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Review Article

Effect of TENS in Management of Knee Osteoarthritis–A Systematic Review

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Abstract: Background: Osteoarthritis is a major cause of musculoskeletal disability. Nonpharmacological and nonsurgical treatment is preferred for the management of knee osteoarthritis (OA). However, evidences are lacking regarding the effectiveness of multimodal physiotherapy program including, combination of various physical modalities (TENS, IR, US etc.) with therapeutic exercises, for the management of knee OA. **Objectives:** To determine recent research evidences for the effectiveness of TENS interventions for treatment of knee OA patients. **Methods:** This systematic review mainly includes randomized controlled trails. Searching done by Google Scholar, PubMed and PEDro from 2010 to 2019. We used terms like-knee pain, OA, TENS, and physiotherapy management. **Results:** Present outcomes shows that TENS intervention is effective technique in reducing pain in patients with Knee OA without adverse effects. After implementing the inclusion and exclusion criteria, 50 articles were retrieved using the keywords, but only 05 articles were selected for the study. **Conclusion:** Electrotherapy modalities in conjunction with exercise therapy program designed for treating knee OA patients proved to be more superior to exercise alone at improving quadriceps muscle activation by reducing pain and increasing function during exercise.
Keywords: Electrotherapy, exercise, knee osteoarthritis, physiotherapy.

Introduction

Knee joint is the most common joint affected by osteoarthritis (OA) in people older than 60yrs. About 10%–20% of this population experience knee pain globally. Around 80% of them experience restriction in movement and remaining 20% are notable to perform activities of daily living; certainly, 11% of knee OA patients need assistance in basic individual care[1]. About 40% of the total population aged over 70 suffers from the most common form of arthritis-osteoarthritis (OA)[2].

Osteoarthritis commonly affects middle age to elderly population. It is the most common disease of arthritis and can occur together with other types of arthritis. It is a disease of the entire joint, involving not only the joint lining but also cartilage, ligaments, and bone. It is characterized by breakdown of the cartilage, bony changes of the joints, deterioration of tendons and ligaments, and various degrees of inflammation of the synovium[3]. Scott and Kowalczyk reported that a cohort study found that radiologic features of knee osteoarthritis were very common in adults: 13% of women 45–65 years of age (an incidence of 3% per year)[4]. In Saudi Arabia, Al-Arfaj and Al-Boukai in their cross-sectional study found radiographic knee osteoarthritis in 53.3% males and 60.9% females. Approximately 18% of women and 10% of men suffer symptoms due to osteoarthritis[5,6].

Women demonstrated higher levels of pain, physical disability and pain behavior than men with knee osteoarthritis[7]. Physical therapy provides a variety of intervention such as manual therapy techniques, balance, coordination and functional retraining techniques, knee taping techniques etc[8]. Transcutaneous electrical nerve stimulation (TENS) is a common treatment modality for musculoskeletal pain and has been demonstrated to be effective for managing osteoarthritis knee pain[9]. Many researchers have shown the effectiveness of TENS and exercise therapy separately in the management of knee OA.

Thus, this review was conceived to determine the treatment of OA knee by TENS in order to find out if TENS management approach is consistent with existing recommendations and guidelines for clinical practice.

Methods

This review study is performed in accordance to PRISMA-Preferred Reporting Items for Systematic Reviews and Meta‐ Analyses[10].

Search Strategy

The searching was done in PubMed, Google Scholar and PEDro. Keywords like-Knee pain, TENS, exercise, Osteoarthritis and physiotherapy management. We included past 10 years articles (mainly RCTs-Randomized controlled trial) published in English language only from 2010-2019. The title and abstracts of all articles in the searches were screened in accordance with the inclusion and exclusion criteria to identify potentially eligible articles. Full texts of potential articles were read and assessed independently by the two reviewers.

Inclusions criteria

- ✓ Age greater than or equal to 40 years.
- ✓ Ability to perform physical therapy exercise.
- ✓ Chronic knee pain ≥3 months.
- ✓ Studies were published in English language only.
- ✓ The study patients have no knee surgery history.
- ✓ Studies which determined effects of electrotherapy and exercise on Knee OA.

Exclusion criteria

- ✓ Studies including patients <30 years.
- ✓ Patients admitted in hospital or in long-term center.
- ✓ Studies with surgical treatments for knee OA and those who had total knee replacement within 6 months before the study.
- ✓ Diseases and surgeries related to lower limb and spine.
- ✓ Neurological disorders and Cardio vascular problems with increased heart rate.

Quality assessment

Methodological quality of selected articles was assessed using PEDro Scale[11] consisting of 11 questions in two aspects. Criteria 2-9 assess internal validity and criteria 10-11 assess statistical information required to make a study interpretable. Scoring of each question is done in accordance to its existence or nonexistence in the assessed study. The final scoring is done by the addition of all positive answers. Studies considered of high quality scoring ≥5 (5/10) as stated by Moseley et al.[12]. Therefore in our review all included studies scoring ≥5 were found to be of high in methodological quality. The studies were analyzed in PEDro scale by two independent investigators.

