International Journal of Physical Education, Sports and Health 2021; 8(3): 01-04

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2021; 8(3): 01-04

www.kheljournal.com
Received: 02-03-2021
Accepted: 10-04-2021

Dimitrios Lytras
Ph.D., Department of Physiotherapy, Faculty of Health Sciences International Hellenic University - Alexander Campus, Sindos, Thessaloniki, Greece

Paris Iakovidis
Ph.D., Department of Physiotherapy, Faculty of Health Sciences International Hellenic University - Alexander Campus, Sindos, Thessaloniki, Greece

Anastasios Kottaras
Department of Physiotherapy, Faculty of Health Sciences International Hellenic University - Alexander Campus, Sindos, Thessaloniki, Greece

Andreas Fotios Tsimerakis
Department of Physiotherapy, Faculty of Health Sciences International Hellenic University - Alexander Campus, Sindos, Thessaloniki, Greece

Ioannis S Myrogiannis
MSc. Laboratory of Hygiene–Medical Statistics, School of Medicine, Aristotle University of Thessaloniki, University Campus, Thessaloniki, Greece

Corresponding Author:
Dimitrios Lytras
Ph.D., Department of Physiotherapy, Faculty of Health Sciences International Hellenic University - Alexander Campus, Sindos, Thessaloniki, Greece

A review on interferential current analgesic effects in individuals with chronic low back pain

Dimitrios Lytras, Paris Iakovidis, Anastasios Kottaras, Andreas Fotios Tsimerakis and Ioannis S Myrogiannis

DOI: https://doi.org/10.22271/kheljournal.2021.v8.i3a.2051

Abstract
Chronic Low Back Pain (CLBP) is defined as mechanical musculoskeletal pain in the lower back that has no known cause and lasts for more than 12 weeks. It is one of the four most common health problems in the world with huge socio-economic consequences. Various interventions are used for its physiotherapy treatment, such as electrotherapy methods that seem to have a positive effect on reducing pain and improving the functioning of these patients. The aim of this review was to evaluate the efficacy of interferential current (IFC) in the treatment of patients with CLBP. The following databases were searched in English: MED line, Science Direct and Scopus; with the following keywords: Efficacy, chronic low back pain, interferential current electrotherapy, physiotherapy, rehabilitation. The review included 11 studies of which 10 were randomized control trials and one pilot study. Electrotherapy protocols were applied that included both the individual application of IFC protocols and combinations with other therapies**.** Discussion – results: The results of these clinical trials reinforce data on the positive effect of IFC on pain and quality of life in patients with CLBP. Their immediate analgesic effect has been shown to be effective both when applied as a single treatment and when combined with other natural means such as TENS or other physiotherapy interventions such as massage, stretching, Pilates and manual therapy techniques.

Keywords: Chronic low back pain, Interferential current electrotherapy, physiotherapy, rehabilitation

Introduction
Chronic Low Back Pain (CLBP) is characterized as lower back pain lasting more than 12 weeks [1, 2]. Its prognosis is considered good, as a significant percentage of patients suffering from CLBP recover before 12 months [3]. However, as with all chronic pain conditions characterized by prolonged duration of symptoms, there is an adverse effect on both the functional ability and the quality of life of people of productive age [4].
According to recent epidemiological studies, the global prevalence of CLBP reaches 31% [3] while it is among the four most common reasons for leave of absence from work in people of working age in developed countries [5]. It has been calculated that the annual CLBP treatment cost, both direct and indirect, in the US is in the area of $84.1-624.8 billion [6]. Due to its great socio-economic impact on the world population, the search for the most effective treatment is imperative.
Electrotherapy has been shown to contribute to better treatment of CLBP in physiotherapy. Interferential current (IFC) is an analgesic current that is widely used in clinical practice which results from the combination of currents from two different sources of electricity and offers analgesia [7]. It is an alternating current of medium frequency [8]. The gate control pain theory is most commonly cited as an explanation for the analgesic effect of IFC, even though the exact mechanism is not yet fully understood [9]. This theory proposes that the transmission of pain stimuli carried by small-diameter fibers (C and Aδ) is prevented by the activation of local inhibitory circuits of the dorsal spinal cord due to stimulation of large-diameter fibers (Aβ) [10]. Electrotherapy, along with other physiotherapy practices such as massage, manual therapy mobilization and therapeutic exercise, especially when combined, prove beneficial for the patient [11]. Gracey *et al.* [12], in a study of 157 physiotherapists in Northern Ireland with 1062

CLBP patients, found that IFC were the most widely electrotherapy tool used (30.3%), ranking them as the first choice within this type of therapy to treat this condition.

