# Percutaneous electrical stimulation improves chronic knee pain and function. A Systematic Review and Meta-analyses

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### ABSTRACT

**Objectives.** The aim of this systematic review and meta-analysis was to evaluate the effectiveness of the percutaneous electrical stimulation in the modulation of pain and its implication in the function of patients with a painful knee condition.

**Methods**. A search was conducted from database inception to September 2023 across PubMed, Web of Science and Scopus databases. Randomized controlled trials were included. Two reviewers performed independent data extraction and methodologic quality assessment of the studies. Study quality was assessed using the PEDro scale and the risk of bias was evaluated with the Cochrane Assessment tool.

**Results**. Eight studies were included. A significant statistical effect was found (p< 0.001) for reducing pain and improving function after treatment. Additionally, a significant statistical effect was presented for reducing pain (p= 0.009) and improving function (p< 0.001) after follow-up. The risk of bias was low.

**Conclusion**. This review showed a positive effect of applying the percutaneous electrical stimulation reducing pain and improving function in adults with a painful knee.

KEYWORDS: knee joint, pain, electrical stimulation therapy, systematic review

## **INTRODUCTION**

Knee pain affects up to 25% of the adult population, and its prevalence has increased a 65% in the past 20 years, causing more than 4 million primary care visits annually. [1] This

condition carries a negative effect on the functionality [2] and the mental health, increasing the risk of developing psychological distress. [3]

The modulation of pain with the electrical current has been widely used in many painful conditions. [4] There are different application forms, including transcutaneous electrical nerve stimulation (TENS), neuromuscular electrical stimulation (NMES), interferential current (IFC), etc. Among the different forms of applying, in the last years, percutaneous electrical stimulation is one of the most clinically used. [4]

The percutaneous electrical stimulation consists of the application through a needle, of a biphasic continuous current with a high or low frequency and a specific pulse duration. [5,6] It has been applied in different tissues and different localization, e.g., periosteal, muscle, nerve. [7] These applications have as main effect the analgesia based on Melzack and Wall control gate theory, [8] bringing potential effects on the activation of inhibition descending pathways of pain. [9]

Percutaneous electrical stimulation has been demonstrated to be effective in the pain treatment of different locations as the low back. [10] The study of Nascimento et al. [10] reported that this treatment can improve pain modulation, reducing motor-evoked potential and increasing intracortical inhibition, suggesting positive effects in patients with central sensitization. [9] However, to date, no systematic review has studied the effects of the percutaneous application in the modulation of chronic knee pain. For this reason, the aim of this systematic review and meta-analysis was to evaluate the effectiveness of the percutaneous electrical stimulation in the modulation of pain and its implication in the function of patients with a painful knee condition.

#### MATERIAL AND METHODS

#### Search strategies and selection criteria

This systematic review and meta-analysis adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. [11] The international Prospective Register of Systematic Reviews (PROSPERO) registration number is CRD42022380071.

An electronic search was conducted using the following electronic databases: PubMed, Web of Science, and Scopus database of randomized controlled trials. Relevant publications were included from inception until September 2023. To define the research question, the PICOS [12] (Participants, Interventions, Comparisons, Outcome and Study design) model was applied.

The search on the different databases was based on: ("Percutaneous electrical stimulation" OR "Intramuscular electrical stimulation" OR "Electrical dry needling" OR "Percutaneous electrical nerve stimulation" OR "Percutaneous TENS" OR "Peripheral nerve stimulation" OR "Percutaneous electric nerve stimulation" OR "Percutaneous electric nerve stimulation" OR "Percutaneous electrical nerve stimulation" OR "Percutaneous neuromodulation therapy" OR "Neuromodulation therapy, percutaneous" OR "Percutaneous neuromodulation" OR

percutaneous" OR "Electrical neuromodulations, percutaneous" OR "Neuromodulation, percutaneous electrical" OR "Neuromodulations, percutaneous electrical" OR "Percutaneous electrical neuromodulations") AND ("Knee"). This strategy was modified and adapted for each database.

The inclusion criteria of the article were: (1) Adult's patients with painful knee; (2) percutaneous electrical stimulation interventions focused on knee pain and knee function; (3) the percutaneous electrical stimulation intervention had to be compared to a control intervention; (4) only randomized clinical trials were included. Full texts in English were included.

The participants in selected studies had to be symptomatic adults ( $\geq$  18 years old) with chronic knee pain that was diagnosed as painful knee, including different etiologies. The trials will be included if they used percutaneous electrical stimulation as a continuous bi-phasic current. The interventions could be compared to any type of stimulation, placebos, or other techniques or a combination of them.

The clinical trials were selected by two reviewers who independently applied the inclusion criteria, initially identified from the title and abstract. the full texts of each trial were also independently evaluated. When there was a disagreement between the reviewers, a third author intervened to resolve the inclusion decision.

Reviewers were not blinded to information relating to the articles reviewed. A standardized formulary was used to extract the data concerning participants, types of intervention, follow-up, clinical outcome measures, and findings. The formulary was elaborated according to the directions of the Cochrane Handbook for Systematic Reviews of Interventions-Version 5.1.0. [13]

The PEDro scale was used independently by the authors to assess the methodological quality of the included studies. The PEDRo scale has proven to be reliable and valid for rating the quality of randomized controlled trials. [14] When available, the PEDro score for each trial was compared with the PEDro database. Another author was consulted in the case of persisting disagreement. Articles were not excluded based on their quality. The PEDro score assesses with 10 items the internal validity and presentation of the statistical analysis of the studies. The presence of indicators of the quality of the evidence is presented as 1 point and not 0 points. A trial was considered of low quality when PEDro score was less than 5 points. [14]

The risk of bias was assessed using the Cochrane Risk of Bias Tool for Randomized Controlled Trials method. [13] It consists of seven elements with six subscales (selection bias, performance bias, detection bias, attrition bias, reporting bias and other bias). It is considered that a study is of high quality when there is low risk for each domain. Fair quality when one criterion does not meet (i.e., high risk of bias for one domain) or two criteria are unclear, and there is no known important limitation that could invalidate the results. Poor quality, when one criterion is not meet or two criteria are unclear, and there are important limitations that could invalidate the results; and when two or more criteria are listed as high or unclear risk of bias.

## Data analysis

Review Manager Software (RevMan version 5.1, updated March 2011) was used to pool the results of the studies and perform a meta-analysis. We contacted trial authors if it was possible when data were insufficient for meta-analyses purposes (e.g., no means provided, no standard deviation provided). Ultimately, only those variables for which data were available were included in the meta-analysis. Variables for which the necessary data could not be obtained were ex-cluded from the analysis.When p-values or 95% confidence intervals were given and standard deviations were missing, these were calculated via the embedded Review Manager calculator. We used I<sub>2</sub> to examine statistical heterogeneity, where the percentages quantified the magnitude of heterogeneity: 25% = 10w, 50% = medium, and 75% = high heterogeneity. [15] Using this scale, if I<sub>2</sub> was higher than 50%, a random-effects model was used. [15] Forest plots were generated to illustrate the overall effect of interventions.

#### RESULTS

We identified 351 studies through database searching. After removing duplicates and screening titles and abstracts of all remaining unique articles, 8 were selected. Eight of them were included after the inclusion criteria were checked [16-23]. Five studies analyzed the effects of the periosteal electrical dry needling, [16,19,20,22,23] two studies analyzed the effects of electrical intramuscular stimulation, [18, 21] one study [17] analyzed the effect of ultrasound-guided percutaneous neuromodulation (Figure 1).

# Please, insert figure 1

Data studies are detailed in Table 1. A total of 742 individuals with painful knees were recruited. The range of age was  $37\pm9.6$  to  $71.5\pm5.6$ . All studies concerned chronic knee pain; however, the range of pain intensity was  $8\pm3.3$  to  $10.6\pm3.4$  when WOMAC Pain was used,  $5.27\pm1.91$  to  $7.921\pm1.04$  when VAS was applied and  $56.4\pm14.56$  to  $56.9\pm18.88$  when the Numeric rating scale was evaluated. The range of pain duration was  $0.58\pm0.22$  to  $11.08\pm1.88$  years.

