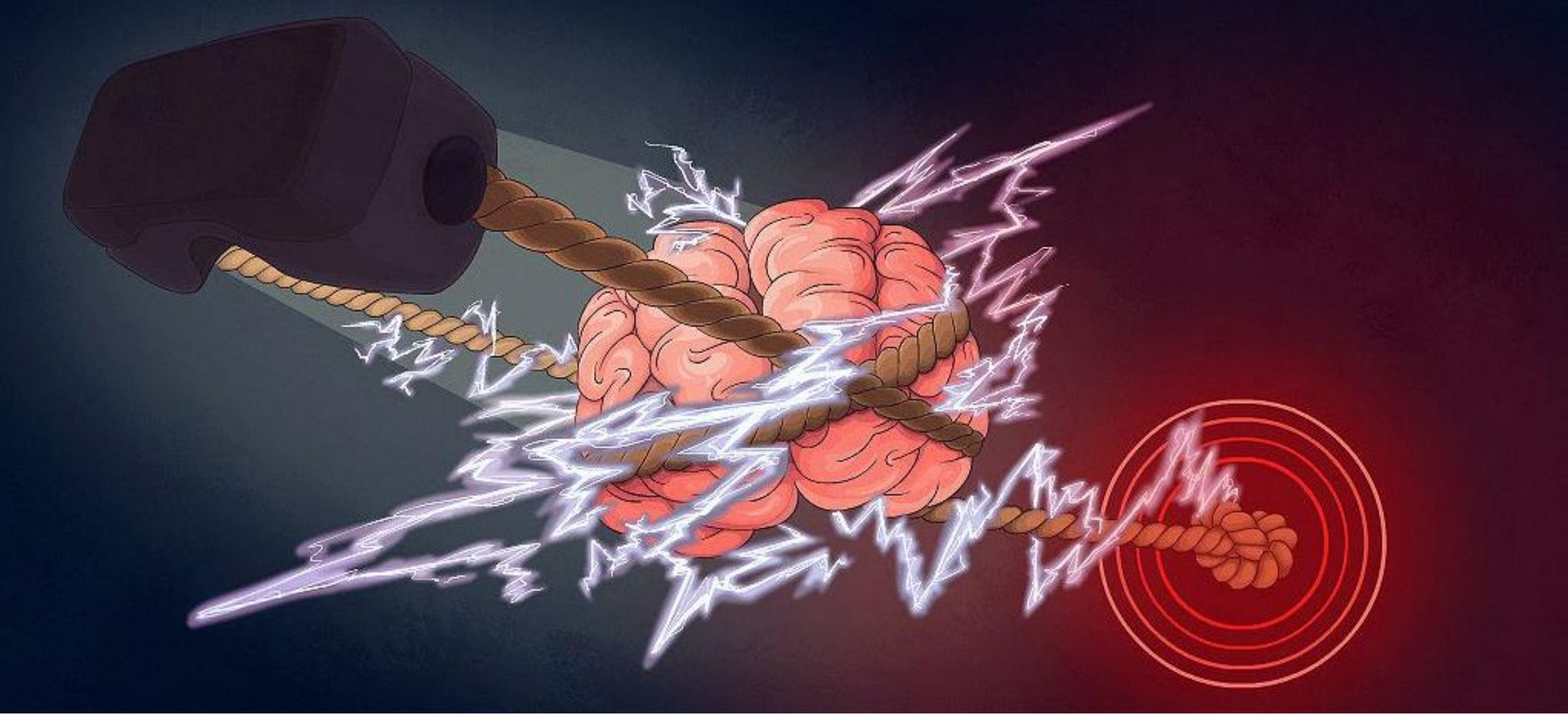

# Virtual Reality Workshop

## April 26th, 2024 | Shriners Hospitals for Children®-Canada

Virtual Reality For Children's Health

Hôpitaux Shriners pour enfants
Shriners Hospitals for Children®

RÉSEAU DE RECHERCHE EN SANTÉ BUCCODENTAIRE ET OSSEUSE

# Booths and Posters sessions

From 11:00 to 12:00 pm

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PICH
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Global Research Training

