提醒治疗法: 家庭的神经康复治疗新概念
Remind-to-move: A new concept in home-based neurorehabilitation

香港理工大学康复治疗科学系
副教授方乃权博士

Acknowledgements:

Wayne, Wei Xijun, PhD candidate

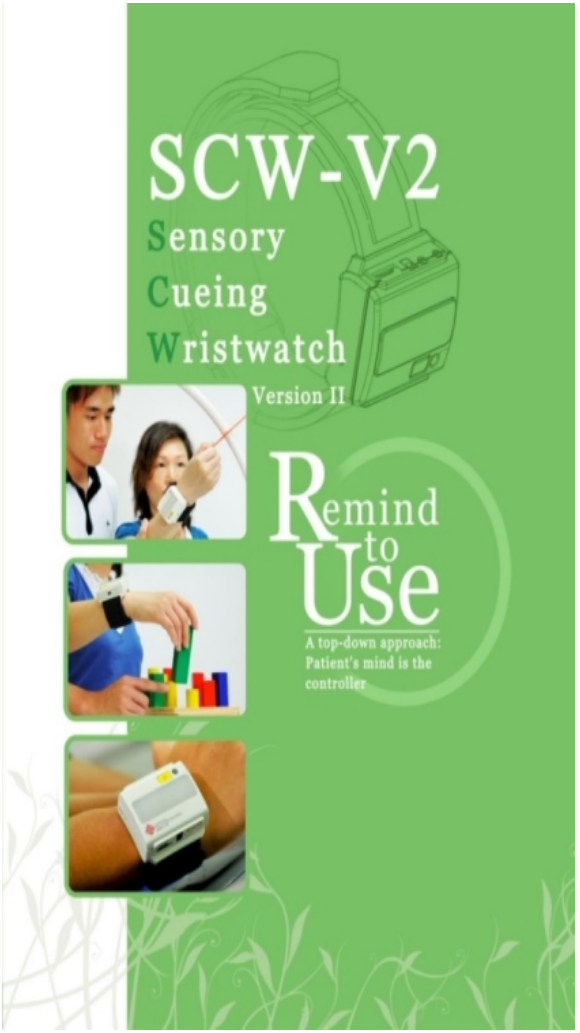
Dr. Vicky, Dong Anqin, PhD

Dr. Nicole, Yang Yonghong, PhD

Grant: GRF, RGC, UGC (560812M)

提醒治疗法

- 由香港首創之新偏癱上肢復康治療方法
- 为了改善腦中風及大腦麻痺患者「习惯性废用」的情况
- 感知提示仪器会在预设的时间发出提示震动
- 感知提示感知信号，增加患者偏瘫半身的专注力
- 诱发患者按照作业治疗师的指示做出适当动作或增加在日常生活中使用患手，令患者手部及患侧整体功能得以改善，以加快患手的康复进度。



THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學 I/E Institute for Entrepreneurship 企業發展院

Issue | Feb 2013

Technology Frontier

News Bite on PolyU's Innovation

"Reminding" to boost stroke recovery

New assistive device to make a difference for stroke patients

"My mom had a stroke last year when she was 70. Like the other stroke sufferers, she is left with weakness on the right side of her body. We all know that regular exercise can boost recovery for her impaired hands and arms. However, she often leaves her right limbs unused despite repeated reminders and encouragement from the family and the doctor. As a daughter, it's really sad to watch her body functions deteriorate progressively," said Jane, sharing a classic case of frustration facing stroke survivor family. In fact, all the stroke survivors know that engaging proactively in therapeutic exercise is important. However, the road to recovery is long and windy, thus they tend to give up easily. Now, a new healthcare device designed by researchers at The Hong Kong Polytechnic University could make a difference for the stroke patients and their family. This device can be taken home to stimulate the use of the impaired hands and arms throughout the day. It will surely help the patients to shorten their recovery time and regain their independence in lives.

Stroke patients can now benefit from a new assistive device from PolyU's Department of Rehabilitation Sciences. The device boosts recovery by reminding patients to work harder on their impaired hands and arms. It is simple and easy to use for the patient as well as the therapists and healthcare professionals.

According to the Hospital Authority, stroke is the leading cause of severe disability in Hong Kong. Stroke survivors are left with partial paralysis where there is limited movement on one side of the body due to damage in the brain. Occupational therapy can help restore functions in the hands, arms and legs but researchers found that arms are slower to recover than legs. This problem is quite common among patients after stroke or brain injury.

As a part of a novel and innovative treatment – "Remind to Move", PolyU's new device is called "sensory cueing wristwatch", which is specially made to better manage in-home exercise programmes for clients with hemiplegic arms due to stroke or children with cerebral palsy. Therapists can now have effective intervention even when patients are in their own homes.

A program will be input into the wristwatch, which in no way can be altered by the patient. Strapped on the affected hand, the sensory-cueing wristwatch sends signals in vibration at fixed time intervals, reminding a patient to do exercises as prescribed. Movements are detected and recorded by a built-in sensor, which helps the therapist analyse the patient's condition by frequency and

Tuesday, January 8, 2013 The Standard 英文虎報

Health & Beauty

Timing your recovery

Joy Li

STROKE IS THE most significant cause of severe disability in Hong Kong, according to statistics from the Hospital Authority. In the rehabilitation process, researchers found, the patient's upper extremities, hands and arms, are slower to recover than their legs.

An important factor preventing these stroke patients from enjoying full functional recovery is that they tend to shun using their dysfunctional hand, eventually leaving it useless.

To help patients make conscious movements periodically and hasten their chances of returning to normal life, the research team at Hong Kong Polytechnic University's Department of Rehabilitation Sciences has developed a novel treatment device called "Remind to Move."

It is designed for those with hemiplegic arms because of stroke or children with cerebral palsy.

The device is a specially made sensory-cueing wristwatch that sends signals – like light or vibration – at fixed intervals to remind patients that it is time to use their "bad" hand.

Kenneth Fong Nai-kuen, team leader and associate professor of the department, said the device aims to tackle the "deliberate non-use" problem.

This hindrance is common among stroke recovery patients and children with cerebral palsy.

A typical person makes more use of his or her stronger hand to perform everyday tasks. It is the same among patients: regardless of which hand is impaired, they tend to avoid using it.

Deliberately suppressing movement leaves the patient unable to develop the limb further. For children, this muscular atrophy could see one hand twice as large as the other one, Fong said.

The traditional approach is called constraint-induced movement therapy. The patient's normal hand is wrapped up so they are forced to use their impaired hand. However, "it is hard and sometimes awkward for patients to use only one hand.

Poly U's Kenneth Fong says the 'Remind to Move' device, above, aims to tackle the 'deliberate non-use' problem.

Being single-handed can also hinder a person's sense of balance, increasing the risk of falling over.

Lau Kin-hung is chairman of the Hong Kong Stroke Association, a self-help organization started by stroke patients. He had a stroke eight years ago when he was just 48, and the movement on the right side of his body was seriously affected.

Because he lived on the fourth floor of an old building without a lift, he had to climb the stairs every day. As a result, his legs recovered quickly but his hand recovery was much slower.

Lau can lift his right hand only up to his chest, but holding a glass to drink was impossible.

It is important for stroke patients to repeatedly practice motion with their affected limb. This will speed up rehabilitation, Lau said. "However, people are generally lazy and need to be constantly reminded otherwise they don't bother to use that limb."

Lau was among a dozen patients in the two-week pilot study who tried out the sensory-cueing wristwatch. He wore it for three hours every day. His movements were recorded by a built-in accelerometer, which helps his therapist analyze data such as frequency and intensity of the patient's movement.

Lau said his arm has become much more flexible and functional after two weeks of intensive exercise. "I can now hold a glass and drink water with my right hand. My hand is now more flexible. The device is convenient to use and I can continue with the treatment at my own convenience at home, and not necessarily in the hospital," he said.

Fong said the device is not meant to replace the traditional approach to treating patients.

"What is important is not the technology but rather the top-down concept. Patients can consciously use their limb and it soon becomes a habit."

The device is produced in limited quantities. The occupational therapy departments of five hospitals under the Hospital Authority have started using it. The average cost of each device is about HK$ 2,000. Fong hopes to get companies interested in manufacturing and distributing the device on a large scale.

Website: www.rs.polyu.edu.hk

joy.li@singtaonewscorp.com

E8 二〇一二年十二月三十一日 星期一
星島副刊 FEATURES SINGTAO DAILY

健新知

感知提示手表 治偏癱新法

香港理工大學康復治療科學系的專家，最近成功為腦中風及大腦麻痹患者研發出一套創新的治療方法，名為「提醒治療法」。患者只須將「感知提示手表儀器」戴在手腕上，儀器便會於預先設定的時間，發出感知提示[illegible]

在兒童身上，便會影響他們的手部發育。

「感知提示手表儀器」會發出感知提示訊號(如閃燈)，加強患者對偏癱半身的專注力，誘發其按照職業治療師的指示，適時做適當的動作，又或[illegible]

力。社區研究結果顯示，慢性中風者每天戴上提示儀器三小時，並同時配合患側上肢的密集式動作訓練，兩星期後，患側活動能力便有顯著改善。「提醒治療法」也可應用在患有大腦麻痹及半側偏癱的兒童上，由於手表不會發出聲響，因此不會影響學習。

醫院管理局轄下五家公立醫院的職業治療部，已開始使用「感知提示手表儀器」。患者毋須在治療人員監督下，也可自行在家中練習，加快康復進度。目前，研究人員正開發新一代手表，欲加入有效的活動監察模式等，務求令更多社會大眾及患者受惠。

整理：Esther

■理大研發的「感知提示[illegible]為腦中風及大腦麻痹患者[illegible]

■由於提示手表不會發[illegible]響兒童上課。

明報 2012.12.14 星期五 編輯 鄭利群 港聞 A16

理大感知手表 提醒半癱者運動

【明報專訊】理大研發「感知提示手表」，可在預設時間發出提示信號，提醒腦中風和大腦麻痺患者進行復康運動，加快復康進度。負責研究的**理大康復治療科學系副教授方乃權**表示，治療方法有效提升患者近五成活動量，避免因「習慣性廢用」而加速肢體機能退化。

理大復康治療科學系副教授方乃權（左）為新健社主席劉劍雄（右）戴上的，就是「感知提示手表」。 （勞雅文攝）

預設時間發聲震動發光

不少腦中風和大腦麻痺患者會出現半身偏癱，方乃權舉例說，因其中一隻手活動能力不理想，患者往往會依賴健康的一邊手，導致癱瘓的手康復進度減慢，甚至出現機能退化。理大於2008年起研發「感知提示手表」，透過在預設時間發出提示信號，如發聲、震動及發光，提醒患者在日常生活中多使用患手及按職業治療師指示進行復康運動，同時可記錄患者的運動量參考。

方乃權說，有關治療法已經過3項臨牀研究，初步證實患者每日帶上「手表」3小時及配合密集式動作訓練，兩星期後患手的活動能力已有改善，亦可增加患者的活動量近三成。他表示，有關研究現時已應用於醫管局轄下5間醫院的職業治療部，由於小量生產，「手表」的成本價爲2000元。

中風患者、新健社主席劉劍雄於2004年48歲時中風，導致右邊身癱瘓，並於2010年參與試用「手表」。他說，由於政府提供康復療程未必足夠，透過「手表」就可隨時隨地提醒他多運動，他現時已可提起手至下巴位置。

[illegible] 星期五

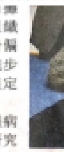
[illegible]知手錶提半癱者多「動[illegible]

[illegible]導致半身癱瘓患者，因[illegible]擬復康進度。香港理工[illegible]透過自行研發的感知提[illegible]鍛煉，研究顯示中風病[illegible]量最高可提升五成，患[illegible]工商界合作，改良設計[illegible]了三項研究，讓四十名住院中風患者、[illegible]患者及八名大腦麻痺兒童，每日戴手錶[illegible]果發現兩至三星期後，患者手部運動量[illegible]至五成，手部功能亦有明顯進步。

文仔（化名）八歲時因手術併發症[illegible]韓太指他的左手三年來均恢復緩慢，直[illegible]錶，情況顯著改善。從錄影片段可見，[illegible]左手及不能翻轉桌上紙牌，惟戴表兩星期後，左手可舉直，亦可翻紙牌及用湯匙。中風患者組織「新健社」主席劉劍雄八年前中風致右身偏癱，他試用手錶後，右手由只舉至胸部進步可舉至面前，「人始終有惰性，有隻手錶定時定候提醒，會有大啲動力做運動。」

