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Research article

Musical Vibration–Based Electrical Massage for Pain and Physiological Responses Following Femoral Fracture Surgery: A Quasi-Experiment

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Abstract

Pain after major orthopaedic surgery may delay movement and interfere with sleep and rehabilitation. This study examined musical vibration–based electrical massage for pain and physiological responses following femoral fracture surgery using a three-day, two-group quasi-experimental study. The study took place at Siaga Utama Orthopedic Hospital, Purwodadi, Central Java, Indonesia, in 2026 and included 50 postoperative femoral fracture patients, 25 assigned to intervention and 25 to comparison care. The intervention consisted of E-MASIV, an electrical massage intervention coordinated with musical vibrations. Outcomes were assessed using pain intensity scores, heart rate and respiratory rate measured before and after each daily session. The mean intervention-group pain reduction was 0.04 points on day one, 0.56 on day two and 0.88 on day three. Between-group changes were not different on day one ($p = 0.317$), but differed on day two ($p = 0.035$) and day three ($p < 0.001$). Heart-rate and respiratory-rate changes differed between groups on all three days (reported $p < 0.001$). In interpretation, multisensory stimulation might divert attention from pain and support relaxation, but the modest absolute pain changes should be considered in relation to analgesic regimens and clinical thresholds. Physiological changes are supportive outcomes rather than independent proof of analgesia. The design and measurement constraints mean that associations should not be represented as definitive causal effects.

INTRODUCTION

Pain after major orthopaedic surgery may delay movement and interfere with sleep and rehabilitation. Nonpharmacological adjuncts are attractive when they can complement, rather than substitute for, analgesia. Electrical massage coordinated with music might modify sensory attention and sympathetic arousal; evaluating pain alongside heart and respiratory rates provides a broader but still short-term picture.[1,2,3]

The distinction between knowledge, attitudes, immediate physiological response and enduring patient outcomes is essential when interpreting educational or behavioural interventions. Measures may change because of repeated testing,

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increased attention, changes in care environments or clinical recovery. Consequently, a comparison group and a clearly reported measurement timetable are especially important for evaluating findings of practical nursing interest.[4,5,6,7]

We assessed whether the prespecified outcomes differed during the documented observation period in the populations and services studied. We deliberately distinguish changes over time from adjusted intergroup intervention effects, and statistical significance from clinical importance. This distinction is especially relevant when a study is conducted under routine service conditions rather than using individual randomisation.

METHODS

Study design and setting

The investigation used a three-day, two-group quasi-experimental study. It was conducted in Siaga Utama Orthopedic Hospital, Purwodadi, Central Java, Indonesia, in 2026. The manuscript retains the allocation scheme described in the source and does not infer randomisation where none was reported. The study was analysed as a pragmatic evaluation of a context-specific nursing intervention, with outcomes measured over the schedule indicated in the thesis.

Participants and allocation

The study enrolled 50 postoperative femoral fracture patients, 25 assigned to intervention and 25 to comparison care. Participants were enrolled from the stated healthcare services rather than a population-based sampling frame. Because assignment was not random and some study arms were formed at separate facilities or wards, observed arm differences may include differences in case mix, care delivery or baseline exposure. Participants' denominators are reported explicitly where the source provides coherent values.

Intervention and comparison care

The intervention was E-MASIV, an electrical massage intervention coordinated with musical vibrations. The comparison condition was usual postoperative management without the combined device intervention. As an implementation package, the intervention may combine content, provider contact and changes in delivery format; its separate components cannot be attributed independent effects unless the original design included a factorial or component comparison, which it did not.

Outcome measurement

The prespecified or described measurements were pain intensity scores, heart rate and respiratory rate measured before and after each daily session. Outcome direction, categories and units are retained in the Results, and no additional outcome is inferred from the intervention's intended clinical benefit. In particular, a questionnaire result is not treated as proof of a later clinical endpoint; similarly, a single-session physiological response is not equated with long-term disease control.

Statistical analysis

The documented analysis used paired t-tests or Wilcoxon within groups and Mann–Whitney tests for between-group changes. Two-sided statistical significance is interpreted against the study's stated 0.05 threshold. A reported $p = 0.000$ is expressed as $p < 0.001$ rather than an impossible exact probability of zero. Raw records were not supplied separately; therefore no independent confidence intervals, adjusted estimates or participant-level reanalyses were invented.

