



Effect of Virtual Reality on Pain Management After Head and Neck Surgery: Preliminary Results From a Randomized Controlled Trial

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INTRODUCTION

Optimal postoperative pain management is challenging. Virtual reality (VR) provides an immersive, three-dimensional (3D) experience that has been explored to reduce reliance on pharmacologic management of pain. The purpose of this study is to evaluate the effect of VR on postoperative pain management after head and neck surgery using an interactive VR experience compared to a two-dimensional (2D) control intervention.

METHODS

This is a prospective, randomized controlled clinical trial (NCT#04464304) of patients who have undergone major head and neck surgery requiring inpatient admission. Beginning in July 2020, patients were randomly assigned to participate in a fifteen-minute interactive gaming experience (Angry Birds, Resolution Games) using an Oculus Quest VR headset (**Figure 1**) or using a smartphone.

Utilization of analgesics including opioids up to eight hours pre- and post-intervention are recorded. Pain scores are obtained pre-intervention and post-intervention immediately after the intervention and then hourly up to four hours after intervention use. A short questionnaire is administered to evaluate for patient satisfaction with their experience and interest in using their assigned intervention in the future on a 5-point Likert scale.

RESULTS

We plan to enroll a total of 30 patients, randomizing 15 to each group. We have completed enrollment for 23 patients. Procedures included surgical resection of thyroid, oral cavity, and oropharyngeal malignancies, total laryngectomy, tracheostomy, and free tissue reconstruction. On preliminary analysis, there are no significant differences between the VR group (n=10) and control group (n=13) in comparing age, gender, BMI, Charlson Comorbidity Index, preoperative opioid use, or time to intervention after most recent opioid use.

There are no significant differences in reduction of pain scores immediately after intervention (mean $\pm$ SD: -1.8 ± 1.3 vs. -0.9 ± 2.0 , $p=0.24$), 1 hour after (-0.7 ± 1.0 vs. 0.1 ± 1.7 , $p=0.19$), 2 hours after (-0.5 ± 1.4 vs. 0.5 ± 1.8 , $p=0.18$), 3 hours after (-0.6 ± 1.6 vs. 0.5 ± 2.4 , $p=0.25$), or 4 hours after intervention use (-0.6 ± 1.6 vs. 0.5 ± 2.1 , $p=0.2$). There was one distinct outlier in pain score among the control group immediately after intervention use. After excluding this outlier with marked pain score reduction to 0, VR patients demonstrated a greater reduction in post-intervention pain score immediately after intervention use (-1.8 ± 1.3 vs. -0.4 ± 0.7 , $p=0.004$) (**Figure 2A and Figure 2B**).

VR patients demonstrate a larger reduction in 4 hour post-intervention opioid use compared to 4 hours pre-intervention (morphine milligram equivalents, MME: -10.1 ± 13.6 vs. -1.7 ± 3.3 , $p=0.04$) (**Figure 3**). VR patients are trending towards a larger reduction in 8 hour post-intervention opioid use compared to 8 hours pre-intervention (MME: -12.1 ± 21.4 vs. 0.0 ± 11.0 , $p=0.1$). There was a trend towards greater enjoyment of the VR experience (5-point Likert scale: 4.4 ± 0.5 vs. 3.9 ± 1.1 , $p=0.23$) and patients wanting to use the VR experience more often in their healthcare (5-point Likert scale: 4.4 ± 0.8 vs. 3.8 ± 1.2 , $p=0.16$). There have been no adverse events reported.

Figure 1. Patients utilizing VR.



Figure 2. A) Change in pain score immediately after intervention use. **B)** Change in pain score immediately after intervention use without outlier.