Please, insert table 1

#### Quality assessment and Risk of Bias

The methodological quality of studies included in this review was assessed according to the PEDro (Physiotherapy Evidence Database) scale. [14] All studies [16-23] reached

the minimum score (6/10) to be considered good quality. The range was from 6/10 to 9/10. The worst quality criteria on which none of the studies reached a positive score was the blinding of physical therapists. The best criteria on which all studies obtained a positive score were in randomization of the sample, the initial comparability of the most important prognostic factors, the follow-up assessment and study point measures and measures of variability. (Table 2).

Please, insert table 2

When Cochrane Risk of Bias Assessment was applied, [13] three of eight studies presented good quality, [18,19,21] and five studies presented poor quality (figure 2). [16,17,20,22,23]

Please, insert figure 2

Table 3 shows the interventions and the results obtained.

## Please, insert table 3

Five of the included studies performed PES by stimulating the periosteum with acupuncture needles, [16,19,20,22,23] a protocol of four to nine acupuncture needles was established at symptomatic sites of the knee concert, and two of the studies also included a booster session. Two of the included studies performed an intramuscular ESP procedure . [18, 21] Only one study evaluated direct nerve stimulation by inserting an acupuncture needle into the perineurium of the femoral nerve. [17]

All the studies carried out a 30-minute ESP, [16,18-23] except for the study by García Bermejo et al. [17] which directly stimulated the nerve with periods of 1.5 minutes. In addition, all included studies included pain and functionality as one of their variables. [16-23] Significant improvements in favor of the PES intervention were found for both pain and functionality in five of the included studies. [16-18,20,23]

#### **Meta-Analysis**

Results obtained in pain and functionality have been analyzed across different clinical moments (post-treatment, follow-up).

## Effects of percutaneous electrical stimulation on pain modulation

Results obtained in pain modulation have been analyzed as shown in Figure 3.

For after treatment moment, the pooled mean difference (MD) showed significant overall effect of percutaneous electrical stimulation when compared to sham control (MD = -0.47; 95% CI = -0.67, -0.26; p < 0.00001), or to other interventions (MD = -0.84; 95% CI = -1.29; -0.39; p < 0.0003). The pooled mean difference (MD) showed significant overall effect of the intervention when compared to control groups (MD = -0.68; 95% CI = -0.92, -0.43; p < 0.00001). Heterogeneity was medium (I<sub>2</sub> = 58%).

## Please, Insert Figure 3a

In a follow-up analysis, the pooled mean difference (MD) didn't show a significant overall effect of percutaneous electrical stimulation when compared to sham control (MD = -0.22; 95% CI = -0.51, 0.06; p = 0.12). However, when percutaneous electrical stimulation was compared to other intervention, the pooled mean difference (MD) showed significant overall effect (MD = -1.22; 95% CI = -2.07; -0.38; p < 0.00001). The pooled mean difference (MD) showed significant overall effect of the intervention when compared to control groups (MD = -0.75; 95% CI = 1.25, -0.26; p = 0.003). Heterogeneity was high (I<sup>2</sup> = 89%).

#### Please, Insert Figure 3b

#### Effects of percutaneous electrical stimulation on functionality

Results obtained in functionality have been analyzed as shown in Figure 4.

When the functionality was analyzed after treatment, the mean difference (MD) showed a significant overall effect of percutaneous electrical stimulation when compared to sham controls (MD = -0.24; 95% CI = -0.46, -0.03; p = 0.03), and to other intervention (MD = -0.65; 95% CI = -0.89, -0.42; p < 0.00001). The mean difference (MD) of the percutaneous electrical stimulation compared to control groups showed significant overall effect (MD = -0.86; 95% CI = -1.29, -0.43; p = 0.0003). Analysis showed high heterogeneity (I<sup>2</sup> = 69%).

#### Please, Insert Figure 4a

When the functionality was analyzed in the follow-up, the mean difference (MD) didn't show significant overall effect of percutaneous electrical stimulation when compared to sham controls (MD = -0.2; 95% CI = -0.42, 0.02; p = 0.08), but the mean difference (MD) showed significant overall effect of percutaneous electrical stimulation when compared to other interventions (MD = -1.48; 95% CI = -2.52, -0.45; p < 0.00001). The mean difference (MD) of percutaneous electrical stimulation compared to control groups showed significant overall effect (MD = -0.78; 95% CI = -1.30, -0.25; p = 0.004). Analysis showed medium heterogeneity (I<sup>2</sup> = 90%).

Please, Insert Figure 4b

### DISCUSSION

The aim of this systematic review and meta-analysis was to evaluate the effectiveness of the percutaneous electrical stimulation in the modulation of pain and its implication in the function of patients with a painful knee condition. The results showed a positive effect of the percutaneous electrical stimulation in painful knee conditions, improving pain and function.

The time spent in the treatment was longer than 20 minutes, in most of the included studies, the application time was 30 minutes, [16,18-23] only the study of Garcia-Bemejo et al. presented an application time of 1.5 minutes since the application of the current went directly to the perineurium of the nerve. [17] In a similar way to the study of Hamza et al. [24] that reported significant clinical results with applications of more than 15 minutes.

The needle placement was also heterogeneous. One study [17] applied the needle near the nerve, two studies [18, 21] placed the needles in muscle points, and the rest of the studies applied it in knee periosteal points. [16,19,20,22,23] Nevertheless, in the same line as our results, previous studies [25,26] have already compared that needle placement alters the efficacy of the treatment.

The analysis of the functionality has shown significant improvement after intervention and even showed significant results in the follow-up. [16,19,20,22,23] In this line, previous research has obtained similar results in functionality when electrical currents were applied with percutaneous applications for low back pain [27] and knee arthroplasty. [28]

## Limitations

This review has some limitations to comments. Firstly, despite the positive results obtained, they should be interpreted with caution due to the differences in the electrical parameters (frequency, pulse width, duration) and the needle placement. Additionally, more studies that apply PENS are necessary to realize a good evaluation of its effects. Another limitation is that the current systematic review and meta-analysis focus exclusively on studies categorized as percutaneous electrical stimulation, and other applications as electroacupuncture have not been included. Finally, the follow-up of the studies was carried out at different moments, and it could be confusing, it should be standardized in the future.

## Conclusion

In conclusion, the use of percutaneous electrical stimulation was found a positive effect in reducing pain and improving short- and long-term function in adults with painful knee. Future studies are needed to clarify the treatment doses and patient profiles that may benefit most from this intervention.

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# Figure 2. Risk of bias

Study ID							
Tian et al. 2022	•		•	•	•		Low risk
García-bermejo et al. (2020)	•	1	+	•	+		Some concerns
Da Graca-Tarragó et al. (2019)	•	+	+	+	•	•	High risk
Dunning et al. (2018)	•	+	+	+	•	•	
Elbadawy et al. (2017)	•	•	•	+	•	• D1	Randomisation process
Da Graca-Tarragó et al. (2016)	•	+	+	+	•	+ D2	Deviations from the intended interventions
Weiner et al. (2013)	•	•	•	+	•	<b>•</b> D3	Missing outcome data
Weiner et al. (2007)	1	•	+	1	•	• D4	Measurement of the outcome
						DS	Selection of the reported result

