Implementation of Virtual Reality and Fitbit Wearable Activity Devices in Postoperative Recovery: A 4-Arm Randomized Controlled Trial

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OBJECTIVE

To examine the impact of digital interventions (virtual reality [VR] and Fitbit wearable activity devices) on postoperative recovery after head and neck surgery. We hypothesize that patients utilizing VR and encouraged to achieve daily ambulation goals in their postoperative recovery would demonstrate reduced opioid use, which may suggest improved postoperative pain control.

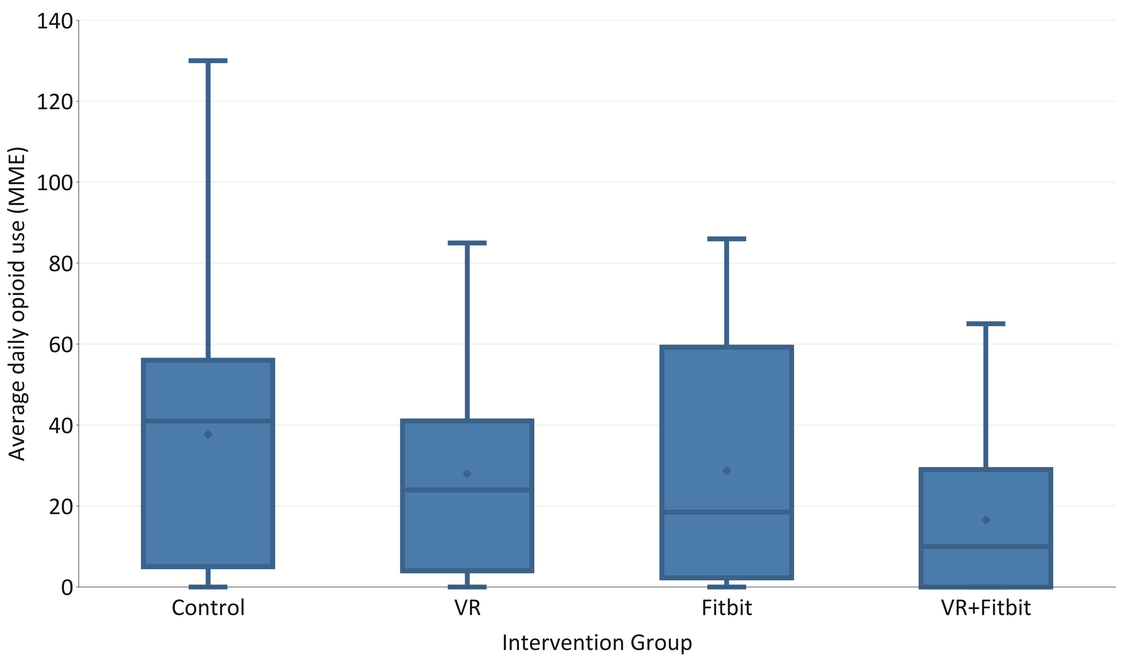
METHODS

- Prospective, 4-arm, randomized controlled trial at a single tertiary academic center among patients undergoing inpatient surgery from November 2021 to July 2022.
- Inclusion: English speaking, ≥ 18 years of age, expected length of stay (LOS) ≥ 2 days.
- Exclusion: Planned postoperative admission to the intensive care unit (ICU), social or psychiatric conditions that may interfere with compliance, isolation precautions, history of vertigo or motion sickness, history of seizure or epilepsy, mobility restrictions, use of a walker or wheelchair at baseline, cardiac pacemaker or defibrillator use, requirement for hearing aid use at all times, and expected reconstruction or wound care that would impact the ability to utilize a VR headset.
- Patients completed preoperative and and postoperative measures: Generalized Anxiety Disorder 7-item scale (GAD7), Patient Health Questionnaire-9 (PHQ9), and Insomnia Severity Index (ISI).
- The primary outcome measure was average daily opioid use measured as morphine milligram equivalents (MME). Hospital satisfaction was determined using a visual analog scale (VAS) on a 100mm scale.

Groups

- Control: Standard postoperative care.
- VR: Brought VR headsets starting postoperative (POD)1 for up to 30 minutes at a time. Repeated VR utilization was given at minimum 3 hours apart.
- Fitbit: Provided Fitbit devices starting POD1. Encouraged to achieve a goal of 2,000 steps per day. Daily steps counts and total sleep time (TST) were recorded.
- VR+Fitbit: Provided VR headsets and the Fitbit devices combining protocols used in VR and Fitbit groups
- The projected minimal sample to achieve 80% power was 17 per group (total n=68). A final sample size of 20 per group (n=80) was determined to account for potential drop-outs.

Figure 1. Average daily opioid use among each cohort



VR + Fitbit group had significantly reduced average daily opioid use compared to control patients (10.0 [29.0] MME vs. 40.70 [50.0] MME, U=96, z=-2.1, p=0.04).

