

Original Research Article

Dry needling is effective in reducing acute pain in patients with severe knee osteoarthritis

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ABSTRACT

Background: The objectives of the study was to evaluate the efficacy of dry needling inactivation of trigger points in acute pain relief and function improvement in patients with severe knee osteoarthritis.

Methods: Thirty participants choose between dry needling or static stretching. It was analyzed the immediate effects of a single dry needling intervention, compared to a control group that received static stretching. Outcomes of the study was timed up and go test; visual analogue scale and brief pain inventory.

Results: The group treated with dry needling had a better result on the visual analogue scale and on the brief pain inventory scale. There was no difference in time up and go performance in relation to the control group. The muscle group with the highest prevalence of trigger points was the thigh adductors (83.3%), despite valgus or varus frontal plane misalignment of the limb.

Conclusions: The inactivation of trigger points by dry needling in patients with acute pain due to severe osteoarthritis of the knees obtained better relief compared to static stretching of the musculature.

Keywords: Pain, Osteoarthritis, Knee, Trigger points, Myofascial pain syndromes

INTRODUCTION

Pain is probably the worst symptom related to osteoarthritis. Attempting to relieve acute pain attacks can lead patients to opioid abuse or eventually to unnecessary surgery. New effective ways of relieving acute pain attacks need to be studied. Pain mechanisms involved in osteoarthritis (OA) are multifactorial. Intra-articular tissue damage and inflammation are important, but other mechanisms could exacerbate the symptoms. One reason for the disconnection between the extent of structural damage and pain is the occurrence of changes in the central and peripheral nervous system. Another reason is the presence of myofascial trigger points (MTPs) located in the muscles around the joint.¹⁻³

The MTPs are hard, well-defined palpable nodules present in a tight band of skeletal muscle and are highly prevalent in patients with knee OA. There are many techniques used in the treatment of MTPs, like stretching, intermittent cold, ischemic compression, injections, dry needling and others.⁴⁻⁶

Dry needling involves the introduction of an acupuncture needle directly into the MTP, to inactivate it. Possible advantages of its use in relation to trigger-point infiltration include a reduction in the risk of allergic reactions and costs with the use of local anesthetics or other medications.

The primary objective of this study was to test the efficacy of dry needling to relief pain and improves function in patients with severe knee OA, in comparison with stretching. Secondary objectives were to determine the prevalence of MTPs in muscles of the lower limbs and the possible correlation with limb misalignment.

METHODS

This study was carried out from August 2018 to February 2019 at Hospital de Clínicas, the teaching hospital of Campinas University (Campinas, Brazil). After approval by the local Ethics Committee (protocol number CAAE 2.757.232/2018), 30 patients with severe knee OA, who complain of acute worsening of knee pain while waiting in a list for total knee arthroplasty (TKA), were invited to participate in the study. After signing an Informed Consent Form (ICF), they were included in the study.

Inclusion criteria

Both genders, between 30 and 75 years-old age, with severe knee OA according to Kellgren-Lawrence

radiographic criteria (grade 4), with surgical indication of TKA, with an acute onset pain in the knee who did not improve with orally taken over-the-counter painkillers, like ibuprofen, dipirona or acetaminophen were included.

Exclusion criteria

Fibromyalgia, hemophilia, lupus, cancer with treatment completed less than five years previously, previous TKA surgery, varicose veins, absence of gait and those who wanted to stop their participation at any time were excluded.

Study design

Non-randomized, open label, two arm parallel clinical trial. After physical examination to detect MTPs, participants were divided into two groups: a group treated with dry needling (DNG) or a control group treated with static stretching of the lower limbs (SSG). Figure 1 illustrates a flowchart diagram of the study.

