Fall 11-3-2018

Effect of Interferential Current in the Management of Musculoskeletal Pain: A Systematic Review

Ginny Skipper SPT

Sarah Maissy SPT
University of Puget Sound

Roger Allen PhD, PT
University of Puget Sound

Effect of Interferential Current in the Management of Musculoskeletal Pain: a Systematic Review

Sarah N. Maissy, SPT[1]; Virginia H. Skipper, SPT[1]; Roger J. Allen, PhD, PT[1,2]

1. School of Physical Therapy 2. Neuroscience Program

University of Puget Sound - Tacoma, WA, United States

Original Presentation

American Physical Therapy Association
Combined Sections Meeting
New Orleans, LA
February 23, 2018

References

1. Pereira GD, Cassolato KM, Lazarin PH, Canto TO, Portolez JLM, Bertolini GRF. Interferential current effect, 2000Hz, on the induced pain threshold. Rev Bras Med Esporte. 2011;17(4):257-260. doi:10.1590/S1517-86922011000400009
2. 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. 2016;20(10):1653-1666. doi:10.1002/ejp.889
3. Gundog M, Atamaz F, Kanyilmaz S, Kirazli Y, Celepoglu G. Interferential current therapy in patients with knee osteoarthritis: comparison of the effectiveness of different amplitude-modulated frequencies. Am J Phys Med Rehabil. 2012;91(2):107-113. doi:10.1097/PHM.0b013e3182328687
4. Koca I, Boyaci A, Tutoglu A, Ucar M, Kocaturk O. Assessment of the effectiveness of interferential current therapy and TENS in the management of carpal tunnel syndrome: a randomized controlled study. Rheumatol Int. 2014;34(12):1639-1645. doi:10.1007/s00296-014-3005-3
5. Atamaz FC, Durmaz B, Baydar M, et al. Comparison of the efficacy of transcutaneous electrical nerve stimulation, interferential currents, and shortwave diathermy in knee osteoarthritis: a double-blind, randomized, controlled, multicenter study. Arch Phys Med Rehabil. 2012;93(5):748-756. doi:10.1016/j.apmr.2011.11.037
6. Fuentes J, Armijo-Olivo S, Funabashi M, et al. Enhanced therapeutic alliance modulates pain intensity and muscle pain sensitivity in patients with chronic low back pain: an experimental controlled study. Phys Ther. 2014;94(4):477-489. doi:10.2522/ptj.20130118
7. Suriya-Amarit D, Gaogasigam C, Siriphorn A, Boonyong S. Effect of interferential current stimulation in management of hemiplegic shoulder pain. Arch Phys Med Rehabil. 2014;95(8):1441-1446. doi:10.1016/j.apmr.2014.04.002
8. Rocha CS, Lanferdini FJ, Kolberg C, et al. Interferential therapy effect on mechanical pain threshold and isometric torque after delayed onset muscle soreness induction in human hamstrings. J Sports Sci. 2012;30(8):733-742. doi:10.1080/02640414.2012.672025
9. 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 Rev Paul Med. 2011;129(4):206-216.
10. Fuentes J, Armijo-Olivo S, Magee DJ, Gross DP. A preliminary investigation into the effects of active interferential current therapy and placebo on pressure pain sensitivity: a random crossover placebo controlled study. J Physiother. 2011;97(4):291-301. doi:10.1016/j.physio.2011.01.001

Contact Information

smaissy@pugetsound.edu

Introduction

Interferential current (IFC) is widely used in conjunction with other therapies to manage musculoskeletal pain. IFC uses two medium frequency carrier currents which interfere deeper in tissues, producing an amplitude modulated frequency (AMF). The interference creates the effect of low frequency stimulation with less discomfort for patients compared to direct low frequency stimulation. The predominant proposed mechanisms of analgesia include the gate control theory of pain and endogenous opioid production. Since previous systematic reviews have found a lack of studies examining the independent treatment effects of IFC, this study reviewed the isolated effects of IFC compared to control groups.

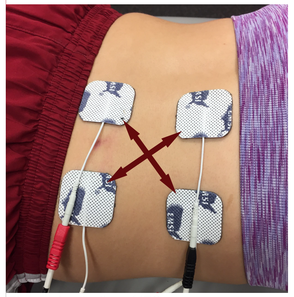

Figure. Application of IFC

Purpose

The purpose of this study was to conduct a systematic review of existing literature addressing the potential effectiveness of IFC as an adjunctive biophysical agent for treating musculoskeletal pain.

