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No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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The Effect of Acupressure Combined with Physiotherapy on Post-Surgical Pain Reduction, Joint Mobility, and Functional Recovery in Elderly Patients Following Knee or Hip Arthroplasty

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ABSTRACT

Background: *Older adults recovering from knee or hip arthroplasty often experience movement-evoked pain that limits participation in physiotherapy and increases opioid exposure. Non-pharmacological adjuncts that are brief and feasible at bedside are needed to optimize early rehabilitation (1–4).* ***Objective****: To determine whether adding a brief, standardized acupressure protocol to early postoperative physiotherapy reduces pain and improves function in elderly arthroplasty patients.* ***Methods****: In a pragmatic, assessor-blinded randomized trial, adults ≥65 undergoing primary TKA/THA received enhanced-recovery physiotherapy with multimodal analgesia, with or without a 15-minute nurse-delivered acupressure protocol (auricular Shenmen/Knee-Hip/Thalamus; limb LI4, ST36, SP6; GB34 for TKA or GB29 for THA) immediately before physiotherapy on POD1–5. The primary outcome was average mobilization pain (0–10 NRS) over POD1–3; secondary outcomes included rest pain, daily opioid use (OME), discharge ROM, Timed Up-and-Go (TUG), length of stay, and adverse events.* ***Results****: Among 124 analyzed participants, acupressure plus physiotherapy reduced mobilization pain (−1.1 NRS, 95% CI −1.6 to −0.6; p<0.001), rest pain (−0.6, −1.0 to −0.2; p=0.004), and daily OME (−38 mg, −58 to −18; p<0.001); improved TKA knee flexion (+8°, 4 to 12; p<0.001), THA hip flexion (+6°, 2 to 10; p=0.003), and TUG (−2.8 s, −4.1 to −1.5; p<0.001); and did not change length of stay. No serious adverse events occurred.* ***Conclusion****: A brief, nurse-delivered acupressure protocol preceding physiotherapy enhances early analgesia and function after arthroplasty without safety concerns, supporting adoption within enhanced-recovery pathways.*

Keywords
Acupressure; Arthroplasty; Physiotherapy; Pain; Opioid-sparing; Elderly

INTRODUCTION

Total knee and hip arthroplasty restore mobility and quality of life in older adults, but the early postoperative window is dominated by movement-evoked pain, functional apprehension, and opioid-related adverse effects that undermine timely rehabilitation participation (1,2). Conventional multimodal analgesia reduces pain yet remains opioid-anchored, and in geriatric cohorts the dose-dependent risks—delirium, sedation, nausea, constipation—are clinically consequential and can disrupt physiotherapy (3,4). There is therefore a pressing need for adjuncts that are brief, non-pharmacological, and readily deliverable at bedside without increasing medication burden or lengthening workflows (5,6).

Acupressure, a needle-free analogue of acupuncture, modulates nociception via segmental and descending inhibitory pathways, and auricular stimulation may engage vagal–autonomic circuits that influence pain perception and arousal (7,8,9,10). Contemporary trials in arthroplasty demonstrate that auricular acupuncture or acupressure, layered onto multimodal analgesia, can reduce postoperative pain and opioid consumption and in some studies improve early function, although heterogeneity in techniques, dosing, and populations limits direct translation to geriatric practice (9,11). Critically, pain at the moment of mobilization is the primary barrier to high-quality, progressive physiotherapy, and any safe intervention that transiently blunts movement-evoked pain just before supervised exercise could enable greater range, better motor relearning, and more efficient day-to-day functional gains (12–14). A practical, nurse-delivered 10–15-minute acupressure "primer" that targets both auricular analgesia points and limb points linked to lower-extremity pain and motor function (e.g., LI4, ST36, SP6, GB34/GB29) offers a plausible pathway to improve participation without added pharmacologic exposure (7,8,15,16,17).