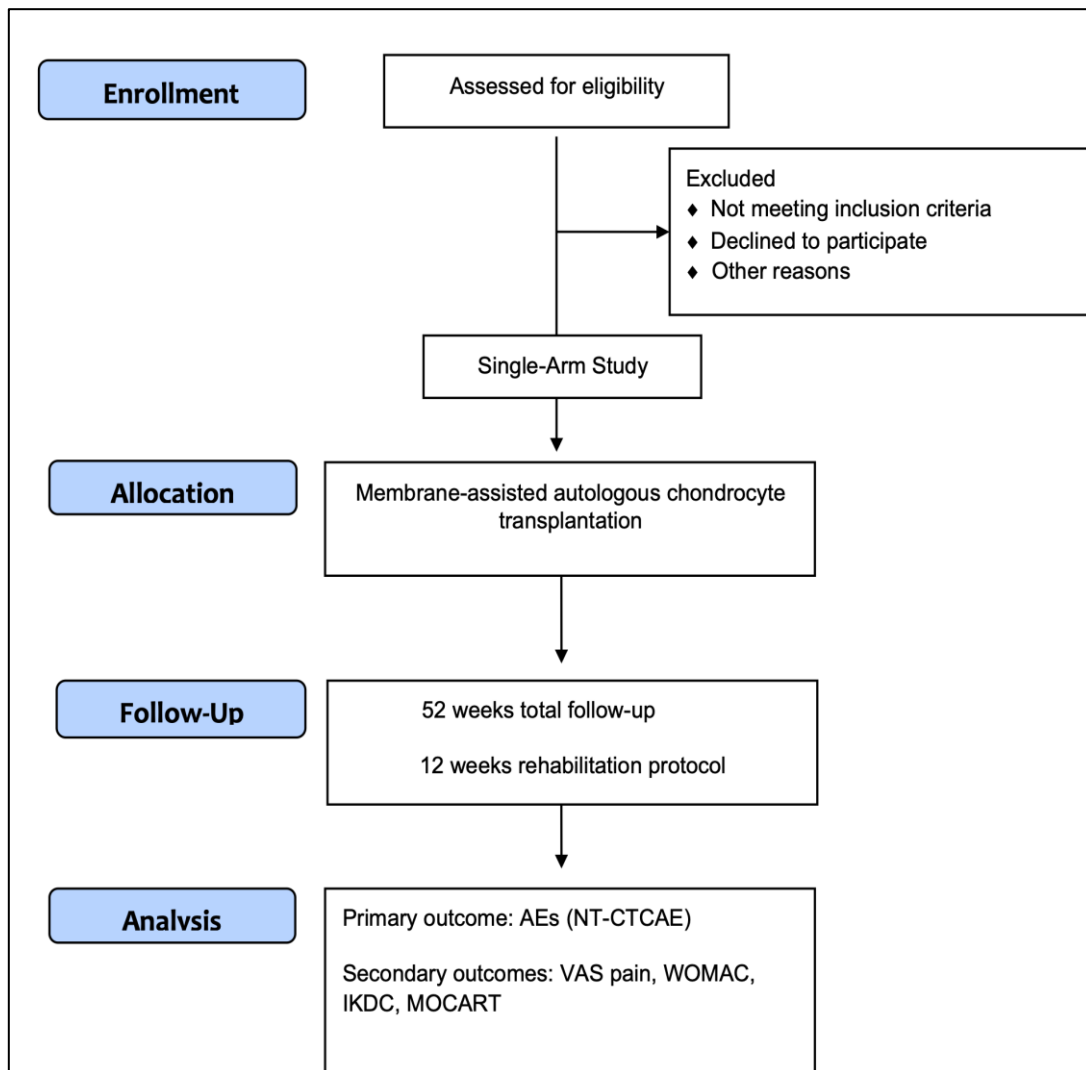


Figure 1: CONSORT’s chart flow diagram of participants in the study.

Interventions

Identification of MTPs

The diagnosis of active and latent MTPs was performed by two physical therapists by palpation of the muscles of the lower limbs, according to the classical criteria of Travell and Simons.⁶

Dry needling

It is an intervention that uses an acupuncture needle to penetrate the skin, without the introduction of any drug to stimulate the underlying MTPs. Sterile and disposable needles of systemic acupuncture size 0.30×75 millimeters were used. Preliminary research showed that this intervention is effective for inactivating MTPs. Needles were inserted only in active MTPs, according to Hong's "fast in and fast out" technique: the needle was inserted 20 times in each selected point and then held stationary for a period of 10 minutes.^{7,8}

Static muscle stretching

Static passive stretching of the extensor and knee flexor muscle groups, hip adductors, hip abductors and ankle plantar flexors was maintained for 30 seconds according to a previously described technique.⁹