方乃權補充，手部功能輕至中度受損病人，皆適合使用新技術，惟仍需進一步研究如何達最佳效果。理大科技轉移及創業培育項目經理盧良成指，大學自行生產每隻手錶成本近二千元，正聯繫工商界合作夥伴，務求改進設計，大量生產以降低成本。

■感知提示手錶可定時提醒半身偏癱病人進行手部復康訓練。



■方乃[illegible]感知提[illegible]煉。劉[illegible]右手功[illegible]

記錄的運動時間及次數。理大進行

感知提示手錶[illegible]

【本報訊】因中風、大腦麻痺致半身偏癱的病人，因手部活動較差而往往忽略其功能，甚至棄用患手。理工大學全球首次研發「感知提示手錶」，透過震動、發聲及發光功能，每5至10分鐘提示病人要多用患手。三項初步研究指病人佩戴手錶後，手部活動幅度及活動量大增，有助恢復手部功能。

該校08年起研發此手錶，經訊號提醒病人日常要多用患手，或按職業治療師指示作康復訓練，手錶藏感應器及記憶體，可記載患手活動量及幅度。負責研發的理大康復治療科學系副教授方乃權指，傳統康復治療會教病人用布紮實「好手」，逼他們用患手生活，但對病人日常不便，並增加跌倒風險。手錶使用簡單又便宜，病人可於家居使用，毋須經常到醫院。

個別公院讓病人試用

其中一項研究邀請兩間公院共40名中風病人參與，當中一半人用該手錶、另一半人用無提示的手錶，持續3周、每日戴3小時。評估指使用有提示手錶的病人，患手在3周內平均郁動共2,400次，比無提示的病人平均郁動1,700次多逾四成。手錶成本價以千元計算，已在美國及中國獲發明專利，該校將再評估手錶使用期長短的成效，手錶暫未推出市場，只有個別公院為病人試用。

中風組織「新健社」主席劉劍雄，04年中風右身癱瘓，他試用手錶後右手有改善。他說：「人有惰性，唔想郁隻患手，長時間肌肉關節就綳緊，右手緊到打唔開。用咗手錶後，右手活動明顯靈活咗。」韓太現年12歲的兒子，3年前因手術致缺血性中風，左手癱瘓，3年康復治療也無大改善，拇指無法「掂到」尾指。兒子試用手錶兩周後明顯改善活動能力，左手就可拿杯飲水，並可成功點手指。

[illegible]傳呼機。

太陽報 2012.12.14 星期五 港聞7・醫知健 A22

感知手錶提醒中風者鍛煉手部

【本報訊】中風或大腦麻痺導致半身偏癱患者，因活動不靈或會習慣棄用患手，窒礙復康進度。香港理工大學近日開創一套「提醒治療法」，透過自行研發的感知提示手錶，定時提醒患者進行手部鍛煉，研究顯示中風病人使用兩至三星期後，手部運動量最高可提升五成，患手功能明顯改善。理大欲與工商界合作，改良設計及減低成本。

理大康復治療科學系副教授方乃權表示，半身偏癱患者若過分依賴健全的手，會導致患手「習慣性廢用」。該學系自〇八年起研發感知提示手錶，職業治療師先制訂運動療程，患者戴上手錶後，手錶會在提示時間響鬧，治療師可分析手錶紀錄的運動時間及次數。理大進行了三項研究，讓中風患者及八名大腦麻痺兒童，每日戴手錶三至五小時，結果發現患者手部功能有明顯進步。文仔（化名）八歲時因手術併發症引致中風，媽媽韓太指他的左手三年來均恢復緩慢，直至試用提示手錶，情況改善。文仔原無法舉開左手及不能翻轉桌上紙牌，惟戴錶兩星期後，左手可舉直，亦可翻紙牌。中風患者組織「新健社」主席劉劍雄八年前中風致右身偏癱，他試用手錶後，右手由只舉至胸部進步可舉至面前。方乃權指手部功能輕至中度受損病人，皆適合使用新技術，惟需進一步研究如何達最佳效果，如每日應佩戴多久及持續佩戴多久。

■方乃權（左二）[illegible]感知提示手錶（小圖）有助上肢偏癱患者更主動地進行復康鍛煉。劉劍雄（中）試用手錶後右手功能改善。

提示錶 助半身偏癱病人康復

理大研發

伸直手指、提起水杯等動作看似簡單，但對部分中風及大腦麻痺患者而言卻是奢望。為此，理工大學研發出「提醒治療法」，協助半身偏癱病人做康復治療。研究顯示，此法可增加偏癱肢體三分一至一半活動量。

記者：譚琦恩

半身偏癱常見於腦中風及大腦麻痺患者。理大康復治療科學系副教授方乃權指出，很多患者一邊手活動不理想，慢慢放棄使用，形成「習慣性廢用」，令康復減慢。「若發生於小孩身上，更可能影響他們的手部發育，造成大細手。」

要克服「習慣性廢用」，患者必須每天進行重複性及密集性練習。理大於是在2008年開始研發感知提示手錶，藉聲響、震動及閃燈，每隔一段時間就提醒患者做康復運動。手錶同時備有記憶體，可紀錄手部每天的活動量，方便治療師於覆診時給予指導。

日戴三至五小時 顯著改善

過去數年，「提醒治療法」已先後應用於住院中風病人、社區長期中風患者及大腦麻痺兒童身上，結果新療法對三者皆有顯著作用。每天佩戴三至五小時，患手的活動量已大幅提升三至五成，病人的手部活動能力亦得到顯著改善。

中風患者組織、新健社主席劉劍雄於八年[illegible]間中心進行八個月康復治療，其後就很少再用左手，令肌肉逐漸退化，「人有惰性，唔郁開就唔郁！」

直至兩年前使用感知提示手錶，其左手活動量大大提升，每隔數分鐘便會

5間

感知提示手錶目前只小量生產，暫有屯門醫院、沙田醫院、九龍醫

理大發明的感知提示手錶（紅圈）已在美國及中國內地取得專利。

F3 二〇一二年十二月十四日 星期五
星島教育 SingTao Education 大學版

理大首創 優化傳統治療

手表提示儀 改善中風偏癱

不少腦中風和大腦麻痺病人出現半身不遂，但病人由於偏癱的手活動不靈，出現「習慣性廢用」的情況，令活動不靈的手部康復進度緩慢，理工大學康復治療科學系專家首創「提醒治療法」，並研發「感知提示手表儀器」，分別可通過聲音、震動和閃燈，提示上肢偏癱人士適時進行手部復康訓練，醫院臨牀報告更顯示，戴上提示儀器的中風病人組比對照組多一半至三分一的活動量。

記者 [illegible]

負責研究的理大康復治療科學系副教授方乃權表示，傳統復康訓練是通過把健全的手紮住，逼使偏癱人士使用另一隻手進行密集性練習，但這方法局限於單手訓練，且須長時間把健全的手紮住，會有跌倒的危險，亦難以出外活動，並非人人喜歡。為鼓勵手部偏癱病人適時進行復康訓練，避免「習慣性廢用」，理大〇八年開始研發「感知提示手表儀器」，優化傳統治療。

按時發出提示信號

「感知提示手表儀器」是配戴於活動不靈的手，可由職業治療師預設時間發出聲音、震動和閃燈的提示信號，提醒上肢偏癱人士適時為手部做復康動作訓練。儀器裝有動作感應器和記憶卡，以記錄偏癱人士活動程度、次數和反應時間，亦方便職業治療師跟進復康情況，杜絕偷懶。

方乃權稱，研究團隊已為「提醒治療法」完成三個臨牀研究，當中在醫院找來三十多位住院中風病人進行的對照研究，結果顯示戴上提示儀器的病人組，較對照組多一半至三分一的活動量，有效減少「習慣性廢用」情況，手部的活動能力亦明顯得到改善。

■理大康復治療科學系副教授方乃權(左)表示，「感知提示手表儀器」有助令上肢偏癱人士減少「習慣性廢用」；圖右為新健社主席劉劍雄，他試用兩周後，表示有助中風偏癱人士作為後期復康治療。 [illegible]攝

〇四年中風導致右邊身偏癱的新健社（中風患者及家屬互助社）主席劉劍雄，曾試用「感知提示手表儀器」兩周，他表示，「儀器有助中風已久的上肢偏癱人士作為後期治療，因為醫院管理局的康復治療通常只在受傷後三個月至半年內提供，以後則靠病人自己練習。」

現時每隻「感知提示手表儀器」成本價為二千元，已獲五間公立醫院的職業治療部購買並使用，研究團隊更獲得研究資助局撥款，實踐「提醒治療法」進一步針對成人中風患者和腦癱兒童作研究，同時希望與工商界合作開發新一代「感知提示手表儀器」，務求降低成本，惠及大眾。

中风后上肢恢复

85% 的中风患者有上肢功能丧失, 只有5-20% 将恢复完整功能, 但30-60% 在6個月将继续没有功能

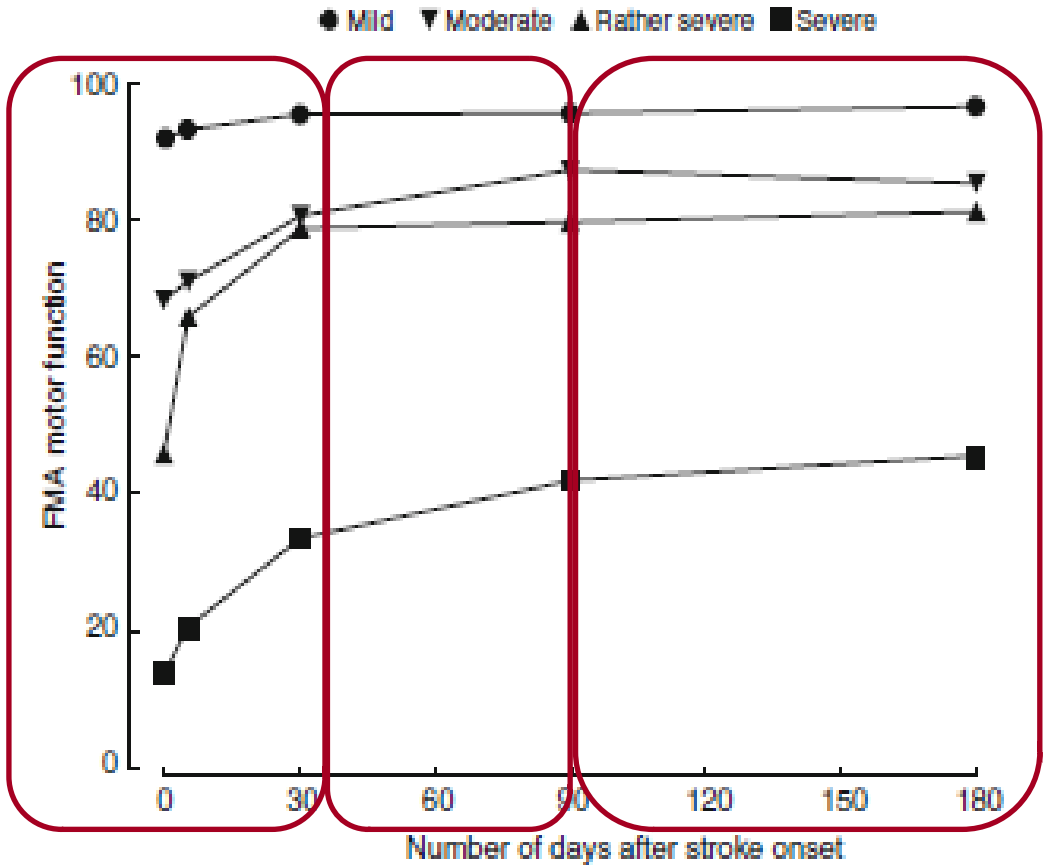


Fig. 2.1 Changes in post-stroke upper limb hemiparesis score. After the stroke onset, the FMA score of upper limb hemiparesis reaches a plateau state on Day 90 regardless of the severity (Adopted from Ref. [3])

Duncan, P. W. Goldstein, L. B., Matchar, D., et al. (1992). Measurement of motor recovery after stroke. Outcome assessment and sample size requirement. Stroke, 23, 1084-9.