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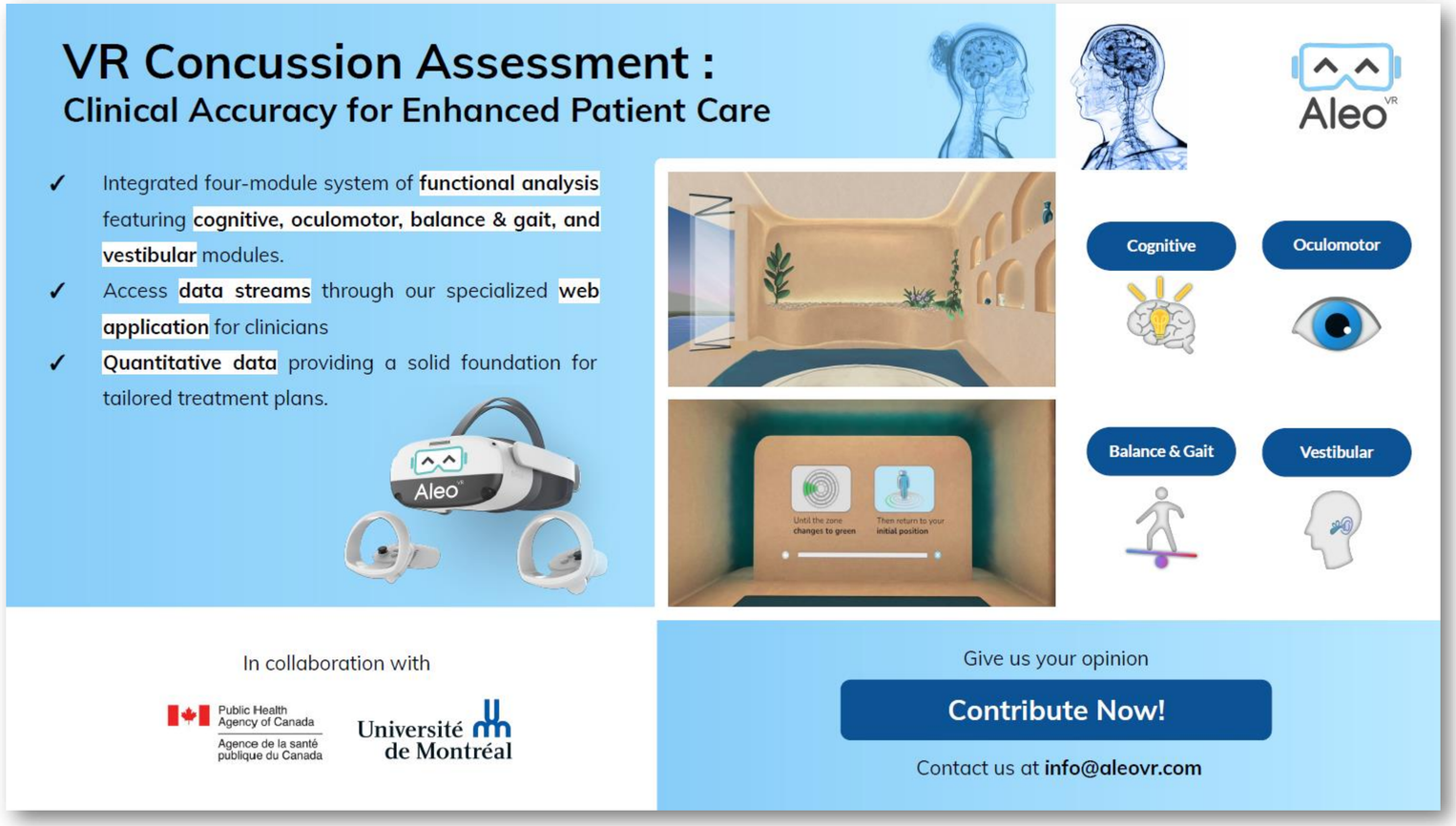

# AleoVR

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# Pain in Child Health (PICH)

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PICH Pain in Child Health Global Research Training

The Pain in Child Health (PICH) research training initiative started in 2001 and brings the paediatric pain research community together from across the globe. This interdisciplinary community of researchers is focused on cultivating new talent and promoting new discoveries in childhood pain.

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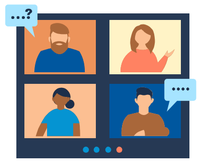

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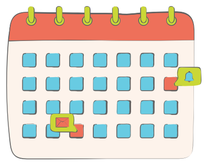

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PICH has cultivated a tight-knit community of scientists and trainees dedicated to learning and informing changes in practice to minimize pain in children and youth.

