

Project Title

H-MAN Robot for Upper Limb Rehabilitation After Stroke

Project Lead and Members

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Organisation(s) Involved

Tan Tock Seng Hospital

Healthcare Family Group(s) Involved in this Project

Medical, Occupational Therapy, Healthcare Administration

Applicable Specialty or Discipline

Rehabilitation Medicine, Education & Research, Community Health

Aim(s)

This technology-enabled decentralised model of care demonstrated higher training intensity with safety, minimal supervision, without a concomitant increase in manpower.

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Conclusion

See poster appended/ below

Project Category

Technology

Virtual Reality, Medtech, Robotics

Care & Process Redesign

Valued Based Care, Patient Reported Outcome Measures, Patient Reported Experience Measures, Patient Satisfaction, Functional Outcome, Productivity: Time Saving, Cost Saving, Manhour Saving, Operational Management: Resource Allocation, Logistic Management, Inventory Management

Keywords

Upper Limb Disability, Stroke Rehabilitation, Robotics-Aided Therapy (RAT), Virtual Reality (VR) Game, H-MAN 2D Planar Upper Limb Robot, Robotic Training

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Summary of project

Upper limb (UL) disability affects 39% of stroke survivors at 6 months with poor outcomes. Repetitive, task specific and intensive arm training is needed to excite neuroplasticity in the crucial first 6 months post-stroke for optimal recovery.

In general, the intensity of therapy is suboptimal along the continuum of care from inpatient stroke rehabilitation to the clinic and community.

Robotics-aided therapy (RAT) is an evidence-based method to deliver task-specific, intensive and progressive, engaging therapy with virtual reality (VR) games. However, the majority of commercially available robots are costly, bulky, complex to deploy and restricted to research institutions.

The **H-MAN 2D** planar upper limb robot, a portable, table top, low-cost device has been deployed since 2021, at TTSH-Clinic of Advanced Rehabilitation Therapeutics (CART), day rehabilitation centres and nursing homes.

This technology-enabled **decentralised model of care** demonstrated higher training intensity with safety, minimal supervision, without a concomitant increase in manpower.



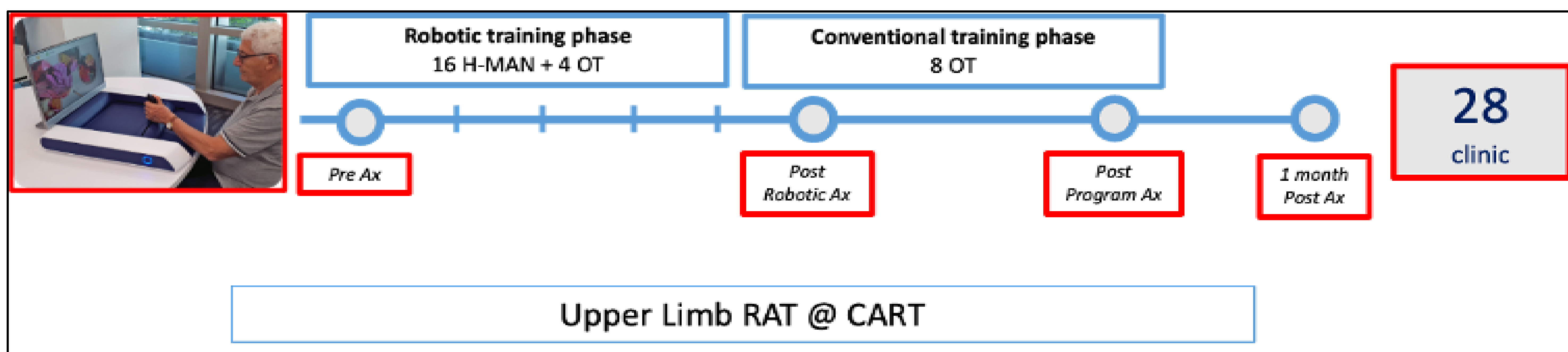
Strategy and team

The H-MAN (2 units) were adopted by TTSH-CART a tertiary rehabilitation ambulatory clinic in 18 Oct 2021 as an **ongoing** monitored RAT clinical programme. (Figure 2)

Team composition involves multidisciplinary rehabilitation team of doctors, occupational therapists (OT), industry partners (Articares Pte Ltd) and clinical operations staff.

Stroke patients in the subacute to chronic outpatient phase are the main beneficiaries.

Systems solutions need to overcome current low intensity in conventional rehabilitation without an equivalent incremental increase in staff or time and integration of RAT into clinical protocols. The goal was to move away from the traditional treatment model of 1:1 patient: therapist ratio which is technology-enabled.



Reproducible work process

- (i) Acquisition of H-MAN with financial, MDOTS, BME certification, finance charge codes
- (ii) Physical set up of 2-HMAN in CART clinic
- (iii) Programmatic outcomes assessments according to clinic protocols (see figure above)
- (iv) TTSH & Articares for further refinement of H-MAN design, passive arm supports.
- (v) Interdisciplinary rehabilitation team (TTSH-CART), IT, operations and finance teams (charge codes, clinic scheduling), Articares (after sales service)
- (vi) A cloud-based software CARE platform transmits training data to therapists from individual /locations for remote monitoring. (figure 3 & 4)
- (vii) Telerehabilitation using home robots currently in joint-development supported by CHISEL-Temasek Foundation 2021-22, NHIC-I2I-2104007(2022-23)

Measures of improvement

Clinical outcomes : Fugl Meyer Motor scale (FMA)

Clinic attendances by time since implementation