Inpatient discharge & death in all hospitals due to stroke in Hong Kong in 2015 = 24,500

小組mCIMT(改良式強制性運動治疗)

Human Movement Science 28 (2009) 798–808

Contents lists available at ScienceDirect

Human Movement Science

journal homepage: www.elsevier.com/locate/humov

Effect of small group treatment of the modified constraint induced movement therapy for clients with chronic stroke in a community setting

Daniel P.K. Leung, Adelina K.Y. Ng, Kenneth N.K. Fong *

Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong

ARTICLE INFO

Article history:
Available online 17 October 2009

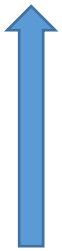
PsycINFO classification:
3297

Keywords:
Stroke
Hemiparetic upper extremity
Constraint induced movement therapy
Small group treatment

ABSTRACT

This study investigated the effects of the group treatment component of the modified constraint induced movement therapy (mCIMT) protocol for clients with chronic stroke in a community setting. A within-subjects longitudinal study was conducted to which eight participants with chronic stroke being treated in a community setting in Hong Kong were recruited. Ten 3-h group sessions were conducted on two occasions within a four-week period, with four participants per group. Participants' less-affected hands were restrained in a mitt, with a target of wearing it for 4 h per weekday. Laboratory based tests and the Motor Activity Log (MAL) were used repeatedly to measure participants' hemiparetic upper extremity functions and the use of the limb in real-life on four measurement occasions: at baseline (four weeks before training), pre-test (one day before training), post-test (one day after training), and follow-up (four weeks after training). The Wilcoxon signed-rank test showed participants' baselines were stable four weeks before the intervention. The Friedman test found significant differences between pre-test, post-test and follow-up in the Box and Block Test (BBT), the total score, grasp and pinch subscores of the Action Research Arm Test (ARAT), and the Hong Kong Version of the Functional Test for the Hemiplegic Upper Extremity (FTHUE-HK), the Wolf Motor Function Test (WMFT), and the MAL. All these gains were maintained during the 1-month follow-up. The small group treatment component of the mCIMT was found to be effective, feasible, and capable of improving both

- 在社区8位慢性中风患者
- 在连续2周内，在5小时内，在手套中抑制受影响较小的手；
- 以小组形式患肢体密集任务专项训练3小时，3 节/周治疗
- Outcomes:
  - 7 levels
  - ARAT
  - WMFT
  - BBT
  - MAL



塑造(Shaping) 的例子: 上肢学习任务

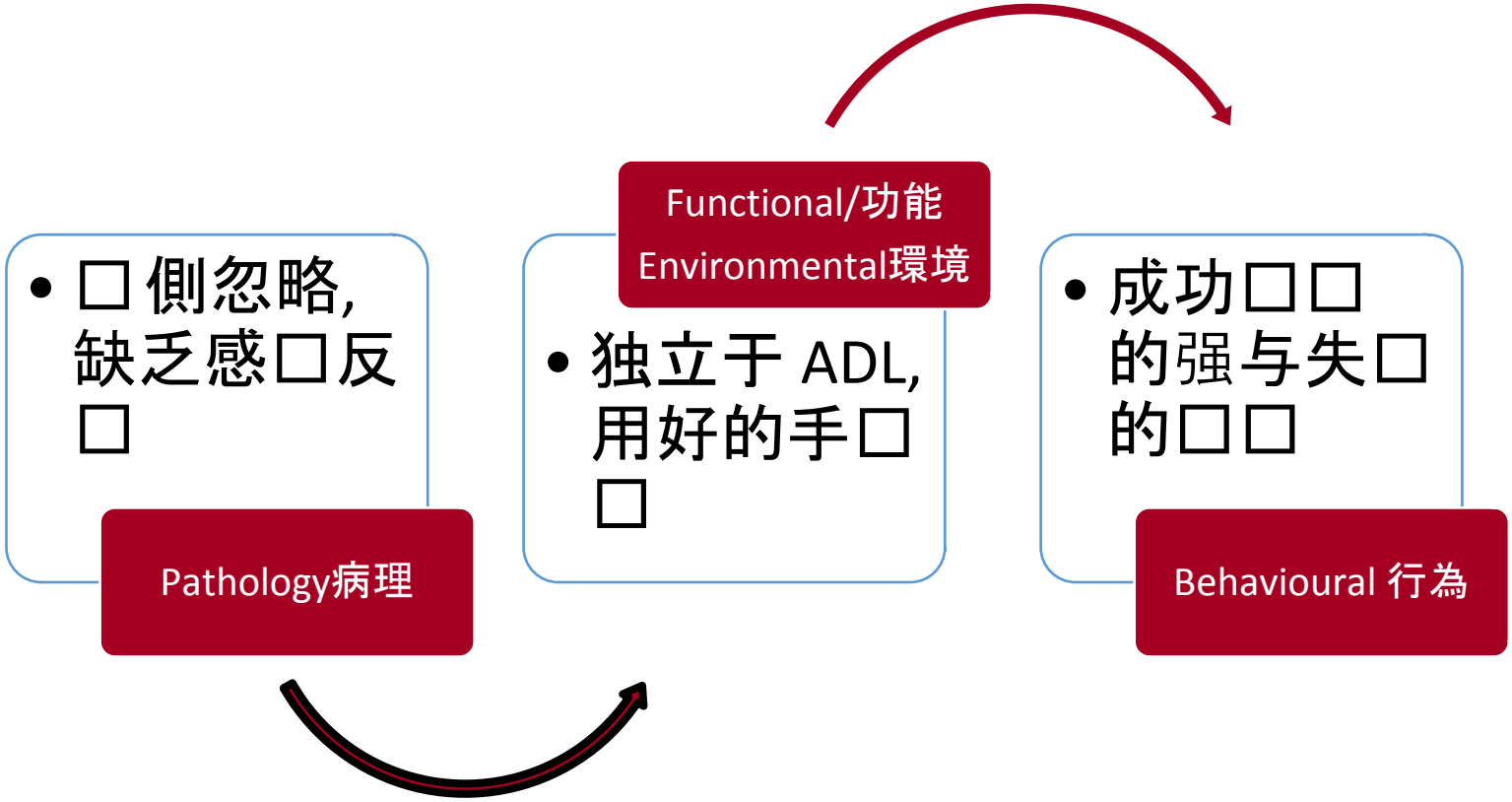
选择适合满足上肢
需求的任务

外在反饋

连续逼近 Continuous approximation:
执行运动序列的部分

不断重复的任务实践

中风后偏瘫臂不使用的发展模型



Grade A

- Early rehabilitation from an early stage
- Increase frequency (+) and amount of training (?)
- Task-specific training (+with metronome and imagery)

Grade B

- CIMT for patients with mild paralysis
- FES for wrist dorsiflexor muscle for patients with moderate paralysis

Grade C

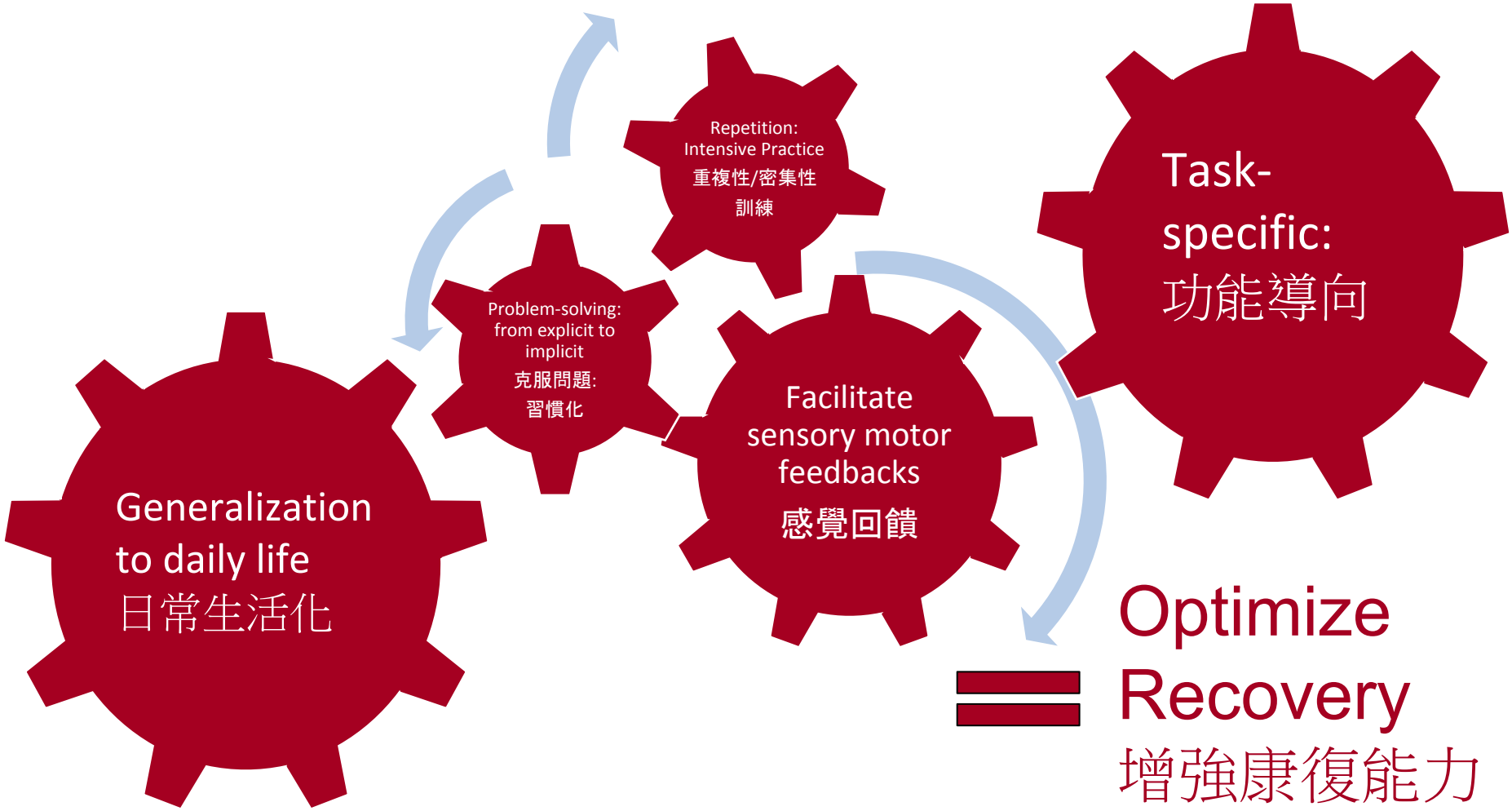
- Neuromuscular facilitation (NDT, PNF, etc.) can be performed but there is no evidence that shows methods are effective

为了加强实践力度, 很多科研制定干预措施, 鼓励患者进行自我指导的练习。
大多数干预措施不能很好地转化为日常活动

Ref: Shinohara Y, Ogawa S, et al. Japanese guidelines for the management of stroke. Tokyo: Kyowa Kikaku; 2009. p. 308–12.

Ref: Langhorne P, Coupar F, Pollock A. Motor recovery after stroke; a systematic review. Lancet Neurol. 2009;8:741–54.