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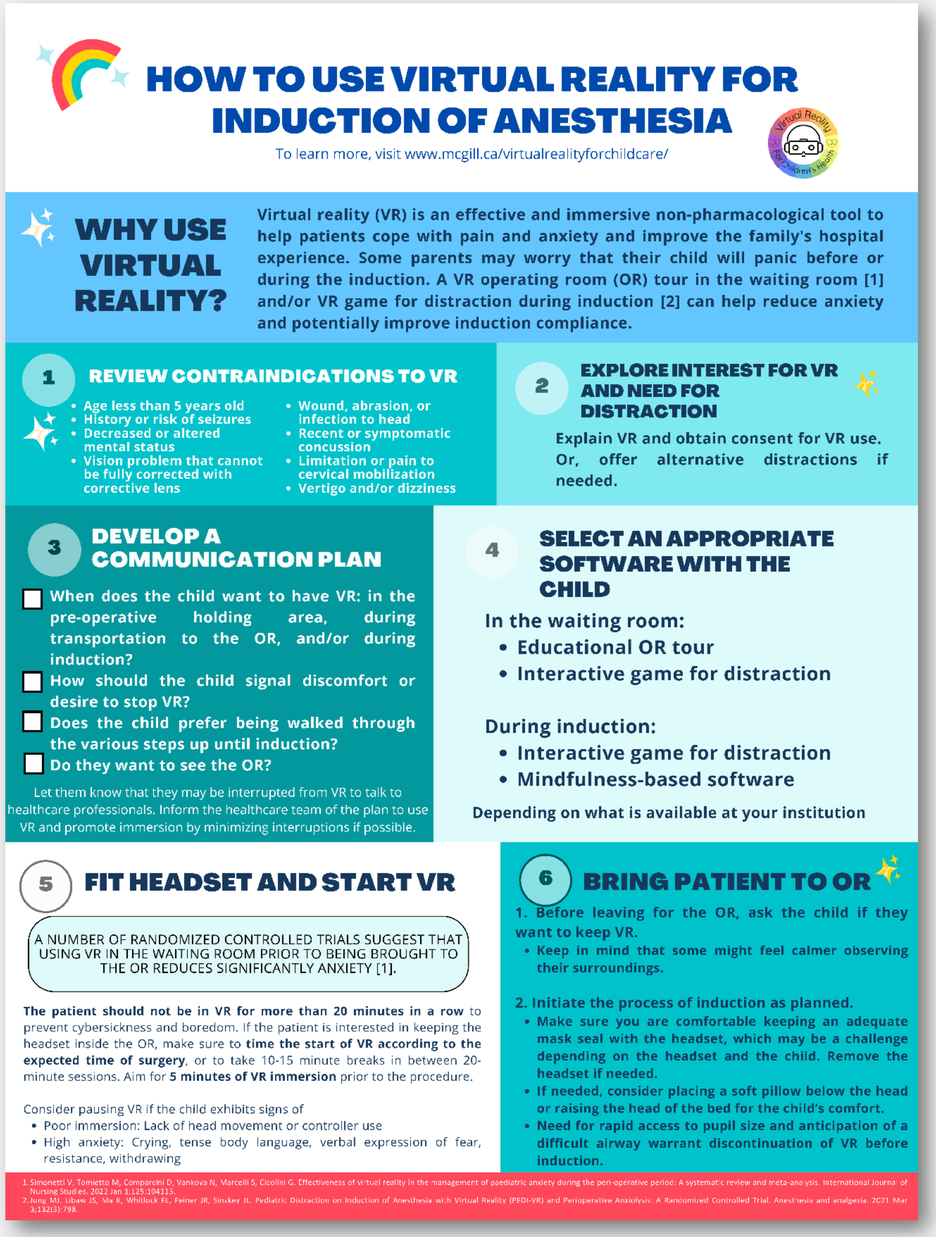

## HOW TO USE VIRTUAL REALITY FOR INDUCTION OF ANESTHESIA

To learn more, visit www.mcgill.ca/virtualrealityforchildcare/

### WHY USE VIRTUAL REALITY?

Virtual reality (VR) is an effective and immersive non-pharmacological tool to help patients cope with pain and anxiety and improve the family's hospital experience. Some parents may worry that their child will panic before or during the induction. A VR operating room (OR) tour in the waiting room [1] and/or VR game for distraction during induction [2] can help reduce anxiety and potentially improve induction compliance.

### 1 REVIEW CONTRAINDICATIONS TO VR

- Age less than 5 years old
- History or risk of seizures
- Decreased or altered mental status
- Vision problem that cannot be fully corrected with corrective lens
- Wound, abrasion, or infection to head
- Recent or symptomatic concussion
- Limitation or pain to cervical mobilization
- Vertigo and/or dizziness

### 2 EXPLORE INTEREST FOR VR AND NEED FOR DISTRACTION

Explain VR and obtain consent for VR use. Or, offer alternative distractions if needed.

### 3 DEVELOP A COMMUNICATION PLAN

- ☐ When does the child want to have VR: in the pre-operative holding area, during transportation to the OR, and/or during induction?
- ☐ How should the child signal discomfort or desire to stop VR?
- ☐ Does the child prefer being walked through the various steps up until induction?
- ☐ Do they want to see the OR?

Let them know that they may be interrupted from VR to talk to healthcare professionals. Inform the healthcare team of the plan to use VR and promote immersion by minimizing interruptions if possible.

### 4 SELECT AN APPROPRIATE SOFTWARE WITH THE CHILD

In the waiting room:

- Educational OR tour
- Interactive game for distraction

During induction:

- Interactive game for distraction
- Mindfulness-based software

Depending on what is available at your institution

### 5 FIT HEADSET AND START VR

A NUMBER OF RANDOMIZED CONTROLLED TRIALS SUGGEST THAT USING VR IN THE WAITING ROOM PRIOR TO BEING BROUGHT TO THE OR REDUCES SIGNIFICANTLY ANXIETY [1].

**The patient should not be in VR for more than 20 minutes in a row** to prevent cybersickness and boredom. If the patient is interested in keeping the headset inside the OR, make sure to **time the start of VR according to the expected time of surgery**, or to take 10-15 minute breaks in between 20-minute sessions. Aim for **5 minutes of VR immersion** prior to the procedure.

