EFFECTIVENESS OF NEUROMUSCULAR ELECTRICAL STIMULATION TRAINING COMBINED WITH EXERCISE ON PATIENT-REPORTED OUTCOMES MEASURES IN PEOPLE WITH KNEE OSTEOARTHRITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

MAURÍCIO TATSCH XIMENES CARVALHO[1]; VICTOR HUGO GUESSER PINHEIRO[2]; CRISTINE LIMA ALBERTON[3]

[1]UNIVERSIDADE FEDERAL DE PELOTAS – carvalhomauricio960@gmail.com
[2]UNIVERSIDADE FEDERAL DE PELOTAS – victorguesser@gmail.com
[3]UNIVERSIDADE FEDERAL DE PELOTAS – tinialberton@yahoo.com.br

1. INTRODUCTION

Knee osteoarthritis (OA) is a common multifactorial joint disease that is a leading cause of disability and significantly affects both older adults and women (CUI et al. 2020). People with knee OA experience pain and limited physical function (HALL et al., 2022). In this regard, patient-reported outcome measures (PROMs), including pain and function, are an essential assessment component to understanding the functional implications of knee OA from the patient's perspective (DAVIS et al., 2022).

Exercise is a non-pharmacological therapy in knee OA recommended as the first line of treatment by several clinical guidelines (OVERTON et al., 2022). However, some barriers are recognized to people engagement in exercise programs (KANAVAKI et al., 2017). A recent systematic review highlighted the promising effects of combining Neuromuscular Electrical Stimulation (NMES) with voluntary contractions in healthy people and orthopedic patients (BORZUOLA et al., 2022). However, there still needs to be consensus in the literature on using NMES combined with exercise in people with knee OA. The present review aimed to investigate the effectiveness of NMES training combined with exercise on PROMs in people with knee OA. For this purpose, this review includes randomized, parallel-group trials focusing on the effectiveness of a combined intervention, NMES added to the exercise, or superimposed voluntary contractions compared to exercise alone.

2. METHODS

A systematic review was reported in agreement with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PAGE et al., 2021). A priori methodological review protocol was registered in International Prospective Register of Systematic Reviews (PROSPERO) - registration number: CRD42021291755.

The inclusion criteria were: (1) participants: symptomatic knee OA or radiographic (tibiofemoral OA) with the symptomatic condition, regardless of the stage of the disease; (2) intervention: NMES program combined with exercise or superimposed onto voluntary contraction with more than four weeks duration to elucidate this intervention's long-term effects; (3) comparators: exercise control group; (4) outcome measures: PROMs. (5) study design: randomized controlled trials.

A systematic literature search was conducted in five electronic databases by two independent investigators (MTXC and VHGP) for indexed full-text publications (i.e., PubMed, PEDro, LILACS, EMBASE, and SPORTDiscus) in April 2022. A search strategy used MeSH terms, such as "Osteoarthritis, Knee" and "Electric Stimulation Therapy." Search terms were combined using Boolean operators AND or OR.

Two independent investigators reviewed the search results and removed duplicates. Titles and abstracts of all articles identified by the search strategy were screened to identify potentially eligible studies. The reference lists from retrieved articles were manually checked. Two investigators independently examined the risk of bias in each included study using the revised RoB 2.

Full-text articles were stored electronically and systematically reviewed, including a year of publication, participant characteristics, NMES protocols, and exercise programs. We performed a data synthesis considering each PROMs. R software (version 4.2.2) and the “meta” package were used for data analyses. The standardized mean difference (SMD) and 95% confidence intervals (95%CI) were determined for continuous data, and a random-effects model with inverse variance was applied for the calculation. We assess the statistical heterogeneity using the Cochran Q test and estimated by the I^2 statistic. Studies were judged as having a high heterogeneity when I^2 values were greater than 50%. A p-value less than 0.05 indicated a statistically significant difference.

3. RESULTS AND DISCUSSION

The search retrieved 489 records from electronic databases. After removing 73 duplicates, 416 titles and abstracts were read, of which 405 were not eligible. Out of 11 articles read, six were excluded. Of 11 eligible articles, five articles were included in this systematic review, including one additional study identified by hand searching in the reference list of the eligible studies. Based on the RoB 2 tool overall risk of bias was high, with five of the six assessed studies judged as a general risk of bias of ‘high risk’ and only one graded as ‘some concerns’.

The effect of NMES plus exercise on pain was examined through a random-effect model by pooling data from two trials (137 participants). No significant effect of NMES at a specific joint angle combined with exercise on pain was detected (SMD, -0.33; 95% CI, - 1.05 to 0.39; I^2 =76%; p=0.37) (Fig 1).

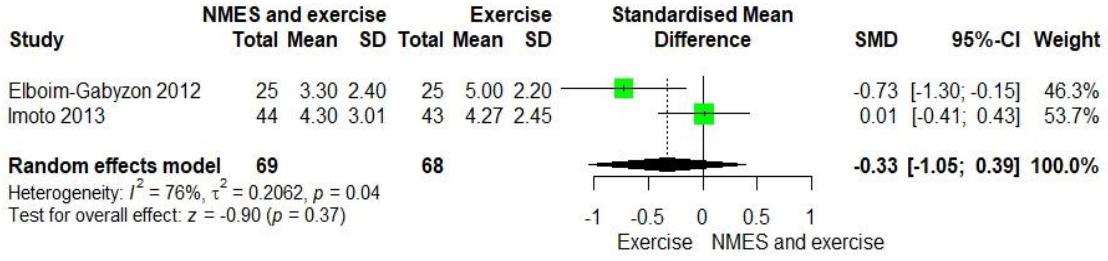

Figure 1. Effect of NMES and exercise on pain.

In the qualitative synthesis, the systematic analysis of the literature on this specific topic shows in three studies improvement in pain after NMES combined with exercise compared to exercise alone. In contrast, the other three studies revealed no difference between groups in pain, although similar improvement after treatments. There was no additional effect of NMES on self-reported functional

ability, stiffness, and physical function. In only one study, symptoms (such as clicking, swelling, catching, restricted range of motion, and stiffness), daily living function, sports function, and quality of life were improved after whole-body electrostimulation combined with exercise.

Previous systematic reviews found that NMES significantly impacts pain, function, and quadriceps femoris muscle strength in knee osteoarthritis (GIGGINS, FULLEN e COUGHLAN, 2012). However, studies included in this review compared NMES in combination with any other therapeutic intervention that differs from our review. We aimed to investigate NMES only combined with exercise. In this sense, another systematic review found that NMES associated with exercise, compared to an active control group, increased isometric muscle strength of quadriceps muscle in patients with knee osteoarthritis, with very low-certainty evidence (BISPO et al., 2021). Our review focused only on NMES combined with exercise, including other NMES alternatives such as superimposed on voluntary contractions and in a whole-body configuration. In addition, we focus on the effectiveness of combined intervention on PROMs.

4. CONCLUSION

This review found insufficient evidence for the effectiveness of NMES combined with exercise to improve PROMs in people with knee OA. Although there may be a decrease in pain in certain studies, future high-quality clinical trials are required to confirm the use of NMES in conjunction with exercise in clinical settings.

5. REFERENCES

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