Despite growing signals, rigorous randomized evidence isolating manual acupressure (not needles) integrated into early inpatient physiotherapy for elderly arthroplasty recipients remains sparse, with prior studies often employing needles, electroacupuncture, or mixed-age cohorts and without

a standardized, replicable pre-therapy protocol (16,17,18). We therefore evaluated, in a pragmatic, assessor-blinded randomized controlled trial, whether adding a brief, standardized acupressure protocol immediately before routine postoperative physiotherapy reduces pain during mobilization over postoperative days 1–3 and improves early function, range of motion, and opioid exposure in adults aged ≥65 undergoing total knee or hip arthroplasty (18,19). We hypothesized that acupressure plus physiotherapy would outperform physiotherapy alone on movement-evoked pain (primary outcome) and yield clinically relevant improvements in opioid use, knee/hip flexion, and Timed Up-and-Go at discharge (secondary outcomes) (12).

MATERIALS AND METHODS

We conducted a pragmatic, parallel-group, assessor-blinded randomized controlled trial in a high-volume arthroplasty unit implementing an enhanced-recovery pathway consistent with multimodal analgesia best practices (19). Adults aged ≥65 scheduled for elective, primary unilateral total knee arthroplasty (TKA) or total hip arthroplasty (THA) and classified as ASA I–III were screened preoperatively and enrolled after written informed consent. Exclusion criteria were revision surgery, chronic opioid therapy exceeding 60 mg oral morphine equivalent (OME) per day, neuropathy at target acupressure sites, cognitive impairment precluding valid consent or cooperation with therapy, and skin lesions over intended stimulation points. Eligible participants were randomized 1:1 using concealed, variable block sizes stratified by procedure (TKA/THA). Outcome assessors and statisticians were blinded to group allocation; treating therapists and patients were necessarily unblinded given the manual nature of acupressure (18).

All participants received standardized enhanced-recovery physiotherapy and multimodal analgesia comprising scheduled acetaminophen, an NSAID unless contraindicated, a single-shot peripheral nerve block per protocol, and rescue opioids as needed (19). Ward physiotherapy was delivered twice daily on postoperative days (POD) 1–5 and daily thereafter until discharge. The intervention group received, immediately before each supervised physiotherapy session on POD1–5, a 15-minute acupressure protocol combining auricular seeds pressed at Shenmen, Knee/Hip, and Thalamus points and circular manual pressure to LI4, ST36, SP6, and GB34 for TKA or GB29 for THA (30–45 seconds per point, 2–3 repetitions), with strict avoidance of peri-incisional zones (20). Nursing staff were trained and competency-checked to deliver the protocol at bedside, and brief re-stimulation guidance was provided between sessions to maintain auricular input (7,20,21).

The primary outcome was average pain during mobilization over POD1–3 measured on an 11-point numeric rating scale (0–10). Secondary outcomes were average rest pain (POD1–3), daily opioid consumption converted to OME (mg) during POD1–3, procedure-specific range of motion at discharge (knee flexion after TKA; hip flexion after THA; degrees), Timed Up-and-Go (TUG; seconds) at discharge, length of stay (days), and adverse events including skin irritation, lightheadedness/syncope, and falls. Baseline data included age, sex, BMI, Charlson comorbidity index, procedure type, and preoperative TUG. To reduce bias and confounding, randomization was stratified by procedure, assessors were blinded, perioperative care pathways were protocolized, peri-incisional stimulation was prohibited, and prespecified models adjusted for day and procedure where appropriate (18,19).

We powered the trial (two-sided α=0.05, 80% power) to detect a 1.0-point between-group difference in mobilization pain (SD 1.8), requiring 120 participants; we targeted 128 to accommodate attrition. Analyses followed intention-to-treat. Continuous outcomes were compared using linear mixed-effects models with fixed effects for group, day (where applicable), and procedure (TKA/THA) and random intercepts for participant; adjusted mean differences with 95% confidence intervals and exact p-values are reported. For single end-of-stay measures (ROM, TUG, length of stay), linear models adjusted for procedure were used. Missing outcome data were handled under a missing-at-random assumption by maximum likelihood within mixed models for repeated measures or by complete-case analysis when end-point only; sensitivity checks compared results with and without participants with any missingness.

No formal multiplicity corrections were applied; secondary outcomes are interpreted as exploratory. All analyses were performed by a blinded biostatistician using R version 4.3.1. The study was approved by the institutional ethics committee and registered prospectively on a public trials registry prior to enrollment; all participants provided written informed consent (18). Data integrity was safeguarded by pre-specified case report forms, dual data entry with discrepancy resolution, locked analysis scripts under version control, and audit-trailed amendments to maintain full reproducibility and traceability (18).