Consider pausing VR if the child exhibits signs of

- Poor immersion: Lack of head movement or controller use
- High anxiety: Crying, tense body language, verbal expression of fear, resistance, withdrawing

### 6 BRING PATIENT TO OR

1. Before leaving for the OR, ask the child if they want to keep VR.
   - Keep in mind that some might feel calmer observing their surroundings.
2. Initiate the process of induction as planned.
   - Make sure you are comfortable keeping an adequate mask seal with the headset, which may be a challenge depending on the headset and the child. Remove the headset if needed.
   - If needed, consider placing a soft pillow below the head or raising the head of the bed for the child's comfort.
   - Need for rapid access to pupil size and anticipation of a difficult airway warrant discontinuation of VR before induction.


1. Simonetti V, Tomietto M, Comparcini D, Vankova N, Marcelli S, Cicolini G. Effectiveness of virtual reality in the management of paediatric anxiety during the peri-operative period: A systematic review and meta-analysis. International Journal of Nursing Studies. 2022 Jan 1;125:104113.
2. Jung MJ, Libaw JS, Ma K, Whitlock EL, Feiner JR, Sinskey JL. Pediatric Distraction on Induction of Anesthesia with Virtual Reality (PEDI-VR) and Perioperative Anxiolysis: A Randomized Controlled Trial. Anesthesia and analgesia. 2021 Mar 3;132(3):798.


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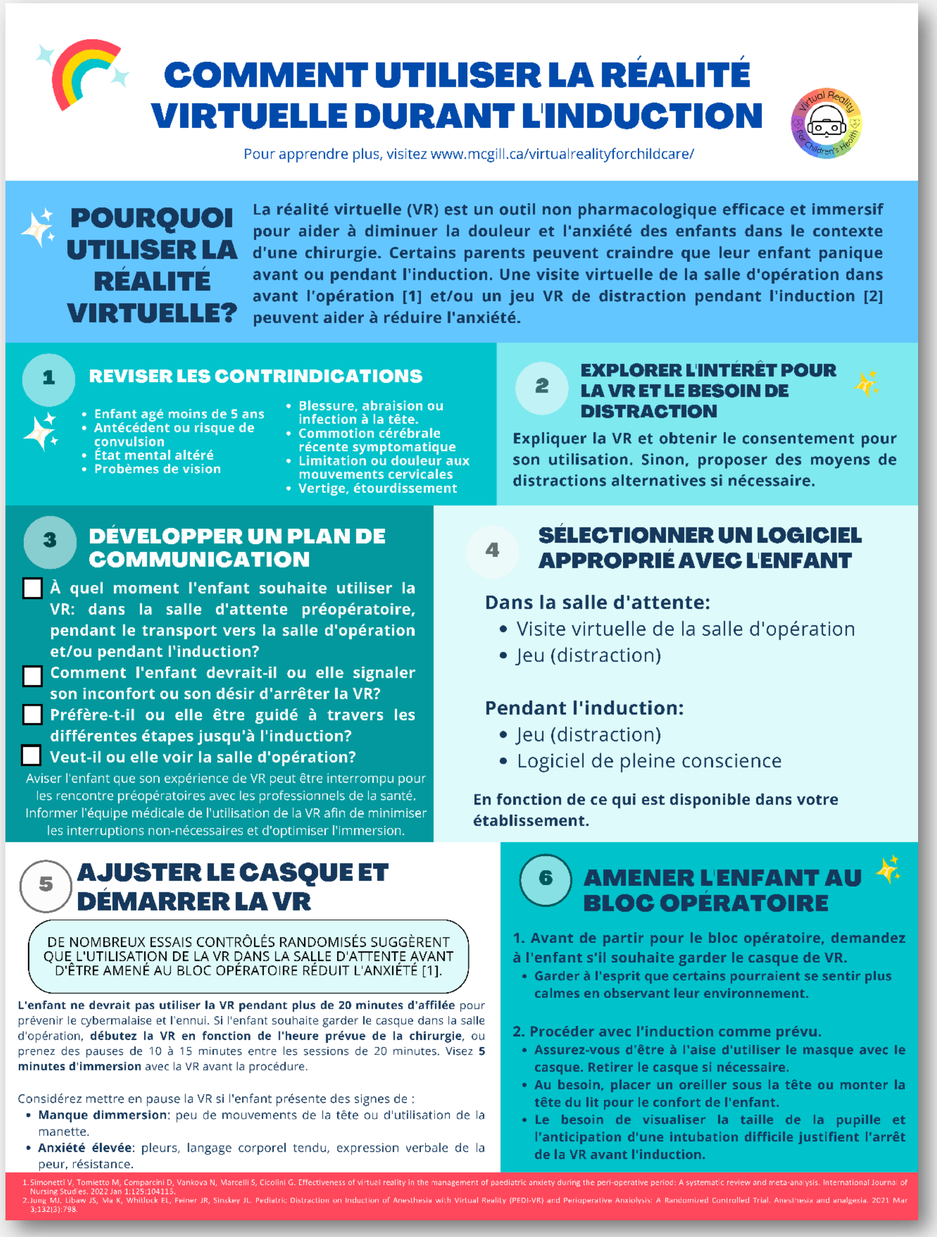

## COMMENT UTILISER LA RÉALITÉ VIRTUELLE DURANT L'INDUCTION

Pour apprendre plus, visitez www.mcgill.ca/virtualrealityforchildcare/

### POURQUOI UTILISER LA RÉALITÉ VIRTUELLE?

La réalité virtuelle (VR) est un outil non pharmacologique efficace et immersif pour aider à diminuer la douleur et l'anxiété des enfants dans le contexte d'une chirurgie. Certains parents peuvent craindre que leur enfant panique avant ou pendant l'induction. Une visite virtuelle de la salle d'opération dans avant l'opération [1] et/ou un jeu VR de distraction pendant l'induction [2] peuvent aider à réduire l'anxiété.

