Understanding the Clinical Integration of Immersive Virtual Reality: Preliminary Findings from a Rehabilitation Setting

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BACKGROUND

- **Virtual reality** (VR) is a **new** and **emerging** technology in the healthcare field
- **Immersive VR** is the presentation of an **artificial environment** that convincingly replaces users' real-world surroundings to suspend disbelief and **fully engage** with the created environment[1]
- VR has been used in **rehabilitation fields** (i.e., neuro, amputee and contraindications situations)
- Previous studies report **patient improvements using VR** (e.g., upper limb motor recovery in stroke patients[2]; improved neurological function in patients with spinal cord injury and cerebral palsy[3]; decrease in phantom limb pain[4])
- However, **more research is required** about best VR types for treatment, frequencies and intensities of treatment, and if benefits are maintained long term

PURPOSE

The objective of this initiative was to understand the **implementation of immersive VR into a rehabilitation setting**, focusing on the experiences of clinicians with respect to perceived benefits, engagement, and usability.

METHODS

- Input from clinical staff, information technology, equipment specialists, and infection control was solicited to develop a process for **procuring**, **testing**, and **evaluating** an immersive VR headset and its **integration** into a rehabilitation setting
- This inter-professional collaboration allowed for a comprehensive approach to ensure patient safety and experience were considered from various perspectives
- Clinicians were encouraged to share any successes or challenges experienced, as well as suggestions for future implementation

1 https://whatis.techtarget.com/definition/immersive-virtual-reality-immersive-VR
2 Laver KE, et al. (2018). Virtual reality for stroke rehabilitation. Stroke.
3 Mao Y, et al. (2014). Virtual reality training improves balance function. Neural Regen Res.
4 Murray CD, et al. (2007). The treatment of phantom limb pain using immersive virtual reality: three case studies. Disabil Rehabil.

FINDINGS

- Clinicians provided feedback regarding ideal features of a VR headset with respect to **hardware and software**, and **integration of immersive VR into a rehabilitation setting**.

1) Procurement Criteria

- **Usability:** "Lightweight, user friendly, reliable casting, ease of remote use, high quality 'watching' experiences that are also engaging"
- **Usability:** Patient mobility – neck and trunk mobility
- **Specifications:** "Wired/wireless, price, degrees of freedom"
- **Compatibility:** Sony PS, Android, PC, mobile, tablet

2) Technical Equipment & Workflow Integration

- **Patient Eligibility:** Review contraindications to clear patients for participation (e.g., seizures, hearing aid removal, patients in isolation, pacemakers/electrical implants, patient's vision, history of motion sickness, etc.)
- **Integrating VR into appointment:**
  - "Patient must be able to verbalize, direct their experience, and let us know if they want to stop."
  - Slower speed and simpler games required
- **Clinicians:** Training, recommended apps, time limits (e.g., 15 min), designated rooms for equipment
- **Safety:** Training and checklist (Safety is priority)

3) Infection Prevention and Control

- **Across Patients and groups:** "We had to buy a special face mask"
- **Cleaning:** "The new [VR headset] has a fabric cover—not easy to clean"
- **Patient Eligibility:** Mitigating communicable challenges like "Eye infections (ensuring medical clearance from physician)"

Table 1. VR Headsets Comparison Chart

	Oculus Quest	Oculus Rift	Oculus Go	Pico Neo	HTC VIVE	HTC VIVE Focus	Target
Clinical Rating for Procurement (1=low, 5=high)	5	3	4	4	3	4	5
Price Per Unit	$399 USD	$529 CAD*	$330 CAD	$749 USD	$700 CAD*	TBD	≤$800 CAD
Platform	Standalone	Windows PC ($2000 CAD)	Standalone	Standalone	Windows PC ($2000 CAD)	Standalone	Standalone
Current Availability	Yes	Yes	Yes	Yes	Yes	Canada TBD	Immediate Availability
Field of View	110 Degree**	110 Degree	101 Degree	101 Degree	110 Degree	110 Degree	≥ 110 Degree
Degrees of Freedom	6	6	3	6	6	6	≥ 6
Refresh Rate	72Hz	90Hz	60Hz & 72Hz	90Hz	90Hz	75Hz	≥ 72Hz
Wireless	Yes	No	Yes	Yes	No	Yes	Yes
Total Cost	$399 USD	~$2500 CAD	$330 CAD	$749 USD	~$2700 CAD	NA	≤$800 CAD
Accessories Included	*Price per unit includes all standard accessories to get started.*						

*Additional costs to meet PC requirement, approximately $2000 more.
**Oculus has declined to report the field of view (FOV) for the Oculus Quest. FOV reported as equal to Oculus Rift.
Information last updated Mar 2020

DISCUSSION

This initiative may inform the implementation of immersive VR in rehabilitation and in other clinical settings. Future initiatives can build upon these findings for guidance on **immersive VR use with specific populations/diagnoses**, as well as **optimize clinical integration** making adoption of VR more feasible.

CONCLUSIONS

Incorporating immersive VR into rehabilitation has the **potential to enhance clinical outcomes** and **create positive experiences for patients**. Further exploration of benefits, integration, and best practices associated with using immersive VR in a rehabilitation setting is necessary to ensure the adoption of this promising intervention.