

Effects of Passive Static Stretching on Hip Range of Motion in Patients with Joint Pathologies and Healthy Individuals: A Pilot Study

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1. Introduction and Study Overview

This pilot study aimed to explore the effects of a four-week passive static stretching program on hip mobility in three groups: patients who had undergone total hip arthroplasty (THA), patients with chronic non-surgical hip pain, and healthy individuals with no history of hip problems. The main goal was to investigate whether the stretching protocol could improve hip flexion and abduction, while also assessing feasibility, safety, and adherence to the intervention.

We enrolled 12 participants in total (7 women and 5 men; mean age 52.5 ± 6.8 years), divided into three homogeneous groups of four participants each. Group A included patients who had undergone THA, Group B consisted of patients with chronic hip pain, and Group C comprised healthy volunteers. Participants were selected based on their ability to complete the protocol, absence of neurological or musculoskeletal conditions affecting motor control, and no contraindications to stretching. All participants provided written informed consent before enrollment.

2. Study Design and Intervention

The study followed a prospective, non-randomized design and adhered to the CONSORT extension for pilot and feasibility studies. This approach ensured transparency and rigor, even though the small sample size meant that all analyses were primarily exploratory.

The stretching program consisted of assisted hip flexion and abduction exercises, each held for 30 seconds, performed three times per week for four consecutive weeks (12 sessions in total). Every session was supervised by an experienced kinesiologist, who ensured proper positioning, correct biomechanical alignment, and submaximal intensity to avoid pain or injury. All sessions took place in a controlled laboratory environment to minimize variability in temperature, lighting, noise, and equipment.

Participants were asked to maintain their usual daily routines and refrain from initiating any new hip-specific rehabilitation or medication during the study period.

3. Outcome Measures

The primary outcome was hip range of motion (ROM), measured in flexion and abduction using high-precision triaxial electronic sensors (Sensorize) equipped with accelerometers and gyroscopes. Measurements were taken both before and after the intervention by the same assessor with extensive experience, ensuring consistency and reliability.

Secondary outcomes included treatment feasibility, adherence, and safety. Although participants and therapists could not be blinded due to the nature of the intervention, outcome assessors and data analysts were blinded to group allocation.

4. Statistical Analysis Plan

Given the small sample size ($n=4$ per group), analyses were mostly descriptive. Continuous variables were summarized using means and standard deviations, while categorical data were presented as counts and percentages.

Pre–post comparisons of hip ROM within each group were performed using two-tailed paired t-tests, with a significance threshold of $p < 0.05$. Analyses were conducted separately for flexion and abduction. No post hoc or subgroup analyses were performed. Missing data were either imputed or excluded, depending on availability.

5. Baseline Characteristics

Participants ranged from 32 to 77 years of age, with diverse occupational and activity backgrounds. Some reported unilateral or bilateral hip pain, while others were asymptomatic. Baseline ROM reflected these differences:

Group	n	Flexion (°)	Abduction (°)
A (THA)	4	78.2 ± 5.4	27.4 ± 3.1
B (Chronic hip pain)	4	89.6 ± 4.9	33.7 ± 2.8
C (Healthy)	4	101.3 ± 6.2	40.9 ± 4.1

6. Results and Interpretation

After completing the 4-week program, all groups showed significant improvements in hip flexion and abduction ($p < 0.05$). No adverse events were reported, and all participants attended every session, indicating high adherence and feasibility.

Given the exploratory nature of this pilot study, results should be interpreted cautiously. Nonetheless, the findings suggest that passive static stretching is safe, well-tolerated, and potentially beneficial for improving hip mobility in both clinical and healthy populations.