### 1 REVISER LES CONTRINDICATIONS

- Enfant agé moins de 5 ans
- Antécédent ou risque de convulsion
- État mental altéré
- Probèmes de vision
- Blessure, abraision ou infection à la tête.
- Commotion cérébrale récente symptomatique
- Limitation ou douleur aux mouvements cervicales
- Vertige, étourdissement

### 2 EXPLORER L'INTERÊT POUR LA VR ET LE BESOIN DE DISTRACTION

Expliquer la VR et obtenir le consentement pour son utilisation. Sinon, proposer des moyens de distractions alternatives si nécessaire.

### 3 DÉVELOPPER UN PLAN DE COMMUNICATION

- ☐ À quel moment l'enfant souhaite utiliser la VR: dans la salle d'attente préopératoire, pendant le transport vers la salle d'opération et/ou pendant l'induction?
- ☐ Comment l'enfant devrait-il ou elle signaler son inconfort ou son désir d'arrêter la VR?
- ☐ Préfère-t-il ou elle être guidé à travers les différentes étapes jusqu'à l'induction?
- ☐ Veut-il ou elle voir la salle d'opération?

Aviser l'enfant que son expérience de VR peut être interrompu pour les rencontre préopératoires avec les professionnels de la santé. Informer l'équipe médicale de l'utilisation de la VR afin de minimiser les interruptions non-nécessaires et d'optimiser l'immersion.

### 4 SÉLECTIONNER UN LOGICIEL APPROPRIÉ AVEC L'ENFANT

Dans la salle d'attente:

- Visite virtuelle de la salle d'opération
- Jeu (distraction)

Pendant l'induction:

- Jeu (distraction)
- Logiciel de pleine conscience

**En fonction de ce qui est disponible dans votre établissement.**

### 5 AJUSTER LE CASQUE ET DÉMARRER LA VR

DE NOMBREUX ESSAIS CONTRÔLÉS RANDOMISÉS SUGGÈRENT QUE L'UTILISATION DE LA VR DANS LA SALLE D'ATTENTE AVANT D'ÊTRE AMENÉ AU BLOC OPÉRATOIRE RÉDUIT L'ANXIÉTÉ [1].

**L'enfant ne devrait pas utiliser la VR pendant plus de 20 minutes d'affilée** pour prévenir le cybermalaise et l'ennui. Si l'enfant souhaite garder le casque dans la salle d'opération, **débutez la VR en fonction de l'heure prévue de la chirurgie**, ou prenez des pauses de 10 à 15 minutes entre les sessions de 20 minutes. Visez **5 minutes d'immersion** avec la VR avant la procédure.

Considérez mettre en pause la VR si l'enfant présente des signes de :

- **Manque dimmersion**: peu de mouvements de la tête ou d'utilisation de la manette.
- **Anxiété élevée**: pleurs, langage corporel tendu, expression verbale de la peur, résistance.

### 6 AMENER L'ENFANT AU BLOC OPÉRATOIRE

1. Avant de partir pour le bloc opératoire, demandez à l'enfant s'il souhaite garder le casque de VR.
   - Garder à l'esprit que certains pourraient se sentir plus calmes en observant leur environnement.
2. Procéder avec l'induction comme prévu.
   - Assurez-vous d'être à l'aise d'utiliser le masque avec le casque. Retirer le casque si nécessaire.
   - Au besoin, placer un oreiller sous la tête ou monter la tête du lit pour le confort de l'enfant.
   - Le besoin de visualiser la taille de la pupille et l'anticipation d'une intubation difficile justifient l'arrêt de la VR avant l'induction.


1. Simonetti V, Tomietto M, Comparcini D, Vankova N, Marcelli S, Cicolini G. Effectiveness of virtual reality in the management of paediatric anxiety during the peri-operative period: A systematic review and meta-analysis. International Journal of Nursing Studies. 2022 Jan 1;125:104113.
2. Jung MJ, Libaw JS, Ma K, Whitlock EL, Feiner JR, Sinskey JL. Pediatric Distraction on Induction of Anesthesia with Virtual Reality (PEDI-VR) and Perioperative Anxiolysis: A Randomized Controlled Trial. Anesthesia and analgesia. 2021 Mar 3;132(3):798.

# Additional Resources

## VIRTUAL REALITY IN ANESTHESIA
### Research Article Summary

Simonetti V, Tomietto M, Comparcini D, Vankova N, Marcelli S, Cicolini G. **Effectiveness of virtual reality in the management of paediatric anxiety during the peri-operative period: A systematic review and meta-analysis**. International Journal of Nursing Studies. 2022 Jan 1;125:104115.