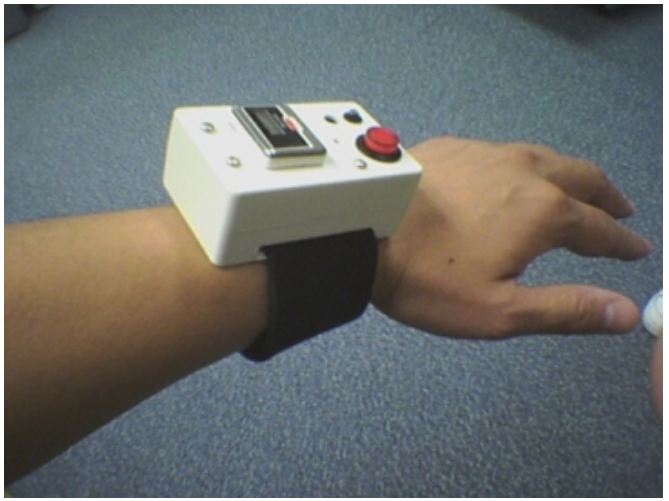
Stroke Rehabilitation



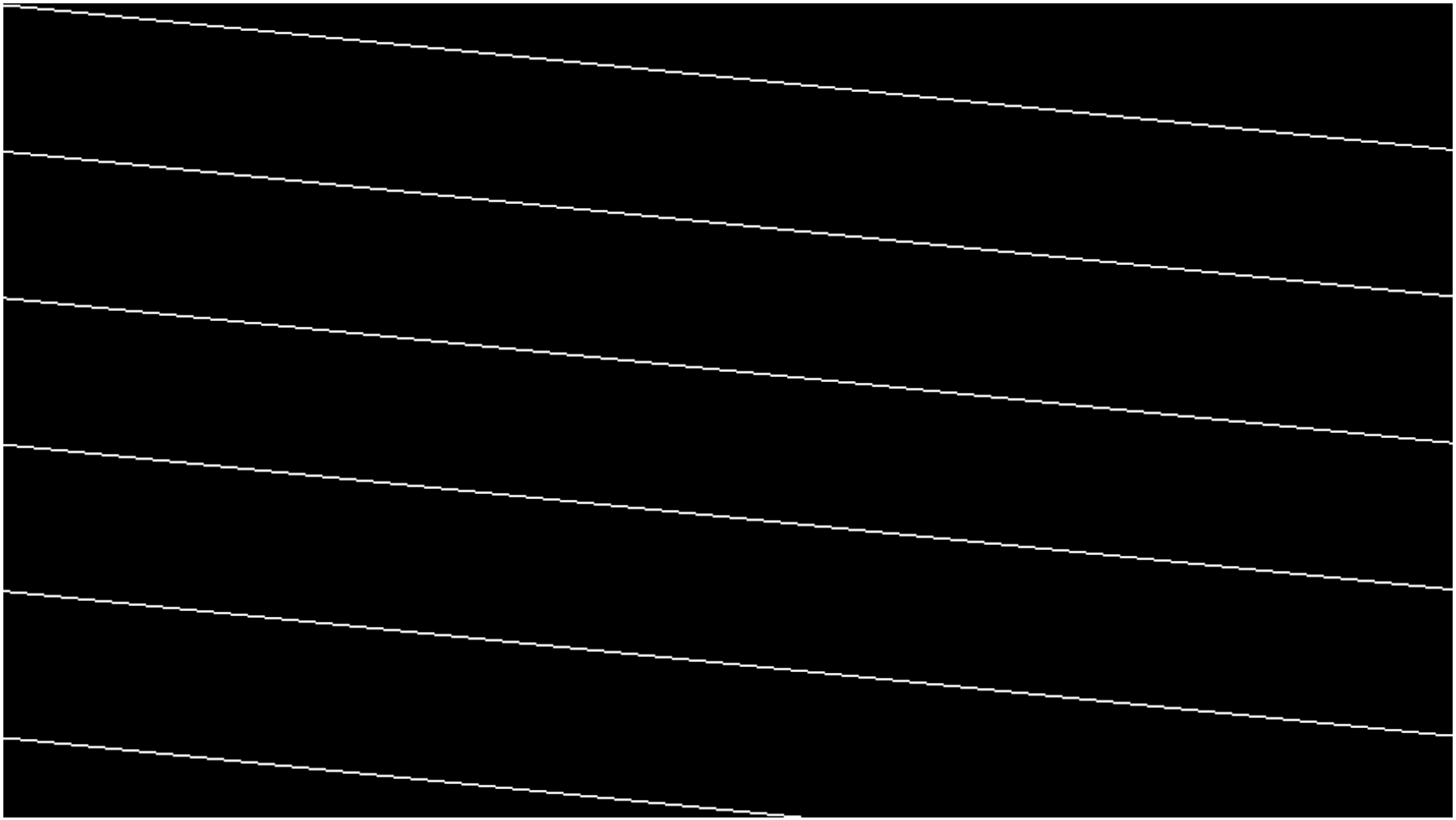
早期研究

限制诱发运动治疗(CIMT)

Figure 1. Pirate wearing a sling and waving the sword with the affected arm

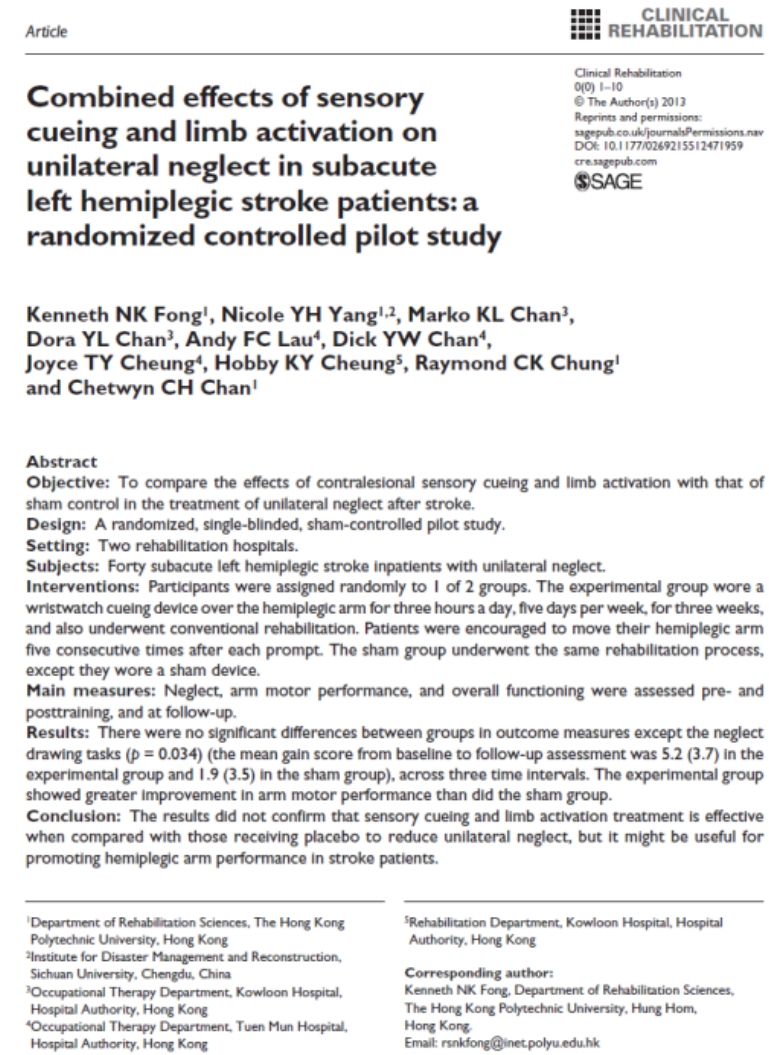


First generation 第一代



中风患者与单侧忽略

Fong, K. N. K., Yang, N. Y. H., Chan, M. K. L., Chan, D. Y. L., Lau, A. F. C., Chan, D. Y. W., et al. (2013). Combined effects of sensory cueing and limb activation on unilateral neglect in subacute left hemiplegic stroke patients: A randomized controlled pilot study. *Clinical Rehabilitation*, *27*(7), 628-637.



Article

CLINICAL REHABILITATION

Clinical Rehabilitation
0(0) 1–10
© The Author(s) 2013
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0269215512471959
cre.sagepub.com
SAGE

Combined effects of sensory cueing and limb activation on unilateral neglect in subacute left hemiplegic stroke patients: a randomized controlled pilot study

Kenneth NK Fong[1], Nicole YH Yang[1,2], Marko KL Chan[3], Dora YL Chan[3], Andy FC Lau[4], Dick YW Chan[4], Joyce TY Cheung[4], Hobby KY Cheung[5], Raymond CK Chung[1] and Chetwyn CH Chan[1]

Abstract

Objective: To compare the effects of contralesional sensory cueing and limb activation with that of sham control in the treatment of unilateral neglect after stroke.
Design: A randomized, single-blinded, sham-controlled pilot study.
Setting: Two rehabilitation hospitals.
Subjects: Forty subacute left hemiplegic stroke inpatients with unilateral neglect.
Interventions: Participants were assigned randomly to 1 of 2 groups. The experimental group wore a wristwatch cueing device over the hemiplegic arm for three hours a day, five days per week, for three weeks, and also underwent conventional rehabilitation. Patients were encouraged to move their hemiplegic arm five consecutive times after each prompt. The sham group underwent the same rehabilitation process, except they wore a sham device.
Main measures: Neglect, arm motor performance, and overall functioning were assessed pre- and posttraining, and at follow-up.
Results: There were no significant differences between groups in outcome measures except the neglect drawing tasks ($p = 0.034$) (the mean gain score from baseline to follow-up assessment was 5.2 (3.7) in the experimental group and 1.9 (3.5) in the sham group), across three time intervals. The experimental group showed greater improvement in arm motor performance than did the sham group.
Conclusion: The results did not confirm that sensory cueing and limb activation treatment is effective when compared with those receiving placebo to reduce unilateral neglect, but it might be useful for promoting hemiplegic arm performance in stroke patients.

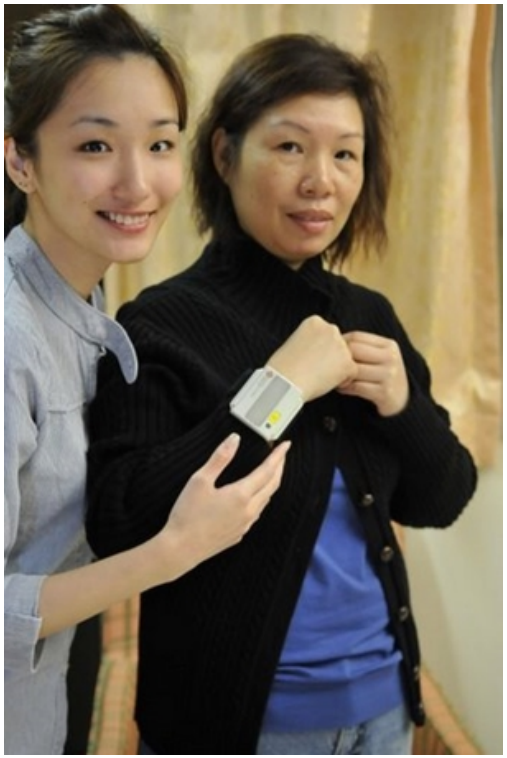
[1]Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong
[2]Institute for Disaster Management and Reconstruction, Sichuan University, Chengdu, China
[3]Occupational Therapy Department, Kowloon Hospital, Hospital Authority, Hong Kong
[4]Occupational Therapy Department, Tuen Mun Hospital, Hospital Authority, Hong Kong
[5]Rehabilitation Department, Kowloon Hospital, Hospital Authority, Hong Kong

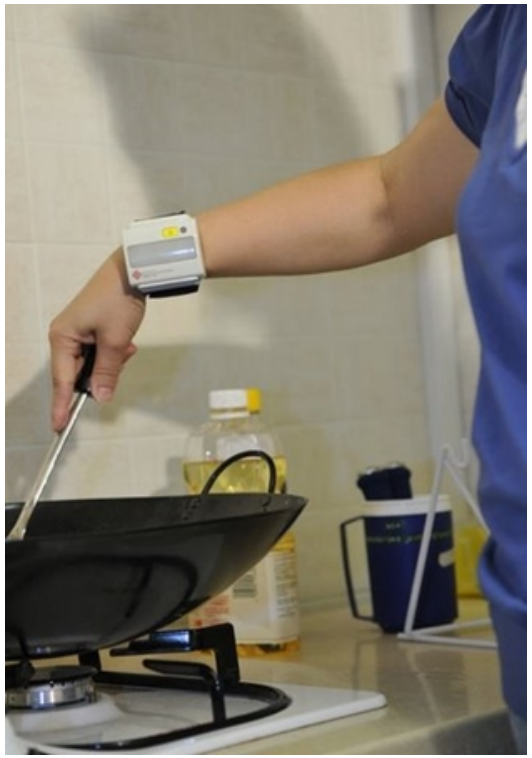
Corresponding author:
Kenneth NK Fong, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Hong Kong.
Email: rsnkfong@inet.polyu.edu.hk

- >2家医院对单侧忽略的亚急性脑卒中患者的随机对照试验
- >每天3小时，每周5天，3周
- >与假组Sham 比较，单侧忽略减少及手部控制改善

Training against non-use in hemiplegic arm in daily life at home
患手配合日常生活活動

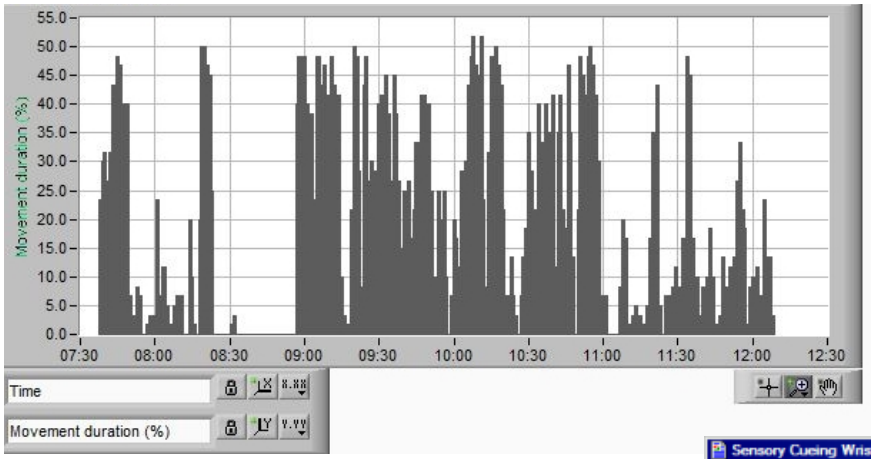
感知提示手錶 (SCW-V2) + 長時間配戴及定時提示 + 增加偏癱半身注意力 + 按指示配合日常生活活動手部





