

Virtual Reality as a Complimentary Therapy to Improve Pain in Sickle Cell Disease

Simon Robertson
Founder / CEO KindVR

Academy for Sickle Cell and Thalassaemia Conference
The Royal College of Physicians, London
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My Background

- **Game designer wanting to do more than entertain**
- **Started volunteering in 2014**
- **Doctors at UCSF Benioff Children's Hospital Oakland encouraged collaborative exploration of VR as a therapeutic tool**
- **Research began in 2015**
- **Honored to be invited to share our findings**

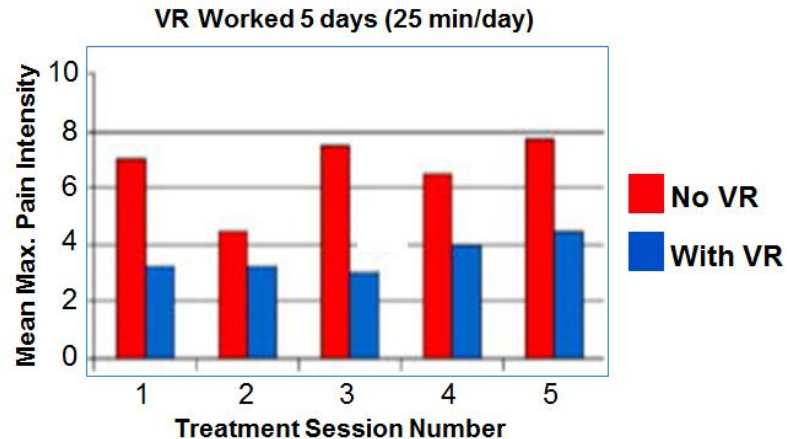
What is Virtual Reality (VR)?

- **Tool capable of tricking the brain's senses**
 - **Visual System – Realtime stereo 3D images**
 - **Auditory System - Realtime 3D spatial audio**
 - **Low latency head tracking, updating the virtual world as you look around**
- **Creates sense of presence**
- **Cognitive tasks to engage the mind**



Early VR Research

- Burn patients reported an average 35% reduction in pain while in immersive VR
- Equipment was expensive (\$35,000) and cumbersome (desktop computer based) but it worked!



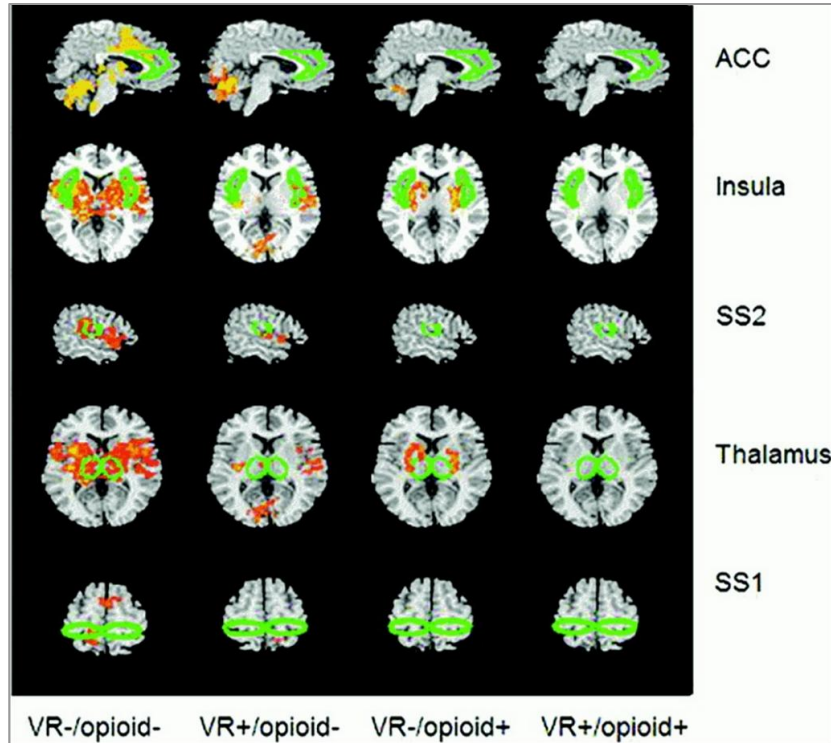
Flores A, Hoffman HG, Russell W, et al. Longer, multiple virtual reality pain distraction treatments of Hispanic and Caucasian children with large severe burns. CyberTherapy Conference. San Diego, CA: 2008.

