Spasms Treatment. (27)	To evaluate the effect of the targeted radiofrequency therapy (TR therapy) at 500 kHz for treatment of pain caused by trigger points and functional muscle spasms compared to the methods of the conventional physiotherapy.	The average decrease of the pain perception in the treatment group was 77% and 63% in the control group. The enhancement of the abilities to perform ADL both in the treatment group and in the control group was on average 41% and 21%, respectively. Student's t-test showed a significant difference between the post-treatment results in both groups. There was a statistical difference between the results from VAS for pain perception of both groups.
6	Tranquilli C, Ganzit G P, Ciufetti A, Bergamo P, Combi F. Multicenter study on TECAR therapy in sports pathologies. (28)	To evaluate pain reduction with VAS and to reduce motor recovery time.	The results of this study showed significance both in acute and chronic injuries with a quick and immediate reduction of the pain and reduced recovery times, determined by a prompt return to activity. VAS values were lower both in chronic and acute cases.
7	Kazalakova K. Efficacy evaluation of TR therapy in the treatment of acute and chronic disorders in sports. (29)	To demonstrate the efficiency of applying a new non-invasive radiofrequency (R.F.) device in the treatment of acute and chronic musculoskeletal disorders.	The final results showed that there was considerable improvement in both, articular and muscular and tendinous disorders with a fast pain relief, measured with VAS. No adverse cases were noted during the course of the study.
8	Ganzit GP, Stefanini L, Stesina G. Tecar Therapy in the Treatment of Acute and Chronic Pathologies in Sports. (10)	To demonstrate efficiency of TECAR therapy in the treatment of acute and chronic musculoarticular pathology in athletes.	Most patients reported pain relief and functional improvement at the end of the treatment. The categories of the modified Steinbrocker index and VAS were statistically significant. There were statistically significant changes, both in acute and chronic cases, and in the three pathology groups observed. The results indicate that TECAR therapy is a useful tool in treating locomotor pathologies in sports.
9	Mondardini P, Tanzi R, Verardi L, Briglia S, Maione A, Drago E. Novel methods for the treatment of muscle trauma in athletes. (30)	To present the results of a 2-year study protocol aimed to verify the efficacy of TECAR therapy in muscle lesions of various grades in athletes.	The results were extremely good regarding speed of resolution of the clinical-symptomatological and ultrasound situation. Further, the study confirmed theoretical safety of TECAR therapy given there were no side effects detected.
10	Aftosmidis D, Zakalka I, Spanidou K, Kagioglou K. The effect of Human TECAR Synergistic Healthcare methodology to reduce pain and edema after the grade II ankle's sprain. (31)	To evaluate the effectiveness of human TECAR synergistic healthcare methodology in rehabilitation of a Grade II ankle sprain in short time.	After five treatments, on the 6 th day following the injury, the pain reduced from 7 to 2 at VAS and the mass previously present on the foot, withdrew with an average reduction of the edema at 3 cc.
11	Gonkova M, Hasan S. Effect of targeted radio frequency therapy in combination with post-isometric relaxation in the treatment of pain syndrome in cervical region. (32)	To evaluate the combined effect of TR therapy and post-isometric relaxation (PIR) in the treatment of pain related to the cervical spine with mobility limiting factor.	The study shows that there is a statistical difference between the results obtained in the treatment group and control group, in terms of levels of improvements in condition.
12	Molina A, Eschacho B, Molina M V, Mariscal S. Cervicalgia, lumbago, sciatica: Application of capacitive energy transfer system. (7)	To substantiate the efficacy of capacitive transfer TECAR® therapy in patients with cervical and lumbar pain, with cases of pathology being secondary to surgical treatment.	The clinical evaluation of the obtained data provided conclusion that a significant improvement was achieved in 65% of the patients treated with capacitive energy transfer.

(Contd...)

TABLE 1. (Continued)