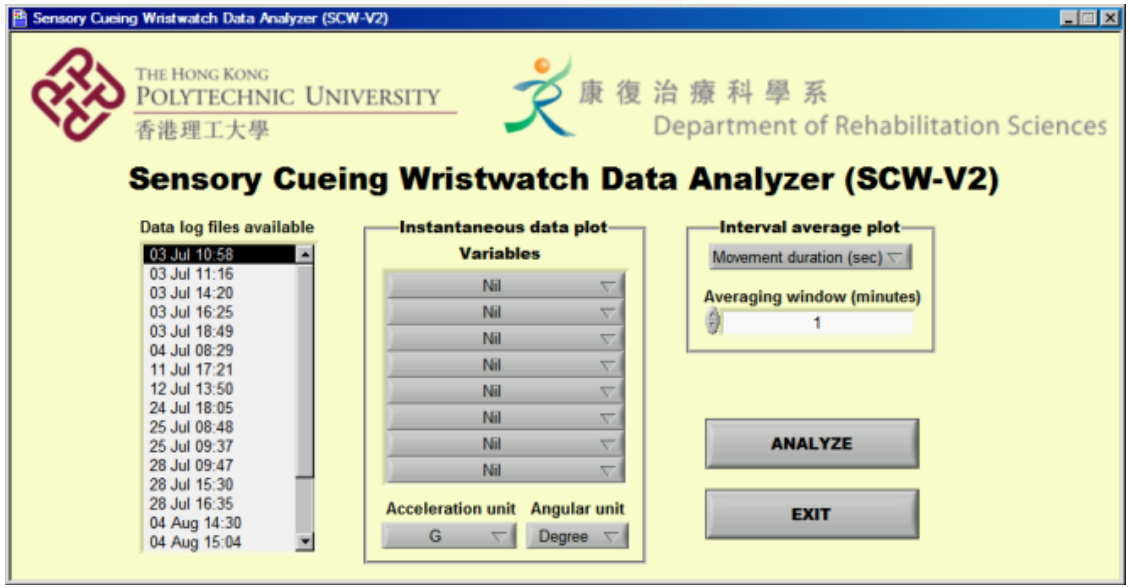
Upper Limb Function	Related motion in Feeding, grooming, and other light ADL	Related motion in dressing, transfer, bathing, and other heavy ADL or IADL tasks	Description of Affected Upper Limb involvement
Level 1 Level 2	(1/2a)Place affected arm on table / chest/ face level and back to thigh	(1/2b)Place affected arm down to ankle level and back to thigh	(1/2 ab) Less affected arm hold affected arm at wrist to complete the movement passively or assistive active
Level 3	(3a)Place affected arm on table / chest/ face level and back to thigh	(3b) Reach out affected arm at overhead level and place back to thigh (3c) Place affected arm from thigh to chair/ bed at side	(3ac) Passively (3c) Actively
Level 4	(4a) Affected arm reach out at chest level and back to thigh	(4b) Affected arm perform shoulder external rotation and back to affected thigh	(4ab) active or active assistive
Level 5	(5a) Affected hand hold or assimilate to reach forward at chest level for any feeding utensils and bring to mouth.	(5b)Reaching affected arm from affected thigh to back ward at thigh level	(5a) active (5b) active and encourage shoulder external rotation and full elbow extension practice
Level 6	(6a) Affected arm reach forehead and place back to thigh	(6b) Affected arm reach forehead and back to affected thigh	(6ab) active
Level 7	(7a) Affected arm reach overhead to get object and place back to thigh	(7b) Extended affected wrist and push arm forward to reach at chest level, like pushing door to open	(7ab) active

電腦分析 - 監察患者康復進展
Computer software for monitoring and analysis



Statistics

Total number of movements in the day	1845
Movement duration (% of 24 hours)	3.61
Movement duration (% of log period)	19.17
Response time maximum (sec)	4.00
Response time minimum (sec)	4.00
Mean response time (sec)	4.00
Response time standard deviation (sec)	0.00



社区慢性中风患者

Fong, K. N. K., Lo, P. C. P., Yu, Y. S. Y., Cheuk, C. K. L., Tsang, T. H. T., et al. (2011). Effects of sensory cueing on voluntary arm use for patients with chronic stroke: A preliminary study. *Archives of Physical Medicine and Rehabilitation*, *92*(1), 15-23.

- 慢性中风患者(N=16), 穿戴3 小时每天2周
- 更适合于中度上肢损伤

ORIGINAL ARTICLE

Effects of Sensory Cueing on Voluntary Arm Use for Patients With Chronic Stroke: A Preliminary Study

Kenneth N. Fong, PhD, OTR, Pinky C. Lo, BSc, Yoyo S. Yu, BSc, Connie K. Cheuk, BSc, Toto H. Tsang, BSc, Ash S. Po, BSc, Chetwyn C. Chan, PhD

ABSTRACT. Fong KN, Lo PC, Yu YS, Cheuk CK, Tsang TH, Po AS, Chan CC. Effects of sensory cueing on voluntary arm use for patients with chronic stroke: a preliminary study. Arch Phys Med Rehabil 2011;92:15-23.

Objective: To investigate the effect of a 2-week program of sensory cueing in which vibration induces the use of the paretic upper extremity in participants with chronic stroke in the community.

Design: A single-group longitudinal study.

Setting: Self-help organizations.

Participants: A convenience sample of 16 community residents (N=16) with chronic unilateral stroke and mild to moderate upper-extremity impairment stratified by the severity of their paretic arm function, measured by using the Functional Test for the Hemiplegic Upper Extremity (FTHUE).

Interventions: Participants engaged in repetitive upper-extremity task practice for 2 weeks while wearing an ambulatory sensory cueing device on their affected hand for 3 hours a day.

Main Outcome Measures: Evaluations were conducted on the 3 occasions of pretest (1 day before training), posttest (immediately after training), and follow-up test (2 weeks after training) by using the following behavioral measures of paretic upper-extremity performance: the Action Research Arm Test (ARAT), the Box and Block Test, the Fugl-Meyer Assessment (FMA), the FTHUE, power and pinch grips, the Motor Activity Log assessment of arm use, and kinematic data obtained from the device.

Results: Significant differences were found in ARAT and FMA scores among the pretest, posttest, and follow-up evaluations. The lower functioning group achieved a more significant increase in overall upper-extremity score than in the hand score for the FMA.

Conclusion: A combination of sensory cueing and movement-based strategies is useful and feasible in improving paretic upper-extremity performance in participants with chronic stroke; however, additional studies with a larger sample size and longer treatment period in a randomized controlled trial would be beneficial.

Key Words: Chronic stroke; Learned nonuse; Paretic upper extremity; Rehabilitation; Sensory cueing; Voluntary arm use.

© *2011 by the American Congress of Rehabilitation Medicine*

STROKE IS THE MOST significant cause of severe disability and results in many chronically disabled patients in the population.[1] Functional recovery of the paretic upper extremity after stroke often is slower than that of the lower extremity and is 1 of the greatest challenges faced by rehabilitation professionals.[2] More than 60% of patients with chronic stroke have motor dysfunction in their upper extremities, with only 5% showing complete functional recovery.[3]

One of the biggest problems arising in upper-extremity rehabilitation after stroke is "learned nonuse," in which some of the patient's motor impairment is caused by the learned suppression of movement rather than brain cell damage.[4] One of the main advances made in recent years has been the introduction of CIMT to overcome the learned nonuse of the paretic limbs in daily living activities in the home.[5] CIMT involves restraint of the unaffected limb in either a mitt or sling for 90% of waking hours over a number of weeks and training of the paretic limb during the treatment period,[6] or its modified version, involving different levels of intensity through variation in the duration and frequency of sessions and in total treatment duration.[7-10] It now is clear that the phenomenon underlying CIMT is that it repeatedly induces the use of the paretic arm in task-specific functions and involves the upper extremities in intensive practice, even where they reach a performance plateau.[11-13] Although CIMT is highly efficacious for stroke survivors who show some voluntary wrist and finger extension,[5] it may not be so in patients with chronic stroke with moderate to severe impairment or poorer functioning of the affected upper extremity.[14,15] CIMT also may be difficult to carry out because of safety concerns, especially for patients who have difficulty with balance and therefore may be at risk for falling when the less-affected arm is restrained.[9,13] It also is awkward for patients to walk outdoors with a limb restrained in a mitt.

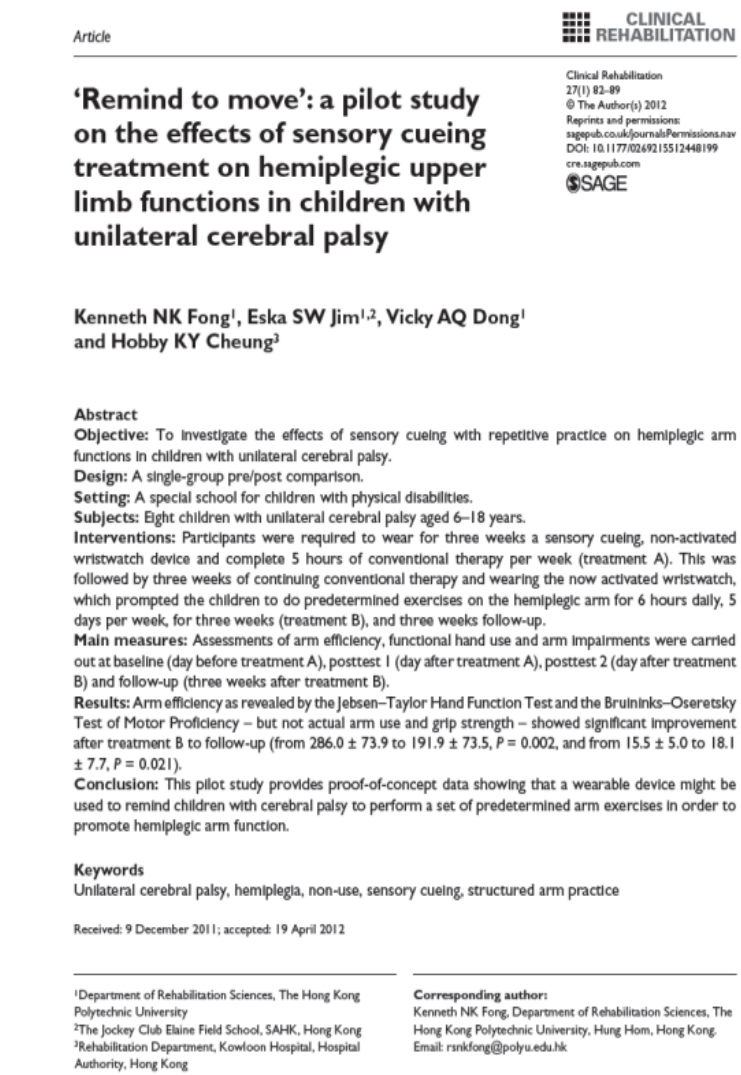
Other effective treatments that use different theoretical approaches have been used to tackle upper-extremity impairment, including neurofacilitation techniques, repetitive bilateral arm training, and robot-aided exercise training. However, these approaches may require a number of costly therapy hours and expensive equipment. An effective self-administered home exercise program recently has been developed for upper-extremity recovery in patients with stroke, but it still requires staff to teach and monitor closely and the patient has to be very

Table 3: Differences in Primary Outcome Measures at Pretest, Posttest, and Follow-up

Outcome Measures	Pretest	Posttest	Follow-up	χ^2	*P*	Multiple Comparisons*‡
ARAT	36.00±20.07	39.81±18.67	40.81±18.63	11.85	.003†	1–2
BBT	20.50±17.15	23.44±19.52	24.50±19.84	7.85	.020	
FMA						
Upper Extremity	27.69±7.13	29.38±6.31	29.94±6.23	8.00	.018	
Hand	16.06±9.62	17.62±9.42	19.31±9.08	21.97	.000†	1–3; 2–3
Total	43.88±16.12	47.12±14.70	49.25±14.67	18.66	.000†	1–3; 2–3
FTHUE	4.75±1.39	5.00±1.27	5.00±1.27	8.00	.018	
MAL						
AOU	1.71±1.49	1.98±1.51	2.10±1.45	9.10	.011	
QOM	1.83±1.61	1.89±1.48	2.20±1.49	7.31	.026	
Grip						
Power	12.04±10.00	12.22±8.91	13.76±11.40	4.51	.105	
Pinch	4.03±2.36	4.22±2.45	4.61±2.49	4.63	.099	

NOTE. N=16. Values shown as mean ± SD. Pretest indicates 1 day before intervention; posttest, 1 day after intervention; and follow-up, 2 weeks after intervention.
ABBREVIATION: ND, not done.
*Wilcoxon signed-rank test with $P \leq .017$.
†$P \leq .005$.
‡Post hoc analysis had not been carried about for no significant within group differences across all measurement occasions.