Data Analysis

The screening of included articles was done by two independent investigators. The selected articles were analyzed in an organized manner including parameters given: author-year, study design, subjects-age, interventions, study duration, outcome measures, and results. Differences between the

investigators were solved by conversation to reach agreement and settled by using Cohen's kappa statistics.

Results

Studies identified

After implementing the inclusion and exclusion criteria, 50 articles were retrieved using the keywords- Knee pain, TENS, exercise, Osteoarthritis and physiotherapy management. 20 articles were excluded as they were found in more than one database. For eligibility criteria 30 articles were screened. Further 25 articles excluded because either they were not available in full text, objective not available, they did not meet exclusion and inclusion criteria or no control group (Figure-1). Finally, 05 articles were selected by agreement for quality assessment phase.

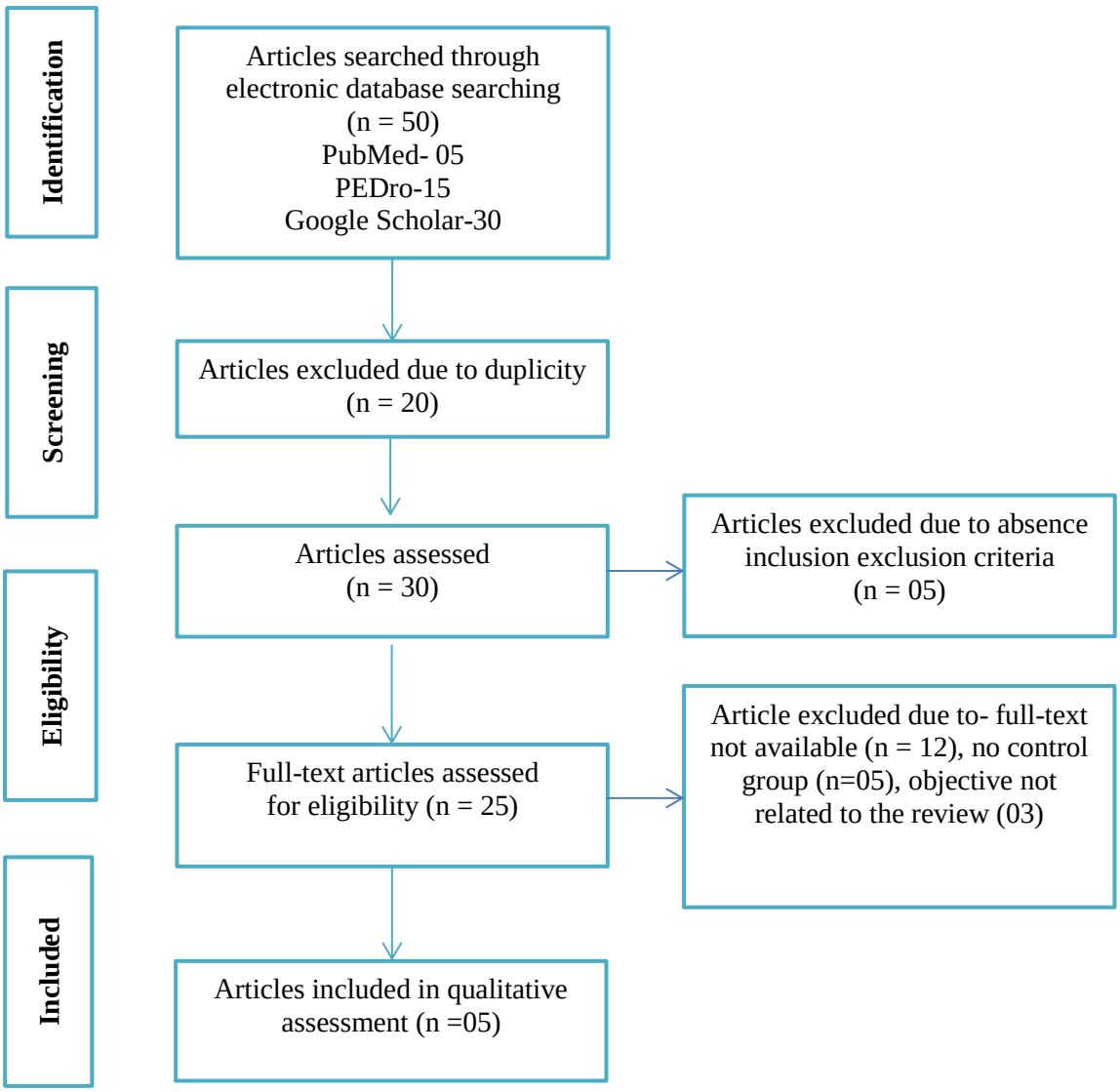

Figure 1. Flow diagram showing the screening and selection of articles

General data of the included studies

Selected articles in this review are summarized in Table 1 including given parameters: author-year, study design, subjects, interventions, study duration, outcome measures, and results. All 05 studies included in this study were RCTs[13-17]. All studies were conducted between 2010 and 2019. Number of participants in the studies ranged from 30 to 75. All articles were experimental. Concerning the efficacy of results established in the most of the articles, TENS were found to be significantly effective on pain and function between pre- and post-intervention assessments.