Citation	Author, title, reference number	Aim	Result
13	Raffaeta G, Menconi A, Togo R. Experimental study: Therapeutic application of TECAR therapy in cervical pain syndromes. (33)	To evaluate the therapeutic efficacy of TECAR therapy “by patients,” with chronic cervical pain syndromes, recruited on an ongoing basis.	The value NRS decreased from 6.63 to 2.70, up to 2.55 at follow-up to 2 months. The analysis of the results of the neck pain questionnaire (NPQ) showed that there was a significant decrease in the NPQ score from 37.95% to 16.67% at the end of treatment and after 2 months at follow-up, it was 12.54%.
14	Vicent Pastor E, Inglés Pernía F. Effectiveness of therapeutic hyperthermia by capacitive-resistive electric transfer for degenerative neck pain. (34)	To evaluate the effectiveness of non-invasive hypothermia system by radiofrequency based on capacitive-resistive electric transfer in the treatment of degenerative cervical pain compared to phonophoresis. The second objective was to evaluate the patients’ tolerance to the treatment.	With its faster analgesic effect, the INDIBA’s method of hyperthermia by capacitive-resistive electric transfer (CRET) has proved to be an effective and safe method for treating degenerative neck pain in comparison to commonly applied ultrasound.
15	Saggini R, De Antoni A, Cancelli F, Cacchio A, Di Mascio R, Di Nicola M, et al. Hyperthermia to treat low back pain and gonarthrosis. (35)	To present the results obtained with the treatment of low back pain due to slipped disk and moderate gonarthrosis.	The statistical analyses of the results showed that there is a significant pain reduction and reduced intake of NSAID after the treatment in the case of both disorders. There was an optional stabilization of VAS results in the group of patients suffering from gonarthrosis, also at follow-ups 6 and 12 months after treatment. However, in the case of low back pain, the instances in which pain returns after 6 and 12 months are statistically significant.
16	Andrade J, Carvalho P, Crasto C, Cardoso R, Montes A. Effects of TECAR Therapy on Delayed Sensation of Muscle Discomfort in Quadriceps. (36)	To evaluate the effects of TECAR therapy in delayed onset muscle soreness on quadriceps.	It was noted that there was significantly less pain in the TECAR group than in the group without TECAR, at moment M24 later. There was difference in the single leg hop and pressure pain threshold variable.
17	Gi-Wook Kim, Yu Hui Won, Sung-Hee Park, Jeong-Hwan Seo, Dae-Hyun Kim, Hyung Nam Lee, et al. Effects of a Newly Developed Therapeutic Deep Heating Device Using High Frequency in Patients with Shoulder Pain and Disability: A Pilot Study. (37)	To evaluate and compare the effectiveness of this deep heating device with ultrasound in pain relief and enhancing function in patients with shoulder issues.	All patients presented significant improvements regarding shoulder pain and shoulder function when comparing the results before the treatment and the results immediately after treatment and 4 weeks following the treatment.
18	Morelli L, Bramani S C, Cantaluppi M, Pauletto M, Scuotto A. Comparison among different therapeutic techniques to treat low back pain: A monitored randomized study. (38)	To compare two therapeutic methods for treating this chronic disease: The oxygen-ozone therapy and the diathermy through TECAR® therapy.	The results show an improvement in both groups, but in the second group (treated with oxygen-ozone therapy plus physio-kinesiotherapy), the improvement is better (from 6% to 57%) than in the first group (from 20% to 38%).
19	Terranova A, Vermiglio G, Arena S, Ciccio A, Di Dio S, Vermiglio M. TECAR therapy in the post-surgical treatment of femur fractures. (39)	To evaluate the results of the pain and edema treatment with TECAR therapy in patients suffering from fracture of the femur and treated surgically with osteosynthesis, endo, or arthroplasty.	In the group treated with TECAR therapy, there was statistically significant reduction on the 4 th day and on the 7 th day. There was no significant pain reduction in in the control group. Regarding edema, the values decreased in a statistically insignificant way in both groups until reaching a similar value on the 30 th day. The decrease in volume developed earlier in the TECAR group than in the control group.
20	Shanthanna H, Chan P, McChesney J, Thabane L, Paul J. Pulsed radiofrequency treatment of the lumbar dorsal root ganglion in patients with chronic lumbar radicular pain: A randomized, placebo-controlled pilot study. (40)	To determine feasibility of a larger trial (primary objective) and investigate the efficacy of PRF in pain reduction.	It was practically not feasible to conduct a large-scale trial to establish efficacy considering that the effect was minor. It is necessary to recruit a challengingly large number of participants over a number of years. Considering the recent evidence, until clearer parameters for the application of PRF are set, physical practitioners will have to use their personal experience judgment regarding its clinical applicability.
21	Notarnicola A, Maccagnano G, Gallone M F, Covelli I, Tafuri S, Moretti B. Short-term efficacy of capacitive-resistive diathermy therapy in patients with low back pain: A prospective randomized controlled trial. (41)	To compare the effectiveness of Doctor TECAR Therapy™ with the laser therapy in the management of low back pain (LBP).	The pain and disability tended to improve over time in these two groups. This improvement was statistically significant in the TECAR group at all follow-ups (F.U.s) but only at T1 in the laser group. When these two treatments were compared, there was a significant difference in favor of the TECAR group at T2 and T3.
22	Osti R, Pari C, Salvatori G, Massari L. Tri-length laser therapy associated to TECAR therapy in the treatment of low back pain in adults: a preliminary report of a prospective case series. (9)	The aim of this study was to evaluate the efficacy of HILT associated with TECAR therapy in the treatment of low back pain, with or without leg pain.	The results of this study clearly evidence the efficacy of the combination of CRet and laser therapy in the treatment of low-back pain. The VAS score decreased from an average value 8.1 before the treatment to an average value of 2.6 at the 8-week follow-up with a statistically significant difference ($p < 0.01$).

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TABLE 1. (Continued)

