



Gamification for Pain Reduction in Pediatric Burn Dressing Changes: A Non-pharmacological Strategy

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Dear Editor,

Burn injuries in children cause significant physical and emotional trauma, with daily dressing changes intensifying pain and distress. These procedures, essential for healing and infection prevention, are often dreaded by young patients and their caregivers, making effective pain management critical. Pharmacological pain management, primarily relying on opioids, carries risks of dependency, side effects, and inadequate relief in some cases. These limitations highlight the need for non-pharmacological interventions to complement or reduce reliance on medications, improving the overall experience for pediatric patients (1).

Non-pharmacological approaches, such as distraction, have shown promise in reducing pain and anxiety during medical procedures. Methods like music therapy, guided imagery, storytelling, mobile apps, and serious games engage children, making procedures less intimidating. Gamification, particularly through virtual reality (VR), stands out for its immersive and interactive qualities, offering a novel way to manage pain. Gamification via VR games distracts children during burn dressing changes, effectively reducing pain perception.

A randomized controlled trial involved 36 children aged 5 - 17 undergoing daily burn dressing changes for at least one week. The VR group (n = 18) used a smartphone-based VR game, "Virtual River Cruise", requiring active engagement through head tilting to aim at targets in a cooling snow environment. The control group (n = 18) received standard care without VR. The VR group reported a mean pain score of 3.2 ± 1.1 compared to 4.8 ± 1.3 in the control group ($P = 0.002$),

achieving a clinically meaningful pain reduction (33.3% for child-reported overall pain; 31.6% for caregiver-reported worst pain, RCT); (Table 1) (2). Blinding was applied to outcome assessors but not participants or caregivers due to the intervention's nature. Satisfaction was high, with 85% of children and 90% of caregivers reporting positive experiences. Engagement scores were higher for active VR (78.9 vs. 72.7) compared to passive VR, with similar trends for fun (85.7 vs. 77.3) and realism (73.1 vs. 59.1) (3).

Beyond VR, other gamification methods like mobile apps and serious games show potential. For example, storytelling apps engage younger children, while rehabilitation games improve motor function and pain tolerance. Music therapy has comparable efficacy to VR in some settings, suggesting opportunities for integrated approaches (4).

Despite its promise, VR-based gamification faces limitations. Accessibility barriers, including equipment costs and suitability for younger children or those with sensory sensitivities (e.g., motion sickness), hinder equitable use. Younger children (5 - 10 years) may struggle with VR headsets due to fit or comprehension, while adolescents (11 - 17 years) often respond better due to familiarity with gaming (5). Logistical challenges, such as staff training for VR setup and ensuring culturally appropriate content, remain underexplored. The evidence base is narrow, focusing primarily on VR, with limited comparisons to other non-pharmacological methods like music therapy or guided imagery. Long-term effects, such as impacts on psychological outcomes or treatment adherence, are understudied. Large-scale, multisite RCTs are needed to validate VR's efficacy across diverse populations and

Table 1. Pain Scores from RCT on Virtual Reality-Based Gamification for Pediatric Burn Dressing Changes (N = 18)

Groups	Mean $\pm$ SD Pain Score	Pain Reduction (%)
VR	3.2 $\pm$ 1.1	33.3 (child), 31.6 (caregiver)
Control	4.8 $\pm$ 1.3	-
P-Value	0.002	-

Abbreviation: VR, virtual reality.

settings, addressing these gaps and practical considerations (6).

Conclusions

The VR-based gamification offers a compelling non-pharmacological approach to reducing pain during pediatric burn dressing changes. Its immersive nature outperforms passive distractions, but challenges like cost, accessibility, and sensory sensitivities require attention. Integrating VR with other methods, such as music therapy or storytelling, and conducting broader, long-term studies will strengthen its role in comprehensive pain management.

Footnotes

Authors' Contribution: Study concept and design: R. A. and A. B.; Acquisition of data: R. A.; Analysis and interpretation of data: R. A. and A. B.; Drafting of the manuscript: R. A.; Critical revision of the manuscript for important intellectual content: R. A.; Statistical analysis: R. A. and A. B.; Administrative, technical, and material support: R. A.; Study supervision: R. A. and A. B.

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