Methods

CINAHL, PubMed, Cochrane Library, PEDro, SportDISCUS, and CENTRAL were searched between November 2016 and February 2017 with the following terms: interferential current, interferential therapy, interferential electrical stimulation, pain, and analgesia. Articles met inclusion criteria if they were randomized controlled trials (RCT) that had IFC as an intervention and an assessment of pain as an outcome measure. Studies were excluded if they were duplications, had a publication date prior to 2009, were not published in English, used thermal induced pain in healthy subjects, if the effects of IFC were not tested in isolation of other treatments, or if no form of a control group was used.

Results

The initial search yielded 285 results with 10 eligible studies adhering to inclusion and exclusion criteria, published from 2011-2016. Participants across studies included healthy individuals with experimentally induced pain and patients with the following diagnoses: chronic low back pain, carpal tunnel syndrome, shoulder hemiplegia, and knee osteoarthritis. Outcome measures included subjective pain reports such as the visual analog scale (VAS) or the numeric pain rating scale, objective physiological measurements such as pain-free ROM or a 15 meter walk test, pain behavior assessments such as medication use, and functional outcome measures such as the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). These 10 studies were analyzed with a PEDro scale: scores ranged from five through nine, with a mean value of seven. All nine RCTs that used a carrier frequency of 4,000 Hz reported a positive effect of IFC: seven reported a reduction in a measure of pain and two reported a decrease in use of pain medication. One RCT reported no significant effect of IFC when using a carrier frequency of 2,000 Hz. Four of the 10 RCTs evaluated long-term effects: three RCTs found significant lasting benefits, while one RCT found no significant long term improvements.

Table 1. Study Characteristics

Author, Year	Study Design	PEDro Score	Number of Participants	Patient Population	Trial Groups	Treatment Duration	Outcome Measures	Key Findings
Correa et al, 2016	Parallel RCT	9	150	CLBP	IFC: Placebo, 1 kHz, 4 kHz	12 sessions x 30 minutes	ii, iv, v, vi, vii, xv, xviii	There was no significant difference between groups for pain intensity at rest or with movement, but both treatment groups had significantly lower frequeny of pain medication usage. The 1 kHz IFC group had significantly improved pressure pain threshold and temporal summation. There was no significant difference between the groups at 4 month follow up.
Fuentes et al, 2014	Parallel RCT	8	117	CLBP	IFC: Placebo (limited TA, enhanced TA), Frequency not reported (limited TA, enhanced TA)	1 session x 30 minutes	iv, vi, xxiii, xxi, xxii	IFC significantly reduced pain intensity and pressure pain threshold. Enhanced therapeutic alliance significantly increases the positive effects of IFC.
Koca et al, 2014	Parallel RCT	5	75	CTS	IFC: 4 kHz TENS: 100 Hz Splint therapy: worn during night sleep	IFC & TENS: 15 sessions x 20 minutes Splint therapy: 3 weeks	vii, x, xii, xiii-a, xiii-b	IFC was significantly more effective than splint therapy for the following measures: VAS, mMDL, and mSNCV. IFC was significantly more effective than TENS for the following measures: VAS, symptom severity, functional capacity, mMDCL, and mSNCV. Outcome measures were evaluated three weeks post-treatment completion.
Suriya-amarit et al, 2014	Parallel, matched-pair RCT	6	30	Shoulder hemiplegia	IFC: Placebo, 4 kHz	1 session x 20 minutes	iv, v, xii	IFC significantly reduced pain during movement and increased pain-free PROM for shoulder flexion, abduction, IR, and ER.
Atamaz et al, 2012	Parallel RCT	9	203	Knee OA	IFC: Placebo, 4 kHz TENS:Placebo, 80 Hz SWD: Placebo, 27.12 MHz,	15 sessions x 20 minutes	vii, ix, xv, xvi, xix, xx, xxv	All treatment groups had signitificant decreases in pain assessments. The IFC treatment group had significantly lower paracetamol intake at 1, 3, and 6 months with no other significant differences between groups.
Gundog et al, 2012	Parallel RCT	6	60	Knee OA	IFC: Placebo, AMF 40 Hz, AMF 100 Hz, AMF 180 Hz [Carrier freq. 4 kHz]	15 sessions x 20 minutes	vi-a, vi-b, vi-c, ix, xiii, xv, xxiv, xx-a, xx-b, xx-c, xix	All treatment groups had significant improvements on all outcome measures except for knee AROM. These improvements remained significant at 1 month follow up. There was no significant difference in improvement between the treatment groups.
Rocha et al, 2012	Parallel RCT	5	41	Healthy, DOMS induced	IFC: Placebo, 4 kHz	1 session x 30 minutes	vi, viii	IFC significantly increased pressure pain threshold. There was no significant difference between groups for isometric peak torque.
Facci et al, 2011	Parallel RCT	7	150	CLBP	IFC: 4 kHz TENS: 20 Hz No treatment	10 sessions x 30 minutes	i-a, i-b, i-c, iii, vii, xv, xvi	IFC was significantly more effective at reducing pain, disability, and medicine usage than controls. There was no significant difference between IFC and TENS.
Fuentes et al, 2011	Crossover RCT	7	40	Healthy, pressure induced	IFC: Placebo, 4 kHz No treatment	3 sessions x 30 minutes	vi	IFC significantly decreased pressure pain threshold.
Pereira et al, 2011	Crossover RCT	5	14	Healthy, pressure & temperature induced	IFC: 2 kHz No treatment	1 session x 15 minutes	ii, vii, vi	IFC significantly reduced the pain threshold to cold. There was no significant difference between groups for pressure pain threshold.

