

## Reduction of Preoperative Anxiety Using Virtual Reality vs Midazolam: A Randomized Controlled Trial

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**Background/Introduction:** More than 50% of pediatric patients experience significant stress and anxiety prior to surgery<sup>1</sup>. High anxiety can result in increased postoperative pain, increased analgesic consumption and delayed recovery<sup>2</sup>. In order to reduce this preoperative anxiety, multiple therapeutic modalities have been developed, including the use of distraction, such as playing video games, watching movies, and listening to music. In severe cases of anxiety, anxiolytic and sedative medications like midazolam are used. However, given the acknowledged drawbacks of medications, including the risk of paradoxical reactions to the drug, alternatives to medication for reducing preoperative anxiety in patients may be useful. Our study compares the use of Virtual Reality (VR) to midazolam in reducing preoperative anxiety in surgical patients, and assesses differences in induction compliance, emergence delirium, pain scores, and opioid use in VR vs midazolam-treated patients.

**Methods:** 27 first-time surgical patients between the ages of 5-11 undergoing tonsillectomy or tonsillectomy and adenoidectomy procedures were randomly assigned to either receive midazolam (0.5mg/kg up to 25mg) or play an interactive underwater-themed immersion game using VR. The Modified Yale Preoperative Anxiety Scale (mYPAS) was administered by a single child life specialist preoperatively, and only patients who reached a threshold of >40 on mYPAS scoring were enrolled (scale range: 23-100). Additional anxiety measurement was tested using the adult and child State-Trait Anxiety Inventory (STAI). Midazolam or VR was administered prior to transport to the OR, and mYPAS was scored again at the time of separation from family. The Induction Compliance Checklist (ICC) was utilized for further data collection and assessment of patients at the time of anesthesia induction. VR-treated patients continued use of the VR headset up to and through mask induction. A standardized anesthesia induction protocol was used for all patients. The Pediatric Anesthesia Emergence Delirium scale (PAED) was administered at emergence, post-operatively. Postoperative nurses scored pain and administered IV pain medication as needed. Group means and standard deviations were reported and compared with 2-sided *t* tests.

**Results:** Interim results showed that 57% of first time surgery patients scored with mYPAS had scores >40, indicating anxiety. The mYPAS anxiety scores dropped  $21.67 \pm 12.5$  points following midazolam treatment ( $p < 0.001$ ) and dropped  $28.3 \pm 9.2$  points following VR treatment ( $p < 0.001$ ). There was no significant difference in mYPAS scores between groups following treatment (midazolam =  $32.0 \pm 5.2$ ; VR =  $25.6 \pm 5.1$ ;  $p = 0.11$ ). There were no significant differences between midazolam and VR-treated groups in the Induction Compliance Checklist (ICC), emergence delirium (PAED), peak postoperative pain scores, and medication use for pain control, post-operatively. This study is currently ongoing.

**Conclusion:** Based on these results, VR appears to provide an equivalent alternative to midazolam in reducing preoperative anxiety. Distraction and immersion with VR can help minimize preoperative anxiety during peak stress events, including separation from parents, arrival in the OR, and anesthetic induction. VR was equivalent to midazolam in preoperative induction compliance, and, postoperatively, patients in both groups had similar emergence

delirium, pain scoring, and pain medication use. The patient population for this study was limited and additional studies will be necessary to confirm if the conclusions formed are generalizable to the entire pediatric population, including patients with developmental delays and previous surgical experience undergoing a variety of procedures.

**References:**

1. Kain ZN, Mayes LC, O'Connor TZ, Cicchetti DV. Preoperative anxiety in children: predictors and outcomes. Arch Pediatr Adolesc Med. 1996;150:1238 –1245.
2. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC. Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. Pediatrics. 2006; 118(2):651-8.

