# Improving balance and reducing pain in Osteoporosis using Augmented Reality (AR) exergames: Results from a Clinical Trial

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## Background

Osteoporotic fractures are a major cause of disability, mortality, and healthcare costs. 50% of women and 25% of men are at risk of experience fractures.

Exercise is effective for preventing falls and fractures, patient motivation and adherence to exercise regimens remain significant challenges.

Our clinical trial aimed to evaluate the efficacy of augmented reality (AR) pose-tracking exergames in improving balance and reducing fall risk in individuals with osteoporosis.

## Methods

Run-in: 48 participants

Baseline assessment (Pain: Visual Analogue scale (VAS), Balance: Timed Up and Go (TUG) test) + Technological assessment

Phase 1: 41 participants aged 60-86 years old - 12 training sessions i.e. 6 weeks, twice a week for 20min.

### Control group (N=21)

Traditional training

Age (median): 68 years old

Weights

Step up / Lunges

Sit to Stand

Squats

Arm Raises




### Intervention group (N=20)

Exergames training

Age (median): 70 years old

Weights

Camera

AR headset

Final assessment (Pain: VAS, Balance: TUG test)

## Results

### Pain:

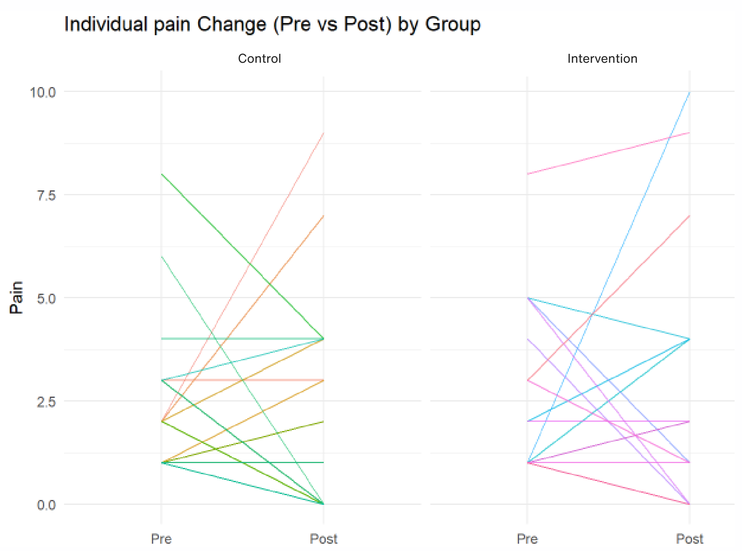
Both groups self-reported pain reduction on the VAS. The pain difference (Pain score at study-end – Pain score at baseline) shows a greater range for the intervention group.

- Intervention: -5 to +4 (mean = -0.42, median = -1, SD =2.32)
- Control: -6 to +5 (mean = -0.14, median = 0, SD = 2.89)

### Balance:

The TUG test (higher value represents an increased risk of falls) shows a greater balance improvement for the intervention group.

- Intervention: -3.47 to +3.73 (mean = 0.05, median = 0.05, SD =1.98)
- Control: -2.98 to +455 (mean = 0.35, median = 0.25, SD = 1.79)




*“ My knees are better. I feel my arms are a bit stronger. And it's easier for me to get off a chair” (female aged 72)*

*“I noticed that I was able to do heavier weights. That was the big thing, I noticed. I felt very confident doing heavier weights” (female aged 72)*

*“I used to have pain in my hips, when I when I sat down, when I stood up from sitting, and I don't have that now” (female aged 64)*

*“I felt that it was an achievement for me to do it. I used to do a lot of squats, years ago. You know, and I was very good at doing squats” (female aged 76)*

## Conclusions

Self-reported outcomes indicated that the intervention group experienced enhanced balance, mobility, and a greater reduction in pain. AR exergames are equivalent if not slightly better, compared to traditional rehabilitation in improving balance and reducing pain.

## Acknowledgments

We thank the participants who identified the need for and participated in this trial. We thank the Health Research Board Clinical Research Facility Galway (HRB-CFRG) for providing facilities for the trial.

Scan to see the games

Ollscoil na Gaillimhe University of Galway

d-real SFI centre for research training in digitally-enhanced reality

Taighde Éireann Research Ireland