Outcomes

Visual analogue scale (VAS) for generalized lower limb pain, numbered 0 to 100; brief inventory of pain (BIP%); Western Ontario and McMaster universities osteoarthritis index (WOMAC); "timed up and go" test (TUG). The TUG test was repeated 3 times at each evaluation, using a mean of the measurements in the data analysis.¹⁰⁻¹³

Statistical analysis

The sample size calculation was based on VAS scale. According to a previous work, the minimal clinically important difference (MCID) of VAS scale is 30 millimeters.¹⁰ This value was assumed as an estimate for the standard deviation (SD). Considering the difference between pre- and post-treatment means as 30, the sample size required to detect MCID was calculated as 15 participants in each group.

The distribution of each continuous variable was evaluated by the Kolmogorov-Smirnov test. To compare the means, Student's t-tests were used for independent or paired samples, in cases where the parametric assumptions could be maintained, or the Mann-Whitney test for independent samples and the Wilcoxon test for paired samples, when these assumptions were rejected. For the qualitative variables Pearson's Chi-square test or Fisher's exact test were used. All tests performed were two-tailed. The significance level of 5% ($p < 0.05$) was considered for all tests. The software used was SPSS version 22.0 (Armonk, NY: IBM Corp.).

RESULTS

Thirty participants were included, with a minimum age of 39 years and maximum of 75 years (mean 62.4 years-old \pm 8.6 SD). Pre-treatment WOMAC scale ranges from 23 to 91 (mean 58.6 \pm 17.1 SD). There were nineteen female participants (63.3%) and eleven male participants (36.7%). Twelve participants (40%) reported regular use of walking aids. After non-randomized allocation, demographic data (age, gender, WOMAC scale and deformity in the frontal plane) remained homogeneous between groups (Table 1).

Table 1: Participant demographics data.

Demographics data	CG (n=15)	DNG (n=15)	P value
Gender	10 F/ 5 M	9 F/ 6 M	0.144
Mean age (years)	60.4 (7.9)	64.4 (9.1)	0.056
Compartment most affected by knee osteoarthritis	R medial 12 (80%)	R medial 13 (86.6%)	
	R lateral 3 (20%)	R lateral 2 (13.3%)	
	L medial 13 (86.6%)	L medial 13 (86.6%)	
	L lateral 2 (13.3%)	L lateral 2 (13.3%)	
Mean WOMAC	60.4 (14,9)	56.7 (19,5)	0.567

Control group (CG); male (M); female (F); osteoarthritis (OA); right (R); left (L).

Dry needling obtained better results on the VAS scale (Figure 2) and on the BIP% scale (Figure 3). There was no difference in TUG performance in relation to SSG (Figure 4).

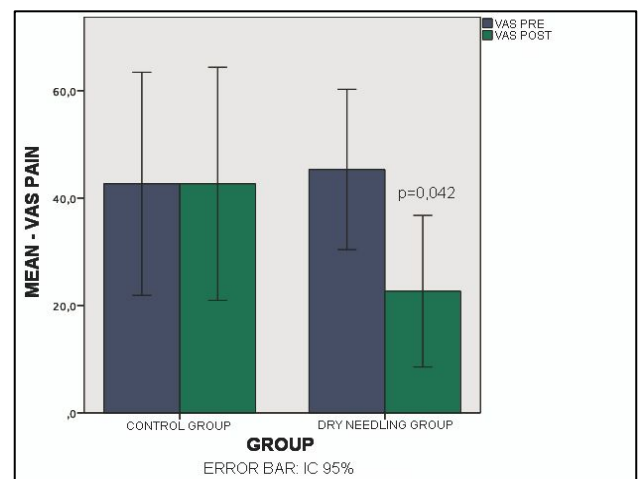


Figure 2: Comparison of the means and confidence intervals of the VAS clinical scale, pre and post treatment results, between DNG and SSG groups.

Pre-treatment: DNG=45.3 mm \pm 27 SD; SSG= 42.7 mm \pm 37.5 SD; $p=0.78$). Post-treatment: DNG=22.7 mm \pm 25.5 SD. SSG= 42.7 mm \pm 39.2 SD; $p=0.04$.