### Key Takeaway
Virtual reality (VR) is **effective** for reducing anxiety in children undergoing elective surgery under general anesthesia (GA).

### Methods
- Systematic review and meta-analysis of randomized controlled trials (RCTs) comparing VR vs standard of care (SOC).
- Primary outcome: Anxiety levels assessed by the Modified Yale Preoperative Anxiety Scale (mYPAS)
- Secondary outcomes: Pain, Induction compliance assessed with Induction Compliance Checklist (ICC), Behavioral disturbances, Emergence delirium

### Results
- Seven studies were included in the systematic review, six of which were included in the meta-analysis.


**Anxiety**
VR reduced anxiety compared to SOC (PL=-0.341, [95%CI]: = -0.620 to -0.107).

**Induction compliance**
The results were mixed concerning the effectiveness of VR for improving compliance compared to SOC. VR improved compliance in 2 studies at the same institution (p<0.01, 0=0.038) [3, 4], but not in 2 other studies [1, 5] including the study that employed VR during induction.

**Pain**
VR did not reduce pain post-operatively and 2 weeks after surgery compared to SOC (Revised Faces Pain Scale p=0.699 at post-op, p=0.454 at 2 weeks) [2].

**Emergence delirium**
There was no difference in emergence delirium in VR group compared to SOC [2, 6].

**Behavioral disturbances**
There was no difference in postoperative behavioral disturbances with VR compared to SOC except in one study (Procedural Behavioral Rating Scale p = 0.010) [2].

References
1. Jung MJ, Libaw JS, Ma K, Whitlock EL, Feiner JR, Sinskey JL. Pediatric Distraction on Induction of Anesthesia with Virtual Reality (PEDI-VR) and Perioperative Anxiolysis: A Randomized Controlled Trial. Anesthesia and analgesia. 2021 Mar 3;132(3):798.
2. Eijlers R, Dierckx B, Staals LM, Berghmans JM, van der Schroeff MP, Strabbing EM, Wijnen RM, Hillegers MH, Legerstee JS, Utens EM. Virtual reality exposure before elective day care surgery to reduce anxiety and pain in children: A randomised controlled trial. European journal of anaesthesiology. 2019 Oct;36(10):728.
3. Ryu JH, Park SJ, Park JW, Kim JW, Yoo HJ, Kim TW, Hong JS, Han SH. Randomized clinical trial of immersive virtual reality tour of the operating theatre in children before anaesthesia. Journal of British Surgery. 2017 Nov;104(12):1628-33.
4. Ryu JH, Park JW, Nahm FS, Jeon YT, Oh AY, Lee HJ, Kim JH, Han SH. The effect of gamification through a virtual reality on preoperative anxiety in pediatric patients undergoing general anesthesia: a prospective, randomized, and controlled trial. Journal of clinical medicine. 2018 Sep 1;7(9):284.
5. Park JW, Nahm FS, Kim JH, Jeon YT, Ryu JH, Han SH. The effect of mirroring display of virtual reality tour of the operating theatre on preoperative anxiety: A randomized controlled trial. IEEE journal of biomedical and health informatics. 2019 Jan 11;23(6):2655-60.
6. Ryu JH, Oh AY, Yoo HJ, Kim JH, Park JW, Han SH. The effect of an immersive virtual reality tour of the operating theater on emergence delirium in children undergoing general anesthesia: A randomized controlled trial. Pediatric Anesthesia. 2019 Jan;29(1):98-105.

To learn more, visit www.mcgill.ca/virtualrealityforchildcare/

## LA RÉALITÉ VIRTUELLE EN ANESTHÉSIE
### Résumé d'article de recherche

Simonetti V, Tomietto M, Comparcini D, Vankova N, Marcelli S, Cicolini G. **Effectiveness of virtual reality in the management of paediatric anxiety during the peri-operative period: A systematic review and meta-analysis**. International Journal of Nursing Studies. 2022 Jan 1;125:104115.

### Conclusion principale
La réalité virtuelle (VR) est efficace pour réduire l'anxiété chez les enfants qui ont une chirurgie élective sous anesthésie générale.

### Méthode
- Revu systématique et méta-analyse des essais contrôlés randomisés comparant la VR aux soins standards.
- Critère de jugement principal: Niveau d'anxiété évalué par l'échelle d'anxiété préopératoire de Yale modifiée (mYPAS).
- Critères de jugement secondaires: Douleur, "Induction compliance" mesuré par le Induction Compliance Checklist (ICC), perturbations comportementales post-opératoire, délire post-anesthétique.

### Résultats
- Sept études ont été incluses dans la revue systématique, dont six ont été incluses dans la méta-analyse.


**Anxiété**
La VR a réduit l'anxiété comparé aux soins standards (PL=-0.341, [95%CI]: = -0.620 à -0.107).

**"Induction compliance"**
Les résultats étaient mixtes concernant l'efficacité de la VR pour améliorer le "induction compliance" comparé aux soins standards. La VR a amélioré le induction compliance dans 2 études dans le même établissement (p<0.01, 0=0.038) [3, 4], mais pas dans 2 autres études [1, 5] incluant celle qui a utilisé la VR pendant induction.

