Special Interest Group on Pain in Childhood
INTERNATIONAL ASSOCIATION FOR THE STUDY OF PAIN

Pediatric Pain Letter
Commentaries on pain in infants, children, and adolescents

February 2022 **Vol. 24 No. 1** **www.childpain.org/ppl**

Editor: Deirdre E. Logan, PhD, deirdre.logan@childrens.harvard.edu

Associate Editor: Abbie L. Jordan, PhD, a.l.jordan@bath.ac.uk

Commentary

Using virtual reality distraction during wound management: A brief case report in a patient with epidermolysis bullosa

Lisa Nicole D'Alessandro, Irene Lara Corrales, Sara Klein, Dana Kondo, and Jennifer Stinson

Introduction

Epidermolysis bullosa (EB) is a class of inherited skin disorders characterized by mechanical fragility of the skin and mucous membranes leading to blistering and erosion (Pope et al., 2012; Fine et al., 2014; Prodinger et al., 2019). According to the National Organization for Rare Disorders (NORD, 2021), EB prevalence is 1 out of every 50,000 live births. Classification of EB occurs within 4 subtypes: EB simplex (EBS), junctional EB (JEB), dystrophic EB (DEB), and Kindler EB (Fine et al., 2014). Each subtype has varying degrees of mucocutaneous involvement with EBS being the mildest to DEB the most severe, with greatest associated disease burden (Bruckner et al., 2020). Due to the visibility of blistering and sequel skin involvement, EB has the potential to considerably affect patients' emotional well-being due to the burden of pain, adverse effects of treatment, and decline in social engagement (Jain & Murrell, 2018). In the absence of a cure, early recognition and treatment of complications and supportive wound care are the mainstays of treatment (Pope et al., 2012).

Pain is one of the most debilitating symptoms of EB that lead to disease burden and quality of life reduction (Jain & Murrell, 2018; Schräder et al., 2018). Many patients living with EB experience both chronic pain related to skin fragility and acute pain related to wound care, blistering, eating, and having bowel movements. Decreasing pain is among the main priorities for people living with EB (Bruckner et. al., 2020). Best practice guidelines in pain care during bathing and dressing changes include therapies that address both pain and associated anxiety (Goldschneider et al., 2014). Leaving anxiety and pain untreated can lead to trauma and can negatively influence subsequent experiences in acute procedural pain (Noel et al., 2017).

Pharmacological and non-pharmacological pain reducing strategies are essential to the care plans of children living with diseases that require repeated painful procedures. Despite a plethora of research evaluating such strategies (Stinson et al., 2008), children continue to experience acute procedure-related pain. Cognitive distraction is a well-established adjunct pain management strategy for children living with painful chronic conditions. Several studies suggest virtual reality (VR) as an effective non-pharmacologic analgesic in a range of pain-inducing procedures (Pourmand et al., 2018; Ahmadpour et al., 2019; Gates et al., 2020; Trost et al., 2021). VR incorporates numerous physical sensations using a human-computer interface with the intent to amplify realism in the virtual world (Lavoie et al., 2021). This heightened sense of realism produces a phenomenon known as presence. It is through presence that the user is provided the opportunity to immerse in a novel realistic experience (Won et al., 2017; Lavoie et al., 2021). Immersion in the VR world has the potential to distract the user's attention away from pain-inducing procedures (Malloy & Milling, 2010).

VR is a promising adjunctive/complementary and/or first-line intervention to manage pain and distress in patients undergoing medical procedures (Ahmadpour et al., 2020). Birnie et al. (2018) demonstrated VR distraction to be an acceptable and safe intervention among pediatric cancer patients undergoing implantable venous access device (IVAD) needle insertion. Within both pediatric and adult burn populations much attention has been placed on the application of VR as a pain control measure during burn wound debridement procedures (Hoffman et al., 2011; Maani et al., 2011; Bermo et al., 2020; Hoffman et al., 2020). Maani et al.'s (2011) research utilizing VR as a pain control measure during burn wound debridement indicate patients report significantly less pain when distracted with VR. The authors of this commentary propose that by using VR as a distraction strategy during pediatric wound care in the EB population, patients will report less pain, making it a suitable non-pharmacological strategy to help children cope with recurrent acute painful procedures such as dressing changes at home. The authors of this paper report on a case study that explores using VR distraction during caregiver wound care with a young boy living with recessive DEB.

Case presentation

In accordance with best practices in pediatric pain management, this case study involved an interdisciplinary collaboration between departments at the Hospital for Sick Children: Anesthesia and Pain Management, Dermatology and Child Life. The patient and caregiver provided consent to use both VR and have photos of their experience included in this report.