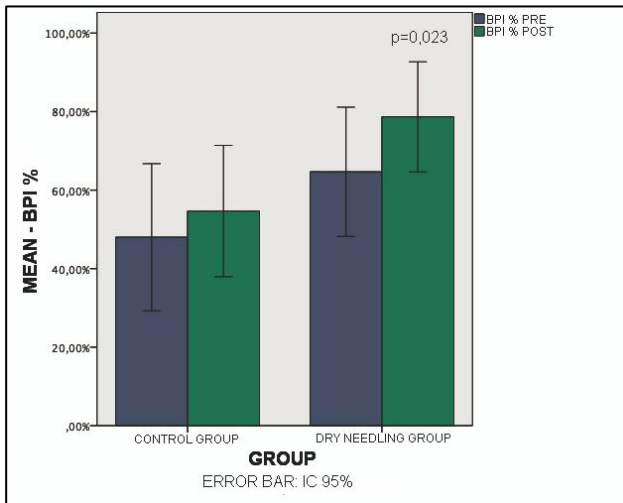


Figure 3: Comparison of the means and confidence intervals of TUG functional test, pre and post treatment results, between DNG and SSG groups.

Pre-treatment: DNG=14.4 seconds±10.1 SD; SSG=14.8 seconds±6.3 SD; p=0.51. Post-treatment: DNG=12.9 seconds±7.9 SD; SSG=13 seconds±4.8 SD; p=0.6.

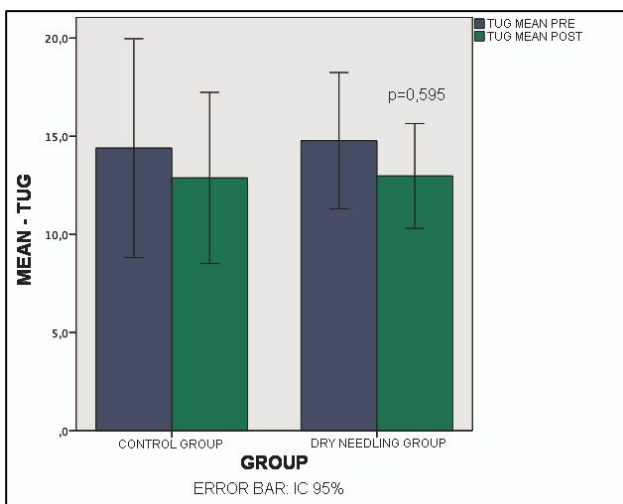


Figure 4: Comparison of the means and confidence intervals of the IBD% clinical scale, pre and post treatment results, between DNG and SSG groups.

Pre-treatment: DNG=64.7%±29.7 SD; SSG=48%±33.8 SD; p=0.15. Post-treatment: DNG=78.7%±25.3 SD; SSG=54.7%±30.2 SD; p=0.02.

Regarding prevalence in lower limb muscle groups around the knee, MTPs were most frequently found in distal portion of the adductor muscles (83.3%), followed by the medial gastrocnemius (81.7%) (Table 2).

Knee varus deformity was associated with a predominantly medial OA and was observed in 51 knees (85%), while the valgus deformity with a predominantly lateral OA was present in only 9 knees (15%). No difference was found in the distribution of MTPs among knees with varus or valgus deformity (Table 3).

Table 2: Location of myofascial trigger points by total sample number (n=30).

Muscle group	Subdivision	Prevalence (n=60)	
		N	(%)
Quadriceps	Proximal	38	(63.3)
	Medial	41	(68.3)
	Distal	35	(58.3)
Hamstrings	Proximal	26	(43.3)
	Medial	32	(53.3)
	Distal	30	(50)
Popliteal		46	(76.7)
Adductors	Proximal	39	(65)
	Medial	46	(76.7)
	Distal	50	(83.3)
Iliotibial band	Proximal	38	(63.3)
	Medial	48	(80)
	Distal	47	(78.3)
Lateral gastrocnemius	Proximal	44	(73.3)
	Distal	37	(61.7)
Medial gastrocnemius	Proximal	49	(81.7)
	Distal	48	(80)
Gluteus medius	Proximal	25	(41.7)
	Medial	24	(40)
	Distal	21	(35)
Gluteus maximus	Central	11	(18.3)

Table 3: Comparison of myofascial trigger point frequencies between knees with predominantly medial and lateral osteoarthritis.