Possible Mechanism of Action

“VR may reduce pain by directing patients’ attention into the virtual world, leaving less attention available to process incoming neural signals from pain receptors.”

Hunter Hoffman, PhD
Senior Research Scientist
University of Washington

Synergistic with Opioids



Hoffman, H, et al. The Analgesic Effects of Opioids and Immersive Virtual Reality Distraction: Evidence from Subjective and Functional Brain Imaging Assessments. *Anesthesia & Analgesia* 2007;105:1776 –83

Our Current Project



Specific Aim 1: To test the **usability and acceptability** of immersive virtual reality technology in sickle cell patients hospitalized with pain.

Specific Aim 2: To determine if a virtual reality immersive experience serves as an **effective adjunctive therapy to traditional pain reduction treatments** in patients with sickle cell disease hospitalized due to pain.

IRB: Approved November 2015

Start Date: December 2015

Progress: 25 of 30 patients enrolled

Primary Investigator: Dr. Anne Marsh

Research Team

UCSF Benioff Children's Hospital Oakland



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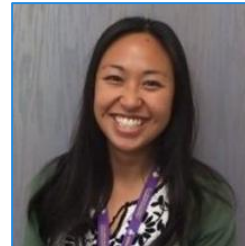
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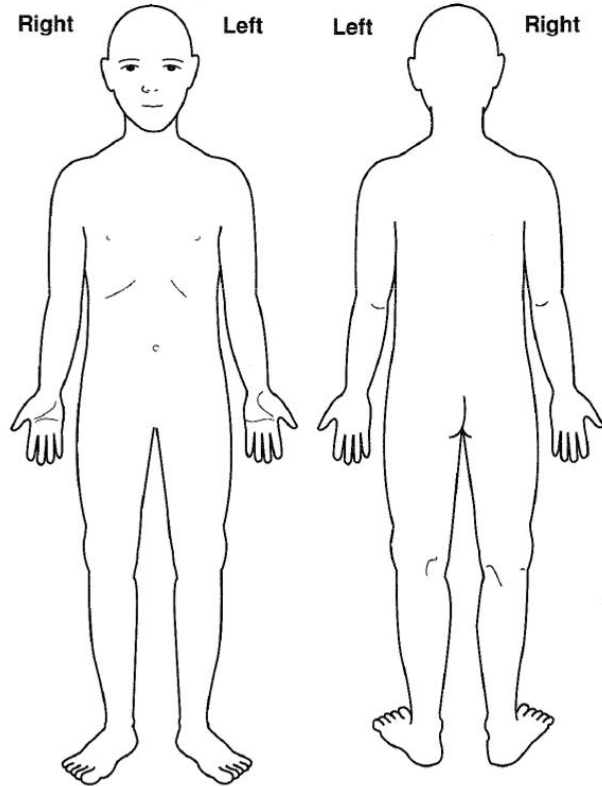


Liat Litwin
Medical Student
Sackler School of Medicine

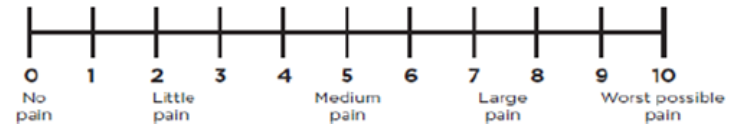
Study Methods

- 15 Minute VR intervention bedside with SCD patients experiencing vaso-occlusive pain
- Participants completed a pain tool and a simulator sickness survey pre- and post-VR experience
- Participants completed a post-study questionnaire

Measurement - Adolescent Pediatric Pain Tool (APPT)



Place a straight up and down mark on this line to show how much pain you have.



Measurement - Adolescent Pediatric Pain Tool (APPT)