# Figure 3. Pain assessment

# Figure 3a. Pain in post-treatment assessment

# Figure 3b. Pain in follow-up assessment

Study or Subaroun	Maza	SD	Total	Maar	Control	Total	Weight	IV Random 95% Cl	Vaar	IV Pandom 05% Cl
1111 C vs Sham	mean	30	rotal	mean	50	Total	weight	iv, kandom, 93% Cl	rear	IV, Kandom, 95% CI
Da Craca-Tarranó (VAS_C2CA)	2 5 2	1.74	15	2.96	1 10	15	6 59/	0 97 [ 1 62 .0 11]	2010	
Da Graca-Tarragó (VAS)	2.33	1.74	12	4 33	1.19	13	5.04	-0.87 [-1.02, -0.11]	2015	
Valoar (WOMAC Pain ClurC2)	5.11	1.34	13	9.32	1.23	13	12 50	-0.04 [-1.05, -0.03]	2010	
Weiner (WOMAC Pain, G1VSG3)	0.8	4.2	5/	0.3	4.4	61	12.5%	-0.35 [-0.71, 0.02]	2013	
Weiner (WOMAC Pain, G2VSG3)	6.17	9.1	38	0.5	9.9	10	12.0%	-0.57 [-0.74, -0.01]	2013	
Subtotal (95% CI)	0.17	3.72	197	8.04	3.25	44	48.0%	-0.55 [-0.96, -0.11]	2007	
	- 2.60	15 - 1 17	10/	11.12	00/	194	40.3%	0.47 [-0.07, -0.20]		
neterogeneity: Tau" = 0.00; Chi"	= 2.08, 0	JI = 4 (F)	= 0.6	T); I, =	0%					
rest for overall effect: $L = 4.48$ (F	< 0.000	(01)								
1.1.2 IG vs Other Intervention										
Tian (VAS)	2.2	0.96	25	3.08	0.86	25	8.6%	-0.95 [-1.54, -0.36]	2022	
García-Bermeio (NRS)	45.8	23.08	13	48 3	17.19	15	6.6%	-0.12 [-0.86 0.62]	2020	
Da Graca-Tarranó (VAS, ClucC2)	0.51	1.31	15	3 33	2 21	15	5.8%	-1.51 [-2.34 -0.60]	2019 ←	
Da Graca-Tarragó (VAS, G3veC2)	2 53	1.74	15	3 32	2 21	15	6.8%	-0.39[-1.11.0/33]	2019	
Junning (WOMAC Pain)	3.4	26	118	4.8	2.8	117	14 6%	-0.52 [-0.78 -0.26]	2018	
Handawy (VAS)	3 80	0.89	30	5 37	0.02	30	8.6%	-1.61 [-2.20 -1.02]	2017	
Subtotal (95% CI)	5.69	0.00	216	3.31	0.53	217	51.1%	-0.84 [-1.29, -0.39]	2017	
Heterogeneity: Tau <sup>2</sup> = 0.22. Chi <sup>2</sup>	= 18 62	df = s	(P = 0.4	102)- 12	= 73%		3 41 4 70	0.011 1.000 (0.00)		
Test for overall effect: 7 = 3.63 (	= 10.03	13)	n = 0.1	0021,1	- 13/6					
(ist for overall effect. 2 = 5.05 (r	- 0.000									<b>—</b>
Total (95% CI)			403			411	100.0%	-0.68 [-0.92, -0.43]		•
Heterogeneity: $Tau^2 = 0.09$ Chi <sup>2</sup>	= 24.07	df = 10	P = 0	007)	2 = 5.89	1				
Test for overall effect: $Z = 5.46$ (F	< 0.000	001)			50/					-1 -0.5 0 0.5
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	Eve	rimont	al	C	ontrol		3	td Maan Difference		Std. Mean Difference
	CADE	Innenu						itu, mean Dinerence		
Study or Subgroup	Mean	SD	Total	Mean	SD T	Fotal	Weight	IV, Random. 95% CI	Year	IV, Random, 95% CI
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itudy or Subgroup	Mean	SD	Total	Mean	SD 1	<u>fotal</u>	Weight	IV, Random, 95% CI	Year	IV, Random, 95% CI
itudy or Subgroup .3.1 IG vs Sham Veiner (WOMAC Pain, G1vsG3)	Mean 6.1	<b>SD</b>	Total	Mean 7.9	SD 1	fotal 61	Weight	IV, Random, 95% CI	Year 2013	IV, Random, 95% CI
Study or Subgroup L.3.1 IG vs Sham Neiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3)	Mean 6.1 6.6	<b>SD</b> 3.5 3.6	<b>Total</b> 57 58	Mean 7.9 7.9	<b>SD</b> 1 4.93 4.93	61 61	Weight 15.4% 15.4%	IV, Random, 95% CI -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06]	Year 2013 2013	IV, Random, 95% Cl
tudy or Subgroup I.3.1 IG vs Sham Veiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain)	6.1 6.6 8.32	3.5 3.6 3.93	57 58 44	Mean 7.9 7.9 7.97	SD 1 4.93 4.93 3.94	61 61 44	Weight 15.4% 15.4% 15.0%	-0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51]	Year 2013 2013 2007	IV, Random, 95% Cl
tudy or Subgroup L.3.1 IG vs Sham Veiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) ubtotal (95% CI)	6.1 6.6 8.32	SD 3.5 3.6 3.93	57 58 44 159	Mean 7.9 7.9 7.97	<b>SD</b> 1 4.93 4.93 3.94	61 61 44 166	Weight 15.4% 15.4% 15.0% 45.8%	IV, Random, 95% CI -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06]	Year 2013 2013 2007	IV, Random, 95% Cl
Study or Subgroup 1.3.1 IG vs Sham Veiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) Subtotal (95% CI) feterogeneity: Tau <sup>2</sup> = 0.03: Chi <sup>2</sup>	6.1 6.6 8.32 <sup>2</sup> = 3.36	SD 3.5 3.6 3.93 df = 2	57 58 44 159 (P = 0.	Mean 7.9 7.9 7.97 .19): 1 <sup>2</sup>	<b>SD</b> 1 4.93 4.93 3.94 = 40%	61 61 44 166	Weight 15.4% 15.4% 15.0% 45.8%	IV, Random, 95% CI -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06]	Year 2013 2013 2007	IV, Random, 95% CI
Study or Subgroup 1.3.1 IG vs Sham Neiner (WOMAC Pain, G1vsG3) Neiner (WOMAC Pain, G2vsG3) Neiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> Test for overall effect: Z = 1.55	$6.1 \\ 6.6 \\ 8.32 \\ e^2 = 3.36 \\ (P = 0.12) $	SD 3.5 3.6 3.93 df = 2	57 58 44 159 (P = 0.	Mean 7.9 7.97 7.97	<b>SD</b> 1 4.93 4.93 3.94 = 40%	61 61 44 166	Weight 15.4% 15.4% 15.0% 45.8%	IV, Random, 95% Cl -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06]	Year 2013 2013 2007	IV, Random, 95% Cl
tudy or Subgroup L3.1 IC vs Sham Weiner (WOMAC Pain, G1vsG3) Weiner (WOMAC Pain, G2vsG3) Weiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> Fest for overall effect: Z = 1.55	$\frac{6.1}{6.6}$ 8.32 $\frac{2}{2} = 3.36$ $(P = 0.12)$	SD 3.5 3.6 3.93 df = 2	57 58 44 159 (P = 0.	Mean 7.9 7.9 7.97 19); I <sup>2</sup>	SD 1 4.93 4.93 3.94 = 40%	61 61 44 166	Weight 15.4% 15.4% 15.0% 45.8%	IV. Random, 95% CI -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06]	Year 2013 2013 2007	IV, Random, 95% Cl
tudy or Subgroup L3.1 IG vs Sham Veiner (WOMAC Pain, C1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> Fest for overall effect: Z = 1.55 I 3.2 IC vs Other Intervention	$\frac{6.1}{6.6}$ 8.32 $2^{2} = 3.36$ $(P = 0.12)$	SD 3.5 3.6 3.93 df = 2	57 58 44 159 (P = 0.	Mean 7.9 7.97 19); I <sup>2</sup>	SD 1 4.93 4.93 3.94 = 40%	61 61 44 166	Weight 15.4% 15.0% 45.8%	IV, Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06]	Year 2013 2013 2007	IV, Random, 95% Cl
Study or Subgroup L3.1 IG vs Sham Veiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain, Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> rest for overall effect: Z = 1.55 .3.2 IG vs Other Intervention	$\frac{6.1}{6.6}$ 8.32 $\frac{2}{2} = 3.36$ (P = 0.12)	SD 3.5 3.6 3.93 df = 2	57 58 44 159 (P = 0.	Mean 7.9 7.97 19); I <sup>2</sup>	SD 1 4.93 4.93 3.94 = 40%	61 61 44 166	Weight 15.4% 15.4% 15.0% 45.8%	IV, Random, 95% Cl -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06]	Year 2013 2013 2007	IV, Random, 95% Cl