Citation	Author, title, reference number	Aim	Result
23	Santamato A, Solfrizzi V, Panza F, Tondi G, Frisardi V, Leggin G. B, et al. Short-term Effects of High-Intensity Laser Therapy Versus Ultrasound Therapy in the Treatment of People With Subacromial Impingement Syndrome: A Randomized Clinical Trial. (42)	To evaluate the short-term effectiveness of high-intensity laser therapy (HILT) versus ultrasound (U.S.) therapy in the treatment of subacromial impingement syndrome (SAIS).	Statistically significant differences in pain level, articular movement, functionality, and muscle strength were observed after 10 treatment sessions for subjects in the HILT group compared to subjects in the U.S. therapy group. Only the difference in change of VAS score between groups (1.65 points) surpassed the accepted minimal clinically important difference for this tool.
24	Štiglić-Rogoznica N, Stamenković D, Frlan-Vrgoč Lj, Avancini-Dobrović V, Schnurrer-Luke Vrbanić T. Analgesic Effect of High-Intensity Laser Therapy in Knee Osteoarthritis. (43)	To investigate the prompt analgesic effect of HILT on patients with knee osteoarthritis.	There was statistically significant decrease in VAS after the treatment ($p < 0.001$). HILT enables prompt analgesic effects in the treatment of knee osteoarthritis.
25	Fiore P, Panza F, Cassatella G, Russo A, Frisardi V, Solfrizzi V, et al. Short-term effects of high-intensity laser therapy versus ultrasound therapy in the treatment of low back pain: A randomized controlled trial. (44)	To evaluate the short-term effectiveness of high-intensity laser therapy (HILT) versus ultrasound (U.S.) therapy in the treatment of low back pain (LBP).	At the end of the 3 weeks' intervention, participants in the HILT group showed a significantly greater decrease in pain (measured by the VAS) and an improvement of related disability (measured by the OLBPDQ) compared with the group treated with U.S. therapy. The findings obtained after 15 treatment sessions with the experimental protocol suggested greater effectiveness of HILT than of U.S. therapy in the treatment of LBP.
26	Viliani T, Carrabba C, Mangone G, Pasquetti P. High-intensity pulsed Nd:YAG laser in painful knee osteoarthritis: the biostimulating protocol. (45)	To analyze the clinical efficacy and the safety of HILT, using a biostimulating protocol in patients with symptomatic knee osteoarthritis.	Subjects were assigned into two groups: (A) A treatment group and (B) waiting list. Patients in Group A showed a highly statistically significant improvement between t0 and t1 in WOMAC scale, and the improvement was kept at follow-up (t2). The patients in the waiting list showed a worsening tendency. The HILT group showed good clinical results regarding pain and functional issues.
27	Alayat MSM, Atya AM, Ali MME, Shosha TM. Long-term effect of high-intensity laser therapy in the treatment of patients with chronic low back pain: A randomized blinded placebo-controlled trial. (46)	The aim of this study was to compare the effect of high-intensity laser therapy (HILT), alone or combined with exercise, in the treatment of chronic low back pain (CLBP).	The range of motion significantly increased after 4 weeks of treatment in all groups, then decreased after 12 weeks at follow-up, but was still significantly more than the baseline value in Groups 1 and 2. Visual analog scale (VAS) and functional disability by both the Roland Disability Questionnaire (RDQ) and the Modified Oswestry Disability Questionnaire (MODQ) results showed significant decrease after the treatment in all groups, although the RDQ and MODQ results were not significantly different between groups 2 and 3. It appears that HILT combined with exercise is more effective in patients with CLBP than either HILT alone or placebo laser with exercise.
28	Kheshe AR, Alayat MSM, Ali MME. High-intensity versus low-level laser therapy in the treatment of patients with knee osteoarthritis: A randomized controlled trial. (47)	To compare the effects of low-level laser therapy (LLLT) and high-intensity laser therapy (HILT) on pain and functional improvement in case of knee osteoarthritis (KOA).	The result was that HILT and LLLT combined with exercise were effective in decreasing the VAS and WOMAC scores after 6 weeks of treatment. HILT with exercises was more effective than LLLT with exercises, and both treatment modalities were better than exercises alone in case of KOA.
29	Gabrhel J, Popracová Z, Tauchmannová H, Nemšák M. Hilterapia® – high-intensity laser therapy in the treatment of severe tendon and ligament injuries. (48)	To objectify the effect of high-intensity laser therapy (HILT) in the treatment of severe tendon and ligament lesions	The results showed that high-intensity laser therapy promoted normalization of temperature patterns in most cases, reparation of tendon and ligament structures in all cases, reduction of pain, and the improved musculoskeletal condition in all cases.
30	Vervainioti A. Nd:YAG laser in the management of low back pain. (49)	To compare the efficacy of high-intensity laser therapy (HILT) with a standard physiotherapy protocol on low back pain and a combination of the two methods. This study also addressed the variation of pain through pain type and localization.	The results showed that a significant percent of patients with acute pain gained full recovery, while there was a significant improvement of pain symptoms in patients affected by chronic pain, but healing was not achieved. Focal pain was alleviated more effectively than distributed pain. The results showed that a therapeutic protocol based on the combination of HILT and standardized physiotherapy may be successfully used to obtain improvement of pain symptoms and early healing in patients with non-specific pain of the lumbar area.
31	Šifta P, Danilov D. Effects of high-intensity laser on gonarthrosis. (50)	To verify the effectiveness of high-intensity laser therapy (HILT) in alleviating pain and increasing the range of motion in the affected joint of patients suffering from arthrosis of the knee joint of higher grades.	After the HILT, there was a statistically significant decrease in the WOMAC, WOMAC-A, WOMAC-B, and WOMAC-C indexes. The t-test proved, with a probability of 99%, that HILT significantly reduced pain, stiffness, and problems with normal daily activities. The study resulted in the following findings: <ul style="list-style-type: none"> • An analgesic effect of a high-intensity laser was observed after the first application • Pain at rest and at night alleviated soon. • None of the patients noticed any side effect of the HILT.

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TABLE 1. (Continued)