Subject selection. An 8-year-old boy with recessive DEB was approached to use VR distraction as an adjunct non-pharmacological strategy during wound management at his routine Dermatology follow up appointment.

Patient history. The patient's pain history included acute pain during wound care reported by

Figure 1. Patient wearing the VR device during wound care. Photographed by the author, 2021. Permission granted for use by patient.

both patient and caregiver. At home pharmacology management of his pain included acetaminophen, ibuprofen and on occasion opioids (morphine). Non-pharmacological management included distraction by family members, listening to music and squeezing a stress ball.

Management and outcome. The patient wore a Google Cardboard VR viewer branded by Vusion VR © (2021 VusionVR Inc.) that enabled the insertion of a mobile phone as the viewing platform. This device was chosen for its affordability ($11.65 CAD) as well as its fit in accordance with the organization's COVID-19 restrictions limiting multiuse devices in the hospital. The Cardboard VR was presented to the patient in sealed plastic packaging which was removed in the room and assembled prior to start of procedure. Assembly took approximately 30 seconds. The patient was able to choose from a list of short videos using the Within app (Milk, 2014) on an iPhone5S. The VR device provided the patient with a 360-degree field of view of the virtual environment as he moved his head. The patient was able to interact with the virtual world through movements of his head during wound care (see Figure 1). Within a few moments, the patient acknowledged pressure points between the bridge of his nose and the VR device. He requested gauze for his nasal bridge as a barrier between the VR device and his skin to reduce friction which may have led to blisters.

Outcome measures. Intensity of pain was rated using a revised verbal rating scale (VRS) asking the patient to rate his pain using the adjectives: none, a little, or lots. The VRS was chosen along with the associated adjectives because of the patient's familiarity using this scale during routine bathing and dressing changes at home. Behavioral/observational pain rating scales were considered so as not to disrupt the immersive experience however the patient's facial blistering and scarring limited their utility.

Both the patient and caregiver identified three areas on the patient's body which in the past week were rated as "lots" of pain during dressing removal.

Table 1
Potential negative effects of virtual reality (VR)

For each question, check off one answer. Only answer questions about how you felt AFTER your VR experience.	Yes / No
Did you have a headache?	No
Did you feel sick to your stomach	No
Did you throw up	No
Did you sweat	No
Did you feel you could concentrate	No
Did you feel dizzy?	No
Did you feel like you could control your body?	Yes
Did your eyes feel sore?	No
Was it hard to see?	No
Did you feel like you lost your balance?	No
Did you feel tired?	No
Did you feel any other symptoms that we haven't asked you about?	No
If yes, describe any symptoms not listed above?	No
How did it feel to be in VR?	Good
If you could change anything about VR, how would you make it better?	To make bath time better

Table 2
Patient's overall experience using virtual reality (VR)

For each statement, please mark an X in the box which best describes your opinion.						
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable
I like using the VR headset					X	
The VR headset helped me during my procedure					X	
The VR headset decreased the amount of pain/anxiety I was feeling				X		
I want to use the VR headset again					X	
The VR headset would help other kids in the hospital					X	

The interviewer asked the patient to rate his pain during dressing change with VR for each of these three areas. The patient's caregiver was encouraged to verbalize his thoughts on how the patient tolerated wound care while being distracted in VR. Potential negative effects of VR (see Table 1) and overall experience of VR (see Table 2) were recorded after the VR experience. Both sets of questions are routinely asked by healthcare providers in the organization after introducing VR to patients.

Results

Patient reported pain intensity during dressing removal with VR in all three areas was "none". Upon introduction of the VR device, the patient verbalized feeling happy using VR. Figure 2 is an example of one moment the patient was found smiling while using VR. The patient's overall experience using VR was very positive. Caregiver verbal report of the VR experience during wound care included feeling pleased that VR made his son smile, decreased his son's pain, and increased distractibility. For example, the father said, "he is very happy, and I am very happy to listen to my son's experience with the (VR) world while I attend to his wounds. Also, having him hold the VR device keeps his hands away from itching his skin while I unwrap his wound". The patient removed the VR device in two instances to remind his father to "be gentle".

Discussion and future implications

The results of this case study support previous literature suggesting VR as a plausible adjunct pain management strategy during painful procedures (Trost et al., 2021). This is the first case study using VR distraction during dressing changes with an EB patient. Distraction properties were witnessed by the attending healthcare providers and verbalized by the patient and caregiver during wound care. These results are consistent with previous studies supporting the use of VR as a distraction intervention to reduce pain and anxiety in pediatric patients undergoing painful procedures (Eijlers et al., 2019).