Abbreviations: CLBP, chronic low back pain; CTS, carpal tunnel syndrome; DOMS, delayed onset muscle soreness; OA, osteoarthritis; TA, therapeutic alliance.

Table 2. Outcome Measures

	Pain		Activities and Participation
i	Brazilian McGill Pain Questionnaire	xiv	Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)
ii	Conditioned Pain Modulation	xv	Medication Use
iii	Duration of Analgesia	xvi	Nottingham Health Profile (NHP)
iv	Numeric Rating Scale (pain intensity at rest)	xvii	Roland Morris Disability Questionnaire (RMDQ)
v	Numeric Rating Scale (pain intensity with movement)	xviii	Sit to Stand
vi	Pain Pressure Threshold	xix	Time to Walk 15 Meters
vii	Visual Analog Scale (VAS)	xx	Western Ontario and McMasters Osteoarthritis Index (WOMAC)
	Body Structures and Function		**Treatment Evaluation**
viii	Hamstring Isometric Peak Torque	xxi	Credibility and Expectancy Questionnaire (CEQ)
ix	Knee Active ROM	xxii	Global Rating Scale
x	Median Nerve Motor Distal Latency (mMDL)	xxiii	Pain Rehabilitation Expectations Scale (PRES)
xi	Median Sensory Nerve Conduction Velocity (mSNCV)	xxiv	Treatment Effectiveness
xii	Pain-Free Passive ROM	xxv	VAS of Satisfaction of Treatment Experience
xiii	Swelling and Synovial Effusion		

Discussion

In this systematic review, including 10 randomized controlled trials, totaling 898 participants, IFC was found to be effective in the immediate management of musculoskeletal pain.

Carrier frequency, as opposed to AMF, may be the more dominant analgesic parameter. Four thousand Hz is the most commonly used carrier frequency. All studies included that used a carrier frequency of 4,000 Hz reported an immediate reduction in pain or a decrease in use of pain medication. Pereira et al,[1] when using a carrier frequency of 2,000 Hz, found that IFC did not significantly alter pain pressure threshold, and in fact, reduced pain threshold to cold. Correa et al[2] reported that both the 1,000 and 4,000 Hz groups had no significant alterations in pain intensity, but did have significantly lower rates of pain medication usage. In addition, the 1,000 Hz group had significant improvement on the physiological pain parameters of temporal summation and pain pressure threshold (PPT). Therefore, while a carrier frequency of 4,000 Hz has been shown to be effective for pain management, further studies are warranted to examine the effectiveness of other carrier frequencies.

Despite a lack of evidence, many authors regard AMF as the most relevant IFC parameter. Gundog et al[3] compared the effectiveness of different AMFs and found no significantly different analgesic effects. Future research addressing the potential physiologic effects of varying the AMF and the associated clinical implications is needed.

Long term follow-ups had mixed results. Three studies[3-5] found significant improvements at three weeks, one month, and six months, respectively. One study[2] found no significant difference at four months. Further research regarding both the long term effectiveness and the immediate duration of pain relief based on various IFC parameters is needed.

Conclusions

The reviewed studies support use of IFC in the treatment of musculoskeletal pain. More research is needed to determine the optimal parameters and evaluate long-term effectiveness.

Clinical Relevance

Current evidence supports utilization of IFC as an effective adjunctive tool for in-clinic palliative intervention in the short-term management of musculoskeletal pain, which may help improve functional outcomes and reduce patient use of pain medications.