The aim of this review is to evaluate the data in the international literature related to the application of IFC regarding the improvement of pain, functional ability and clinical picture of patients with CLBP.

Literature review

The following databases were searched for the literature review: PubMed, Science Direct and Google Scholar; with the following keywords: chronic low back pain, interferential current electrotherapy, physiotherapy, rehabilitation. The review included 11 studies (10 randomized controlled trials and 1 pilot study) and below are their main findings.

The efficacy of TENS and IFC effects in patients with CLBP was compared in a study by Facci *et al.* [13]. The study included 150 participants randomly divided into three groups: TENS, IFC and control group. The control group did not receive any form of therapy, whereas the other two performed 10 30-minutes sessions. Both TENS and IFC had a significant positive effect on reducing pain intensity, improving functioning and reducing drug use compared to the control group as evidenced by the results.

Lara-Palomo *et al.* [14] studied the short-term effects of IFC in adults with CLBP. Their study included 62 participants that were divided into two groups. The intervention group received electromassage with IFC gloves on the lower back while the control group was treated with manual massage on the surface of the same area; more specifically, effleurage, surface pressure and skin rolling. The study had a duration of 10 weeks with 20 sessions in total. Based on the results, the IFC group significantly improved in terms of pain, quality of life and functioning compared to the control group.

The beneficial effects of IFC in the treatment of CLBP patients were demonstrated further in the study of Zambito *et al.* [15]. 26 men and 94 women participated in their study, which had a duration of two weeks with 10 sessions performed. The participants were divided into three groups according to their treatment method. The first one received treatment with IFC, the second only Horizontal Therapy (HT) and the third performed placebo HT (10-, 40- and 40-minute sessions respectively). All groups also followed a stretching exercise program. The IFC and HT groups drastically reduced their pain medication dosage and showed significantly better results in relieving pain and improving their functional ability.

The comparative clinical pilot study of Rajfur *et al.* [16] focused on the efficacy of selected electrotherapy applications on CLBP patients. The study included 127 patients, who were divided into six groups based on their received therapy method: conventional TENS, acupuncture-like TENS, high voltage electrical stimulation, IFC, diadynamic current and control group. According to the results, currents that are applied higher on the surface, such as TENS and high voltage, proved less effective in providing analgesia and improving the functional ability of the CLBP patients in contrast to deeper penetrating currents, such as IFC.

Dias *et al.* [17] in a sample of 250 people compared the effect of TENS and IFC, using different parameters, regarding the achievement of analgesia in patients with CLBP. Eight groups were created with the following parameters: Group 1: GI2kHz/100Hz, Group 2: GI2kHz/2Hz, Group 3: GI4kHz/100Hz, Group 4: GI4kHz/2Hz, Group 5: placebo IFC, Group 6: GT100Hz, Group 7: GT2Hz, Group 8: placebo TENS. An application was performed for a period of 30 minutes either with one current or with the other depending on the group that by the method of randomization each participant was distributed to. Measurements were made before and immediately after the intervention regarding the intensity and quality characteristics of the pain in four points in the lower back. The results showed the very good effect of both TENS and IFC in the treatment of CLBP, as immediate analgesia was observed in the area, especially with the application of IFC at the frequency selected in the 3rd group (GI4kHz/100Hz).

Franco *et al.* [18] in a sample of 148 people compared the efficacy of the IFC application before the Pilates exercises regarding CLBP. For this reason, they divided the participants into two groups, where in the first the application was normal while in the second placebo. The study had a duration of six weeks with 18 interventions and a follow-up was performed after six months. The results did not show any difference in the NRS, MPQ, PPT, PA scales that were initially evaluated. Significant progress was observed in the six-week and six-month post-intervention follow-up measurements.

Correa *et al.* [19] in a sample of 150 people studied the effect of IFC on pain parameters in patients with CLBP. Participants were divided with the randomization method into three groups with the following parameters: Group 1: 1kHz, Group 2: 4kHz, Group 3: Placebo treatment, and followed the program for four weeks with 12 interventions and a follow-up measurement after four months. The results showed that there was no progress in the intensity of pain, although there was a change in the mechanisms of pain, especially after the first intervention in the non-placebo groups.