Citation	Author, title, reference number	Aim	Result
32	Dundar U, Turkmen U, Toktas H, Ulasli AM, Solak O. Effectiveness of high-intensity laser therapy and splinting in lateral epicondylitis; a prospective, randomized, controlled study. (51)	To investigate the effects of high-intensity laser therapy (HILT) in patients with lateral epicondylitis (L.E.) and to compare the results with those of a brace and placebo HILT.	Comparison of the parameters percentage changes after treatment in relation to pretreatment values did not present a significant difference between HILT and brace groups. It is concluded that HILT and splinting are effective physical therapy modalities for patients with L.E. in reducing pain and improving disability, quality of life, and grip strength.
33	Akkurt E, Kucuksen S, Yilmaz H, Parlak S, Salli A, Karaca G. Long-term effects of high-intensity laser therapy in lateral epicondylitis patients. (52)	To investigate short- and long-term effects of high-intensity laser therapy (HILT) in lateral epicondylitis (L.E.) patients.	The results of the study suggest that HILT is a reliable, safe, and effective treatment option in L.E. patients in the short and long term considering pain, functional status, and quality of life.
34	Kim SH, Kim YH, Lee HR, Young Eun Choi. Short-term effects of high-intensity laser therapy on frozen shoulder: A prospective randomized control study. (53)	To evaluate the clinical efficacy of high-intensity laser therapy (HILT) in patients with frozen shoulder.	Patients were assigned into two groups: (1) HILT group and (2) a placebo group. The results showed that the HILT group had a lower pain VAS score at 3 weeks and 8 weeks but no statistically significant difference in the VAS was observed at the final follow-up (12 weeks) between the two groups. No statistical difference in the range of motion ROM and the satisfaction VAS was observed between the two groups at serial follow-ups. It is concluded that HILT provided significant pain relief at 3 and 8 weeks in the management of frozen shoulder, but not at the final follow-up.
35	Angelova A, M. Ilieva E. Effectiveness of High-Intensity Laser Therapy for Reduction of Pain in Knee Osteoarthritis. (54)	To present the effect of high-intensity laser therapy in patients with knee osteoarthritis.	There were two groups: (1) Therapeutic (test) treated with HILT and (2) control group treated with sham laser. Pain levels measured by VAS and dolorimetry significantly decreased in the therapeutic group after 7 days of treatment ($p < 0,001$). This is the reason why HILT can be a method of choice in the treatment of gonarthrosis.
36	Pekyavas NO, Baltaci G. Short-term effects of high-intensity laser therapy, manual therapy, and Kinesio taping in patients with subacromial impingement syndrome. (55)	To compare the effects of Kinesio® taping (K.T.), exercise (EX), manual therapy (M.T.), and high-intensity laser therapy (HILT) on pain, range of motion (ROM), and functioning in patients with subacromial impingement syndrome (SAIS).	Statistically significant differences were found in the treatment results of all parameters in MT+ KT+EX and HILT +MT+ KT+EX groups ($p < 0.05$). Statistically significant differences were found between all the groups ($p < 0.05$) when comparing the means of range of motion (ROM) and shoulder pain and disability index (SPADI). These differences were significant especially between the groups MT + KT+EX and KT + EX ($p < 0.05$) and HILT +MT + KT + EX and KT + EX ($p < 0.05$). HILT and M.T. were found to be more effective in minimizing pain and disability and increasing ROM in patients with SAIS.
37	Pins L. Use of Class IV, High-Intensity Laser Therapy as an Adjunct in Treating a Patient with an Acute Shoulder injury: A Case Report. (56)	To present a case in which high-intensity laser therapy was used successfully to treat a patient with acute shoulder pain. The author also aimed to present evidence supporting the use of high-intensity laser therapy as a supplement to conservative interventions in patients with musculoskeletal injuries.	After the treatment, the patient demonstrated an increase of 20 points on the questionnaire - Focus on Therapeutic Outcomes (FOTO) - representing improved functional status. Further, the patient demonstrated improved ROM and had a notable decrease in pain levels. This case report supports the use of high-intensity laser therapy combined with physical therapy for improving ROM, pain levels, and overall functional status.
38	Metin Ökmen B, Ökmen K, Özkuk K, Uysal B, Sezer R, Koyuncu E. Comparison of the Efficacy of High-Intensity Laser and Ultrasound Therapies in Chronic Shoulder Pain; Randomized Controlled Single-Blind Study. (57)	To compare the efficacy of the high-intensity laser therapy (HILT) and ultrasound therapy (U.S.) for pain and daily activities of patients with chronic shoulder pain.	141 patients were assigned into two groups: (1) US ($n = 70$) and (2) HILT ($n = 71$). In Group 1 and Group 2, statistically significant improvements were found in all the evaluation parameters both post-treatment 1st day and post-treatment findings 30th day ($p < 0.05$). When the groups are compared, statistically significant difference was found in Group 2 both post-treatment 1st day and post-treatment findings 30th day, in all evaluation parameters ($p < 0.05$). The study demonstrates that HILT is superior to U.S. therapy in decreasing pain and improving function in short term in chronic shoulder pain.
39	White PF, Cao X, Elvir-Lazo L, Hernandez H. Effect of High-Intensity Laser Treatments on Chronic Pain Related to Osteoarthritis in Former Professional Athletes: A Case Series. (58)	To evaluate the use of a higher intensity cold laser for treating chronic pain related to osteoarthritis (O.A.) in former NFL football players.	The chronic pain scores were significantly reduced both at rest and with activity after each treatment. The duration of the beneficial effect lasted 1–3 weeks in 64% of the players treated.
40	Choi HW, Lee J, Lee S, Choi J, Lee K, Kim BK, Kim GJ. Effects of high-intensity laser therapy on pain and function of patients with chronic back pain. (59)	To examine the effects of high-intensity laser therapy on pain and function of patients with chronic back pain.	In a comparison between the studied groups, both VAS and Oswestry Disability Index significantly decreased. It is concluded that high-intensity laser therapy can be an effective nonsurgical intervention method for reducing pain and helping the performance of daily routines of patients suffering from chronic back pain.

(Contd...)