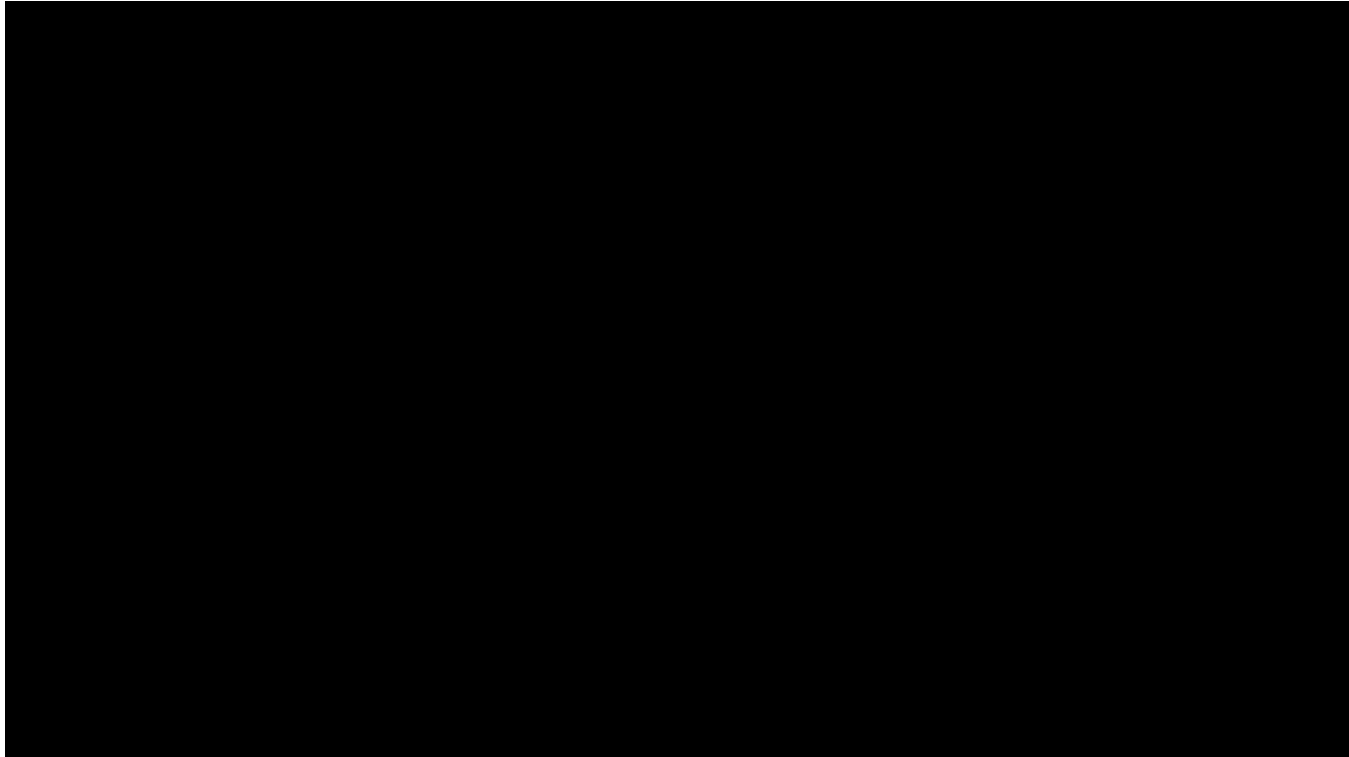
1	5	10	15
annoying	blistering	awful	off and on
bad	burning	deadly	once in awhile
horrible	hot	dying	sneaks up
miserable	6	killing	sometimes
terrible	cramping	11	steady
uncomfortable	crushing	crying	
2	like a pinch	frightening	
aching	pinching	screaming	
hurting	pressure	terrifying	
like an ache	7	12	
like a hurt	itching	dizzy	
sore	like a scratch	sickening	
3	like a sting	suffocating	
beating	scratching	13	
hitting	stinging	never goes away	
pounding	8	uncontrollable	
punching	shocking	14	
throbbing	shooting	always	
4	splitting	comes and goes	
biting	9	comes on all of a sudden	
cutting	numb	constant	
like a pin	stiff	continuous	
like a sharp knife	swollen	forever	
pin like	tight		
sharp			
stabbing			

Research Software – kindVR *Aqua*

- Patients explore and interact within a comfortable underwater world
- Offers both active and passive gameplay, allowing patients to either challenge themselves or to simply relax
- Designed to accommodate patients' needs including limited mobility, range of motion, and various levels of familiarity with interactive games



Video



Patient Demographics

N = 25

Mean Age: 16.8 yrs

Range: 10 – 25 yrs

Female: 19 (76%)