In the study of Almeida *et al.* [20], in a sample of 175 patients with CLBP, an evaluation of efficacy for immediate analgesia of IFC with 2kHz and 4kHz parameters and a frequency band of 2Hz or 100Hz in one session was attempted. Five groups were created: GI2kHz/100 Hz, GI2 kHz/2 Hz, GI4 kHz/100 Hz, GI4 kHz/2 Hz, and a control group with placebo therapy. Significant differences were found in the pain assessment values (NRS) regarding the measurements of the GI2kHz/2Hz, GI4kHz/2Hz, GI4kHz/100Hz groups compared to the control group and the MP Questionnaire measurements of the GI4kHz/2Hz, GI4kHz/100Hz groups as well. The results showed that IFC with frequencies of 4kHz/100Hz have the best results regarding immediate analgesia in patients with CLBP.

Albornoz-Cabello *et al.* [21] assessed the effect of IFC on pain and degree of disability in a sample of 64 people with CLBP. 20 people were in the control group and 44 in the intervention group. The intervention lasted two weeks and 10 sessions were performed. The results showed a significant difference between the two groups regarding the measurements in terms of the parameters evaluated. The intervention group had much better results than the control group that applied massage and soft tissue mobilization techniques.

Dohnert *et al.* [22] compared the efficacy of IFC and TENS in their effect on CLBP in a sample of 28 patients. 14 patients were assigned to the IFC intervention group and 14 to the TENS control group. The interventions were performed in a period of five weeks with 10 interventions in total. The results showed a positive effect in patients with CLBP for both groups, without significant differences between them.

Jung and Sung [23] studied the effect of IFC in 40 patients with CLBP on pain, disability and balance. The participants were equally divided into intervention group and control group. For two weeks and 10 sessions, the intervention group received IFC treatment, while the control group received no actual

application. Measurements were taken before and after the period of interventions. The results showed that IFC has a very good effect in terms of the parameters examined.

Discussion - Results

The TENS and IFC application is presented in four studies [13, 16, 17, 22] which show the equal efficacy of both treatments. Findings in 2 studies are an important indication of the efficacy of IFC [17, 20], concluding that in particular the 4kHz/100Hz frequencies have a large effect on immediate analgesia in people with CLBP. Three studies report the use of IFC and compare them with their placebo application [19, 20, 23]. The results of these studies suggest that their use has long-term benefits in patients with CLBP. Massage as a means of treating CLBP is presented in two studies [14, 21]. In these studies, the combination of electrotherapy and massage seems to yield positive results. One study focused on the combination of IFC and stretching exercises [15] and one on combination therapy with a Pilates program [18]. Both of these studies show long-term positive results in the combined treatment with IFC and exercises or programs with analgesic properties.