TABLE 1. (Continued)

Citation	Author, title, reference number	Aim	Result
41	Alayat MSM, Abdel-Kafy EM, Elsoudany AM, Helal OF, Alshehri MA. Efficacy of high-intensity laser therapy in the treatment of male with osteopenia or osteoporosis: a randomized placebo-controlled trial. (60)	To investigate the effect of high-intensity laser therapy (HILT) on pain, health-related quality of life and fall risk in male with osteopenia or osteoporosis, applied either solely or combined with exercise.	All measured values significantly decreased after treatment in all treatment groups. It is concluded that high-intensity laser is an effective treatment for male patients with osteopenia or osteoporosis. Laser combined with exercise is more effective than exercises or laser alone in decreasing pain, fall risk an increasing quality of life 12 weeks after the treatment.
42	Herdiansyah D, Prabowo T, Goesasi RZ. The Difference on Pain and Range of Motion After High-Intensity Laser Therapy on Myositis Ossificans of the Right Deltoid Muscle: A Case Report. (61)	To show effects of high-intensity laser therapy (HILT) on pain and range of motion (ROM) in a patient suffering from myositis ossificans (MO).	Pain decreased after the therapy and the right shoulder movements were easier. After 2 times/week for 4 weeks of therapy, there was no pain, and the X-ray showed reduced the scope of calcification.
43	Haladaj R, Pingot M, Topol M. The Effectiveness of Cervical Spondylosis Therapy with Saunders Traction Device and High-Intensity Laser Therapy: A Randomized Controlled Trial. (62)	To evaluate analgesic effect and improvement of active mobility of the cervical spine after having been subjected to traction therapy with the Saunders device and high-intensity laser therapy (HILT) at different time intervals.	The results obtained in the two groups were similar immediately after the therapy and after 4 weeks (the medium-term follow-up). However, in long-term follow-up, therapeutic effects of HILT maintained positive. Both therapeutic methods improved the efficiency and demonstrated analgesic efficacy in patients with cervical spondylosis immediately and in the medium term after the therapy. HILT was more effective than the Saunders method in long-term follow-up.
44	White PF, Zafereo J, Elvir-Lazo OL, Hernandez H. Treatment of drug-resistant fibromyalgia symptoms using high-intensity laser therapy: A case-based review. (63)	To evaluate low (1 W), intermediate (42 W) and high level (75 W) high-intensity laser therapy (HILT) in a woman with long-standing fibromyalgia syndrome.	The 1 W treatment produced minimal symptom relief, both the 42 and the 75 W treatments produced a dramatic reduction in overall pain, improved quality of sleep, and increased the level of physical activity for 4–10 days after these treatment sessions.
45	Akkurt F, Akkurt HE, Yılmaz H, Olgun Y, Sen Z. Efficacy of High-Intensity Laser Therapy and Silicone Insole in Plantar Fasciitis. (64)	To investigate the short-term efficacy of high-intensity laser therapy (HILT) and silicone insole in the treatment of plantar fasciitis (P.F.) and to compare it with a full-length silicone insole alone.	Both groups showed a significant improvement regarding all parameters (pain scores, function and quality of life scores, and fat pad thickness) 1 month after treatment. Conjunction of HILT and insole therapy was considered to be more effective than only silicone insole with regard to decrease in pain and increase in quality of life.
46	Ciplak ED, Akturk S, Buyukavci R, Ersoy Y. Efficiency of high-intensity laser therapy in patients with knee osteoarthritis. (65)	To compare the effects of high-intensity laser treatment (HILT) and the transcutaneous electrical nerve stimulation (TENS) and ultrasound (U.S.) combined treatment on pain, functionality, and quality of life in the patients suffering from knee osteoarthritis.	In both groups, a statistical significant change was observed in all parameters after the treatment. In the comparison between the groups, it was observed that HILT provided a significant improvement in pain scores both after the treatment and in the 6 th week than TENS and U.S. combined treatment. HILT in knee osteoarthritis is a statistically significant efficient method for pain and functional scales compared to combination of TENS and U.S.
47	Nicolaou EPT, Dimitrios S, Lamnisos D. Treatment of chronic patellar tendinopathy using an exercise program consisting of eccentric training and static stretching exercises combined with high-intensity light therapy. A pilot study. (66)	To investigate the effects of an exercise program consisting of eccentric training and static stretching exercises combined with high-intensity laser therapy (HILT) in patients with chronic patellar tendinopathy (CPT).	At week 4, there was a rise in VISA-P score of about 37 units. This rise was kept at 1 month follow-up. The results suggest that the combination of an exercise program with HILT is an adequate treatment for patients with CPT.
48	Kolu E, Buyukavci R, Akturk S, Eren F, Ersoy Y. Comparison of high-intensity laser therapy and combination of transcutaneous nerve stimulation and ultrasound treatment in patients with chronic lumbar radiculopathy: A randomized single-blind study. (67)	To compare the effects of high-intensity laser therapy (HILT) and a combination of transcutaneous nerve stimulation (TENS) with ultrasound (U.S.) therapy on pain and functionality in patients with chronic lumbar radiculopathy.	In two groups, VAS and Oswestry Disability Index scores showed significant changes. HILT and TENS+US combined with exercise were effective treatment modalities in decreasing the VAS and ODI scores. TENS+US combined with exercises were more effective than HILT combined with exercise.
49	Taradaj J, Rajfur K, Rajfur J, Ptaszkowski K, Ptaszowska L, Sopol M, Rosińczuk J, Dymarek R. Effect of laser treatment on postural control parameters in patients with chronic nonspecific low back pain: A randomized placebo-controlled trial. (19)	The main objective was to evaluate static postural stability using an objective tool in patients with chronic non-specific lumbar pain after laser treatment with different doses and wavelengths.	Low- and high-intensity laser therapy did not lead to a significant improvement in postural sway in patients with chronic non-specific lumbar pain compared with standard stabilization training based on short- and long-term observation.
50	Nazari A, Moezy A, Nejati P, Mazaherinezhad A. Efficacy of high-intensity laser therapy in comparison with conventional physiotherapy and exercise therapy on pain and function of patients with knee osteoarthritis: A randomized controlled trial with 12-week follow-up. (68)	To compare the effects of high-intensity laser therapy (HILT), conventional physical therapy (CPT), and exercise therapy (E.T.) on pain and function in patients with knee osteoarthritis.	In comparison to other groups, HILT was more efficient in decreasing the VAS, increasing FROM and improving the WOMAC scores both after treatment and after 12 weeks. The effect of HILT and CPT on the knee flexion range of motion, timed up and go test, 6-min walk test, and Western Ontario and McMaster Universities Osteoarthritis pain subscale, was not significantly different after treatment, and both were better than E.T. However, HILT was significantly better than the others at follow-up. HILT combined with exercise therapy, could have positive impacts on knee osteoarthritis patients.