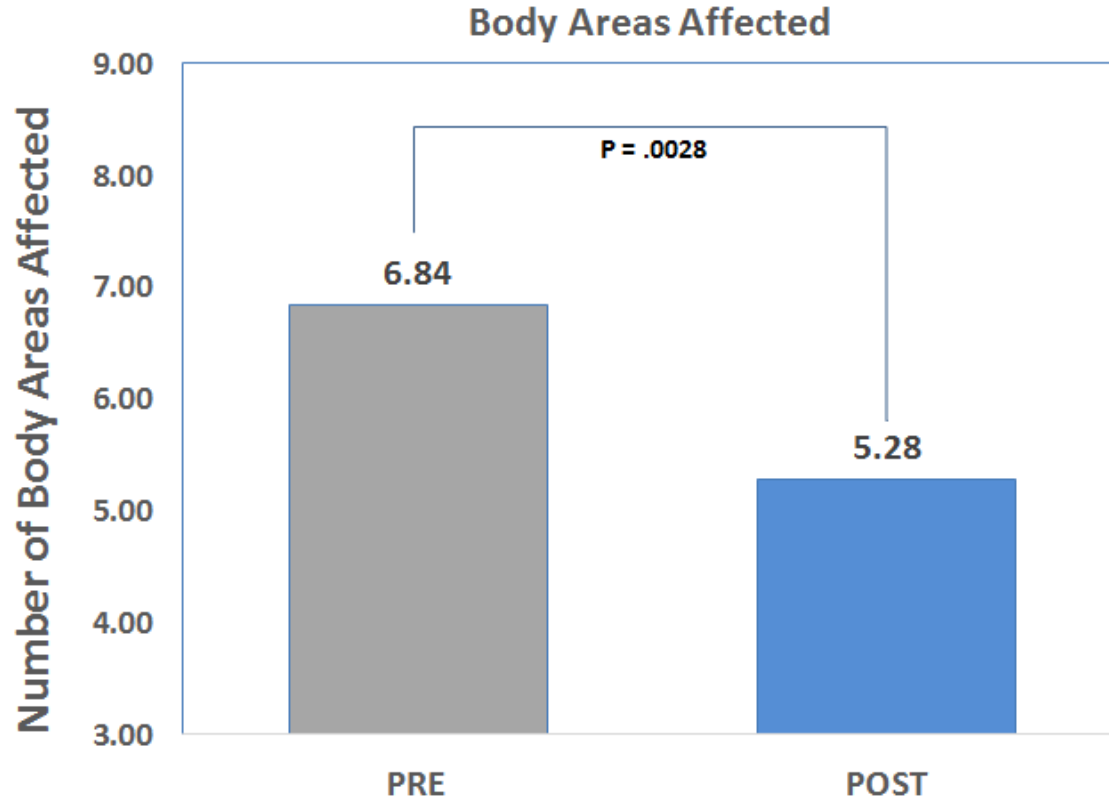
Sickle Cell Genotypes:

SS: 18 (72%)

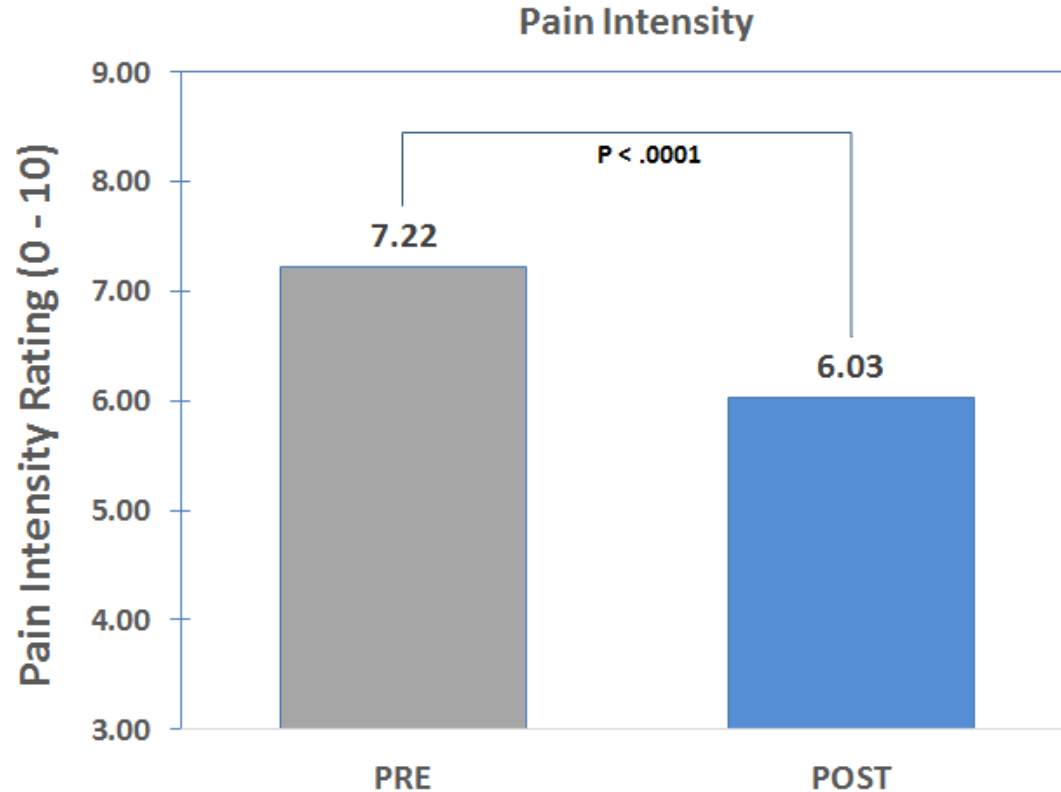
SC: 5 (20%)