tudy or Subgroup L3.1 IG vs Sham Veiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> rest for overall effect: Z = 1.55 L3.2 IG vs Other Intervention Tian (VAS)	$\frac{6.1}{6.6}$ 8.32 $\frac{2}{2} = 3.36$ (P = 0.12) 0.8	SD 3.5 3.6 3.93 df = 2 2) 0.71	Total 57 58 44 159 (P = 0.	Mean 7.9 7.97 19); I <sup>2</sup> 1.48	SD 1 4.93 4.93 3.94 = 40%	61 61 44 166 25	Weight 15.4% 15.4% 15.0% 45.8%	IV, Random, 95% CI -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32]	Year 2013 2013 2007 2022	IV, Random, 95% Cl
itudy or Subgroup 1.3.1 IG vs Sham Weiner (WOMAC Pain, G1vsG3) Weiner (WOMAC Pain, G2vsG3) Weiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> Fest for overall effect: Z = 1.55 1.3.2 IG vs Other Intervention Tian (VAS) García-Bermejo (NRS)	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 $2^{2} = 3.360$ (P = 0.12 0.8 33.1	SD 3.5 3.6 3.93 df = 2 2) 0.71 21.05	Total 57 58 44 159 (P = 0. 25 13	Mean 7.9 7.97 1.19); 1 <sup>2</sup> 1.48 42.3	SD 1 4.93 4.93 3.94 = 40%	61 61 44 166 25 15	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2%	IV, Random, 95% CI 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35]	Year 2013 2013 2007 2022 2022	IV, Random, 95% Cl
study or Subgroup L3.1 IG vs Sham Veiner (WOMAC Pain, C1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> fest for overall effect: Z = 1.55 L3.2 IG vs Other Intervention Tian (VAS) Janning (WOMAC Pain)	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 $2^{2} = 3,36,$ (P = 0.12 0.8 33.1 2.8	SD 3.5 3.6 3.93 df = 2 0.71 21.05 2.5	Total 57 58 44 159 (P = 0. 25 13 118	Mean 7.9 7.97 19); I <sup>2</sup> 1.48 42.3 5.2	SD 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2	fotal 61 61 44 166 25 15 117	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0%	IV, Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57]	Year 2013 2013 2007 2022 2020 2018	IV, Random, 95% Cl
study or Subgroup L3.1 IC vs Sham Weiner (WOMAC Pain, G1vsG3) Weiner (WOMAC Pain, G2vsG3) Weiner (WOMAC Pain) Subtotal (95% C1) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> Fest for overall effect: Z = 1.55 L3.2 IC vs Other Intervention Tian (VAS) García-Bermejo (NRS) Dunning (WOMAC Pain) Hadawy (VAS)	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 $2^{2} = 3.36$ (P = 0.12 0.8 33.1 2.8 2.47	SD 3.5 3.6 3.93 df = 2 0.71 21.05 2.5 0.5	Total 57 58 44 159 (P = 0. 25 13 118 30	Mean 7.9 7.97 19); I <sup>2</sup> 1.48 42.3 5.2 4.73	SD 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99	fotal 61 61 44 166 25 15 117 30	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3%	IV, Random, 95% Cl IV, Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-35, 72, -211]	Year 2013 2013 2007 2022 2020 2018 2017	IV, Random, 95% Cl
study or Subgroup 1.3.1 IG vs Sham Weiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) (ubtotal (95% CI) 4tetrogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> rest for overall effect: Z = 1.55 1.3.2 IG vs Other Intervention Tian (VAS) Jarcía-Bermejo (NRS) Junning (WOMAC Pain) Ibadawy (VAS) ubtotal (95% CI)	$\begin{array}{c} \text{Mean} \\ \hline \text{Mean} \\ \hline 6.1 \\ 6.6 \\ 8.32 \\ \hline 2 = 3.36 \\ (P = 0.12 \\ 0.8 \\ 33.1 \\ 2.8 \\ 2.47 \end{array}$	SD 3.5 3.6 3.93 df = 2 0.71 21.05 2.5 0.5	Total 57 58 44 159 (P = 0. 25 13 118 30 186	Mean 7.9 7.97 19); I <sup>2</sup> 1.48 42.3 5.2 4.73	SD 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99	fotal 61 61 44 166 25 15 117 30 187	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2%	IV, Random, 95% CI IV, Random, 95% CI -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-27, -0.38]	Year           2013           2013           2007	IV, Random, 95% Cl
study or Subgroup L3.1 IG vs Sham Weiner (WOMAC Pain, C1vsG3) Veiner (WOMAC Pain, C2vsG3) Veiner (WOMAC Pain) ubtotal (95% CI) L3.2 IG vs Other Intervention Tian (VAS) Tarcía-Bermejo (NRS) Junning (WOMAC Pain) Ibadawy (VAS) ubtotal (95% CI)	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 $2 = 3.36$ (P = 0.12 0.8 33.1 2.8 2.47 2.20 2.20 2.20 2.20 2.20 2.20 2.20 2.2	SD 3.5 3.6 3.93 df = 2 0.71 21.05 2.5 0.5	Total 57 58 44 159 (P = 0. 25 13 118 30 186	Mean 7.9 7.97 19); l <sup>2</sup> 1.48 42.3 5.2 4.73	SD 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99	fotal 61 61 61 44 166 25 15 117 30 187	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2%	IV, Random, 95% CI 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38]	Year           2013           2013           2007           2022           2020           2018           2017	IV, Random, 95% Cl
Study or Subgroup 1.3.1 IG vs Sham Weiner (WOMAC Pain, C1vsG3) Weiner (WOMAC Pain, C2vsG3) Weiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> Test for overall effect: Z = 1.55 1.3.2 IG vs Other Intervention Tian (VAS) Sarcia-Bermejo (NRS) Junning (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>2</sup>	$\frac{1}{1}$ $\frac{6.1}{6.6}$ $\frac{6.32}{2}$ $\frac{2}{2} = 3.366$ $\frac{1}{2}$ $\frac{0.8}{33.1}$ $\frac{2.8}{2.47}$ $\frac{2}{2} = 28.52$	SD 3.5 3.6 3.93 df = 2 0.71 21.05 2.5 0.5 2, df = 1	Total 57 58 44 159 (P = 0. 25 13 118 30 86 6 < 0	Mean 7.9 7.97 19); I <sup>2</sup> 1.48 42.3 5.2 4.73 0.0000	SD 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); l <sup>2</sup> =	Fotal         61         61         61         44         166         25         15         117         30         187         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         80%	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2%	1. Wear Difference 1. Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% Cl
Study or Subgroup L3.1 IG vs Sham Weiner (WOMAC Pain, G1vsG3) Weiner (WOMAC Pain, G2vsG3) Weiner (WOMAC Pain) Subtotal (95% C1) 4tetrogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> Fest for overall effect: Z = 1.55 L3.2 IG vs Other Intervention Tian (VAS) Jarcía-Bermejo (NRS) Junning (WOMAC Pain) Jibadawy (VAS) Jubotal (95% C1) 4tetrogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>1</sup> fest for overall effect: Z = 2.85	$\begin{array}{c} \text{Mean} \\ \hline \text{Mean} \\ \hline 6.1 \\ 6.6 \\ 8.32 \\ \hline 2 = 3.36 \\ (P = 0.12 \\ 0.8 \\ 33.1 \\ 2.8 \\ 2.47 \\ \hline 2 = 28.52 \\ (P = 0.00 \\$	SD 3.5 3.6 3.93 df = 2 2) 0.711 21.05 2.5 0.5 2, df = 1 2, df = 2	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < 0	Mean 7.9 7.9 7.97 1.19); t <sup>2</sup> 4.23 5.2 4.73	SD 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); I <sup>2</sup> =	Fotal         61         61         61         44         166         25         15         117         30         187         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         89%         80%	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2%	IV. Random, 95% Cl -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38]	Year           2013           2013           2007	IV, Random, 95% Cl
