

Table S1. Spearman correlations between PENS dimensions, adherence, and clinical outcomes in the IVR group, including exact p-values and bootstrap-derived 95% confidence intervals.

Variable	Outcome	Spearman's ρ	95% CI	p-value
PENS Competence	Adherence (%)	-0.27	-0.66 to 0.14	0.317
PENS Competence	Δ Depression	0.27	-0.26 to 0.77	0.317
PENS Competence	Δ Anxiety	-0.31	-0.76 to 0.20	0.241
PENS Competence	Δ Stress	-0.07	-0.58 to 0.47	0.801
PENS Competence	Δ FIQ-R	-0.23	-0.66 to 0.29	0.386
PENS Autonomy	Adherence (%)	-0.11	-0.61 to 0.44	0.686
PENS Autonomy	Δ Depression	0.13	-0.33 to 0.58	0.646
PENS Autonomy	Δ Anxiety	0.10	-0.43 to 0.52	0.722
PENS Autonomy	Δ Stress	0.04	-0.42 to 0.54	0.875
PENS Autonomy	Δ FIQ-R	-0.11	-0.58 to 0.37	0.690
PENS Enjoyment/Pleasure	Adherence (%)	-0.07	-0.64 to 0.45	0.797
PENS Enjoyment/Pleasure	Δ Depression	-0.09	-0.55 to 0.44	0.741
PENS Enjoyment/Pleasure	Δ Anxiety	-0.23	-0.66 to 0.30	0.397
PENS Enjoyment/Pleasure	Δ Stress	-0.11	-0.56 to 0.40	0.687
PENS Enjoyment/Pleasure	Δ FIQ-R	0.22	-0.32 to 0.65	0.419
PENS Intuitive Control	Adherence (%)	0.41	-0.11 to 0.79	0.118
PENS Intuitive Control	Δ Depression	0.63	0.23 to 0.86	0.008
PENS Intuitive Control	Δ Anxiety	0.05	-0.46 to 0.59	0.859
PENS Intuitive Control	Δ Stress	-0.06	-0.59 to 0.50	0.812
PENS Intuitive Control	Δ FIQ-R	0.21	-0.48 to 0.72	0.435
PENS Presence/Immersion	Adherence (%)	0.13	-0.44 to 0.70	0.644
PENS Presence/Immersion	Δ Depression	-0.09	-0.68 to 0.57	0.728
PENS Presence/Immersion	Δ Anxiety	-0.13	-0.71 to 0.38	0.640
PENS Presence/Immersion	Δ Stress	-0.39	-0.82 to 0.17	0.134
PENS Presence/Immersion	Δ FIQ-R	-0.29	-0.72 to 0.26	0.283

Abbreviations: PENS, Player Experience of Need Satisfaction; FIQ-R, Fibromyalgia Impact Questionnaire-Revised; IVR, immersive virtual reality. Positive Δ values indicate greater clinical improvement. Confidence intervals were estimated using bootstrap resampling due to the small sample size.