Muscle group	Medial (n=51)	Lateral (n=9)	P value
	N (%)	N (%)	
Quadriceps	41 (80.4)	9 (100)	0.146
Hamstrings	33 (64.7)	6 (66.7)	0.909
Gluteus	30 (58.8)	6 (66.7)	0.658
Iliotibial band	42 (82.4)	9 (100)	0.172
Adductors	45 (88.2)	9 (100)	0.278
Lateral gastrocnemius	36 (70.6)	9 (100)	0.060
Medial gastrocnemius	43 (84.3)	9 (100)	0.202
Popliteal	37 (72.5)	9 (100)	0.073

DISCUSSION

The results obtained in this study corroborate the hypotheses that dry needling, a technique to inactivate MTPs, is effective in the relief of acute pain crises in patients with severe knee OA.

The efficacy of dry needling on pain relief and inactivation of MTPs has been previously investigated in different pain scenarios. In a blinded randomized clinical trial, 24 participants with knee OA were divided into

three groups: dry needling, traditional acupuncture and false acupuncture (superficial needlework that does not completely transfix the dermis). Participants performed five sessions weekly and were followed up for twenty weeks, achieving a significant reduction of VAS and WOMAC in the dry needling and traditional acupuncture groups, which persisted for five weeks after the end of treatment. However, that results are related to chronic pain, differently from our study, where we tried to evaluate the effect of dry needling on acute pain crises.¹⁴

In the other hand, a pilot study with 20 participants, blinded and randomized, with two parallel groups, one treated with six sessions of dry needling and another with a false needling, showed no difference in VAS and WOMAC, but again in a chronic pain scenario. The small sample size and the lack of statistical power may be the cause of this lack of difference through a type 2 error.¹⁵

Another randomized clinical trial used dry needling or false needling in patients submitted to TKA during anesthesia, in order to obtain postoperative analgesia. Dry needling showed significant improvement of postoperative VAS and WOMAC in relation to the control group. Again, this scenario of postoperative pain is different from the situation of acute pain related to OA evaluated in our study.¹⁶

In relation to the prevalence of the trigger points in the muscle groups of the lower limbs that is related to the movements of the knee, the adductor of the thigh was the muscle group most frequently affected. Prevalence of MTPs in individuals with knee OA is already recognized, but data differ for the most affected muscle group. Quadriceps has been cited as the most affected muscle in studies that did not evaluate the adductor muscles of the thigh.^{5,14,17,18}

One study analyzed 114 participants with knee OA and concluded that the most affected muscles are the vastus medialis (75.4%) and the vastus lateralis (65.78%). Thigh adductors were affected in 51.2%.¹⁹ However, the lower incidence of MTPs in thigh adductors in that study could be explained by differences in the inclusion criteria. In our study, only participants with severe KOA were included, whereas in that study all KOA degrees were included. We hypothesized that in cases of severe knee OA, there is a weakness of the quadriceps and the adductors are overused in an attempt to increase extension force as previously described.²⁰

Knee deformities are recognized as poor prognostic factors for OA progression. The correlation between the progression of KOA and knee misalignment is described in the literature, but to the best of our knowledge, no previous study addressed the correlation between knee alignment and MTPs distribution in muscle groups.²¹ In this sample there was no difference in MTPs distribution between knees with varus or valgus deformities. It seems reasonable to think that there may be a difference in the

overload or disuse of certain muscle groups according to the deformity. The problem is that valgus OA is rare. In our sample, it represented only 15% of the cases. Therefore, we hypothesized that a type 2 error could explain the lack of difference.

This study has some limitations. Only patients with severe knee OA refractory to conservative treatment were included, so results could not be validated to all patients with OA. Allocation was not randomized, because some participants reported fear of needles. We would have to consider this fear as exclusion criteria, but we decided not to do that because of the risk of an elevated attrition bias. Allocation was not blinded, because of the nature of the control group. Previous studies complain that literature was lacking a study with a non-invasive control group.^{14,16} Finally, follow-up was not long enough to evaluate the duration of the analgesia promoted by one session of dry needling.

CONCLUSION

The inactivation of trigger points by dry needling in patients with acute pain due to severe osteoarthritis of the knees obtained better relief compared to static stretching of the musculature.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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