Study or Subgroup 1.3.1 IC vs Sham Weiner (WOMAC Pain, C1vsG3) Weiner (WOMAC Pain, C2vsG3) Weiner (WOMAC Pain) Subtotal (95% C1) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> Test for overall effect: Z = 1.55 1.3.2 IC vs Other Intervention Tian (VAS) Dunning (WOMAC Pain) - Badawy (VAS) Subtotal (95% C1) Heterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>1</sup> rest for overall effect: Z = 2.85 (VAS)	$\begin{array}{c} \text{Expectation}\\ \text{Mean}\\ \hline \\ 6.1\\ 6.6\\ 8.32\\ \hline \\ 2 = 3,36\\ (P = 0.12\\ 0.8\\ 33.1\\ 2.8\\ 2.47\\ \hline \\ 2.8\\ 2.47\\ \hline \\ (P = 0.00\\ \hline \end{array}$	SD 3.5 3.6 3.93 df = 2 2) 0.71 21.05 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 14 14 14 14 14 14 14 14 14 14	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < 1	Mean 7.9 7.97 7.97 1.9); + <sup>2</sup> 1.48 42.3 5.2 4.73 0.0000	<b>SD</b> 1 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); 1 <sup>2</sup> =	Fotal         61         61         61         64         166         166         166         166         177         30         187         89%         187	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2%	IV. Random, 95% CI 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38]	Year           2013           2013           2007	IV, Random, 95% Cl
Study or Subgroup 1.3.1 IC vs Sham Weiner (WOMAC Pain, C1vsG3) Weiner (WOMAC Pain, C2vsG3) Weiner (WOMAC Pain) Subtotal (95% CI) 4eterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> Fest for overall effect: Z = 1.55 1.3.2 IG vs Other Intervention Tian (VAS) Sarcía-Bermejo (NRS) Dunning (WOMAC Pain) Subtotal (95% CI) 4eterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>2</sup> fest for overall effect: Z = 2.85 (Total (95% CI)	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 $2^2 = 3.36.$ (P = 0.12 0.8 33.1 2.8 2.47 $2^2 = 28.52.$ (P = 0.00	SD 3.5 3.6 3.93 df = 2 2.0 0.71 21.05 2.5 0.5 2, df = 1 244	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < 1) 345	Mean 7.9 7.97 7.97 1.9); + <sup>2</sup> 1.48 42.3 5.2 4.73 0.0000	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); l <sup>2</sup> =	Fotal         61         61         61         64         44         156         25         15         117         30         187         89%         353	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	IV. Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% Cl
Study or Subgroup L3.1 IC vs Sham Weiner (WOMAC Pain, G1vsG3) Weiner (WOMAC Pain, G2vsG3) Weiner (WOMAC Pain) Subtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> Fest for overall effect: Z = 1.55 L.3.2 IC vs Other Intervention Tian (VAS) Junning (WOMAC Pain) Bibdawy (VAS) Jubtotal (95% CI) Heterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>1</sup> 'est for overall effect: Z = 2.85 (Tatal (95% CI)	$\frac{6.1}{6.6} = \frac{6.1}{3.2}$ $\frac{6.1}{2} = \frac{6.1}{3.36}$	SD 3.5 3.6 3.93 df = 2 2) 0.711 21.05 2.5 0.5 2, df = 1 2, df = 2 2, df = 1 2, df = 2 2, df = 1 2, df = 2 2, df = 1 2, df = 1 3, df = 1 4, df = 1 3, df = 1 3, df = 1 3, df = 1	Total 57 58 44 159 (P = 0. 25 13 186 3 (P < 1 345 5 (P < 1)	Mean 7.9 7.9 7.97 1.9); 1 <sup>2</sup> 1.48 42.3 5.2 4.73 0.00000	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); I <sup>2</sup> =	fotal         61 <th6< td=""><td>Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%</td><td><ul> <li>IV, Random, 95% Cl</li> <li>0.42 [-0.78, -0.05]</li> <li>-0.30 [-0.66, 0.06]</li> <li>0.09 [-0.33, 0.51]</li> <li>-0.22 [-0.51, 0.06]</li> </ul> -0.90 [-1.49, -0.32] <ul> <li>-0.40 [-1.15, 0.35]</li> <li>-0.83 [-1.10, -0.57]</li> <li>-2.84 [-3.57, -2.11]</li> <li>-1.22 [-2.07, -0.38]</li> </ul> -0.75 [-1.25, -0.26]</td><td>Year 2013 2013 2007 2022 2020 2018 2017 -</td><td>IV, Random, 95% Cl</td></th6<>	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	<ul> <li>IV, Random, 95% Cl</li> <li>0.42 [-0.78, -0.05]</li> <li>-0.30 [-0.66, 0.06]</li> <li>0.09 [-0.33, 0.51]</li> <li>-0.22 [-0.51, 0.06]</li> </ul> -0.90 [-1.49, -0.32] <ul> <li>-0.40 [-1.15, 0.35]</li> <li>-0.83 [-1.10, -0.57]</li> <li>-2.84 [-3.57, -2.11]</li> <li>-1.22 [-2.07, -0.38]</li> </ul> -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% Cl
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tudy or Subgroup 1.3.1 IG vs Sham Weiner (WOMAC Pain, C1vsG3) Veiner (WOMAC Pain, C2vsG3) Veiner (WOMAC Pain) ubtotal (95% C1) teterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> rest for overall effect: Z = 1.55 1.3.2 IG vs Other Intervention Tian (VAS) Junning (WOMAC Pain) Ibadawy (VAS) ubtotal (95% C1) leterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>1</sup> rest for overall effect: Z = 2.85 (otal (95% C1) leterogeneity: Tau <sup>2</sup> = 0.39; Chi <sup>1</sup> est for overall effect: Z = 2.96 (otal (95% C1)	$\begin{array}{c} \text{Experimental mean} \\ \text{Mean} \\ \hline \\ 6.1 \\ 6.6 \\ 8.32 \\ \end{array}$	<u>SD</u> 3.5 3.6 3.93 df = 2 2) 0.71 21.05 2.5 0.5 2.5 0.5 2.4 df = 2	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < 0 345 6 (P < 0	Mean 7.9 7.97 1.97; + <sup>2</sup> 1.48 42.3 5.2 4.73 0.0000	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); I <sup>2</sup> =	Fotal         61 <th6< td=""><td>Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%</td><td>IV, Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]</td><td>Year 2013 2013 2007 2022 2020 2018 2017 -</td><td>IV, Random, 95% CI</td></th6<>	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	IV, Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% CI
