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RESPONSE TO LETTER

How Can the Sedative and Analgesic Effects of Virtual Reality Technology Be More Precisely Assessed in Pediatric Dental Care? Methodological Insights From an Ongoing Randomized Controlled Trial [Response to Letter]

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Dear editor

We want to extend our sincere gratitude for your careful review and valuable feedback[1] on our recent study titled "Analgesic and sedative effects of virtual reality on children with acute pulpitis: a study protocol for a randomised controlled trial". We appreciate your insights and would like to address your concerns and questions as follows:

Refining Exclusion Criteria for VR-Induced Motion Sickness Screening and Recent Analgesic Use Definition

[Response]: We greatly appreciate the authors for pointing out the shortcomings in our criteria for VR-induced motion sickness screening and analgesic exclusion, and we sincerely apologize for these oversights. Regarding VR-induced motion sickness, we acknowledge that the recommended 5–10 minute familiarization session after enrollment is not sufficiently rigorous. In subsequent studies, we will define this as a mandatory procedure and add standardized observation records to monitor adverse reactions. Regarding analgesic use, we will explicitly define "recent use" as within 24 hours before treatment, and explain the rationale for this time window to ensure balanced baseline characteristics between groups.

Clarifying Blinding Implementation Strategies Under Visible VR Intervention Conditions

[Response]: We acknowledge that blinding of participants and operators is not feasible due to the visible VR device. As outlined in our protocol, only independent outcome assessors are blinded to group allocation, which represents the highest achievable blinding level in VR intervention trials. Assessors do not observe the clinical procedures and score only standardized recordings, minimizing observer bias. Nevertheless, we greatly appreciate the authors for raising this important methodological concern, and we apologize for the inadequate description of the blinding process in the original

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protocol. We fully accept their valuable suggestions. In subsequent research, we will provide a detailed description of the blinding implementation, explicitly acknowledge this limitation in the Discussion section, and discuss the potential impact of observer bias on the interpretation of results.

Enhancing Anxiety and Immersion Measurement Methods

[Response]: We recognize the clinical relevance of anxiety during local anesthesia (T1) and pulp exposure (T2). However, VAS-A (subjective anxiety scale) cannot be completed at these stages due to clinical necessity. T1 and T2 are critical invasive steps requiring children to keep mouth open, head still, and fully cooperate. Interrupting treatment for self-reporting would disrupt the procedure, increase agitation, prolong operation time, and artificially alter anxiety states, leading to invalid data. Regarding VR engagement assessment, we clarify that in this pragmatic clinical trial, "immersion duration" refers to the actual time children wear the VR glasses throughout the procedure, which will be clearly recorded. While eye-tracking technology can more accurately reflect psychological immersion, it is not feasible in routine pediatric dental practice due to equipment limitations and potential interference with clinical operations. We acknowledge the potential value of heart rate variability (HRV) as an objective physiological indicator of pain and anxiety. However, HRV measurement requires specialized equipment and stable conditions, which are difficult to achieve during dynamic pediatric dental procedures. Therefore, this study focuses on clinically feasible and validated assessment measures.

Optimizing Control Group Design to Address Non-Specific Psychological Effects

[Response]: We appreciate the thoughtful consideration of non-specific psychological effects. Our control group receives standard clinical care without additional distraction, which directly addresses the core research question: whether VR adds benefits to routine treatment. A 2D video control would evaluate two distraction methods rather than VR's incremental value, limiting clinical generalizability. Our design prioritizes real-world applicability, which is essential for translating research into practice.

Specifying Missing Data Handling Methods Under the Intention-to-Treat Framework

[Response]: We thank the authors for raising this important methodological point. We confirm that our statistical analysis will strictly follow the intention-to-treat (ITT) principle. Although not fully detailed in the current protocol, we have predefined a comprehensive missing data handling plan. We will first conduct a missing pattern analysis to classify data as missing completely at random (MCAR), missing at random (MAR), or missing not at random (MNAR). For MCAR or MAR data, multiple imputation will be applied. For MNAR data, pattern mixture models with sensitivity analysis will be considered. We will also categorize and report reasons for participant withdrawal, such as VR intolerance, equipment malfunction, or voluntary withdrawal, and compare dropout distributions between groups. Finally, both ITT and per-protocol analyses will be reported, and any discrepancies will be discussed in detail. These procedures will be fully described in the final manuscript to enhance transparency and reproducibility.

Thank you for pointing out the methodological oversights in our study. These were indeed our omissions, and we will revise them carefully to ensure rigor and reliability.

Finally, we look forward to completing this trial and providing high-quality evidence for VR use in pediatric acute pulpitis, supporting its clinical translation. We sincerely appreciate your attention and guidance, and welcome further discussions.

Disclosure

The authors declare no competing interests in this communication.

Reference

1. Zhao FY, Fu QQ, Zhu JY. How can the sedative and analgesic effects of virtual reality technology be more precisely assessed in pediatric dental care? Methodological insights from an ongoing randomized controlled trial [Letter]. *J Pain Res*. 2026;19:618223. doi:10.2147/JPR.S618223