Suitability of equipment used may influence the outcome of a case report of this nature. The patient reported the VR head device as bothersome to his nasal bridge, but gauze helped address this. The authors propose that even with minor accommodations made to the VR equipment, the low-cost smartphone carboard VR viewer remains an affordable option to use in the home compared to the high expense of legacy VR systems.

Figure 2. Patient smiling during initial introduction of VR device and game. Photographed by the author, 2021. Permission granted for use by patient.

There are several limitations to the generalization of these results to the pediatric EB patient population. As a case report of n = 1, the extent to which findings of this study hold true for EB patients who have differing skin involvement is limited. Moreover, as this study compared reported pain in a clinical versus home setting, future research is needed to determine if similar results of pain reduction using VR during dressing changes in the home setting would be achieved. Interrupting the use of VR during wound care to record intensity of pain could also be viewed as a disruption of the immersion, which in turn may have influenced the patient's experience of pain. The authors acknowledge the limitation of omitting validated pain measures and in future research will use validated pain measures to ensure reliability.

This case report demonstrates the potential use of using VR distraction during wound management in the pediatric EB patient population. The results of this case study underscore the potential value of repeated administrations of VR as a distraction intervention in the treatment of pain associated with frequent wound care in the home setting. Further research is needed to determine the health benefits and cost effectiveness of VR with a variety of patient populations to determine whether it is a viable and practical form of analgesia to administer at home. Moreover, in addition to using VR distraction during painful procedures, future studies may also use VR mindfulness training to help patients learn psychological coping skills (Nararro-Haro et al., 2016; Gomez et al., 2017; Flores et al., 2018) that may help reduce their stress and anxiety, chronic pain, and anticipatory anxiety prior to wound care.

Lisa Nicole D'Alessandro, MN
Anesthesia and Pain Medicine, Hospital for Sick Children and Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, ON, Canada
email: lisa_n.dalessandro@sickkids.ca

Irene Lara Corrales, MD
Department of Pediatrics, University of Toronto and Dermatology, Hospital for Sick Children, Toronto, ON, Canada

Sara Klein, MScPT
Anesthesia and Pain Medicine, Hospital for Sick Children, Toronto, ON, Canada

Dana Kondo, MSc, CCLS
Virtual Reality Program, Hospital for Sick Children, Toronto, ON, Canada

Jennifer Stinson RN-EC, PhD
Anesthesia and Pain Medicine and Child Health Evaluative Sciences Program, Hospital for Sick Children and Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, ON, Canada

Acknowledgements

The authors thank the patient and caregiver as well as the Hospital for Sick Children virtual reality program and donor to the program.

References

Ahmadpour N, Keep M, Janssen A, Rouf AS, Marthick M. Design strategies for virtual reality interventions for managing pain and anxiety in children and adolescents: scoping review. JMIR Serious Games 2020;8:e14565. www.pubmed.gov/32012042

Ahmadpour N, Randall H, Choksi H, Gao A, Vaughan C, Poronnik P. Virtual reality interventions for acute and chronic pain management. Int J Biochem Cell Biol 2019;114:105568. www.pubmed.gov/31306747

Bermo MS, Patterson D, Sharar SR, Hoffman H, Lewis DH. Virtual reality to relieve pain in burn patients undergoing imaging and treatment. Top Magn Reson Imaging 2020;29:203-208. www.pubmed.gov/32511197

Birnie KA, Kulandaivelu Y, Jibb L, Hroch P, Positano K, Robertson S, et al. Usability testing of an interactive virtual reality distraction intervention to reduce procedural pain in children and adolescents with cancer [formula: see text]. J Pediatr Oncol Nurs 2018;35:406-416. www.pubmed.gov/29950139

Bruckner AL, Losow M, Wisk J, Patel N, Reha A, Lagast H, et al. The challenges of living with and managing epidermolysis bullosa: insights from patients and caregivers. Orphanet J Rare Dis 2020;15:1. www.pubmed.gov/31900176

Eijlers R, Utens EMWJ, Staals LM, de Nijs PFA, Berghmans JM, Wijnen RMH, et al. Systematic review and meta-analysis of virtual reality in pediatrics: effects on pain and anxiety. Anesth Analg 2019;129:1344-1353. www.pubmed.gov/31136330

Fine JD, Bruckner-Tuderman L, Eady RAJ, Bauer EA, Bauer JW, Has C, et al. Inherited epidermolysis bullosa: updated recommendations on diagnosis and classification. J Am Acad Dermatol 2014;70:1103-1126. www.pubmed.gov/24690439

Flores A, Linehan MM, Todd SR, Hoffman HG. The use of virtual reality to facilitate mindfulness skills training in dialectical behavioral therapy for spinal cord injury: a case study. Front Psychol 2018;9:531. www.pubmed.gov/29740365