Study or Subgroup 1.3.1 IC vs Sham Weiner (WOMAC Pain, C1vsG3) Weiner (WOMAC Pain, C2vsG3) Weiner (WOMAC Pain, C2vsG3) Weiner (WOMAC Pain) Subtotal (95% CI) 4eterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>7</sup> Isat for overall effect: Z = 1.55 1.3.2 IG vs Other Intervention Tian (VAS) Sarcía-Bermejo (NRS) Dunning (WOMAC Pain) Subtotal (95% CI) Subtotal (95% CI) 4eterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>7</sup> Fest for overall effect: Z = 2.85 (Total (95% CI) 4eterogeneity: Tau <sup>2</sup> = 0.39; Chi <sup>7</sup> Fest for overall effect: Z = 2.96 (Total (95% CI) Fest for overall effect: Z = 2.96 (Total (95% CI) Fest for overall effect: Z = 2.96 (Total (95% CI) Set for subgroup differences: C	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 0.8 33.1 2.8 2.47 2 = 28.5; (P = 0.0)	<u>SD</u> 3.5 3.6 3.93 df = 2 2) 0.71 21.05 2.5 0.5 2, df = 1 2, df = 1 3, df = 0 3, df = 0	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < () 345 6 (P < () 1 (P =	Mean 7.9 7.97 1.97; 1 1.48 42.3 5.2 4.73 0.0000 0.03),	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 $1); 1^2 =$ $1); 1^2 = 79$	Fotal         61         61         61         44         166         25         15         117         30         187         89%         353         89%         353         89%         44%         44%         44%         44%         44%         44%         44%         44%         44%         44%         44%         44%         45%	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	IV. Random, 95% Cl IV. Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% Cl
Study or Subgroup L3.1 IG vs Sham Weiner (WOMAC Pain, C1vsG3) Weiner (WOMAC Pain, G2vsG3) Weiner (WOMAC Pain) iubutal (95% C1) Heterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> rest for overall effect: Z = 1.55 L.3.2 IG vs Other Intervention Tian (VAS) Jarcía-Bermejo (NRS) Junning (WOMAC Pain) Jibadawy (VAS) Jubtotal (95% C1) Heterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>1</sup> rest for overall effect: Z = 2.85 <b>Total (95% C1)</b> Heterogeneity: Tau <sup>2</sup> = 0.39; Chi <sup>1</sup> rest for overall effect: Z = 2.96 rest for subgroup differences: C	$\begin{array}{l} \textbf{Mean} \\ \textbf{Mean} \\ \hline \\ 6.1 \\ 6.6 \\ 8.32 \\ \end{array}$ $\begin{array}{l} 2 \\ 3.3.1 \\ 2.8 \\ 2.47 \\ \end{array}$ $\begin{array}{l} 2.8 \\ 2.47 \\ (P = 0.01) \\ \hline \\ (P = 0.00) \\ (P = 0.00) \\ \end{array}$	<u>SD</u> 3.5 3.6 3.93 df = 2 0.71 21.05 2.5 0.5 2.5 0.5 2.6 df = 3 3.9 3.6 3.93 0.71 21.05 2.5 0.5 3.6 4.7 3.9 3.6 3.93 3.9	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < 0 1 (P =	Mean 7.9 7.97 1.97 1.48 42.3 5.2 4.73 0.0000 0.033),	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); $l^2 =$ 1); $l^2 =$ 1); $l^2 =$ 1); $l^2 =$ 79	Fotal         61           61         44           166         25           15         15           117         30           187         89%           353         89%           .4%         .4%	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	IV, Random, 95% Cl -0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% Cl
tudy or Subgroup 1.3.1 IC vs Sham Veiner (WOMAC Pain, C1vsC3) Veiner (WOMAC Pain, C2vsC3) Veiner (WOMAC Pain) ubtotal (95% C1) leterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>1</sup> cest for overall effect: Z = 1.55 3.2 IG vs Other Intervention Tian (VAS) Junning (WOMAC Pain) Ibadawy (VAS) ubtotal (95% C1) leterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>1</sup> cest for overall effect: Z = 2.85 (otal (95% C1) leterogeneity: Tau <sup>2</sup> = 0.39; Chi <sup>1</sup> cest for overall effect: Z = 2.96 (otal (95% C1) leterogeneity: Tau <sup>2</sup> = 0.39; Chi <sup>1</sup> cest for subgroup differences: C	$\begin{array}{l} \textbf{Mean} \\ \textbf{Mean} \\ \hline \textbf{6.1} \\ 6.6 \\ 8.32 \\ \hline \textbf{6.8} \\ 3.3.1 \\ 2.8 \\ 2.47 \\ \hline \textbf{6.8} \\ 3.3.1 \\ 2.8 \\ 2.47 \\ \hline \textbf{7} \\ 2 = 28.5; \\ \textbf{7} \\ P = 0.00 \\ \hline \textbf{1} \\ P =$	<u>SD</u> 3.5 3.6 3.93 df = 2 0.711 21.05 2.5 0.5 2.5 0.5 2.4 (df = 1) 2.5 0.5 (df = 2) 3.6 (df = 2) 3.9 (df = 2) (df = 2) (d	Total 57 58 44 159 (P = 0. 25 13 118 30 186 3 (P < 0 345 5 (P < 0 1 (P =	Mean 7.9 7.9 7.97 1.19); 1 <sup>2</sup> 1.48 42.3 5.2 4.73 0.0000 0.03),	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 $1); 1^2 =$ $1); 1^2 =$ $1^2 = 79$	Fotal         61         61         61         44         166         25         15         117         30         187         89%         353         89%         353         89%         44%	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	IV, Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% Cl
tudy or Subgroup 3.1 IC vs Sham Veiner (WOMAC Pain, G1vsG3) Veiner (WOMAC Pain, G2vsG3) Veiner (WOMAC Pain) ubtotal (95% CI) eterogeneity: Tau <sup>2</sup> = 0.03; Chi <sup>2</sup> est for overall effect: Z = 1.55 3.2 IG vs Other Intervention ian (VAS) arcía-Bermejo (NRS) unning (WOMAC Pain) badawy (VAS) ubtotal (95% CI) eterogeneity: Tau <sup>2</sup> = 0.64; Chi <sup>2</sup> est for overall effect: Z = 2.85 ( otal (95% CI) eterogeneity: Tau <sup>2</sup> = 0.39; Chi <sup>2</sup> est for subgroup differences: C	$\frac{Mean}{6.1}$ 6.1 6.6 8.32 9.8 9.33 0.8 33.1 2.8 2.47 2.2 2.8 2.47 2.2 2.8 (P = 0.0(0 + 1)) (P = 0.0(0 + 1	<u>SD</u> 3.5 3.6 3.93 df = 2 2) 0.71 21.05 2.5 0.5 2.5 0.5 2.6 df = 1 2.9 0.71 21.05 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 2.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0	Total 57 58 44 159 (P = 0. 25 13 118 30 186 6 (P < 0 1 (P =	Mean 7.9 7.97 1.9); t <sup>2</sup> 1.48 42.3 5.2 4.73 0.0000 0.033),	<b>SD</b> 1 4.93 4.93 3.94 = 40% 0.77 23.1 3.2 0.99 1); $l^2 =$ 1); $l^2 =$ 1); $l^2 =$ 79	Fotal         61         61         61         44         166         25         15         117         30         187         89%         353         89%         353         89%         .4%         353         89%         .4%         353         89%         .4%         353         89%         .4%         353         89%         .4%         353         89%         .4%         353         89%         .4%         353         89%         .4%         .4%         353         .4%	Weight 15.4% 15.4% 15.0% 45.8% 13.6% 12.2% 16.0% 12.3% 54.2% 100.0%	IV. Random, 95% Cl 0.42 [-0.78, -0.05] -0.30 [-0.66, 0.06] 0.09 [-0.33, 0.51] -0.22 [-0.51, 0.06] -0.90 [-1.49, -0.32] -0.40 [-1.15, 0.35] -0.83 [-1.10, -0.57] -2.84 [-3.57, -2.11] -1.22 [-2.07, -0.38] -0.75 [-1.25, -0.26]	Year 2013 2013 2007 2022 2020 2018 2017 -	IV, Random, 95% C