S/beta+ thalassemia: 2 (8%)

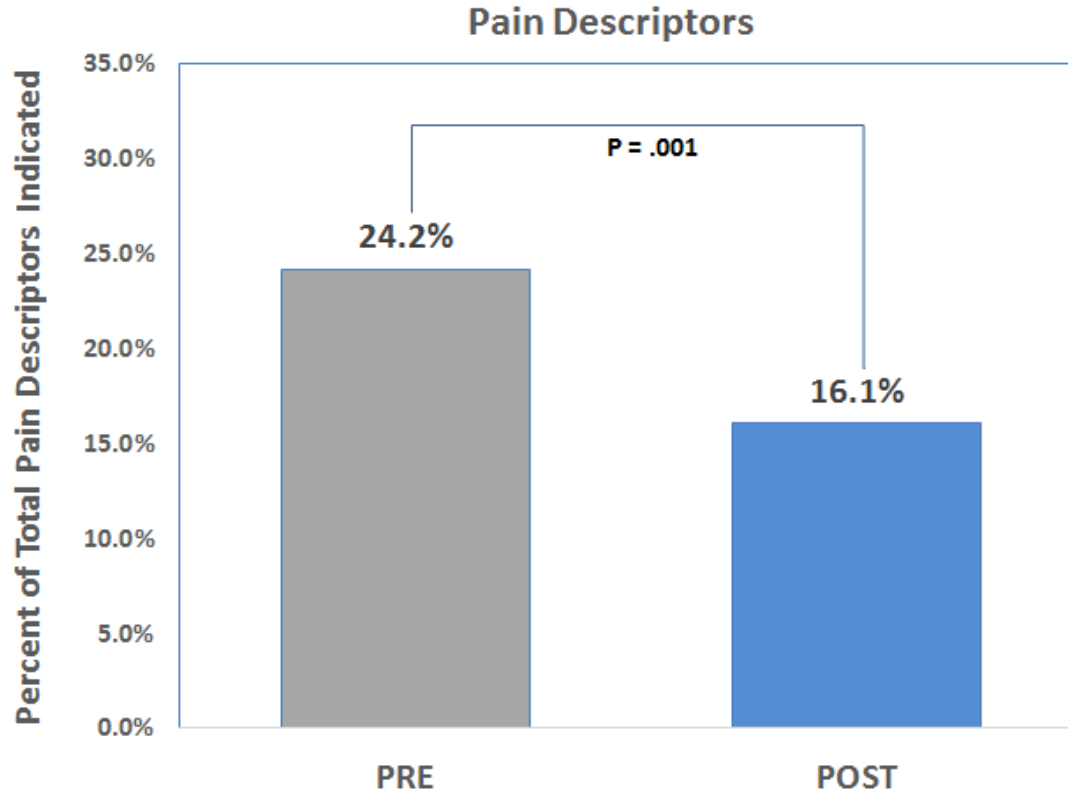
Reduction in Body Areas Affected (-23%)