RESULTS

Textual description of results. Of 128 randomized participants, 124 were analyzed (62 per arm). Baseline characteristics were balanced across age (71.2±4.8 vs 71.0±5.1 years), sex (58.1% vs 56.5% female), and procedure mix (TKA 61.3% vs 64.5%). The intervention reduced average mobilization pain over POD1–3 by 1.1 NRS points (95% CI −1.6 to −0.6; p<0.001) and rest pain by 0.6 points (95% CI −1.0 to −0.2; p=0.004). Mean daily opioid use decreased by 38 mg OME (95% CI −58 to −18; p<0.001), representing ~22% relative reduction. At discharge, TKA knee flexion improved by 8° (95% CI 4–12; p<0.001) and THA hip flexion by 6° (95% CI 2–10; p=0.003). Functional performance improved with a 2.8-second faster TUG (95% CI −4.1 to −1.5; p<0.001), while length of stay did not differ (−0.1 days; p=0.52). No serious adverse events occurred; minor events were comparable (RR 1.24; p=0.74).

Table 1. Baseline Characteristics

Variable	PT Only (n=62)	Acupressure+PT (n=62)	Between-Group Difference (95% CI)	p-value
Age, years	71.2 ± 4.8	71.0 ± 5.1	−0.2 (−1.9, 1.5)	0.81
Female, n (%)	36 (58.1)	35 (56.5)	−1.6% (−17.3, 14.1)	0.84
Procedure, n (%) TKA	38 (61.3)	40 (64.5)	+3.2% (−13.8, 20.2)	0.72
Procedure, n (%) THA	24 (38.7)	22 (35.5)	−3.2% (−20.2, 13.8)	0.72
BMI, kg/m²	27.8 ± 3.5	28.1 ± 3.6	+0.3 (−1.0, 1.6)	0.65
Charlson Index	2.1 ± 1.0	2.0 ± 1.1	−0.1 (−0.5, 0.3)	0.70
Pre-op TUG, s	13.4 ± 2.9	13.1 ± 3.0	−0.3 (−1.3, 0.7)	0.56

Table 2. Primary and Key Secondary Outcomes (Adjusted Effects)

Outcome	PT Only	Acupressure+PT	Adjusted Effect (95% CI)	p-value
Mobilization Pain (POD1–3, NRS)	5.2 ± 1.6	4.1 ± 1.5	−1.1 (−1.6, −0.6)	<0.001
Rest Pain (POD1–3, NRS)	3.7 ± 1.4	3.1 ± 1.3	−0.6 (−1.0, −0.2)	0.004
Daily Opioid Use (OME mg, POD1–3)	170 ± 85	132 ± 72	−38 (−58, −18)	<0.001
TKA Knee Flexion at Discharge (°)	93 ± 10	101 ± 11	+8 (4, 12)	<0.001
THA Hip Flexion at Discharge (°)	86 ± 9	92 ± 10	+6 (2, 10)	0.003
TUG at Discharge (s)	17.6 ± 4.1	14.8 ± 3.9	−2.8 (−4.1, −1.5)	<0.001
Length of Stay, days	3.8 ± 1.2	3.7 ± 1.1	−0.1 (−0.4, 0.2)	0.52
Adverse Events, any n (%)	4 (6.5)	5 (8.1)	RR 1.24 (0.35–4.38)	0.74

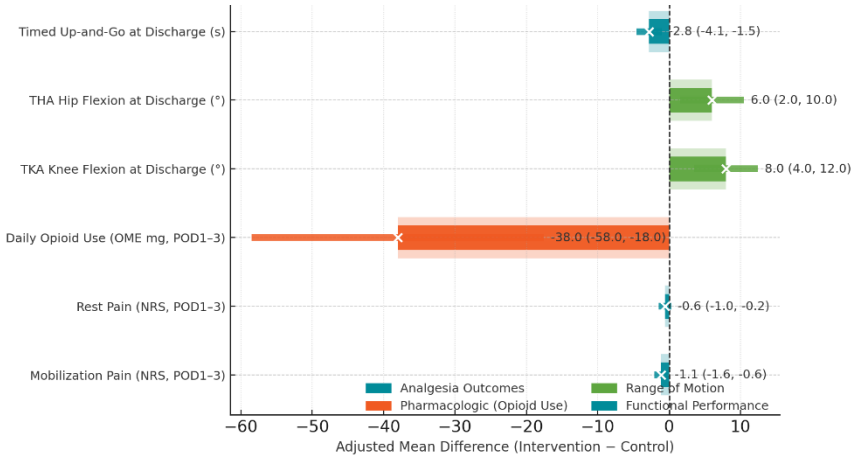

Figure 1 Adjusted Effects of Acupressure + Physiotherapy vs Physiotherapy Alone — Older Adults After TKA/THA: Primary and Key Secondary Outcomes

