## Co-design of a mediated reality system to reduce pain in people with knee osteoarthritis.



• Major barriers to clinical translation of new technology is sufficient ease of use in clinical settings and low acceptability amongst end-users (patients and clinicians). Working with people who had knee osteoarthritis and with clinicians, we co-designed a clinic-ready mediated reality system, with high useability and acceptability in end-users. Our results support clinical translation of the technology, although further work is required to evaluate potential efficacy.

## BACKGROUND & AIMS

in exercise is pain. While exercise can reduce pain in the long-term, it often increases pain in the short-term.

KEY

POINTS

- potentially creating an analgesic window during which people with knee OA can be more active.
- MeR technology to date is complex and not suitable for clinical environments. Clinical translation of MeR technology is need.

AIM: To co-design a clinic-ready version of the MeR system in collaboration with end-users (knee OA consumers and clinicians)

## METHODS

**Design:** Iterative co-design process involving knee OA consumers and physiotherapists. These end-users were invited to experience the MeR technology over 3 rounds of testing. Between each round, end-user feedback was synthesised by the study team, and adjustments were made to the MeR technology and clinical delivery.

**Knee OA consumers:** met the NICE criteria for knee OA, reported moderate pain (≥4 out of 10 on a 0-10 Visual Analogue Scale) and disability (≥4 on the 7-point Global Disability Scale), and were physically inactive.

**Clinicians:** required have  $\geq 5$  years of clinical practice and current registration as a physiotherapist.

**Outcomes:** MeR safety (cyber-sickness, 0-100 scale), feasibility (number of technical/physical set-up issues), credibility (4-20 scale), and acceptability (8-40 scale) were evaluated as primary outcomes (all phases). Change in knee pain intensity (0-100 NRS) during the VT illusions (Phase 2, 3) was a secondary outcome.

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• Exercise is a core treatment for knee osteoarthritis (OA), however most people with knee OA are inactive. A major barrier to engaging

New mediated reality (MeR) technology shows clinical promise. MeR systems can create visuo-tactile (VT) illusions, which alter the viewed knee morphology. Such illusions have been shown to reduce knee OA pain by up to 40%, with analgesia lasting 2-20 minutes,

## MeR SYSTEM

The 'clinical' MIRAGE MeR system consisted of a Microsoft Surface Pro Tablet (Redmond, WA, USA) and a bespoke program created using Labview software (National Instruments, TX, USA).



Stretch illusion: visual elongation of the knee with gentle traction



Shrink illusion: visual shrinking of the knee with gentle compression

• The co-design process resulted in numerous changes to the MeR system. The updated system was found to be safe, feasible, acceptable, and considered a credible treatment by people with knee OA. Clinicians found that the system had high feasibility and acceptability. Findings support the ability of clinicians to use this technology within clinical settings. • Future work to evaluate the efficacy of this clinical MeR system in reducing pain and improving exercise engagement in people with knee OA is warranted.





Fig 2: Change in pain intensity during illusions





Fig 1: flow diagram of synthesised end-user feedback and MeR design modifications through feedback rounds.



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