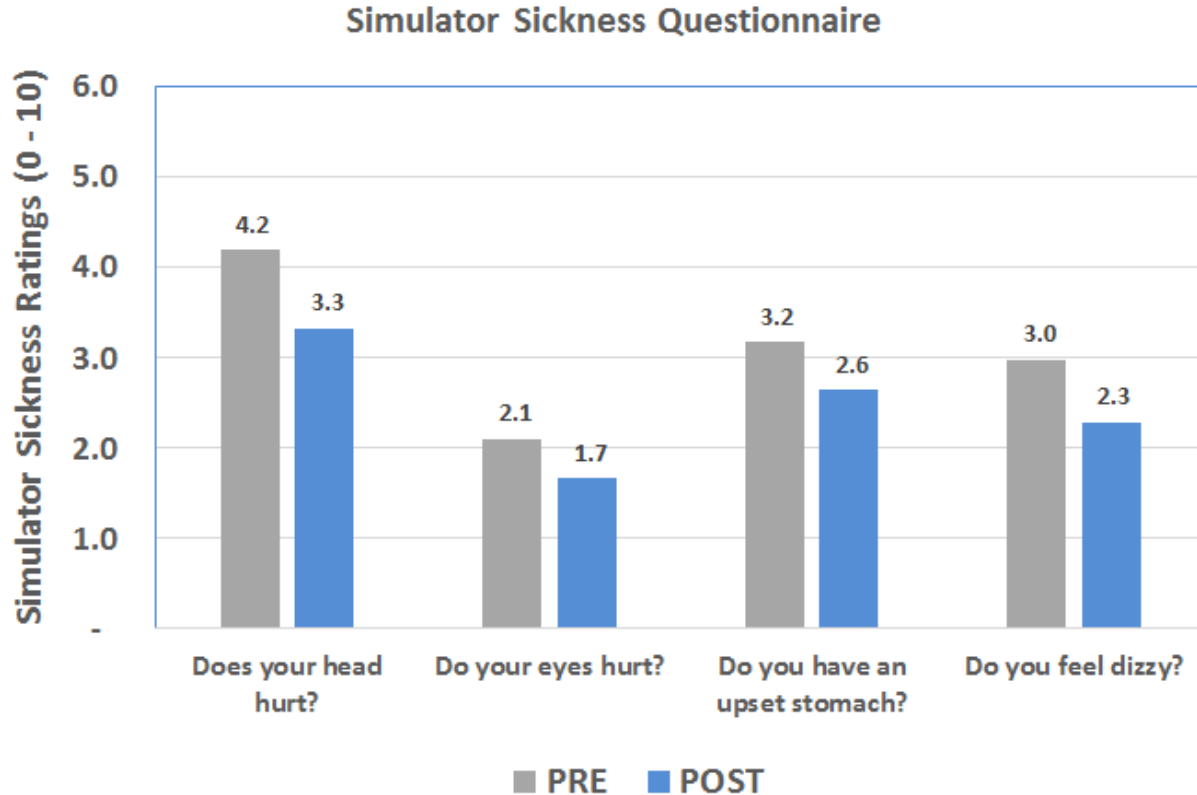
Reduction in Pain Intensity (-16%)



Reduction in Pain Descriptors (-33%)



Simulator Sickness Ratings Declined



Positive Feedback on VR Experience

VR Experience Feedback	Question	Average Score (0 - 10)
Immersion	How much did you feel like you were inside the virtual world?	9.2
Felt Real	How real did Aqua feel to you?	8.4
Fun	How much fun did you have while playing Aqua?	9.4
Comfortable	Playing Aqua was comfortable.	9.6
Hospital Experience	Playing Aqua made me feel better about my hospital stay.	8.6
Play Again	I would play Aqua again when I am in pain.	10.0

Future VR Studies @

UCSF Benioff Children's Hospital Oakland



Sickle Cell Program

- Ongoing project with possible expansion into adult population

Oncology Program

- Port access study

Chronic Pain & Biofeedback

- Teach pain-coping strategies to pediatric oncology patients using guided meditation and biofeedback.

MRI Virtual Practice

- Improve MRI outcomes through patient practice in a safe setting. Goal to reduce need for anesthetic.

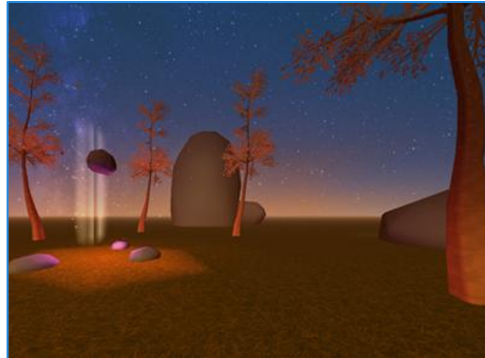
Looking Forward . . .

A Software Platform with Clinically-Validated VR Experiences



Aqua
Pain & Stress

Cancer
Burn Wounds
Sickle Cell Disease
Pre / Post Operative



Guided Meditation
Chronic Pain & Stress

Pain Coping Strategy
Teaching Tool
Biofeedback –
Heart Rate & Respiratory



MRI - Virtual Practice
Education & Training

Staying Still
“Practice through Play”
Improved Imaging Outcomes

Thank You!

Simon Robertson

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