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# Figure 4. Functionality assessment

# Figure 4a. Functionality in post-treatment assessment

# Figure 4b. Functionality in follow-up assessment

	Expe	riment	tal	С	ontrol			Std. Mean Difference		Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year	IV, Random, 95% CI
1.2.1 IG vs Sham										
Weiner (WOMAC Function, G1vsG3)	23.8	13.7	57	27	14.6	61	18.3%	-0.22 [-0.59, 0.14]	2013	
Weiner (WOMAC Function, G2vsG3)	24.4	13.6	58	27	14.6	61	18.3%	-0.18 [-0.54, 0.18]	2013	
Weiner (WOMAC Function)	18.11	10.47	44	22.02	11.48	44	16.6%	-0.35 [-0.77, 0.07]	2007	
Subtotal (95% CI)			159			166	53.2%	-0.24 [-0.46, -0.03]		$\bullet$
Heterogeneity: Tau <sup>2</sup> = 0.00; Chi <sup>2</sup> = 0	.38, df =	2 (P =	0.83); 1	<sup>2</sup> = 0%						
Test for overall effect: Z = 2.19 (P =	0.03)									
1.2.2 IG vs Other Intervention										
Tian (WOMAC Function)	95.15	2.44	25	99.68	3.66	25	11.7%	-1.43 [-2.06, -0.81]	2022 -	
Dunning (WOMAC Function)	12.1	9.8	118	18.7	10.9	117	21.1%	-0.63 [-0.90, -0.37]	2018	
Elbadawy (KOOS ADL)	-32.99	5.71	30	-28.73	5.98	30	14.0%	-0.72 [-1.24, -0.20]	2017	
Subtotal (95% CI)			173			172	46.8%	-0.86 [-1.29, -0.43]		
Heterogeneity: Tau <sup>2</sup> = 0.09; Chi <sup>2</sup> = 5	.32, df =	2 (P =	0.07); 1	<sup>2</sup> = 62%						
Test for overall effect: $Z = 3.91 (P < $	0.0001)									
Total (95% CI)			332			338	100.0%	-0.54 [-0.83, -0.24]		•
Heterogeneity: $Tau^2 = 0.09$ ; $Chi^2 = 1$	5.87. df	= 5 (P =	= 0.007	); $I^2 = 69$	1%				+	
Test for overall effect: Z = 3.60 (P =	0.0003)	0.0		10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -					74	2 -1 0 1
Test for subgroup differences: Chi <sup>2</sup> =	6.27, df	= 1 (P	= 0.01	$  ^2 = 84$	.0%				Ť	Favours (experimental) Favours (control)
	2									- I II
	Expe	riment	tal	0	ntrol	_	5	td. Mean Difference		Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year	IV, Random, 95% CI
1.4.1 IG vs Sham										
Weiner (WOMAC Function, G1vsG3)	22.2	12.2	57	26.1	16.1	61	17.7%	-0.27 [-0.63, 0.09]	2013	
Weiner (WOMAC Function, G2vsG3)	22.9	14.1	58	26.1	16.1	61	17.7%	-0.21 [-0.57, 0.15]	2013	

Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year	IV, Random, 95% CI
1.4.1 IG vs Sham										
Weiner (WOMAC Function, G1vsG3)	22.2	12.2	57	26.1	16.1	61	17.7%	-0.27 [-0.63, 0.09]	2013	
Weiner (WOMAC Function, G2vsG3)	22.9	14.1	58	26.1	16.1	61	17.7%	-0.21 [-0.57, 0.15]	2013	
Weiner (WOMAC Function)	21.63	11.6	44	22.61	11.84	44	17.2%	-0.08 [-0.50, 0.34]	2007	
Subtotal (95% CI)			159			166	52.5%	-0.20 [-0.42, 0.02]		•
Heterogeneity: Tau <sup>2</sup> = 0.00; Chi <sup>2</sup> = 0	).45, df =	2 (P =	0.80);	$ ^2 = 0\%$						22
Test for overall effect: Z = 1.77 (P =	0.08)									
1.4.2 IG vs Other intervention										
Tian (WOMAC Function)	80.36	2.29	25	87.12	2.13	25	13.0%	-3.01 [-3.84, -2.18]	2022 •	
Dunning (WOMAC Function)	10.1	9.3	118	18.7	11.7	117	18.4%	-0.81 [-1.08, -0.55]	2018	-
Elbadawy (KOOS ADL)	-35.24	5.98	30	-30.1	5.98	30	16.1%	-0.85 [-1.38, -0.32]	2017	
Subtotal (95% CI)			173			172	47.5%	-1.48 [-2.52, -0.45]		
Heterogeneity: Tau <sup>2</sup> = 0.75; Chi <sup>2</sup> = 2	4.86, df	= 2 (P	< 0.00	001); l <sup>2</sup>	= 92%					
Test for overall effect: Z = 2.81 (P =	0.005)									
			5 (				02204255			
Total (95% CI)			332			338	100.0%	-0.78 [-1.30, -0.25]		-
Heterogeneity: Tau <sup>2</sup> = 0.37; Chi <sup>2</sup> = 4	9.26, df	= 5 (P	< 0.00	001); l <sup>2</sup>	= 90%					
Test for overall effect: Z = 2.90 (P =	0.004)									Favours [experimental] Favours [control]
Test for subgroup differences: Chi2 =	= 5.70, df	= 1 (	9 = 0.02	$(2),  ^2 = 1$	82.4%					rations [experimental] rations [control]

Study	Knee injury	Design/Partic ipants	Age (Mean± SD)	Sex n(%M en)	Pain durati on (year)	Baseli ne Pain intens ity	Quality assessm ent
Tian et al. (2022) [16]	Knee Osteotom y	RCT/N=50	$\begin{array}{l} G_{1} = \\ 64.76 \pm \\ 6.07 \\ G_{2} = \\ 64.84 \pm \\ 8.84 \end{array}$	$G_1 = 8$ (32) $G_2 = 6$ (25)	NR	$G_1 =$ 7.921 $\pm$ 1.04 VAS $G_2 =$ 7.52 $\pm$ 0.87 VAS	6/10
García - Berme jo et al. (2020) [17]	Unilatera l anterior knee pain	RCT/n = 30	$G_1 =$ 39.3 ± 9.5 $G_2 = 37$ ± 9.6	$G_1 = 5$ (33.33) $G_2 = 4$ (26.66)	$\begin{array}{l} G_1 = \\ 0.6 \pm \\ 0.23 \\ G_2 \\ = 0.58 \\ \pm 0.22 \end{array}$	$G_1 = 56.9 \pm 18.88$ NRS $G_2 = 56.4 \pm 14.56$ NRS	6/10
Da Graca- Tarrag ó et al. (2019) [18]	Knee Osteoarth ritis	RCT/n = 60	$G_1 = 66 \pm 9.08$ $G_2 = 64.14 \pm 9.82$ $G_3 = 64.4 \pm 6.02$	$G_{1} = 0$ (0) $G_{2} = 0$ (0) $G_{3} = 0$ (0) $G_{4} = 0$ (0)	$G_1 \\> 0,5 \\G_2 \\> 0,5 \\G_3 \\> 0,5 \\G_4 \\> 0,5 \\$	$G_1 =$ 5.59 ± 2.63 VAS $G_2 =$ 6.07 ± 2.42 VAS $G_3 =$ 5.27 ±	9/10

Table 1: Characteristics and quality of the included studies

			$G_4 =$ 63.87 ± 7.07			1.91 VAS G <sub>4</sub> = 5.5 ± 2.77 VAS	
Dunni ng et al. (2018) [19]	Knee Osteoarth ritis	RCT/n = 242	$G_1 =$ 57.1 ± 13.2 $G_2 =$ 58.1 ± 13.1	$G_1 =$ 55 (45.45) $G_2 =$ 56 (46.28)	$G_1=$ 4.5 ± 4.7 $G_2 =$ 4.6 ± 5.1	$G_1 = 8.7 \pm 3.2$ WP $G_2 = 8 \pm 3.3$ WP	8/10
Elbada wy et al. (2017) [20]	Knee Osteoarth ritis	RCT/n = 60	$G_{1}= 59.43 \pm 4.17$ $G_{2}= 59.93 \pm 4.35$	$G_1 =$ 10 (33.33) $G_2 =$ 10 (33.33)	$G_1$ =11.0 8 ±1.88 $G_2$ =10.2 5 ±2.16	$G_1 =$ 7.71 ± 0.76 VAS $G_2 =$ 7.49 ± 0.79 VAS	7/10
Da Graca- Tarrag ó et al. (2016) [21]	Knee Osteoarth ritis	RCT/n = 26	$\begin{array}{l} G_1 = \\ 62.15 \pm \\ 7.44 \\ G_2 = \\ 66.85 \pm \\ 7.53 \end{array}$	$G_1 = 0$ (0) $G_2 = 0$ (0)	$G_1=$ $6.67 \pm$ 1.59 $G_2 =$ $6.49 \pm$ 1.48	$\begin{array}{l} G_{1} = \\ 6.85 \pm \\ 0.38 \\ VAS \\ G_{2} = \\ 6.77 \pm \\ 0.43 \\ VAS \end{array}$	9/10
Weine r et al. (2013) [22]	Knee Osteoarth ritis	RCT/n = 190	$G_1 =$ 67.1 ± 8.9 $G_2 =$ 65.8 ± 8.7	$G_1 =$ 55 (87.3) $G_2 =$ 54 (84.4)	$G_1 =$ 5.7 ± 6.4 $G_2 =$ 6.2 ± 6.8	$G_1 = 8.9 \pm 3.3$ WP $G_2 = 9.8 \pm$	7/10