Gates M, Hartling L, Shulhan-Kilroy J, MacGregor T, Guitard S, Wingert A, et al. Digital technology distraction for acute pain in children: a meta-analysis. Pediatrics 2020;145:e20191139. www.pubmed.gov/31969473

Goldschneider KR, Good J, Harrop E, Liossi C, Lynch-Jordan A, Martinez AE, et al. Pain care for patients with epidermolysis bullosa: best care practice guidelines. BMC Med 2014;12:178. www.pubmed.gov/25603875

Gomez J, Hoffman HG, Bistricky SL, Gonzalez M, Rosenberg L, Sampaio M, et al. The use of virtual reality facilitates Dialectical Behavior Therapy® "Observing Sounds and Visuals" mindfulness skills training exercises for a Latino patient with severe burns: a case study. Front Psychol 2017;8:1611. www.pubmed.gov/28993747

Hoffman HG, Chambers GT, Meyer WJ 3rd, Arceneaux LL, Russell WJ, Seibel EJ, et al. Virtual reality as an adjunctive non-pharmacologic analgesic for acute burn pain during medical procedures. Ann Behav Med 2011;41:183-191. www.pubmed.gov/21264690

Hoffman HG, Patterson DR, Rodriguez RA, Peña R, Beck W, Meyer WJ. Virtual reality analgesia for children with large severe burn wounds during burn wound debridement. Front Virtual Real 2020;1:602299. www.pubmed.gov/33585833

Jain SV, Murrell DF. Psychosocial impact of inherited and autoimmune blistering diseases. Int J Womens Dermatol 2018;4:49-53. www.pubmed.gov/29872677

Lavoie R, Main K, King C, King, D. Virtual experience, real consequences: the potential negative emotional consequences of virtual reality gameplay. Virtual Reality 2021;25:69-81.

Maani CV, Hoffman HG, Morrow M, Maiers A, Gaylord K, McGhee LL, et al. Virtual reality pain control during burn wound debridement of combat-related burn injuries using robot-like arm mounted VR goggles. J Trauma 2011;71(1 Suppl):S125-S130. www.pubmed.gov/21795888

Malloy KM, Milling LS. The effectiveness of virtual reality distraction for pain reduction: a systematic review. Clin Psychol Rev 2010;30:1011-1018. www.pubmed.gov/20691523

Milk C. Within (version 3.5.12) [iPhone5S], 2014. https://apps.apple.com/ca/app/within-vr/id959327054

Nararro-Haro MV, Hoffman HG, Garcia-Palacios A, Sampaio M, Alhalabi W, Hall K, et al. The use of virtual reality to facilitate mindfulness skills training in Dialectical Behavioral Therapy for borderline personality disorder: a case study. Front Psychol 2016;7:1573. www.pubmed.gov/27853437

National Organization for Rare Disorders. Rare Disease Database: Epidermolysis Bullosa, 2021. www.rarediseases.org/rare-diseases/epidermolysis-bullosa

Noel M, Rabbitts JA, Fales J, Chorney J, Palermo TM. The influence of pain memories on children's and adolescents' post-surgical pain experience: a longitudinal dyadic analysis. Health Psychol 2017;36:987-995. www.pubmed.gov/28726472

Pope E, Lara-Corrales I, Mellerio J, Martinez A, Schultz G, Burrell R, et al. A consensus approach to wound care in epidermolysis bullosa. J Am Acad Dermatol 2012;67:904-917. www.pubmed.gov/22387035

Pourmand A, Davis S, Marchak A, Whiteside T, Sikka N. Virtual reality as a clinical tool for pain management. Curr Pain Headache Rep 2018;22:53. www.pubmed.gov/29904806

Prodinger C, Reichelt J, Bauer JW, Laimer M. Epidermolysis bullosa: advances in research and treatment. Exp Dermatol 2019;28:1176-1189. www.pubmed.gov/31140655

Schräder NHB, Yuen WY, Jonkman MF. Pain quality assessment scale for epidermolysis bullosa. Acta Derm Venereol 2018;98:346-349. www.pubmed.gov/29057428

Stinson J, Yamada J, Dickson A, Lamba J, Stevens B. Review of systematic reviews on acute procedural pain in children in the hospital setting. Pain Res Manag 2008;13:51-57. www.pubmed.gov/18301816

Trost Z, France C, Anam M, Shum C. Virtual reality approaches to pain: toward a state of the science. Pain 2021;162:325-331. www.pubmed.gov/32868750

Won AS, Bailey J, Bailenson J, Tataru C, Yoon IA, Golianu B. Immersive virtual reality for pediatric pain. Children (Basel) 2017;4:52. www.pubmed.gov/28644422