RESULTS

The mean intervention-group pain reduction was 0.04 points on day one, 0.56 on day two and 0.88 on day three. Between-group changes were not different on day one ($p = 0.317$), but differed on day two ($p = 0.035$) and day three ($p < 0.001$). Heart-rate and respiratory-rate changes differed between groups on all three days (reported $p < 0.001$).

Table 1. Main study outcomes and changes.

Outcome	Pre-intervention	Post-intervention / change	Additional detail
Pain reduction, day 1	—	0.04 points	between-group p = 0.317
Pain reduction, day 2	—	0.56 points	p = 0.035
Pain reduction, day 3	—	0.88 points	p < 0.001
Heart-rate reduction, days 1/2/3	—	6.40 / 4.64 / 3.60 beats/min	p < 0.001 each day
Respiratory-rate reduction, days 1/2/3	—	1.76 / 1.76 / 1.64 breaths/min	p < 0.001 each day

A dash indicates that the specific figure was not reported or is not comparable. P values reflect the statistical results reported for this cohort.

These results are descriptive and inferential findings for the prespecified study context. The table separates pretest measurements from posttest or change measures, avoiding a reinterpretation of category denominators where the source's tabulations conflict. The direction and magnitude of each listed measure should be assessed together with its instrument and the interval between assessments.

DISCUSSION

The most informative finding was that the mean intervention-group pain reduction was 0.04 points on day one, 0.56 on day two and 0.88 on day three. Although this pattern is consistent with the proposed role of the intervention, the statistical result must be interpreted in terms of the design, exposure period and measurement properties. Nonrandomised comparisons and pretest–posttest observations are useful for studying feasibility and initial signals, but they remain vulnerable to confounding and concurrent changes.[8,9,10,11]

Multisensory stimulation might divert attention from pain and support relaxation, but the modest absolute pain changes should be considered in relation to analgesic regimens and clinical thresholds. Physiological changes are supportive outcomes rather than independent proof of analgesia. This explanation is biologically or behaviourally plausible, yet the source data do not test the mechanism directly. It is therefore more appropriate to frame the explanation as a potential pathway than as a demonstrated mediator. Future work should distinguish the core educational or behavioural content from the attention, supervision and accessibility changes that accompany the intervention.

The clinical relevance of the measured outcomes deserves separate scrutiny. A difference in test performance, confidence, adherence score, expressed emotion, pain rating or blood pressure may be worthwhile, but significance alone gives no indication of persistence, implementation cost or downstream patient benefit. Where an endpoint is an intermediate marker rather than the ultimate clinical outcome, research should include longer follow-up and objectively recorded events. Analyses should report effect estimates with uncertainty intervals in addition to p values.[12,13,14,15]

The study also has operational implications for nursing practice. Its context-specific

approach can inform local training materials, patient and family communication, and service-level quality improvement. However, applying it in other populations requires adaptation to resources, literacy, staffing and cultural norms. Implementation should be accompanied by routine monitoring, attention to patient preferences and evaluation of unintended consequences rather than simple replication of the intervention as a fixed package.

Strengths and limitations

A strength is the investigation of an identifiable intervention in a healthcare setting with explicit outcomes. Single-site nonrandom allocation, three-day follow-up, concomitant analgesia, measurement timing and uncertain assessor blinding limit causal and generalisable conclusions. The intervention's electrical and musical components were not separately tested. Additional limitations include the absence of independently available raw datasets for reanalysis and potential reporting variation between prose summaries and statistical tables. The present article therefore privileges directly traceable statistics and does not introduce reconstructed precision.

CONCLUSION

In this study, the mean intervention-group pain reduction was 0.04 points on day one, 0.56 on day two and 0.88 on day three. The findings support further evaluation of the intervention in comparable clinical or community settings but should not be extended to unmeasured patient outcomes or definitive causation. Future work should standardise outcome scoring, report participant flow and between-group adjusted changes, and assess whether observed changes persist beyond the immediate study period.

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