脑瘫儿童在学校学习



Article

CLINICAL REHABILITATION

Clinical Rehabilitation
27(1) 82–89
© The Author(s) 2012
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0269215512448199
cre.sagepub.com
SAGE

'Remind to move': a pilot study on the effects of sensory cueing treatment on hemiplegic upper limb functions in children with unilateral cerebral palsy

Kenneth NK Fong[1], Eska SW Jim[1,2], Vicky AQ Dong[1] and Hobby KY Cheung[3]

Abstract

Objective: To investigate the effects of sensory cueing with repetitive practice on hemiplegic arm functions in children with unilateral cerebral palsy.
Design: A single-group pre/post comparison.
Setting: A special school for children with physical disabilities.
Subjects: Eight children with unilateral cerebral palsy aged 6–18 years.
Interventions: Participants were required to wear for three weeks a sensory cueing, non-activated wristwatch device and complete 5 hours of conventional therapy per week (treatment A). This was followed by three weeks of continuing conventional therapy and wearing the now activated wristwatch, which prompted the children to do predetermined exercises on the hemiplegic arm for 6 hours daily, 5 days per week, for three weeks (treatment B), and three weeks follow-up.
Main measures: Assessments of arm efficiency, functional hand use and arm impairments were carried out at baseline (day before treatment A), posttest 1 (day after treatment A), posttest 2 (day after treatment B) and follow-up (three weeks after treatment B).
Results: Arm efficiency as revealed by the Jebsen–Taylor Hand Function Test and the Bruininks–Oseretsky Test of Motor Proficiency – but not actual arm use and grip strength – showed significant improvement after treatment B to follow-up (from 286.0 ± 73.9 to 191.9 ± 73.5, $P = 0.002$, and from 15.5 ± 5.0 to 18.1 ± 7.7, $P = 0.021$).
Conclusion: This pilot study provides proof-of-concept data showing that a wearable device might be used to remind children with cerebral palsy to perform a set of predetermined arm exercises in order to promote hemiplegic arm function.

Keywords
Unilateral cerebral palsy, hemiplegia, non-use, sensory cueing, structured arm practice

Received: 9 December 2011; accepted: 19 April 2012

[1]Department of Rehabilitation Sciences, The Hong Kong Polytechnic University
[2]The Jockey Club Elaine Field School, SAHK, Hong Kong
[3]Rehabilitation Department, Kowloon Hospital, Hospital Authority, Hong Kong

Corresponding author:
Kenneth NK Fong, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Hong Kong.
Email: rsnkfong@polyu.edu.hk

Fong, K. N. K., Jim, E. S. W., Dong, V. A., & Cheung, H. K. Y. (2012). Remind to move: A pilot study on the effects of sensory cueing treatment on hemiplegic arm functions in children with unilateral cerebral palsy. *Clinical Rehabilitation*, *27*(1), 82-89.

- >特殊学校儿童 (7-18 岁) 与单侧脑瘫 (N=8)
- >每天5小时穿戴, 每周5天, 3周, 在学校
- >相比假組， 可以提高手效率
- >可以在学校全日使用

Patents: 美國及中國註冊專利

Wilkinson & Grist

SOLICITORS & NOTARIES • AGENTS FOR TRADEMARKS & PATENTS

Our ref: AC:JYW:P1159-81P
Your ref:IP-537A

6th Floor, Prince's Building
10 Chater Road, Central, Hong Kong

General Line: (852) 2524 6011
General Fax: (852) 2527 9041
(852) 2877 1295
Direct E-mail: iprop@wilgrist.com
Web Site: www.wilgrist.com

高露雲律師行

July 7, 2010

RECEIVED
13 JUL 2010
PDO

By Post
Partnership Development Office
Room R1007, Shirley Chan Building
THE HONG KONG POLYTECHNIC UNIVERSITY
Hung Hom, Kowloon, Hong Kong
Attn: Ms. Maquita Wong
EMAIL: pdmaquit@polyu.edu.hk

Dear Maquita,

Re : U.S. non-provisional patent application 12/344,102
for "A wearable portable device for increasing user awareness of a paretic limb and recording the user awareness"
in the name of The Hong Kong Polytechnic University

Please be advised that the above-identified patent application has been published on June 24, 2010 under Publication No. US-2010-0160834-A1. A copy of the Notice of Publication of Application issued by the United States Patent and Trademark Office and the full text of the publication are enclosed for your attention.

One advantage of publication is that publication of your application will bar any U.S. or foreign patent application for the invention disclosed in your application which has an effective filing date later than the publication date of your application. Another advantage of publication is that, if your patent application becomes a patent, and if the claims of the issued patent are "substantially identical" to the claims of the published application, and if the person infringing the issued patent had actual notice of the published patent application then, when any such patent issues, you may be entitled to a reasonable royalty for such infringement from the time that such actual notice occurs. Still another,

(19)中华人民共和国国家知识产权局

(12)发明专利

(10)授权公告号 CN 101757778 B
(45)授权公告日 2011.08.17

(21)申请号 200910224638.2

(22)申请日 2009.11.16

(30)优先权数据
12/344,102 2008.12.24 US

(73)专利权人 香港理工大学
地址 中国香港九龙红磡

(72)发明人 方乃权

(74)专利代理机构 深圳市顺天达专利商标代理有限公司 44217
代理人 郭伟刚

(51)Int.Cl.
A63B 26/00(2006.01)

审查员 王歌

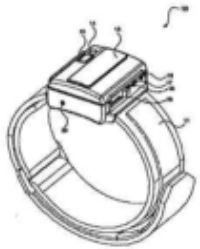
权利要求书 2 页 说明书 7 页 附图 11 页

(54)发明名称

一种增强用户偏瘫肢体的意识并记录此用户意识的可佩带式便携装置、系统及方法

(57)摘要

一种增强用户(患者)偏瘫肢体的意识并记录此用户意识的可佩带式便携装置(10),包括:一个感官信号发生器(52,20)用于发出连续的感官信号来提醒用户按照预定的时间移动偏瘫肢体,一个用户开启的停止发出感官信号的开关(13),以及一个加速计(61)用来检测偏瘫肢体在三轴方向上的移动,其中,用户开启开关(13)后,在事先设定的说明的指导下活动其偏瘫肢体;加速计(61)检测到的偏瘫肢体的移动和感官信号发出后开关(13)被开启的反应时间被数据分析软件记录下来用于分析。本发明还涉及利用这种装置的系统和方法。



Work done by Wei Xijun, PhD candidate

ASSISTIVE TECHNOLOGY
https://doi.org/10.1080/10400435.2017.1414085

Taylor & Francis

Utility of a unilateral accelerometer for monitoring upper extremity use in subacute stroke patients after discharge from hospital

Wayne X. J. Wei, MSc[a], Kenneth N. K. Fong, PhD[a], Raymond C. K. Chung, PhD[a], Jennifer M. W. W. Myint, MBBS[b], Hobby K. Y. Cheung, MBBS[b], and Eddie S. L. Chow, MBBS[c]

[a]Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR; [b]Department of Rehabilitation, Kowloon Hospital, Hong Kong SAR; [c]Department of Medicine and Geriatrics, Tuen Mun Hospital, Hong Kong SAR

ABSTRACT

This study was to investigate the utility of a unilateral accelerometer, which is commonly used for monitoring upper extremity performance, in subacute stroke patients by comparing its use with other upper extremity assessments. Twenty-four participants were recruited and required to wear an accelerometer on the affected wrist for 3 hours daily for the first 4 weeks after discharge from hospital. Assessments included Fugl-Meyer Assessment–Upper Extremity (FMA-UE), Action Research Arm Test (ARAT), Box and Block Test (BBT), and self-reporting Motor Activity Log (MAL). Assessments were made at 0, 4, 8, and 12 weeks after hospital discharge. How long the device was worn, movement amount, and movement percentage were extracted from the accelerometer. Throughout the 12-week observation, significant improvements in the participants were shown by the FMA-UE, ARAT, and BBT ($p < 0.001$, $p = 0.026$, and $p < 0.001$, respectively), but no significant change could be found using MAL or the accelerometer parameters across time ($p = 0.068$ to 0.999). There was moderate-to-good correlation among the assessments; however, no significant correlation was obtained between any of the assessments and the accelerometer data. We suggest that the unilateral accelerometer might not be useful to reflect actual arm functions in daily activities.

ARTICLE HISTORY
Received 31 March 2017
Revised 16 November 2017
Accepted 29 November 2017

KEYWORDS
accelerometer; learned non-use; paretic upper extremity; stroke

Introduction

The phenomenon of learned non-use is quite common in stroke patients and affects their motor recovery (Taub, Miller, & Novack et al., 1993). Even in-patients who receive intensive rehabilitation and are reminded regularly by healthcare professionals to use their more-affected upper extremities are more likely to employ their less-affected ones (Narai, Hagino, Komatsu, & Togo, 2016); thus, it is unsurprising that in an unsupervised environment, chronic-stage stroke patients rely more on their less-affected upper extremities in daily life (Bailey, Klaesner, & Lang, 2015).

Monitoring the frequency of upper extremity use helps healthcare professionals to assess stroke patients' compliance and self-efficacy in overcoming learned non-use outside of rehabilitation settings. In a previous study, the Motor Activity Log (MAL) – a subjective self-report questionnaire – was developed to evaluate learned non-use (Uswatte, Taub, Morris, Light, & Thompson, 2006). On these questionnaires, stroke patients are required to rate their performance (of 30 daily activities in the preceding week) in two dimensions: (1) amount of use (AOU), that is, how often the more-affected upper extremity was used and (2) quality of movement (QOM), that is, how well the tasks were performed (Uswatte et al., 2006). However, self-reporting might influence the accuracy of the assessment; for example, cognitive functioning is often impaired following a stroke, and this could affect a respondent's recall; further, a respondent's desire to satisfy an assessor, avoid embarrassment, and so on might lead to exaggerated self-rating of a respondent's performance/abilities (Adams, Matthews, & Ebbeling et al., 2005; Prince et al., 2008).

Correlation between MAL and other upper extremity assessments may reflect the reliability of stroke patients' self-rating, but there has been little research into this issue. A trial conducted by van der Lee *et al.* found that a translated version of MAL showed moderate correlation with the Action Research Arm Test (ARAT; $\rho = 0.63$); however, after a 2-week intervention, the improvement in the MAL assessment was only weakly correlated with the improvement in the ARAT assessment (van der Lee, Beckerman, Knol, de Vet, & Bouter, 2004).

Use of accelerometers is becoming common for the purpose of counting the number of movements made by an affected upper extremity of stroke patients or quantifying the ratio of the movement of an affected extremity to the movement of a non-affected or less-affected extremity (Noorkoiv, Rodgers, & Price, 2014). Most of these studies have found the ratio to have significant (moderate to high) correlations with assessment based on MAL in subacute or chronic stroke patients (Narai et al., 2016; Noorkoiv et al., 2014; Uswatte et al., 2006; van der Pas, Verbunt, Breukelaar,

CONTACT Kenneth N. K. Fong, PhD nnkfong@polyu.edu.hk Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong SAR.

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/UATY.

© 2018 RESNA

Wei, W. X. J., **Fong, K. N. K.**, Chung, R. C. K., Myint, J. M. W. W., Cheung, H. K. Y., & Chow, E. S. L. (2017). Utility of a unilateral accelerometer for monitoring upper extremity use in subacute stroke patients after discharge from hospital. *Assistive Technology*. https://doi.org/10.1080/10400435.2017.1414085

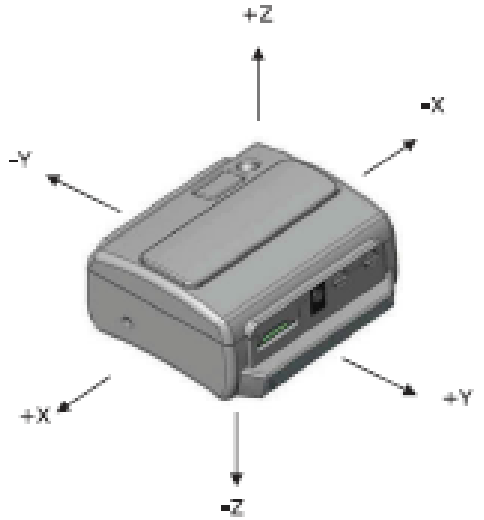


Figure 2. X–Y–Z coordinate system of the wristwatch device.