**Douleur**
La VR n'a pas réduit la douleur postopératoire ni la douleur deux semaines après la chirurgie par rapport aux soins standards (Revised Faces Pain Scale p=0.699 post-op, p=0.454 à 2 semaines post-op) [2].

**Délire post-anesthétique**
Il n'y avait aucune différence dans le groupe VR vs le groupe soins standards [2, 6].

**Perturbations comportementales**
Il n'y avait aucune différence dans les perturbations comportementales postopératoires avec la VR par rapport aux soins standards sauf dans 1 étude (Procedural Behavioral Rating Scale p = 0.010) [2].

Références
1. Jung MJ, Libaw JS, Ma K, Whitlock EL, Feiner JR, Sinskey JL. Pediatric Distraction on Induction of Anesthesia with Virtual Reality (PEDI-VR) and Perioperative Anxiolysis: A Randomized Controlled Trial. Anesthesia and analgesia. 2021 Mar 3;132(3):798.
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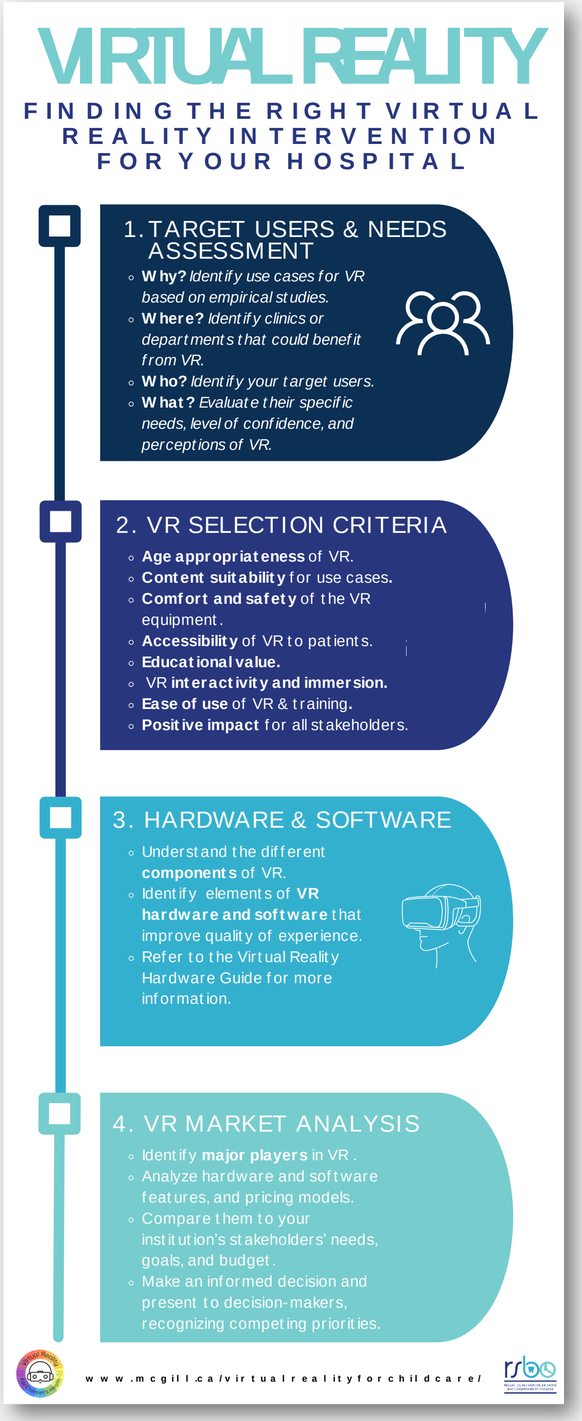
# Additional Resources

Here are some resources to help you in your preliminary steps to bring VR into your clinical practice.



# Additional Resources

Here are some resources to help you in your preliminary steps to bring VR into your clinical practice.

## Virtual Reality Hardware Guide

*A guide to help you understand the key hardware components important for a safe and immersive VR experience.*

### Central Processing Unit (CPU)

- The control center that processes and interprets what is going on in VR and executes instructions, allowing to run a smooth VR experience.

### Graphics Processing Unit (GPU)

- A video card, responsible for rendering realistic graphics in VR.

### Random Access Memory (RAM)

- Short-term memory of VR which minimizes lags and interruptions in the VR experience (min 8GB).

### Motion Tracking

- Sensors monitor the movement and position of the user's head (and/or controllers) within the VR environment.
- Establishes a reliable connection between the user and the VR world, enhancing realism, ensuring safety, and reducing motion sickness.
- A higher ***tracking frequency*** (Hz) reduces the perceived lag between user actions and virtual responses, reducing cybersickness.
- ***Degrees of Freedom*** (DoF) refer to the number of ways you can move in 3D space.
  - 3DoF: conducive to static VR experiences.
  - 6DoF: suited for interactive VR experiences.