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TABLE 1. (Continued)

Citation	Author, title, reference number	Aim	Result
51	Gocevska M, Nikolij-Dimitrova E, Gjerakaroska-Savevska C. Effects of High-Intensity Laser in Treatment of Patients with Chronic Low Back Pain. (69)	To compare the effects between high-intensity laser (HILT) and ultrasound (U.S.) therapy in the treatment of patients with chronic low back pain.	This study has shown that pain and disability in patients with chronic low back pain treated with a high-intensity laser have been significantly reduced, range of motion has been improved. The positive effect was kept for 3 months.
52	Ghanbarnasab M, Nejati P, Moenoddin R, Nejati L. The effect of high-intensity laser therapy on trapezius focal myositis: a rare case report. (70)	To present a case of a patients suffering from focal myositis (F.M.) in the left trapezius muscle who had an excellent response to high-intensity laser therapy (HILT).	The pain level was significantly lower after 3–4 sessions. At the end of the 8 th session, there was a dramatic decrease in the VAS score, and finally, the pain completely disappeared after 1 week. After 3 months, the patient had no pain. The shoulder MRI viewed lesion smaller than before. After 6 months, she had no pain or tenderness in that area and was able to perform all daily tasks without any pain.
53	Ezzati K, Laakso E, Saberi A, Yousefzadeh Chabok S, Nasiri E, Bakhshayesh Eghbali B. A comparative study of the dose-dependent effects of low level and high-intensity photobiomodulation (laser) therapy on pain and electrophysiological parameters in patients with carpal tunnel syndrome: A randomized controlled trial. (71)	To compare the dose-dependent effects of low-level laser therapy (LLLT) and high-intensity laser therapy (HILT) on pain and electrophysiology studies in patients with carpal tunnel syndrome (CTS).	After 3 weeks, in all groups, VAS was significantly lower, compound muscle action potential (CMAP) latency decreased. The interaction of group and time (5 × 2) was significant for pain, the latency of CMAP and CMAP amplitude. The interaction of group and time was not significant for the CMAP conduction velocity, sensory nerve latency, and amplitude. HILT with a power of 1.6 W and low fluence of 8 J/cm ² was superior in reduction of pain and improvement of the median motor nerve conduction compared to LLLT and exercise-only control groups.
54	Kaydok E, Ordahan B, Solum S, Karahan AY. Short-Term Efficacy Comparison of High-Intensity and Low-Intensity Laser Therapy in the Treatment of Lateral Epicondylitis: A Randomized Double-Blind Clinical Study. (72)	To evaluate and compare the short-term efficacy of high-intensity laser therapy and low-intensity laser therapy in the treatment of lateral epicondylitis.	After 3 weeks, there were significant improvements in all of the parameters. However, in the high-intensity laser therapy group, the QDASH, hand grip strength, and SF-36 physical component summary (PCS) scores showed superior improvement compared to the low-intensity laser therapy group. However, each treatment modality was found to be effective and safe for the short-term treatment of lateral epicondylitis.
55	Ahmed M, Abu Taleb E, El Desoky T, Lasheen R, Ameen H. High intensity laser therapy effect on pain in patients with myofascial trigger points. (73)	To investigate the effect of high-intensity laser therapy on pain intensity in patients with acute cervical myofascial trigger points in the upper trapezius muscle.	The results showed that there was significant difference between the two groups in the post-treatment outcome measures where the effect in group (B) is more significant than in the control group (A) at $p > 0.001$. High-intensity laser therapy was found to be quite effective as a physical treatment for patients with cervical myofascial trigger points.
56	Abdelbasset WK, Nambi G, Alsubaie SF, Abodonya AM, Saleh AK, Ataalla NN, et al. A Randomized Comparative Study between High-Intensity and Low-Level Laser Therapy in the Treatment of Chronic Non-specific Low Back Pain. (74)	To compare the effects of high-intensity laser therapy (HILT) versus low-level laser therapy (LLLT) on chronic non-specific low back pain.	Both LLLT and HILT groups showed a significant improvement of the Oswestry Disability Index (ODI), visual analog scale (VAS), lumbar range of motion (ROM), and European Quality of Life (EuroQol) scores, while the control group did not show significant changes. Comparison among the three study groups post-intervention showed significant differences in the outcome measures, while comparison between the LLLT and HILT groups showed non-significant differences.
57	Chen Y-W, Cheng Y-Y, Lee Y, Chang S-T. The Immediate Effect of High-Intensity Laser Therapy on Pain Relief and Shoulder Function in Patients with Subacromial Impingement Syndrome. (75)	To evaluate the immediate effects of high-intensity laser therapy (HILT) on patients with subacromial impingement syndrome (SAIS).	At the end of the evaluation period, comparisons before and after treatment in the HILT group showed significant improvements in all outcome measures, including VAS, shoulder ROM, and CMS. HILT can immediately reduce pain and disability and improve shoulder flexion range of motion in patients with SAIS.
58	Kamal W, Saber M, Aiad K, Serag M, Mostafa EM, Heba A, et al. Effect of High-Power Laser on Shoulder Mobility in Subacromial Impingement Syndrome: Randomized Controlled Trial. (76)	To investigate effects of high-intensity laser therapy (HILT) on shoulder mobility in case of subacromial impingement syndrome.	Comparing HILT and exercise groups after the treatment revealed a statistically significant reduction in ultrasonography dimension of supraspinatus and VAS and significant increase in range of motion of shoulder flexion and abduction in favor to HILT group compared to exercise group. It is concluded that HILT yielded more improvement for shoulder mobility in case of impingement syndrome.
59	Abdel-Aal NM, Ali KM, Eladi HM. Efficacy of high-intensity laser therapy on arthropathy of the hands in patients with systemic lupus erythematosus: A double-blinded, randomized controlled trial. (77)	To find the efficacy of high-intensity laser therapy (HILT) on hands arthropathy in patients with systemic lupus erythematosus.	There were statistically significant differences in handgrip strength, joint swelling count, joint tenderness count, and VAS in favor of the study group. Adding HILT to the standard physical therapies might be more effective than standard physical therapies alone in improving handgrip strength, decreasing joint swelling counts, joint tenderness counts, and pain in patients with hands arthropathy.

