Virtual Reality in Pain Management: A Review Across Acute Procedural and Chronic Pain Rehabilitation

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BACKGROUND

Virtual Reality (VR) has recently emerged as a nonpharmacologic adjunct across two distinct pain regions: acute procedural pain, defined as short-term discomfort caused directly by medical treatments, diagnostic tests, or interventions (wound dressing changes, injections, biopsies, and immunizations. The second region is chronic pain rehabilitation, defined as active, team-based medical programs treating long term conditions (low back pain and chronic regional pain syndrome). The literature has followed roughly the same path for both distinctions; procedural VR research emphasizes distinction based analgesia during time-limited interventions. Chronic pain VR research emphasizes graded exposure, kinesiophobia reduction, and motor retraining over extended treatment courses. However, despite both pathways sharing the same underlying mechanisms, integrated outcomes across both applications did not clarify where VR's analgesic mechanism is consistent versus context-dependent.

METHODS

Targeted web searches across databases using queries such as "virtual reality procedural pain" and "chronic pain rehabilitation". Databases used were PubMed and JMIR.

OBJECTIVE

To systematically review and compare the mechanisms, efficacy, and limitations of VR intervention in acute procedural pain vs chronic pain rehabilitation, with specific focus on Physical Medicine and Rehabilitation (PM&R) applications.

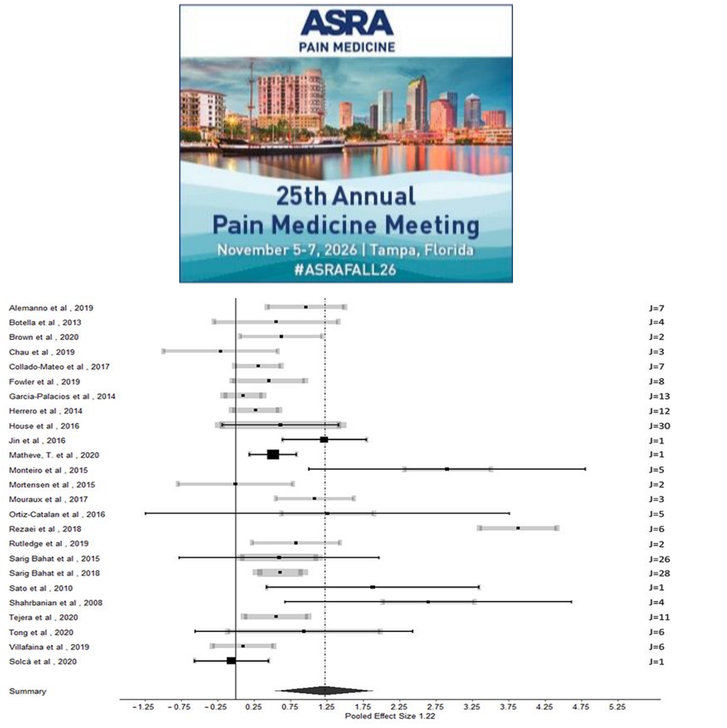


Figure 1. Summary forest plot for the effect of virtual reality on all outcome measurements in patients with chronic pain. Each line presents the results of 1 study. The meta-analytic mean, with the corresponding 95% CI, is presented with a black dot and black line. This black 95% CI represents the total study precision.

RESULTS

Procedural VR literature shows consistent short-term analgesic effects via attention distraction. These are best demonstrated in pediatric and burn populations. A larger pooled analysis reinforced this direction of effect at much greater statistical power. Across randomized controlled trials involving 9,138 patients using reported pain scores, VR produced a significant reduction in pain compared to non-VR control, with a standardized mean difference of −0.65. Chronic pain VR literature shows more varied outcomes with effect sizes diminishing over longer follow-up alongside different pain types and the type of VR used. The systematic reviews and meta-analysis did not show any significant findings for long lasting pain reduction from VR in chronic pain, despite survey data showing a substantial amount of patients with chronic pain are already using the technology.

DISCUSSION/CONCLUSION

Combining the literature suggests that VR's analgesic mechanisms do not transfer to different pain modalities uniformly. From acute distraction based use to chronic rehabilitation, there are a variety of methods to treat a patient's pain from a PM&R clinician's perspective based on pain chronicity and type. Several limitations should be acknowledged. From a literature review standpoint, this is built from a narrative standpoint rather than a multi database systematic review, introducing potential bias. The population also varies widely within this study, which limits direct correlation.

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