Overcoming Health Disparities by Integrating AI and Technology in Stroke Rehabilitation

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INTRODUCTION

Access to high-quality stroke rehabilitation is often limited by socioeconomic status, geography, and resource availability, leading to persistent health disparities in patient outcomes [1]. The integration of artificial intelligence (AI) and digital technologies—such as tele-rehabilitation (TR), adaptive therapy platforms, and wearable sensors—offers clinicians powerful tools to extend personalized, data-driven care beyond traditional clinical environments [2, 3]. These innovations can help therapists monitor progress remotely, tailor interventions, and reach underserved populations, ultimately reducing barriers and promoting more equitable recovery for all stroke survivors. Embracing AI and technology in rehabilitation practice is a critical step toward closing the gap in stroke care and improving functional outcomes across diverse patient groups.

R3THA™ delivers AI-driven, adaptive exercises to personalize hand and arm rehabilitation, offering real-time feedback and remote monitoring for patients and clinicians. Usability studies are conducted to demonstrate its feasibility and strong acceptance in community telerehabilitation, supporting its integration into hybrid care models. This approach helps expand access to high-quality, individualized therapy for individuals recovering from stroke or cerebral palsy who may face barriers to traditional in-person services.

SUBJECTS

Inclusion Criteria: 1) Between 18 and 80 years old 2) Enough shoulder, elbow, wrist, and hand movement to actively interact with the exergames 3) Upper Extremity Fugl-Meyer Assessment (FMA-UE) score equal or higher than 21 4) Receive pro-bono services from Rutgers SLP clinic.

Exclusion Criteria: 1) Severe arm weakness 2) Severe arm spasticity 3) Difficulty following instructions or paying attention 4) Visual problems limiting interaction with a computer screen.

Table 1: Subjects' demographic information

ID	Gender	Age	MOCA	Time Since CVA (months)
Case 1	M	52	7	6
Case 2	F	26	24	73
Case 3	M	34	25	138

METHODS

1. OTS and participants met at the SLP clinic for initial evaluations.
2. A follow-up session was conducted as a home visit to optimize ergonomic setup and provide participants with necessary hardware and software training.
3. Over the next two weeks, participants engaged in 30 minutes of traditional therapy and 30 minutes of R3THA via TR.
4. The final discharge evaluation was conducted in-person, consisting of semi structured interviews (SSI) and post-test assessments.

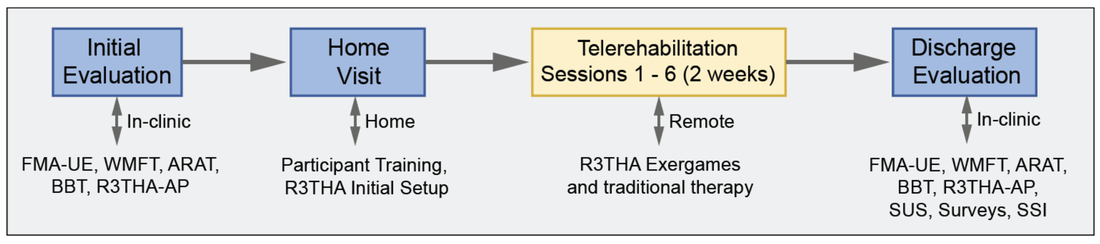


Figure 1. Study Procedure

RESULTS

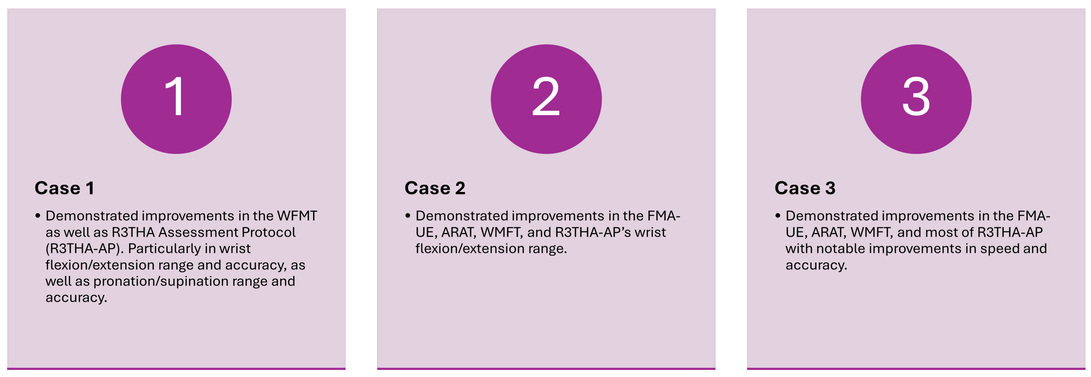


Figure 2. Individual results

Table 2. Changes between Pre and Post intervention assessments

ID	Session	WMFT (Median/Score)	Hand Open and Close Speed	Hand Open and Close Accuracy	FMA-UE	BBT	ARAT
Case 1	Pre	3.40 / 59	4.5	76.08%	64	18	57
	Post	2.70 /72	3	84.52%	64	15	57
Case 2	Pre	7.03 / 35	4.5	75.41%	47	6	22
	Post	7.01 / 41	6	75.55%	56	8	25
Case 3	Pre	3.23 / 50	10.5	88.14%	56	34	55
	Post	2.81 / 71	12.5	92.46%	56	33	57

RESULTS

- Three participants successfully completed the protocol without adverse events.
- SUS results vary from below average (<68) to above average (>68).
- Semi-structured interview reveal that all participants agree that standby assistance from caregiver is necessary.
- Both participants and caregivers agree they would need the assistance of therapist to facilitate playing the games.



Figure 3. R3THA was placed in each patient's home

DISCUSSION

TECH LITERACY FACTOR

All participants indicate R3THA is feasible for telerehabilitation use with

- proper set up
- caregiver support
- fast Wi-Fi
- remote assistance from therapist.

AGE FACTOR

Age could be a factor, as both case 2 and 3, who were young adults, showed an interest in using R3THA again.

Nevertheless, personal preferences and habituation are more probable influences than age.

COGNITIVE FACTOR

Case 1, despite cognitive impairment, interacted with the game, showing feasibility for those lacking full cognitive abilities.

SOCIOECONOMIC FACTOR

R3THA has proven to be compatible and affordable, enabling people from a wide range of socioeconomic backgrounds to use it.

REFERENCES

CONTACT

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