Outcome Measures

The key result tests are VAS, Pressure pain threshold (PPT), Heat pain threshold, Heat temporal summation, Timed "Up & Go" Test (TUG), 6MW test). JKOM, NPRS, WOMAC.

Table 1. Description of the included studies

Author	Study design	Subject	Intervention	Study Duration	Outcome measure	Result
Vance CG et al. 2012[13]	Randomized controlled trial	N=75	Group A: High frequency TENS (HF-TENS) Group B: Low-frequency TENS (LF-TENS) Group C: Placebo TENS	One time Study	Pressure pain threshold (PPT), Heat pain threshold, Heat temporal summation, Timed "Up & Go" Test (TUG),	Compared with placebo TENS, HF-TENS and LF-TENS increased PPT at the knee; HF-TENS also increased PPT over the tibialis anterior muscle. There was no effect on the cutaneous mechanical pain threshold, heat pain threshold, or heat temporal summation. Pain at rest and during the TUG was significantly reduced by HF-TENS, LF-TENS, and placebo TENS.
Shimoura K et al. 2019[14]	Randomized controlled trial	N=50	Group A: TENS Group B: Sham-TENS	One time study	VAS was used to measure knee pain (stair climb test, TUG test, and 6MW test).JKOM used for measuring knee pain and disability	Significant immediate improvement in TENS group in terms of walk distance and VAS score of 6MW test compared to sham -TENS group
Maeda T et al. 2017[15]	Randomized controlled trial,	N=45	Group A: TENS only (control group) Group B: TENS simultaneously combined with local heat application (TENS+LH group) Group C: TENS simultaneously combined with local cold application (TENS+LC group).	One time study	Visual analogue scale and the timed up & go test,	These results suggest that transcutaneous electrical nerve stimulation simultaneously combined with local heat application can immediately improve not only knee pain during standing and walking but also dynamic balance and gait ability in patients with knee osteoarthritis.
Yadav M et al. 2017[16]	Randomized controlled trial	N=45	Group 1:HF TENS + strengthening Group 2:LF TENS + strengthening Group 3:Placebo TENS + strengthening	2 weeks	PPT and NPRS used for pain measurement, TUG and WOMAC were evaluated to measure functional	Both HF and LF TENS produced significant improvement in PPT and functional abilities as measured by WOMAC and TUG compared to Placebo group. No significant difference between the effect of HF

					abilities.	and LF TENS.
Ghosh PK et al. 2015 [17]	Randomized controlled trial	N=30	Group A: Balancing exercise + TENS Group B: Strengthening exercise + TENS	4 weeks (4 days per week)	Outcome measures were VAS-used to measure intensity of knee pain and WOMAC-used for pain, stiffness and functional ability.	Statistically significant improvement was more in Group A compared to Group B after 4 weeks of treatment. Both groups showed significant reduction in WOMAC and VAS score.

Discussions

This review was conducted to determine the efficacy of TENS approaches in improving quality of life in patients with Knee OA. Evidences from RCTs is used to assess the effectiveness of TENS approaches in Knee OA.

There is low to intermediate quality proof that different forms of TENS can reduce pain and improving function for Knee OA relative to other treatments. Several prior studies of Knee OA pain show findings in favor of TENS for individuals with Knee OA pain. However, most of these studies also report that methodological flaws render the evidence insufficient or inconclusive, making it inappropriate to conclude that TENS are more effective compared to usual care or other complementary and integrative medicine therapies.

The present study, using a similar experimental protocol, compared the effects of IFC with another active treatment (TENS) and a control situation (exercise alone) in a further attempt to establish evidence for the effects of electrical stimulation[18]. A recent Cochrane review concluded that TENS was more effective than placebo for the treatment of pain and stiffness in knee OA[19]. Cheing et al. reported that a single session of TENS was better than exercise alone when treatment was given for 60 minutes, 5 days a week[9]. Osiri et al. were used different modes of transcutaneous electrical nerve stimulation setting in osteoarthritis knee pain relief. The result shows that high frequency and strong burst mode TENS used in pain relief of knee osteoarthritis[19].

Conclusion

This systematic review was conducted to investigate the effectiveness of TENS methods designed to improve pain and ROM in Knee OA patients by summarizing the evidences from randomized controlled trials (RCTs). We conclude that TENS program designed for Knee OA treatment can be more effective at increasing Knee ROM and reducing pain. In addition, Knee OA patients can improve self-reported with isometric exercises including ROM exercises.

Conflicts of interest

Authors declare no conflict of interest.

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