Table 1: Characteristics of the studies included in the review

Study (by year)	Population		Intervention		Compare	Outcome
	Patient	Sample Size	Intervention group	Duration	Control	
Zambito *et al*., 2007 [15]	M/F: 26/94	N = 120	Group 1: IFC (10₹), SEP	2 weeks (10 sessions) Follow-up: 6 weeks, 14 weeks	Group 2: HT (40'), SEP Group 3: sham HT (40'), SEP	VAS, Backill scale, MAC
Facci *et al*., 2011 [13]	M/F: 41/109	N = 150	Group 1: IFC	2 weeks (10 sessions)	Group 2: TENS Group 3: control	VAS, McGill Pain and Roland Morris scale
Lara-Palomo *et al*., 2013 [14]	M/F: 41/21	N = 62	Group 1: IFC electro-massage (30₹)	10 weeks (20 sessions)	Group 2: manual massage (20')	VAS, ODI, TSK, RMDQ, McQuade Test, SBT, SF-36, RTAM.
Rajfur *et al*., 2017 [16]	M/F: 50/73	N = 127	D – interferential current stimulation	2 weeks (10 sessions)	A – conventional TENS, B – acupuncture-like TENS, C – high-voltage electrical stimulation, E – diadynamic current, F – control group	VAS, Laitinen scale
Corrêa *et al*., 2016 [19]	M/F: 57/93	N = 150	Group 1: IFC 1kHz (30₹) Group 2: IFC 4kHz (30₹)	4 weeks (12 sessions) Follow up: 4 months	Group 3: placebo IFC (30')	NRS, sit-to-stand test, PPT, FPK20, Roland Morris scale, CPM, GPRS
Franco *et al*., 2017 [18]	M/F: 40/108	N = 148	Group 1: IFC, Pilates	6 weeks (18 sessions) Follow up: 6 months	Group 2: placebo IFC, Pilates	NRS, Roland Morris scale, PPT, TSK, PSFS, GPES
Dias *et al*., 2021 [17]	M/F: 101/179	N = 280	Group 1: GI2kHz/100Hz Group 2: GI2kHz/2Hz Group 3: GI4kHz/100Hz Group 4: GI4kHz/2Hz	Single application / 30 minutes	Group 5: placebo GIP Group 6: GT100Hz Group 7: GT2Hz Group 8: placebo TENS	NRS, MPQ, PPT, PA
Almeida *et al*., 2020 [20]	M/F: 70/105	N = 175	(GI): GI2kHz/100Hz, GI2kHz/2Hz, GI4kHz/100Hz, GI4 kHz/2Hz	Single application	PG: Placebo	NRS, MPQ
Dohnert *et al*., 2015 [22]	M/F: 6/22	N = 28	Group 1: IFC	5 weeks (10 sessions)	Group 2: TENS	VAS, OQ, RMDQ
Albornoz-Cabello *et al*., 2017 [21]	M/F: 20/44	N = 64	Group 1: IFC	2 weeks (10 sessions)	Group 2: Massage therapy, manual therapy, soft-tissue	VAS, OLBDI,
Jung *et al*., 2020 [23]	M/F: 7/13	N = 40	Group 1: IFC	2 weeks (10 sessions)	Group 2: Placebo	VAS, ODI

Horizontal Therapy (HT), Interferential Currents (IFC), Visual Analog Scale (VAS), Verbal Numerical Rating Pain Scale (NRS), Mean Analgesic Consumption (MAC), Functional Questionnaire (Backill), Standard flexion-extension stretching exercise program (SEP), McGill Pain and Roland Morris questionnaires, Oswestry Disability Index (ODI), Tampa Scale for Kinesiophobia (TSK), Roland Morris Disability Questionnaire (RMDQ), McQuade Test, Side Bridge Test(SBT), quality of life scores (SF-36), Range of Trunk Anteflexion Motion (RTAM), Pressure Pain Threshold (PPT), Analogue Pressure Algometer (FPK20), Conditioned Pain Modulation (CPM), Global Perceived Effect Scale (GPRS), Patient-Specific Functional
Scale (PSFS), Global Perceived Effect Scale (GPES), McGill Pain Questionnaire (MPQ), Pressure Algometry (PA), Placebo Interferential Group (GIP)

Conclusions

Overall, it can be said that IFC had a positive and immediate effect on pain relief in CLBP patients, according to the findings of the studies included in this review. However, it should be noted that it should not be used as monotherapy when the goal is long-term results and not just an immediate and temporary positive effect.

A major limitation of this narrative review is the lack of studies investigating the analgesic mechanisms of IFC in patients with CLBP. Modern, high-scoring studies have been presented; however, further research will be needed to more accurately assess the effect of IFC on people with CLBP.

References

1. Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F *et al*. Chapter 4: European guidelines for the management of chronic nonspecific low back pain. Eur Spine J 2006;15(2):192–300.
2. Waddell G, O'Connor M, Boorman S, Torsney B. Working backs Scotland: A public and professional health education campaign for back pain. Spine (Phila Pa 1976). 2007;32(19):2139–43.

3. Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F *et al*. A systematic review of the global prevalence of low back pain. Arthritis Rheum 2012;64(6):2028–37.
4. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M *et al*. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012;380(9859):2163–96.
5. Menezes Costa LDC, Maher CG, McAuley JH, Hancock MJ, Herbert RD, Refshauge KM *et al*. Prognosis for patients with chronic low back pain: Inception cohort study. BMJ 2009;339(7725):850.
6. Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies in the United States and internationally. Spine J 2008;8(1):8–20.
7. Prentice, W E, Quillen W, Underwood F. Therapeutic Modalities in Rehabilitation. 5th ed. McGraw Hill Professional, 2018.
8. Palmer ST, Martin DJ, Steedman WM, Ravey J. Alteration of interferential current and transcutaneous electrical nerve stimulation frequency: Effects on nerve excitation. Arch Phys Med Rehabil 1999;80(9):1065–71.
9. Johnson MI, Tabasam G. An investigation into the analgesic effects of interferential currents and transcutaneous electrical nerve stimulation on experimentally induced ischemic pain in otherwise pain-free volunteers. Phys Ther 2003;83(3):208–23.
10. Melzack R, Wall PD. GateControl-Pain mechanisms - a new theory. [Internet]. Vol. 150, Science, 1965, pp. 971–9. Available from: https://www.canonsociaalwerk.eu/1846_anesthesie/Canon Palliatieve Zorg - Ontstaan van anesthesie - Science - melzackandwallgatecontroltheory.pdf
11. Watson T. The role of electrotherapy in contemporary physiotherapy practice. Man Ther 2000;5(3):132–41.
12. Gracey JH, McDonough SM, Baxter GD. Physiotherapy management of low back pain: A survey of current practice in Northern Ireland. Spine (Phila Pa 1976) 2002;27(4):406–11.
13. Facci LM, Nowotny JP, Tormem F, Trevisani VFM. Effects of transcutaneous electrical nerve stimulation (TENS) and interferential currents (IFC) in patients with nonspecific chronic low back pain: Randomized clinical trial. Sao Paulo Med J 2011;129(4):206–16.
14. Lara-Palomo IC, Aguilar-Ferrándiz ME, Matarán-Peñarrocha GA, Saavedra-Hernández M, Granero-Molina J, Fernández-Sola C *et al*. Short-term effects of interferential current electro-massage in adults with chronic non-specific low back pain: A randomized controlled trial. Clin Rehabil 2013;27(5):439–49.
15. Zambito A, Bianchini D, Gatti D, Rossini M, Adami S, Viapiana O. Interferential and horizontal therapies in chronic low back pain due to multiple vertebral fractures: A randomized, double blind, clinical study. Osteoporos Int 2007;18(11):1541–5.
16. Rajfur J, Pasternok M, Rajfur K, Walewicz K, Fras B, Bolach B *et al*. Efficacy of selected electrical therapies on chronic low back pain: A comparative clinical pilot study. Med Sci Monit 2017;23:85–100.
17. Dias LV, Cordeiro MA, Schmidt de Sales R, Bieberbach M, Korelo RIG, Vojciechowski AS *et al*. Immediate Analgesic Effect of Transcutaneous Electrical Nerve Stimulation (Tens) and Interferential Current (Ifc) on Chronic Low Back Pain: Randomised Placebo-Controlled Trial [Internet]. Journal of Bodywork and Movement Therapies. Elsevier Ltd, 2021. Available from: https://doi.org/10.1016/j.jbmt.2021.03.005
18. Franco KM, Franco Y dos S, Oliveira NB de, Miyamoto GC, Santos MO, Liebano RE *et al*. Is Interferential Current Before Pilates Exercises More Effective Than Placebo in Patients With Chronic Nonspecific Low Back Pain?: A Randomized Controlled Trial. Arch Phys Med Rehabil [Internet] 2017;98(2):320–8. Available from: http://dx.doi.org/10.1016/j.apmr.2016.08.485
19. Corrêa JB, Costa LOP, Oliveira NTB, Lima WP, Sluka KA, Liebano RE. Effects of the carrier frequency of interferential current on pain modulation and central hypersensitivity in people with chronic nonspecific low back pain: A randomized placebo-controlled trial. Eur J Pain (United Kingdom) 2016;20(10):1653–66.
20. Almeida N, Paladini LH, Korelo RIG, Liebano RE, de Macedo ACB. Immediate Effects of the Combination of Interferential Therapy Parameters on Chronic Low Back Pain: A Randomized Controlled Trial. Pain Pract 2020;20(6):615–25.
21. Albornoz-Cabello M, Maya-Martín J, Domínguez-Maldonado G, Espejo-Antúnez L, Heredia-Rizo AM. Effect of interferential current therapy on pain perception and disability level in subjects with chronic low back pain: A randomized controlled trial. Clin Rehabil 2017;31(2):242–9.
22. Dohnert MB, Bauer JP, Pavão TS. Study of the effectiveness of interferential current as compared to transcutaneous electrical nerve stimulation in reducing chronic low back pain. Rev Dor 2015;16(1):27–31.
23. Jung KS. In T-S. Effects of Interferential Current Treatment on Pain, Disability, and Balance in Patients with Chronic Low Back Pain: A Randomized Controlled Study. J Korean Soc Phys Med 2020;15(3):21–7.