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TABLE 1. (Continued)

Citation	Author, title, reference number	Aim	Result
60	Ammendolia A, Marotta N, Marinaro C, Demeco A, Mondardini P, Costantino C. The synergic use of the High-Power Laser Therapy and Glucosamine sulfate in Knee osteoarthritis: A Randomized Controlled Trial. (78)	To determine the efficacy of high-power laser therapy (HPLT) applied together with glucosamine sulfate (G.S.) in knee osteoarthritis	In the mean scores for VAS at T1, no significant differences were found between the two groups with paired T and ANOVA test. However, significant differences between the groups in all outcomes were observed at 6 months (T2). It is concluded that HILT is useful in treating knee osteoarthritis, but when combined with glucosamine sulfate, it may achieve a long-term effect up to 6 months after treatment.
61	Koevska V, Dimitrova-Nikolic E, Mitrevska B, Savevska-Gjerakaroska C, Gocevska M, Kalcovska B. Application of high-intensity laser in pain treatment of patients with knee osteoarthritis. (79)	To compare the effect of HILT with LILT in the treatment of knee osteoarthritis	There is a significant difference between the two groups in VAS score after 10 therapies where significantly lower score was in the HILT group. The comparison of the VAS score between the 2 times in the two groups separately showed that in both, the HILT and the LILT groups, the VAS score after 10 days of therapy was significantly lower compared to that at 0 time. Patients treated with HILT had better results, that is, had a significant reduction in pain than patients treated with LILT. HILT was more effective than LILT.

RESULTS

By reviewing the selected articles related to the effects of CRet therapy on various forms of musculoskeletal disorders, it was found that this therapy has a favorable effect and is mainly applied in pain reduction, improvement of muscles and joint mobility, and edema reduction. CRet's positive effects may be attributed to its capability to increase tissue temperature and enhance blood circulation (8). The analysis of the accessed articles related to HILT effects in musculoskeletal disorders has provided information that this therapy, although having an anti-edematous, anti-inflammatory, and reparative effect, is mostly applied in pain reduction, being either applied solely or in combination with some other physical treatment (17,18).

Analgesic effects of CRet therapy and HILT

Among 61 reviewed papers dealing with analgesic effects of CRet therapy and HILT, it may be noted that the application of these two therapies significantly differs regarding pain location. Namely, while CRet therapy papers mostly deal with pain in joints, muscles, and tendons ($n = 7$), low back pain ($n = 6.5$), and neck pain ($n = 4$) (Figure 1), HILT is largely applied in knee conditions ($n = 11$), shoulder pain ($n = 9$), and low back pain ($n = 8$) (Figure 2). Further, it has to be noted that this overview includes more papers on HILT ($n = 39$) than on CRet therapy ($n = 22$). When viewed in total, for both therapies, most papers deal with low back pain ($n = 14.5$), pain in knees ($n = 11.5$), shoulder ($n = 11$), joints, muscles, and tendons ($n = 10$), neck ($n = 5$), elbow ($n = 4$), hands ($n = 2$), bones ($n = 2$), and feet ($n = 1$) (Figure 3).

Considering that there is no other applicable method for determining pain level except for a subjective assessment, the pain was assessed by the commonly approved and accepted visual analog scale – VAS (51 articles), numeric pain rating scale – NPRS (four articles), Western Ontario and McMaster Universities Osteoarthritis Index – WOMAC (two articles), verbal rating scale – VRS (one article), Victorian Institute of Sport Assessment questionnaire – VISA-P (one article), and Oswestry Low Back Pain Disability Questionnaire (one article) (Figure 4). Given that the vast majority of studies use questionnaires, scales, and surveys, Taradaj et al. were eager to find a more objective way for pain assessment in the

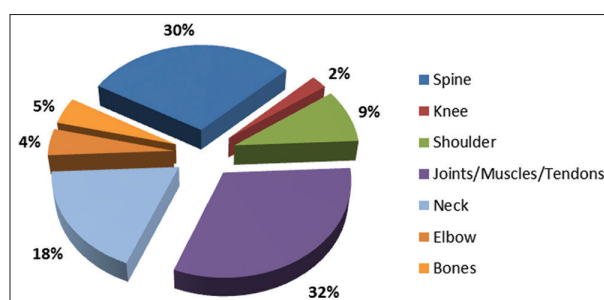


FIGURE 1. Distribution of articles per pain locations treated with CRet therapy.

