

Effectiveness and Usability of VR-based Occupational Therapy Tools: A Comparative Study on Motion Patterns

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Introduction

As South Korea approaches a super-aged society, demand for occupational therapy (OT) is increasing. However, OT faces limitations in diversity, including restricted therapy time, space constraints, and lack of diverse tools, posing challenges for:

- ① Patients : Limited therapy time and space hinder optimized treatment.
- ② Therapists : Limited space and therapy tools restrict diverse treatment options.

Objective

This study aims to verify whether movements and trajectories are similarly implemented when using VR-based occupational therapy tools compared to conventional tools

Method

Participants & Data Analysis

Non-Stroke Group
(n=19)

Stroke Group
(n=20)

Paired
t-test

Independent
t-test

System
Usability
Scale
(SUS)

VR/Conventional Tools Non-Stroke/Stroke Group

ROM arc



Cone



Peg

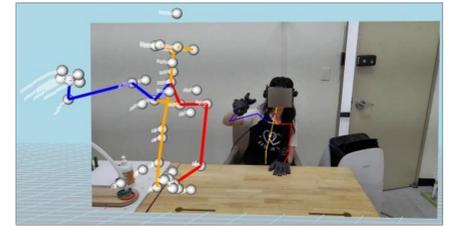
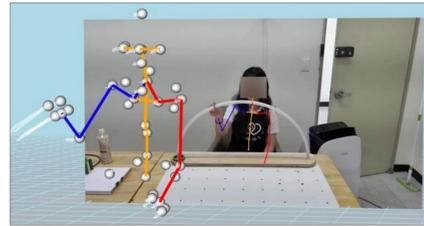


The experiment was recorded on video, and hand trajectory length was analyzed using Real-time 3D Body Tracking software.

The procedure consisted of three phases:

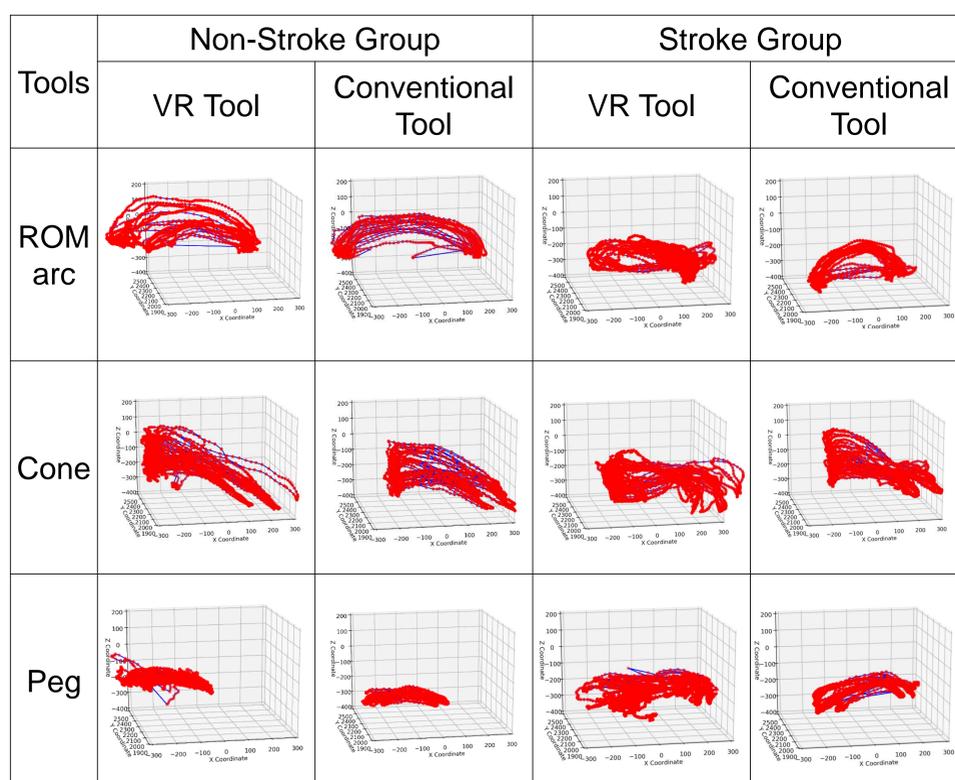
- ① Tutorial session (15m)
- ② Main experiment (3m per session, repeated 2 to 3 times per tool)
- ③ Additional Trials

Real-time 3D Body Tracking Software



Results

Trajectory Comparison



Hand Trajectory(Non-Stroke Group)

Tools	Type	Mean(mm)	SD(mm)	t	P-value
Rom arc	VR	24445.35	±4553.19	0.8987	p > .05
	Conventional	23400.41	±4442.89		
Cone	VR	46717.02	±8789.61	4.5105	p < .001
	Conventional	38306.01	±7204.5		
Peg	VR	24058.15	±5310.24	5.4340	p < .001
	Conventional	16175.47	±4144.82		

Hand Trajectory(Stroke Group)

Tools	Type	Mean(mm)	SD(mm)	t	P-value
Rom arc	VR	28053.28	±9982.95	0.5217	p > .05
	Conventional	26423.28	±9625.04		
Cone	VR	47541.21	±15911.13	0.0817	p > .05
	Conventional	41939.70	±7104.13		
Peg	VR	29313.79	±8685.55	3.0445	p < .001
	Conventional	23670.86	±6416.53		

Group Comparison by Tools

Tools	Type	Mean(mm)	SD(mm)	t	P-value
VR	Non-Stroke	24058.15	±5310.24	-2.2503	p < .05
	Stroke	29313.79	±8685.55		
Peg	Non-Stroke	16175.47	±8685.55	-4.2771	p < .001
	Stroke	23670.86	±6416.53		

Discussion & Conclusion

1. **(Trajectory Length)** Hand trajectory length was longer when using the VR device, likely due to the higher degree of freedom in movement. This increased manipulation difficulty, particularly when grasping and releasing objects.
2. **(Precision Task Performance)** The peg task, which requires higher precision than other tools, showed a significant difference in trajectory length between the stroke and non-stroke groups, as well as between VR and conventional tools.
3. **(Clinical Applicability)** While trajectory length differed between VR and conventional tools, their overall patterns were similar. Positive feedback from the SUS results supports the clinical potential of VR-based occupational therapy tools. The ROM arc and cone tasks suggest that VR tools offer movement effects comparable to conventional tools, highlighting their potential for early-stage rehabilitation training.