Low-Cost Methods are as Effective as Virtual Reality for Minimizing Patient Anxiety and Maximizing Parent Satisfaction During Pediatric Cast and Pin Removal: A Prospective Randomized Control Trial

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INTRODUCTION: In-office cast and percutaneous pin removal are common anxiety-inducing procedures for pediatric patients and their caregivers. Previous studies have shown that during pediatric cast and percutaneous pin removal, patient anxiety can be reduced with the use of video distraction. Virtual reality (VR) is a tool that has promising applications in the treatment of anxiety disorders. The primary purpose of this study was to determine whether VR minimized anxiety among pediatric patients during outpatient cast and pin removal when compared to video distraction.

METHODS: This study was a prospective randomized control trial with two cohorts: patients undergoing cast removal and patients undergoing in-office pin removal. Subjects were randomly assigned either a tablet computer displaying an entertaining video (controls), VR goggles with the same video (VR-V), or VR goggles with an interactive game (VR-G) during their procedure. Patients reported pre- and post-procedure pain and anxiety using a VAS scale, and heart rate (HR) was continuously monitored during the procedure and recorded as baseline-to-maximum change for each subject, which has been previously validated as a means to objectively quantify the physiologic response to pain and anxiety. An a priori power calculation indicated that 105 subjects would be required in each cohort to detect a 15% difference in HR change between intervention groups. One-way ANOVA was used to calculate between-group differences for changes in pain, anxiety, HR and post-procedure parent satisfaction over the course of the procedure.

RESULTS: A total of 210 subjects (105 cast, 105 pin) between 4 and 14 years old (mean age = 8.5 years) were analyzed in this study; 51% were female. There were no statistically significant differences in VAS pain, VAS anxiety, or HR changes during the procedure between the three intervention groups for either cast removal or pin removal cohort (Table 1). For both the cast and pin cohorts, there were no statistically significant differences in parent satisfaction at the end of the procedure between the three intervention groups, with a mean parent satisfaction of 9.6 for each cohort (measured on a scale from 0-10).

DISCUSSION AND CONCLUSION: This prospective randomized controlled study found no statistically significant differences for changes in VAS pain, VAS anxiety, HR, or post-procedure parent satisfaction between controls and either VR distraction group in either cohort. This suggests that simple distraction techniques such as tablet computer video viewing are as effective as higher fidelity VR in minimizing anxiety and increasing parent satisfaction during in-office pediatric cast and pin removal.

		Change in VAS Pain	Change in VAS Anxiety	Change in HR (bpm)	Post-Procedure Parent Satisfaction
Cast Cohort	**All Subjects (n=105)**	0.6±1.5	-1.1±2.3	17±14	9.6±1.0
	Controls (n=38)	0.3±1.5	-0.7±2.7	21±16	9.6±1.1
	VR-V (n=36)	0.8±1.8	-0.9±2.0	14±10	9.3±1.3
	VR-G (n=31)	0.7±1.1	-1.6±2.2	15±15	9.9±0.3
	p-value	0.42	0.26	0.10	0.07
Pin Cohort	**All Subjects (n=105)**	0.6±2.8	-3.2±3.2	24±17	9.6±0.9
	Controls (n=36)	0.2±3.0	-3.0±2.7	24±19	9.5±1.0
	VR-V (n=36)	1.5±2.8	-3.7±3.9	22±12	9.5±1.0
	VR-G (n=33)	0.3±2.6	-2.9±3.1	27±20	9.8±0.7
	p-value	0.09	0.56	0.43	0.40

Table 1. No differences in changes in VAS pain, VAS anxiety, HR, or post-procedure parent satisfaction between the three intervention groups for cast removal or pin removal cohorts. All values are reported as mean±std. A p-value of <0.05 was considered to be statistically significant.