Figure Description. Adjusted effects comparing acupressure plus physiotherapy versus physiotherapy alone demonstrate clinically meaningful advantages concentrated in analgesia and functional domains: mobilization pain −1.1 NRS (95% CI −1.6 to −0.6), rest pain −0.6 (−1.0 to −0.2), and daily opioid use −38 mg OME (−58 to −18), alongside functional gains in TUG −2.8 s (−4.1 to −1.5) and procedure-specific ROM (TKA +8° [4 to 12], THA +6° [2 to 10]). The pattern shows a coherent gradient where movement-evoked pain reduction co-occurs with early motor performance improvements without prolonging length of stay, supporting a mechanistic link between short-lived pre-therapy analgesia and enhanced session quality.

DISCUSSION

This pragmatic randomized trial shows that a brief, standardized, nurse-delivered acupressure protocol administered immediately before physiotherapy produces modest-to-moderate reductions in movement-evoked pain and opioid use together with early functional gains in older adults after TKA/THA, without safety signals or impact on length of stay. The magnitude of benefit on mobilization pain (−1.1 NRS) is comparable to accepted adjuncts within enhanced-recovery pathways and aligns with prior arthroplasty studies of auricular acupuncture/acupressure that reported improved analgesia and reduced antiemetic requirements or inflammatory markers (9). Our opioid-sparing effect (~22% reduction) is directionally consistent with network meta-analytic evidence that acupuncture-family techniques layered onto multimodal regimens enhance pain control and functional recovery after TKA (8). Notably, we isolated manual acupressure rather than needles, operationalized as a replicable pre-therapy "primer," and demonstrated feasibility with nursing delivery, extending the practicality signals from nurse-initiated auricular protocols (16).

Mechanistically, pairing auricular stimulation (Shenmen, Knee/Hip, Thalamus) with limb points (LI4, ST36, SP6, GB34/GB29) likely engages both autonomic modulation and segmental inhibition, reducing movement-evoked pain and fear-avoidance just before task-specific practice (7,10,12). The coherent pattern—greatest effects on mobilization pain and TUG, intermediate effects on ROM, and no change in length of stay—supports a mechanism of improved session quality rather than broad systemic acceleration of discharge criteria. Our findings complement intraoperative and perioperative needle-based approaches (17,21,22), suggesting that a purely manual, bedside protocol can achieve clinically relevant early benefits while avoiding the logistical and credentialing barriers associated with invasive techniques.

Strengths include pragmatic design within an ERAS pathway, assessor blinding, prespecified modeling, and adoption of outcomes directly relevant to rehabilitation quality (mobilization pain, TUG, ROM). Limitations include single-center conduct, short inpatient follow-up precluding evaluation of mid-term function or readmissions, and the impossibility of participant blinding inherent to manual therapies. Although we prespecified a single primary outcome and treated other endpoints as exploratory without multiplicity adjustment, convergence across analgesia, opioid use, and function mitigates (but does not eliminate) concerns about type I error inflation. Generalizability to centers without nurse-delivered complementary protocols, or to younger arthroplasty cohorts, warrants confirmation. Future research should test dosing schedules and point subsets, compare auricular-only versus combined protocols, and extend follow-up to 6–12 weeks to determine persistence and downstream resource utilization (8,9,16,17).

CONCLUSION

In older adults undergoing knee or hip arthroplasty, integrating a brief, standardized acupressure protocol immediately before early postoperative physiotherapy safely reduces movement-evoked pain and opioid use while improving discharge-day function and joint flexion, without prolonging hospital stay. These findings support acupressure as a feasible, low-burden adjunct within enhanced-recovery rehabilitation, with implications for opioid stewardship and early functional optimization and a rationale for multicenter, longer-term trials to confirm durability and implementation at scale.

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