> 单侧加速度计在日常活动中可能不比双侧加速器更能反映中风患者的实际手部功能。

Work done by Wei Xijun, PhD candidate

Wei, W. X. J., **Fong, K. N. K.**, Chung, R. C. K., Cheung, H. K. Y., & Chow, E. S. L. (under review). "Remind-to-Move" for promoting upper extremity recovery using wearable devices in subacute stroke: a multicenter randomized controlled study. *Journal of NeuroEngineering and Rehabilitation*.

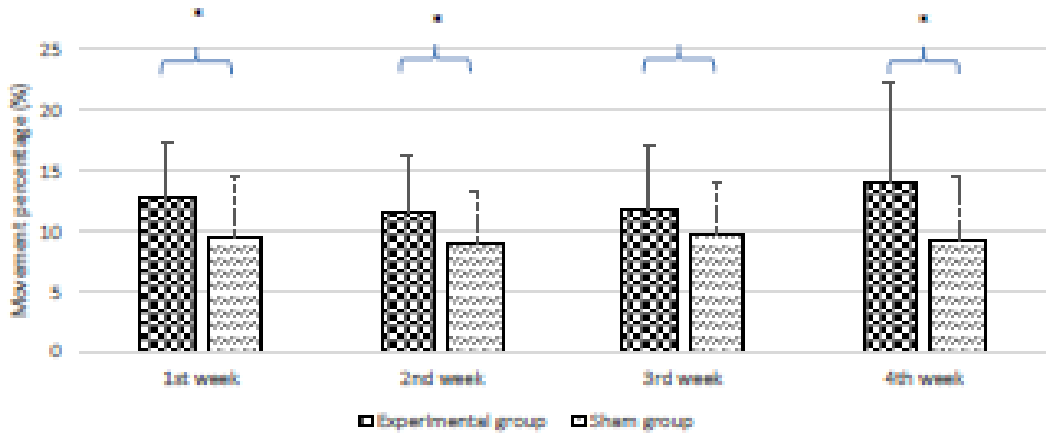


Fig. 3. Movement percentage made by the survivors in experimental and sham groups recorded by the wristwatch during the 4-week intervention.

*$p<0.05$. Error bars are standard deviations. Repeated measure ANOVA indicates significant difference between groups ($p=0.011$).

实验组平均运动百分率显著高于假组。(p=0.011)

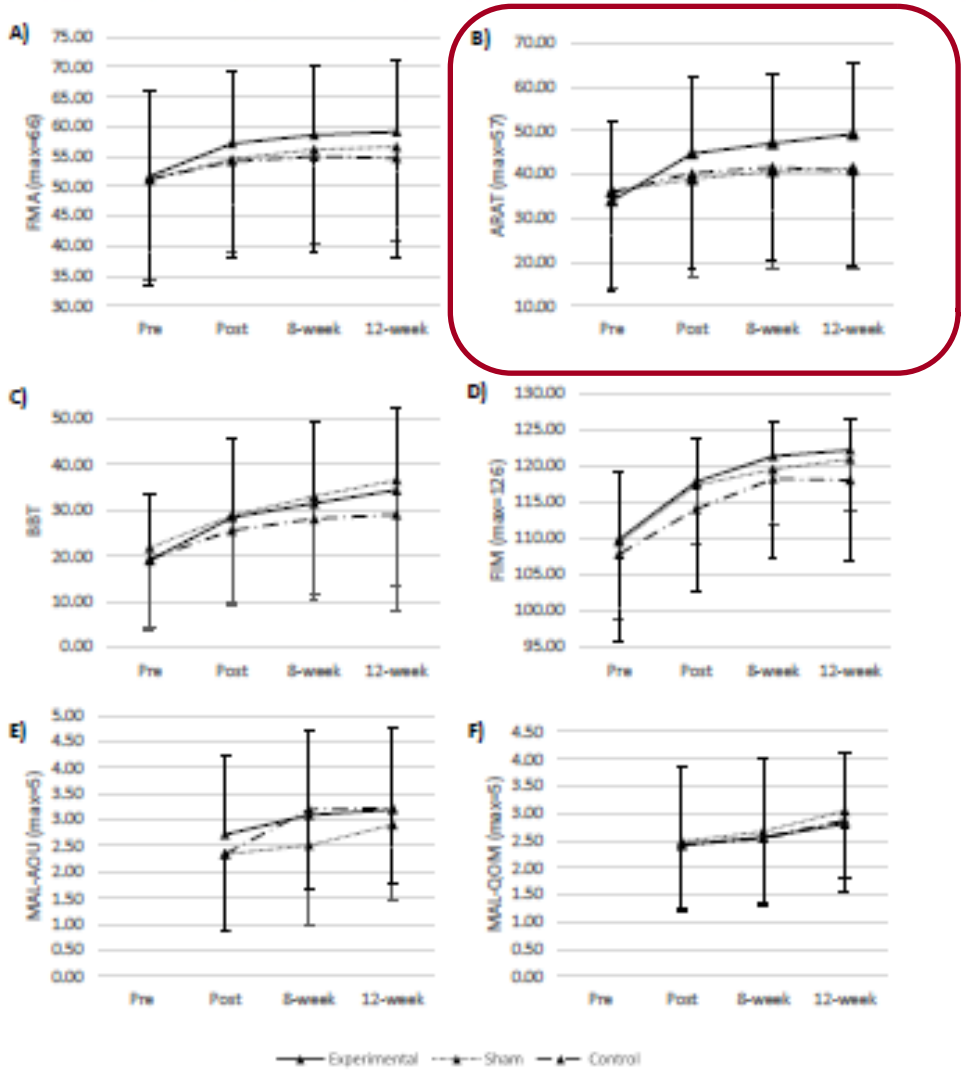


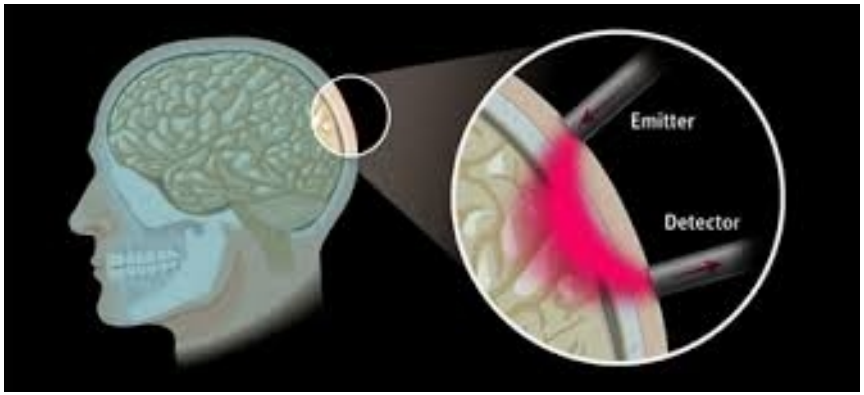
Fig. 4. Performance changes of three groups in 12 weeks

(A) FMA-UE - Fugl-Meyer Assessment Upper Extremity Score. (B) ARAT - Action Research Arm Test. (C) BBT - Box and Block Test. (D) FIM - Functional Independence Measure. (E) MAL-AOU - Amount of Use scale, Motor Activity Log. (F) MAL-QOM - Quality of Movement scale, Motor Activity Log. Error bars are standard deviations. Repeated measure ANOVA indicates significant difference between groups while baseline set as covariance (B).

> 实验组在ARAT的表现明显优于假组。 (p=0.019; mean difference= 6.283, 95% CI 0.815-11.752).

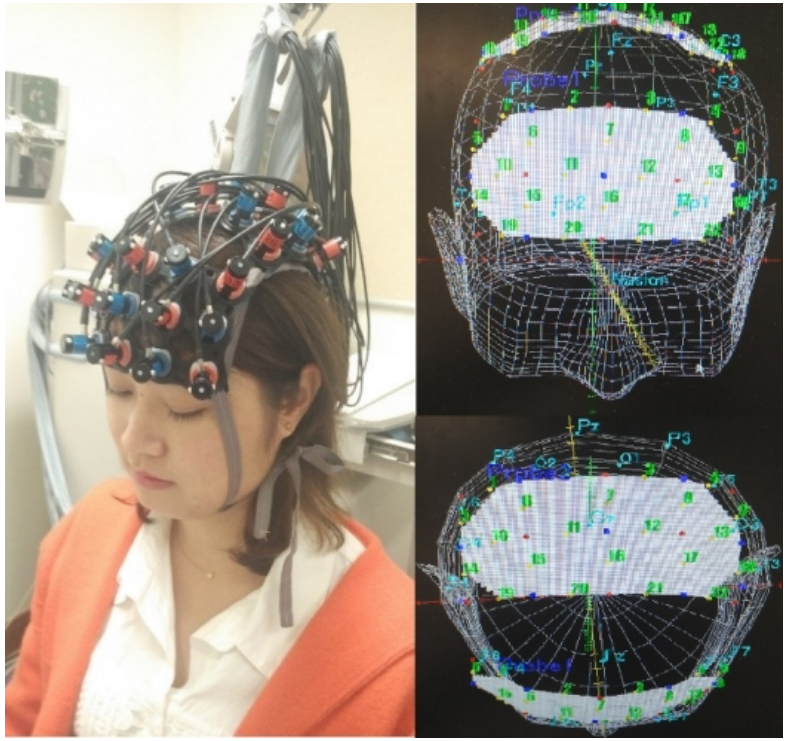
> 相對控制組，通过可穿戴设备 RTM 可以提高对亚急性脑卒中患者上肢康复的治疗效果。

Work done by Wei Xijun, PhD candidate



- 前额皮质(Prefrontal)被发现在健康参与者(Healthy participant)中激活，但在假条件下(Sham)中风的参与者(Stroke participant)较少激活。
- 前额(Prefrontal)和运动神经皮质(Primary Motor cortex)在健康参与者(Healthy participant)中表现出低活化，但在实验条件下，中风参与者(Stroke participant)的兴奋性很高。

Case study using Near-infrared spectroscopy (NIRS) (Manuscript under preparation)



Positioning of the probes (44 channels) attached on the head (prefrontal and primary motor cortex) of a healthy participant

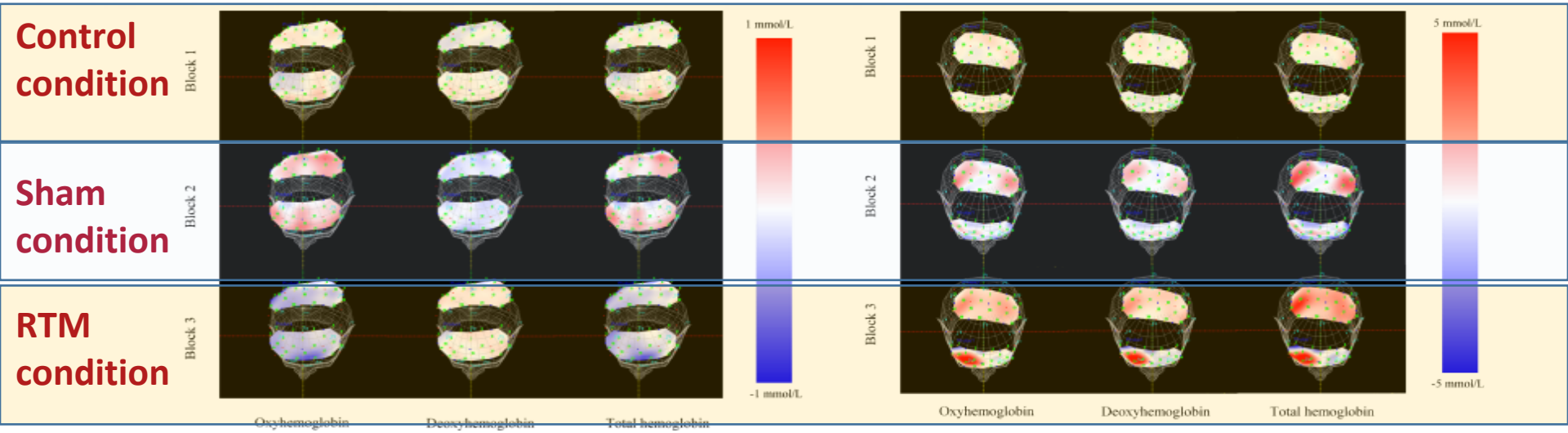


Figure 6-4. Hemoglobin changes of healthy subject B moving her right hand in three conditions

Figure 6-6. Hemoglobin changes of stroke subject B with worse upper extremity function (right side: FTHUE-HK=7) moving his right hand in three conditions

