

Biofeedback Virtual Reality: A Novel Intervention for Pain Catastrophizing in Pediatric Patients

Nora Bell BA^{1,4}, Chloe Boehmer BS BA¹, Rachel Spivak, Vincent Werthmann BA^{1,4}, Max Chou BS^{1,4}, Kristie J Geisler BS CCRP¹, Keith O'Connor BS^{1,4}, Sara E, Williams PhD^{1,2}, Lili Ding PhD^{3,4}, Christopher King PhD^{2,4}, Vanessa A. Olbrecht MD MBA^{1,4}

¹*Department of Anesthesia, Cincinnati Children's Hospital Medical Center,* ²*Division of Behavioral Medicine and Child Psychology, Cincinnati Children's Hospital Medical Center,* ³*Division of Biostatistics and Epidemiology, Cincinnati Children's Hospital Medical Center,* ⁴*University of Cincinnati College of Medicine*

Introduction: Pain catastrophizing, a measure of anxiety, fear, and helplessness related to pain, is associated with negative postoperative pain outcomes, including chronic post-surgical pain and long-term disability. Biofeedback therapy delivered by Virtual Reality (VR-BF), is indicated as a method for pain reduction post-surgically, though its effect on pain catastrophizing is largely unknown.

Hypothesis: VR-BF will decrease pain catastrophizing levels acutely and chronically, compared to distraction (VR-D, active control) and 360 video (VR-360, passive control)

Methods: This study enrolled 15 subjects between ages 8 and 18 undergoing Pectus Excavatum surgery. Patients were randomized to one of the three VR intervention groups. Patients underwent a 10-minute VR session every day beginning at post-operative day 1 until discharge. They completed the child Pain Catastrophizing questionnaire prior to treatment, after the final VR session and two weeks after discharge. The acute and chronic scores were compared to baseline using a paired t-test.

Results: No treatment group had a significant change in total PCS-C scores acutely (VR-BF $p=0.250$, VR-D $p=0.595$, VR-360 $p=0.410$). The VR-BF and VR-D groups had significantly decreased pain catastrophizing chronically (VR-BF $p=0.007^*$, VR-D $p=0.039^*$, VR-360 $p=0.344$). Two subjects were withdrawn.

Conclusions: This study supports the use of distraction and biofeedback delivered through virtual reality as an intervention for the long-term effects of post-surgical pain, including pain catastrophizing. This topic requires further investigation.

Acknowledgements: This study was supported in part by NIH grant T35DK060444. Special thanks to the Department of Anesthesia at Cincinnati Children's Hospital Medical Center and to Luke Wilson and the Invincikids program for the development of the Mindful Aurora Application.