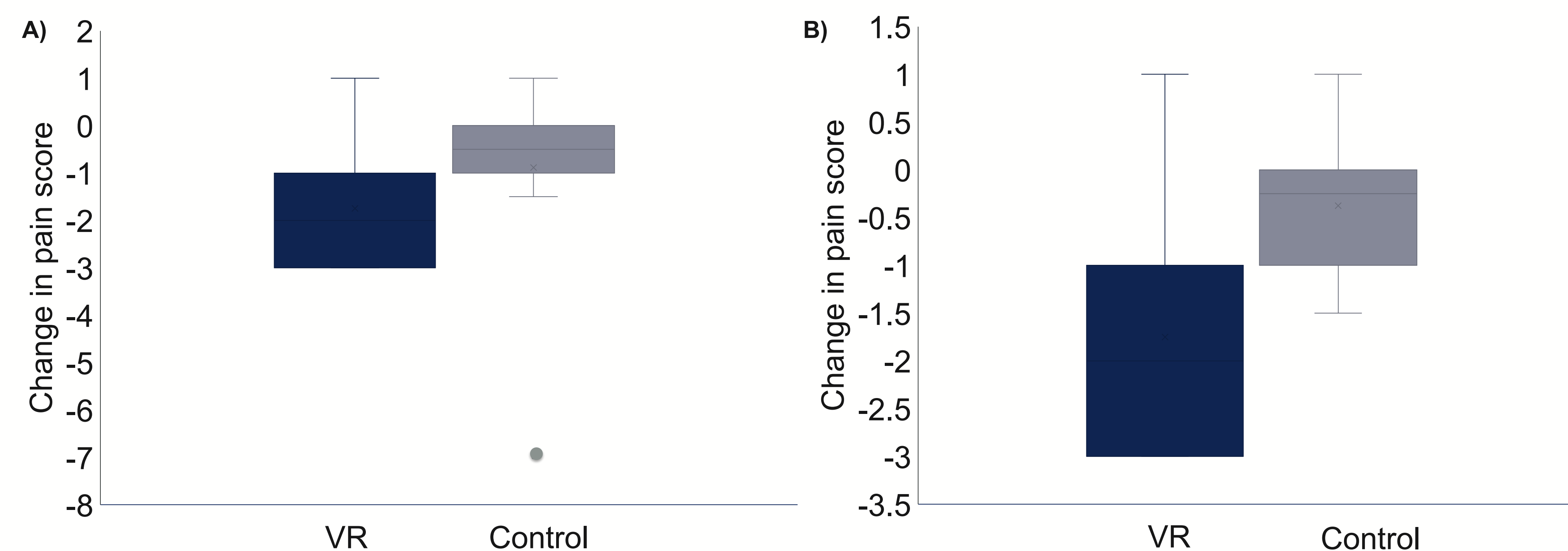
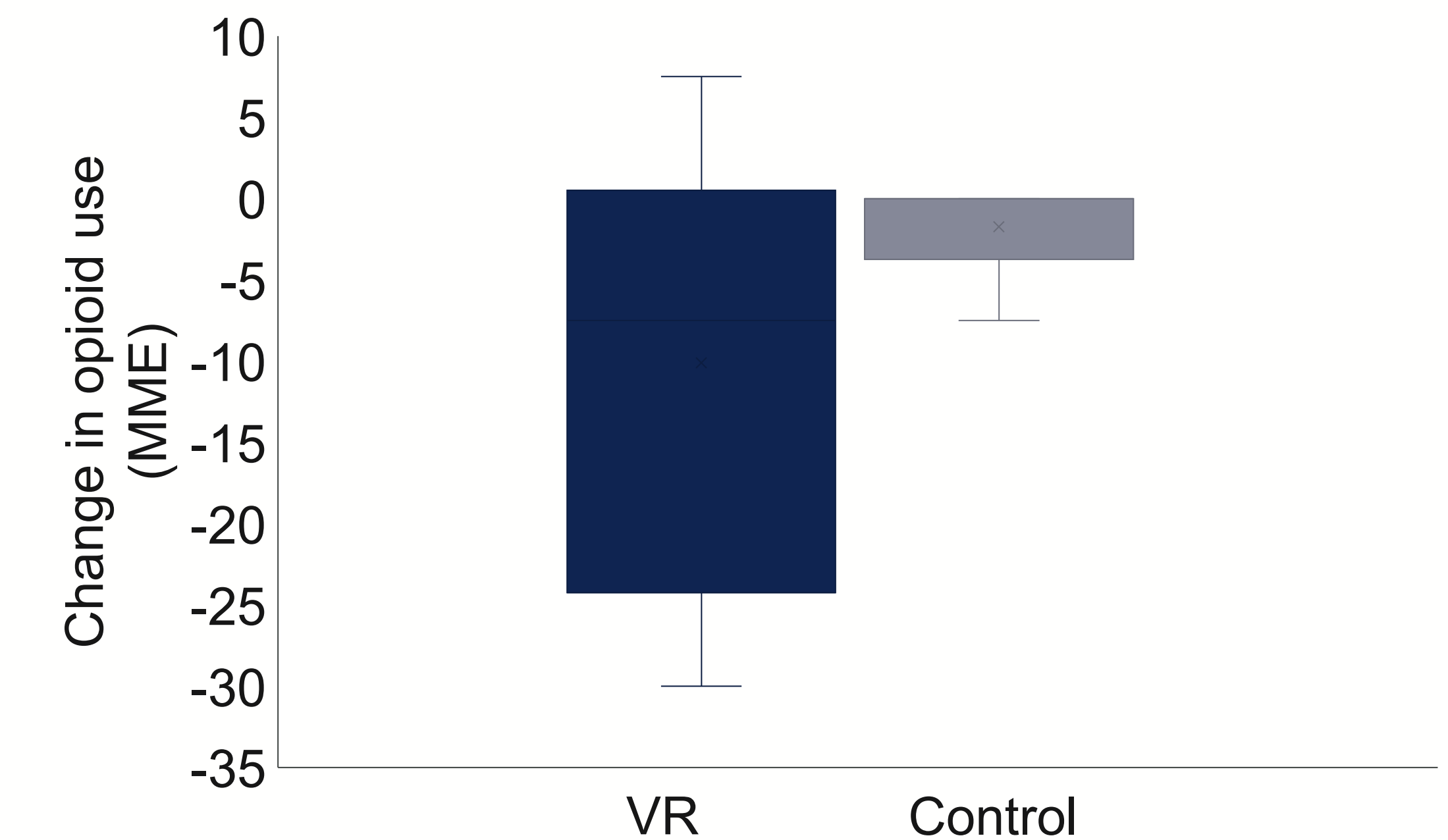


Figure 3. Reduction in opioid 4 hours pre-intervention compared to 4 hours post-intervention.



DISCUSSION

Preliminary analysis of this randomized controlled trial demonstrates that VR appears to be associated with a reduction in short-term pain scores and opioid use compared to the control intervention.

Narcotic analgesics are a major part of postoperative pain management after head and neck surgery, but these have risks including nausea, sedation, respiratory depression, constipation, and dependence. Multimodal analgesia is a strategy to reduce narcotic use and improve recovery. However, medical comorbidities as well as risks of bleeding provide a major challenge that may contraindicate the use of certain medications. It is important to identify non-pharmacologic adjuncts for postoperative pain control that can improve recovery without compromising patient safety. Results from this preliminary analysis suggest that VR may provide a novel non-pharmacologic analgesia option after head and neck surgery.

Additionally, there have been no adverse events reported in use of VR, including nausea, dizziness, or eye strain. Both VR and the control intervention also appear to be well received by patients. Results from this study will be used to create future research protocols utilizing VR in the postoperative setting.

CONCLUSIONS

Virtual reality may be a useful and enjoyable non-pharmacologic adjunct to facilitate pain control and postoperative recovery after head and neck surgery.

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