RESULTS

- Among the final population included for analysis (n=75), the majority of patients were male (69.3%) and mean ± SD age was 58.9 ± 14.6 years. The majority of patients underwent surgery involving the skullbase (32.0%) followed by oral cavity (28.0%). There were no differences in tobacco use, preoperative opioid use, chronic pain, anxiety, depression, surgical site, presence of tracheostomy, free tissue reconstruction, or use of a lumbar drain between groups (p>0.05).

Outcomes

- After outlier removal, there was only a significant difference in opioid use between the VR + Fitbit and control groups (**Figure 1).** There were no differences in other measures (p>0.05).
- There was higher patient satisfaction among patients in the interventions cohorts (control: n=16, 85.0 [22]; VR: n=15, 90.0 [25]; Fitbit: n=14, 97.5 [7]; VR+Fitbit: n=15, 96.0 [7]; p=0.018).

VR Use

- Among the VR and VR+Fitbit groups, VR was brought for utilization 223 times and utilized 63 times (28%). Mean reduction in post-VR pain score was 1.0 ± 1.3, and mean VR-use time was 23.7 ± 7.9 minutes.
- There were 3 mild adverse events noted. One patient had neck discomfort and two patient noted nasal discomfort that resolved within a few minutes without any need for intervention.

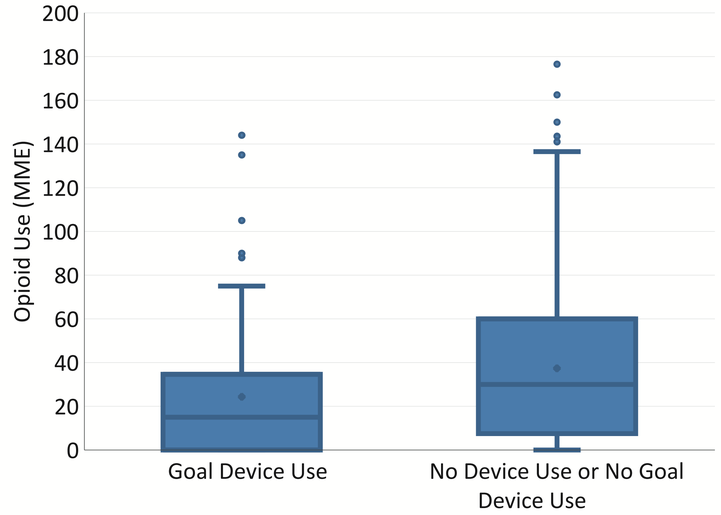
Fitbit Use

- Among patients in the Fitbit and VR+Fitbit groups, mean daily step count was 1,846 ± 1,424 steps.
- Average daily TST of 280.2 ± 79.3 minutes (4.6 ± 1.3 hours). There was an inverse correlation between TST and postoperative ISI scores (r=-0.54, p=0.009).

Combined VR use and Fitbit goals

- Days in which VR was used and/or patients achieved 2,000 steps per day (n=88/324, 27.2%) were associated with reduced opioid use.
- 15.0 [34.7] MME vs. 30.0 [52.5] MME, U=7,971, z=-2.35, p=0.001, **Figure 2**.
- There were also differences in daily pain scores between days in which patients used VR and/or achieved 2,000 steps per day compared to days without goal device use or any device use.
- 3.0 [4.3] vs. 4.0 [3.7], U=7,704, z=-3.59, p<0.001.

Figure 2. Daily opioid use among patients utilizing VR and/or achieved 2,000 steps per Fitbit compared to patients without any device use or goal device use.



DISCUSSION

In this study, combined use of VR experiences and daily step goals provided through Fitbit wearable activity devices was associated with reduced opioid use and improved patient satisfaction among hospitalized patients after surgery.

There is rising use of VR within healthcare, and within the postoperative setting VR has shown to reduce opioid usage. Further, allowing patients to choose the type of content experienced in VR for perioperative management may be the best practice for VR utilization. This study builds on prior work evaluating use of VR among patients undergoing head and neck surgery by demonstrating use of VR within a postoperative recovery protocol may facilitate pain control. Similarly, utilization of wearable activity devices within healthcare may have benefits in objective assessment of postoperative ambulation. Providing step goals for patients may encourage mobilization, and this encouragement may be associated with improved pain and satisfaction among patients utilizing these devices. Strategies to implement these devices in Enhanced Recovery After Surgery (ERAS) protocols may facilitate non-pharmacologic pain control and improved quality of life among patients hospitalized after surgery.

However, there are limitations to compliance and the logistics of optimal device usage. This requires further study.

CONCLUSIONS

Usage of VR and wearable activity devices in postoperative recovery after inpatient surgery may be associated with reduced opioid use and improved patient satisfaction.