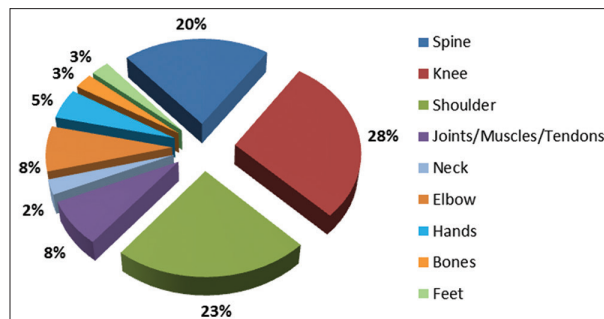


FIGURE 2. Distribution of articles per pain locations treated with HILT.

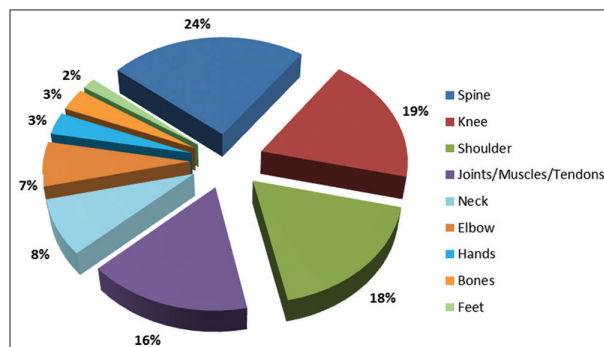


FIGURE 3. Distribution of articles per pain location treated with CRet and HILT.

HILT application. They tried to analyze the posture stability parameters considering that posture stability is partially conditioned by pain level. They used a double-plate stabilometric platform and unfortunately the results did not meet

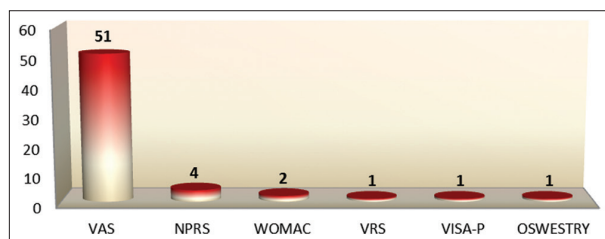


FIGURE 4. Distribution of articles per pain assessment scales.

their expectations, but they believe that this could be used in further studies (19).

Pain assessment is an important guide in the clinical work of a physiotherapist as it helps them define adequate protocols and improves the quality of a treatment cycle. Although it is subjective, it has to be noted that all studies carried out within various settings and under various conditions through subjective pain assessment scales showed that both therapies yielded significant analgesic effects.

DISCUSSION

This article aims to compare the effectiveness of CRet and HILT in the case of painful musculoskeletal conditions by overviewing recent studies. The overviewed papers showed that both therapies are powerful tools in pain reduction. Although in most of these papers, the set protocols, number and frequency of therapies applied, and other parameters usually differ, in both modalities, pain alleviation occurs during or immediately after a therapy cycle application. This only proves that they have effects valuable for further research aiming to find and set the most favorable protocol resulting in complete pain alleviation in both short-term and long-term sense.

CRet therapy analgesic effect develops very fast and lasts long. By observing the therapy effects in the most common musculoskeletal pathologies, it is found that significant effects were achieved immediately after the first therapy cycle. Such results are likely to result from a biological effect on muscles – anti-edemic, anti-inflammatory, and myorelaxant – through a release of endorphins and controlling both pain types – nociceptive and neuropathic (20). The results of the published papers underline the significance of CRet, whether applied individually or in combination with other physiotherapy procedures. A possibility to be applied in any phase of the condition also has a great significance because it is possible to act even in an early phase and prevent greater motor deficit and development of chronicity. Further, CRet is considered efficient in chronic conditions where most other physiotherapy procedures do not result in significant recovery. Although there is a small number of clinical studies in this field, CRet appears to be an effective treatment method for pain relief and better functionality of patients and therefore improved quality of life.

The pain relieving effect of HILT is achieved by the “gate control system,” and it is a result of the irradiation stimulating effect on the regeneration of nerve fibers (21,22). Regardless that the selected studies have different settings and conditions, that some of them searched for short term, some for long term, and some for any effect, it can be seen that the first analgesic effects were noticed immediately

following HILT’s application. It should be noted that long-term effects are usually achieved by applying HILT combined with other physical procedures or medicines. This is probably due to all achieved impacts by HILT – anti-inflammatory, analgesic, and biostimulating. However, one should not neglect that HILT’s effects are quite satisfactory even when applied solely. While searching databases for papers related to CRet and HILT, we found only one article by Raffaella Osti et al. partially dealing with both therapies (8). The study’s results evidence the efficacy of combined CRet and HILT therapies in treating low back pain. The decrease in VAS score had a statistically significant difference (9).

CONCLUSION

Although there are no precisely defined protocols for application either of CRet or HILT in the selected papers, they report positive and encouraging effects. There are still a small and insufficient number of clinical studies and subjects involved in them, and considering the remarkable effects, these two therapies have on pain relief and better functionality of patients, which further result in improved quality of life, both therapies deserve much more attention and research. Considering that studies related to CRet and HILT mostly deal with different pain locations and mainly focus on a few body areas, it is necessary to carry out some research within the scope of other impaired body areas, which also may have a negative impact on quality of life. Learning and understanding all aspects of these two therapies would enable those administering physical therapies not only to establish corresponding protocols for various therapy applications but also to combine these with other physical therapies and medicines to get faster, more efficient, and longer-lasting results. Pain as a dominant characteristic of musculoskeletal conditions not only impairs one’s functionality and adversely affects the quality of life but it is also an economic issue. Hence, proper and prompt treatment may be significant for individuals and society. Therefore, further research and studies related to the effects of CRet and HILT and for evidencing their results are needed.

COMPETING INTERESTS

There are no conflicts of interest to declare by any of the authors of this study.

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