The Effectiveness of Virtual Reality as an Intervention to Decrease Chronic Low Back Pain in Adults as Compared to Standard Therapeutic Intervention: A Systematic Review

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PREVALENCE OF CHRONIC LOW BACK PAIN (LBP)

- According to the American Physical Therapy Association’s “Move Forward” Low Back Pain Survey (2012)¹
  - More than one-third of Americans reported LBP impacts ability to perform daily tasks, exercise, and sleep
  - Nearly 3 in 4 Americans (72%) reported using pain medications to relieve symptoms

- National Institute of Neurological Disorders and Stroke (2014)²
  - 80% of Americans experience LBP
  - Most common cause of job-related disability
PREVALENCE OF CHRONIC LOW BACK PAIN (LBP)

- Centers for Disease Control, Summary Health Statistics (2015)\(^3\)
  - LBP ranked higher than neck pain, face/jaw pain, and pain related to severe headaches and migraines for adults in the U.S. aged 18 and older
  - Greater than one-third of Americans aged 45-75 and older experience LBP

- A qualitative study by Palazzo, Klinger, and Dorner et al examined barriers to exercise program adherence for patients experiencing chronic LBP (2016)\(^4\)
  - Common reasons reported for failed adherence: repetitive exercise program, lack of feedback, fear avoidance behaviors, lack of support, lack of motivation
  - Solutions offered by patients: social networks, videos for guidance in good form, virtual reality programs that provide feedback, progressive challenge
NON-IMMERSIVE VIRTUAL REALITY

Immersive Virtual Reality

- Non-invasive computer simulation
- User interacts with a three dimensional computer generated environment
- User wears a head mounted display
- User interacts via accessory devices such as keyboards, mice, or controllers, or with bodily motions
- Considered to be the highest interactive implementation of virtual reality

Non-Immersion Virtual Reality

- Non-invasive computer simulation
- User interacts with a two dimensional computer generated environment
- Display is usually a computer monitor or a TV screen
- User interacts via accessory devices such as keyboards, mice, or controllers, or with bodily motions
- Less costly to implement than immersive virtual reality
To determine the effectiveness of virtual reality (VR) as an intervention to decrease chronic low back pain (LBP) in adults as compared to conventional physical therapy (PT) intervention.
METHODS

- **Search Terms:**
  - (virtual reality OR VR OR virtual reality gaming OR gaming) AND (back pain OR chronic back pain OR low back pain OR LBP)

- **Search Limits:**
  - English language
  - Human subjects

- **Databases:**
  - MEDLINE/Pubmed, Proquest, CINAHL, Cochrane Library, ScienceDirect
SELECTION CRITERIA

- Selection Criteria:
  - Diagnosis of chronic low back pain (> 2 months)
  - Adults 18 years and older
  - Randomized controlled trials (RCT)
  - Interventions including VR
  - Assessment using a valid and reliable pain scale
EXAMPLE VIRTUAL REALITY SYSTEMS
**Records identified through database searching** (n=607)

**Additional records identified through other sources** (n=3)

**Records after duplicates removed** (n=597)

**Records screened** (n=597)

**Full-text articles assessed for eligibility** (n=9)

**Studies included in qualitative synthesis** (n=6)

**Records excluded** (n=588)
- By title due to irrelevance (573)
- By abstract (15)
  - Study Design: 10
  - Population: 2
  - Intervention: 3

**Full-text articles excluded with reasons** (n=3)
- Study design = 3
### PEDro SCORING

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**Average:** 6.7  
**Range:** 5-10 (Moderate to Good Evidence)
RESULTS

- Samples ranged from 21-52 subjects (207 total)

- Average age of subjects ranged from 24-68 years old

- Five of 6 studies reported baseline average LBP ranging from 6-7 on a visual analog scale

- VR intervention ranged from 15-30 minutes (avg. = 23.3)
  - Frequency ranged from 3-5 sessions/week (avg. = 3.5)
  - Duration ranged from 2-8 weeks (avg. = 5.5)
RESULTS

- Of the 6 studies selected:
  - All used non-immersive VR
  - All reported significant within group differences in pain reduction for VR groups
  - All were compared to control groups receiving traditional therapeutic exercises
  - Interventions included VR as the sole treatment or in conjunction with therapeutic exercises

- Four of 6 studies compared between group differences:
  - Two found statistically significant reductions in pain favoring VR intervention groups
    - Wii Fit Yoga
    - VR Walking program (viewed on screen, with video glasses)
RESULTS

- Other clinically significant benefits reported in the studies:
  - Improved functional outcomes\textsuperscript{6,7,9} (Sit to Stand, TUG, 6MWT, ODI)
  - Decrease in fear avoidance behavior\textsuperscript{7,9} (Tampa Kinesiophobia Scale, FABQ)
  - Improved well-being\textsuperscript{10} (RAND-36 Mental Health Composite)
LIMITATIONS

- Variable treatment parameters
  - Frequency (3-5 sessions), time per session (15-30 min), treatment duration (2-8 wks)

- Variable VR interventions
  - Commercial systems: Wii Fit (recreational games, yoga, task-specific training)
  - VR passive walking program, tablet games
  - VR dodgeball (system developed through research)

- Lack of between group comparisons in two studies
- Lack of follow-up to determine long term effects of interventions
- Limited databases used
CONCLUSIONS

- Moderate to strong evidence suggesting that non-immersive VR is a promising intervention to consider as part of a therapeutic exercise program for patients with chronic LBP, but research is limited to suggest it is superior to therapeutic exercise programs alone.

- Further research is needed to determine which specific non-immersive VR programs and treatment parameters are most effective for quality evidence-based practice.
VR is a novel opportunity for task-specific training in a stimulated, safe environment.

Emerging evidence showing that VR:

- Increases functional outcomes attained in therapy\(^6,7,9\)
- Improves emotional well-being\(^10\)
- Helps to breaks the cycle of fear avoidance behaviors\(^7,9\)
Recommended VR session parameters for pain reduction:

- 20-25 minutes per session
- 3-5 times a week for 4-6 weeks

Clinicians should consider VR as an adjunct to conventional PT to improve delivery of patient care
Future research should:

- Examine pain reduction in VR only groups as compared to conventional PT groups
- Examine effectiveness of VR programs in maintaining improved pain outcomes over time through follow-up assessments
- Determine impact of VR interventions in improving patient adherence to plan of care for chronic LBP
- Establish more consistent treatment parameters for non-immersive VR programs to improve application to practice
- Compare efficacy of non-immersive and immersive VR programs in treatment of chronic LBP
CURRENT RESEARCH ON VR AND LBP

- *Video-game based exercises for older people with chronic low back pain: a protocol for a feasibility randomised controlled trial (the GAMEBACK trial)*\(^\text{12}\) (2017)

- *Attitudes toward a virtual reality physical activity intervention among veterans with chronic low back pain*\(^\text{13}\) (2017)
  - Supplement—Journal of Pain prints abstracts of presentations where data is yet to be published
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REFERENCES


QUESTIONS?