### Headset and Controller Design

- Lightweight headset with balanced weight distribution, adjustable straps, cushioned padding, and built-in wireless/Bluetooth connectivity.
- Foam face mask or silicone mask for easy disinfection between uses.
- Capacitive buttons for those with limited hand strength/dexterity.

### Display Resolution

- The higher the pixel density, the better the display resolution, improving gaming performance, and reducing motion sickness and eye strain.

### Refresh Rate

- A higher refresh rate means images are updated more frequently, minimizing the discrepancy between head movements and display updates, reducing motion sickness, enhancing sense of presence, realism, and comfort.
- Ranges between 75 Hz to 120 Hz for VR.

### Field of View (FoV)

- The wider the FoV, the more of the VR world you can see without turning your head or eyes, increasing sense of immersion and realism, and reducing motion sickness, nausea, and disorientation.
- VR FoV ranges from 90 to 110 degrees.

### Foveated Rendering

- High resolution at gaze focus, with gradually decreasing resolution towards the periphery improves performance and reduces cybersickness by 66%.

### Interpupillary Distance (IPD)

- The distance between a person's pupils (IPD) must match the VR headset IPD to avoid visual discomfort, poor depth perception, eye strain, and distorted image.

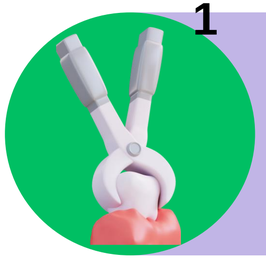
# Additional Resources

Use our ISpy Game to play with your patients or children, as a source of distraction.
Try to find the VR headset!

# Additional Resources

Here are some clinical scenarios of VR use during dental procedures. Can you think through important considerations?

## VIRTUAL REALITY IN DENTISTRY
## Case Scenario 1



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### Patient Information

Chloe, a 9 year-old girl, comes in for the extraction of the two lower first premolars for orthodontic reasons. She has always been healthy. This will be her first dental extraction. She loves dental visits but is anxious with the new procedure.

### Procedure

The extractions will be quick, although invasive. You explore different distractions available during the dental extraction. Chloe and her parents are excited to try out virtual reality (VR) distraction.

### Exercise

You now have to prepare your patient for the dental procedure with the help of VR. Chloe has never used VR .

### Can you answer?

- Indications vs contraindications for VR?
- How will you explain what is VR to the patient?
- What equipment will you need for VR?
- How will you communicate with your patient during VR?
- What if your patient wants to stop using VR during the dental procedure?

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# Additional Resources

Here are some clinical scenarios of VR use during dental procedures. Can you think through important considerations?

## VIRTUAL REALITY IN DENTISTRY
## Case Scenario 2

### Patient Information

2

Nathan, a 5 year-old boy, comes in for his restorative treatment. He suffers from early childhood caries and needs extensive treatment. He doesn't like dental visits, has trouble staying still and is very anxious.

### Procedure

The dental treatment will be carried out in multiple appointments. However, the planned dental intervention for the day will take some time. Procedures for behavior management were discussed with the patient and his parents, and they have chosen to try virtual reality (VR).

### Exercise

You now have to prepare your patient for the dental procedure with the help of VR. Nathan has never used VR before but he loves videogames.

### Can you answer?

- Indications vs contraindications for VR?
- How will you explain what is VR to the patient?
- What equipment will you need for VR?
- How will you communicate with your patient during VR?
- What if your patient wants to stop using VR during the dental procedure?

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To learn more visit
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# Additional Resources

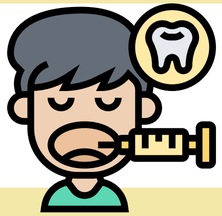
Learn more about the research evidence for VR use during dental procedures.

## VIRTUAL REALITY IN DENTISTRY
## Research Article

Shetty V, Suresh LR, Hegde AM. **Effect of Virtual Reality Distraction on Pain and Anxiety During Dental Treatment in 5 to 8 Year Old Children.** J Clin Pediatr Dent. 2019;43(2):97-102.

### In a Nutshell

Significant reduction in pain perception and state of anxiety in children using virtual reality (VR) during short invasive dental treatments.



### Study Methods

- 120 heathy children aged 5 - 8 years old were randomly selected to receive either conventional behavior management techniques such as Tell-Show-Do, distraction and voice control, or VR during a formocresol pulpotomy.
- VR was administered using a VR headset with occluding eye-pads that blocked the visual field and earphones to deliver sound from the virtual environment.
- Pain perceived during treatment was assessed using the Wong Baker Faces Pain Rating Scale.
- Salivary cortisol levels were measured.


### Study Results

- Significant lower pain perception in children that used VR as a distraction technique, compared to children that used conventional behavior modification techniques.
- Significant decrease in salivary cortisol was greater in children using VR.

### Take-home Message

Virtual reality distraction can be used as an effective behavior modification method in children undergoing short invasive dental treatments.

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# Additional Resources

Learn more about the research evidence for VR use during dental procedures.

## VIRTUAL REALITY IN PEDIATRIC DENTISTRY
## Scientific Literature


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