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			G <sub>3</sub> =	G <sub>3</sub> =	G3 =	3.8
			$66.8 \pm$	52	$7.2 \pm$	WP
			10.4	(82.5)	8.3	G3 =
						10.6 ±
						3.4
						WP
Weine	Knee		$G_1 = 71.5 \pm 5.6$	$G_1 = 18$	$G_1 = 7.6 \pm 7.4$	$G_1 =$ 9.3 ± 3.1
(2007)	Osteoarth	RCT/n = 88	$G_2 =$	(40.91) $G_2=22$	$f_{1.4}$	WP 7/10
[23]	ritis		71.4 ± 5.2	(50)	8.4 ± 7.4	$G_2 = 9$ $\pm 3.4$ WP

SD= Standard Deviation; RCT= Randomized Controlled Trial; G1-4= Group; n= Total

sample

 Table 2: Complementary table of PEDro Scale

Study	1	2	3	4	5	6	7	8	9	10	TOTAL
Tian et al. (2022) [16]	1	1	0	1	0	0	0	1	1	1	6/10
García- Bermejo et al. (2020) [17]	1	0	1	0	0	1	1	1	0	1	6/10
Da Graca- Tarragó et al. (2019) [18]	1	1	1	1	0	1	1	1	1	1	9/10
Dunning et al. (2018) [19]	1	1	1	0	0	1	1	1	1	1	8/10
Elbadawy et al. (2017) [20]	1	1	1	0	0	1	1	0	1	1	7/10
Da Graca- Tarragó et al. (2016) [21]	1	1	1	1	0	1	1	1	1	1	9/10
Weiner et al. (2013) [22]	1	1	1	0	0	0	1	1	1	1	7/10
Weiner et al. (2007) [23]	1	0	1	0	0	1	1	1	1	1	7/10

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Study	Intervention	Description of Experimental Intervention	Outcomes	Main Results
Tian et al. (2022) [16]	G1= PES G2= UC	Nine-knee point standardized (at least 3 of them: over the medial tibial condyle, the femoral epicondyle, and over the anterolateral crest of the tibial tuberosity); 30 min with acupuncture needle	Pain (VAS); Functionality (WOMAC Physical Function)	Significant differences between groups were found in favor of the experimental group in pain and functionality after intervention
García- Bermejo et al. (2020) [17]	G1= PES G2= Sham PES	Intervention of Femoral nerve with an acupuncture needle	Pain (NRS); Functionality (VISA-P; Kujala)	Significant differences between groups were found in favor of the experimental group in pain and functionality

**Table 3:** Studies of the effectiveness of percutaneous electrical stimulation

				after
				intervention
		tDCS		
		intervention		
		of primary		
		motor cortex:		
		five sessions		
		of 30 min		
		PES		
		intervention		
		of vast		Significant
		medial, rectus		differences
	$G_1 = tDCS + PES$	femoris, vast	Pain (VAS).	between groups
Da Graca-	$\Gamma LS$	lateral,	Functionality	were found in
Tarragó et al	G <sub>2</sub> – tDCS + Sham PES	anterior		favor of the G1
(2019) [18]	$G_2 = $ Sham tDCS	tibialis	Physical	in pain and
(2017) [10]	+ PES	muscles and	Function)	functionality
	G4 =Sham tDCS	the pes	T unction)	after
	+ Sham PES	anserine		intervention
		bursae. 30		
		min with		
		acupuncture		
		needle + 12		
		needles		
		inserted along		
		spinous		
		process at L1-		
		S2		
	$G_1 = PES + EX +$	Nine-knee	Pain	No differences
Dunning et al.	МТ	point	(WOMAC	were found in
(2018) [19]	C-EV I MT	standardized	Pain; NRS);	pain and
	$U_2 = EA + MI$	(at least 3 of	Functionality	functionality
1				

		them: over the	(WOMAC	after
		medial tibial	Physical	intervention.
		condyle, the	Function)	Significant
		femoral		differences
		epicondyle,		between groups
		and over the		were found in
		anterolateral		favor of the
		crest of the		experimental
		tibial		group in pain
		tuberosity)		and
		20-30 min		functionality in
		with		six months
		acupuncture		follow up
		needle +		assessment.
		manual		
		therapy +		
		exercise		
		PES		
		intervention		Significant
		in medial and		differences
		lateral		between groups
		femoral		were found in
		condyle;		favor of the
		medial and	Pain (VAS):	experimental
Elbadawy et	G <sub>1</sub> =PES+HEP	lateral tibial	Functionality	group in pain
al. (2017) [20]	G2=TENS+HEP	condyle; head	(KOOS)	and
		of fibula and	(11005)	functionality
		2 additional		after
		needles in the		intervention
		upper third of		and in six
		the tibial		month follow
		shaft; 30min;		up assessment
		with		

		acupuncture		
		needle		
		PES		
		intervention		
		of vast		
		medial, rectus		
		femoris, vast		Significant
		lateral,		differences
		anterior		between groups
		tibialis		were found in
De Course		muscles and	Pain (VAS);	favor of the
Da Graca-	G1=PES	the pes	Functionality	experimental
	G <sub>2</sub> =Sham PES	anserine	(WOMAC	group in pain
(2010) [21]		bursae:, 30	Function)	after
		min with	runction)	intervention.
		acupuncture		No differences
		needle + 12		were found in
		needles		functionality
		inserted along		
		spinous		
		process at L1-		
		S2		
		PES		No differences
		intervention		were found in
	$C_{t} = \text{DES} + \text{DES}$	in periosteum	Pain	pain and
	$O_1 - PES + PES$ booster	of the medial	(WOMAC	function after
Weiner et al	$G_2 = PES +$	and lateral	Pain);	intervention.
(2013) [22]	control PES	femoral	Functionality	Significant
	booster	condyles,	(WOMAC	differences
	$G_3 = Control$	tibial flare and	Physical	between groups
	res	fibular head;	Function)	were found in
		30 min + 5		favor of the
		booster		experimental

		session with the same parameters in G <sub>1</sub>		group in functionality in nine months follow up assessment.
Weiner et al. (2007) [23]	G1= PES G2= Sham PES	PES intervention in periosteum of the medial and lateral femoral condyles, tibial flare and fibular head; 30 min + 5 booster session with the same parameters in G <sub>1</sub>	Pain (WOMAC Pain); Functionality (WOMAC Physical Function)	Significant differences between groups were found in favor of the experimental group in pain and functionality after intervention but no differences between groups were found in three months follow up assessment

*G* 1-4= *Group*; *PES*= *Percutaneous electrical Stimulation Therapy*; *UC*= *Usual Care*; *NRS*= *Numeric Rating Scale*; *VISA-P*= *Victorian Institute of Sport Assessment*; *tDCS*= *Transcranial Direct Current Stimulation*; *VAS*= *Visual Analogue Scale*; *WOMAC*= *Western Ontario and McMaster Universities Osteoarthritis Index*; *EX*= *Exercise*; *MT*= *Manual Therapy*; *HEP*= *Home Exercise Program*; *TENS*= *Transcutaneous Electrical Nerve Stimulation*; *KOOS*= *Knee injury and Osteoarthritis Outcome Score*