健康參與者

脑卒中患者

移动右手

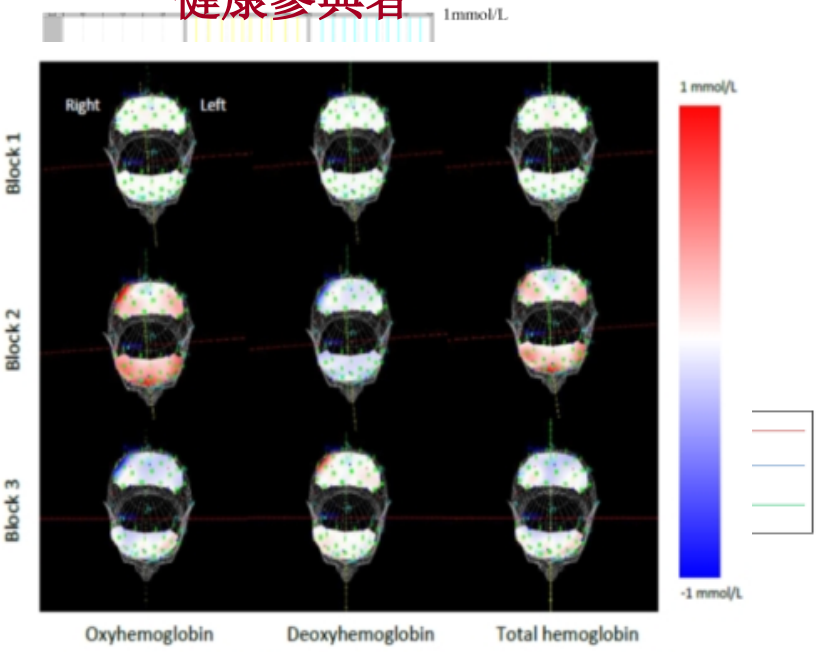


Figure 5-2. Hemoglobin changes of healthy subject A moving her left hand in three conditions

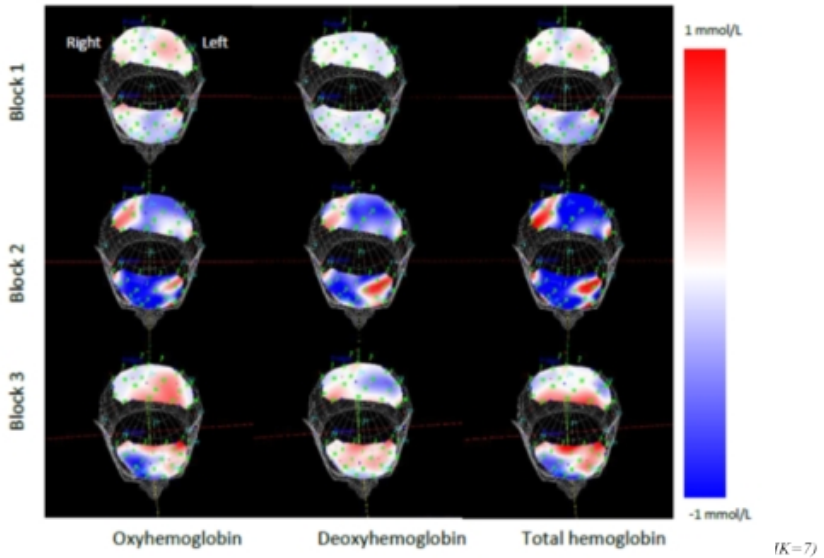
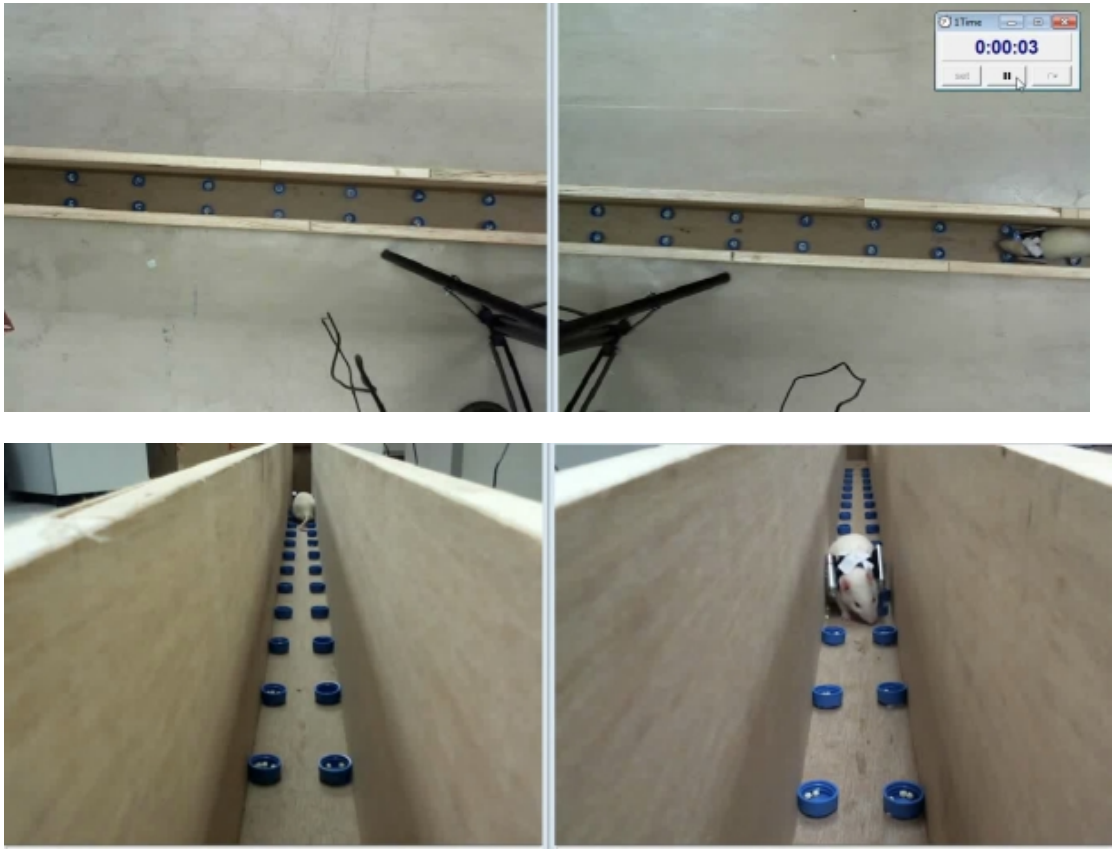


Figure 5-8. Hemoglobin changes of stroke subject B with worse upper extremity function (left side: FTHUE-HK=3) moving his left hand in three conditions

移动左手

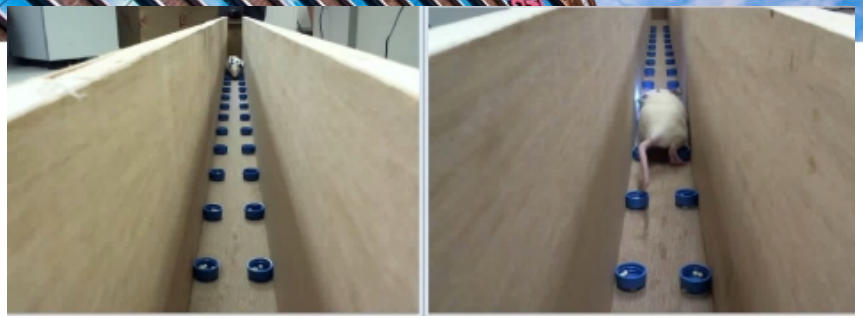
动物试验研究–走廊任务测试

Work by Wayne, Wei Xijun, PhD candidate



- 4 conditions of light cueing:
- A: light on left
- B: light on right
- C: light off
- D: Control

Work by Wayne, Wei Xijun, PhD candidate



Corridor Task test sequence of each rat				
Rat NO	Run 1	Run 2	Run 3	Run 4
1	A	B	C	D
2	B	C	D	A
3	C	D	A	B
4	D	A	B	C
5	D	C	B	A
6	A	D	C	B
7	B	A	D	C
8	C	B	A	D
9	A	B	C	D
10	D	C	B	A

A: Vest on, Light on left,

B: Vest on, Light on right,

C: Vest on, Light off,

D: Vest off

Work done by Dr. Yang Yonghong, PhD

Yang, Y. H., **Fong, K. N. K.**, Li-Tsang, C. W. P., Zhou, D. (2017). Effects of repetitive transcranial magnetic stimulation combined with sensory cueing on unilateral neglect in subacute patients with right hemispheric stroke: a randomized controlled study. *Clinical Rehabilitation*, *31*(9), 1154-1163.

Original Article

CLINICAL REHABILITATION

Clinical Rehabilitation
1–10
© The Author(s) 2016
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0269215516679712
cre.sagepub.com
SAGE

Effects of repetitive transcranial magnetic stimulation combined with sensory cueing on unilateral neglect in subacute patients with right hemispheric stroke: A randomized controlled study

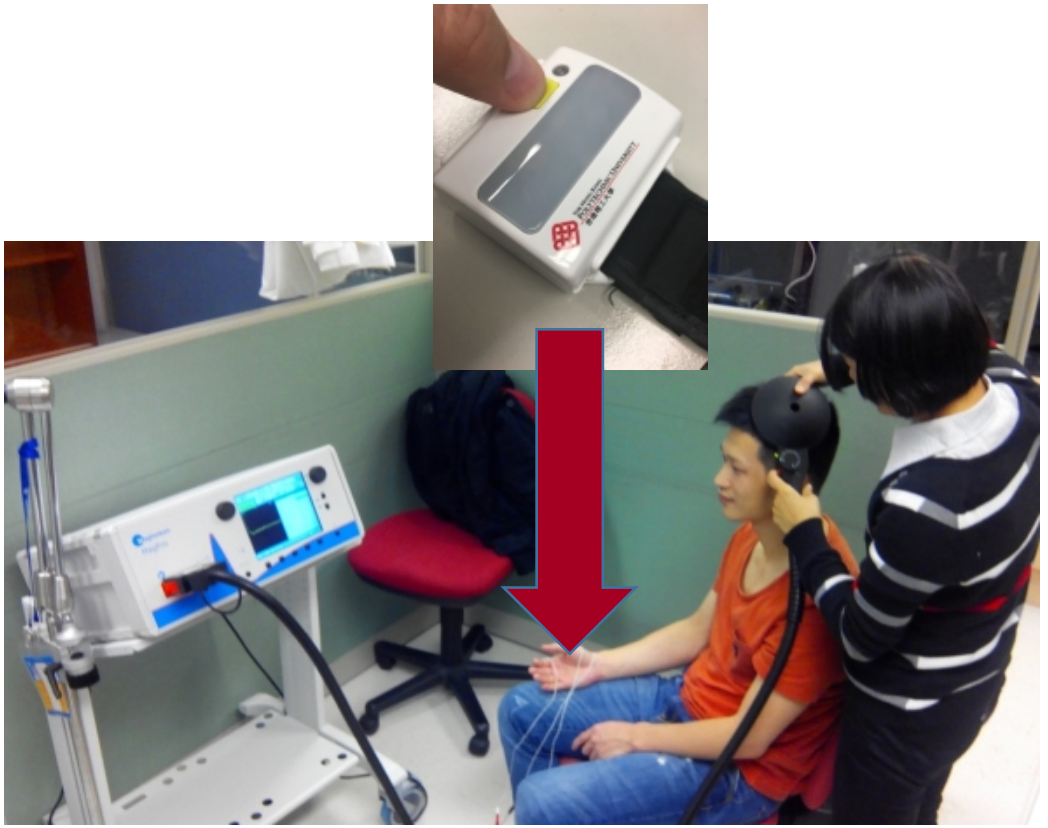
Nicole YH Yang[1,2,3], Kenneth NK Fong[1], Cecilia WP Li-Tsang[1] and D Zhou[4]

Abstract

Objective: To compare the effects of rTMS combined with sensory cueing, rTMS alone, and conventional rehabilitation on unilateral neglect, hemiplegic arm functions and performance of activities of daily living.
Design: A single-blinded randomized controlled trial.
Setting: A convalescent hospital.
Subjects: Sixty inpatients with left unilateral neglect after stroke.
Interventions: Patients were randomly assigned to three groups: rTMS combined with sensory cueing, rTMS, and conventional rehabilitation alone. rTMS at 1 Hz was applied over P5 of the contralesional hemisphere while vibration cueing was emitted using a wristwatch device on the hemiplegic arm, five days per week for two weeks. The first two groups received the same dosage of conventional rehabilitation on top of their experimental interventions. Blinded assessments were administered at baseline, 2 weeks postintervention, and 6 weeks follow-up.
Main measures: Neglect and arm motor performance.
Results: Both rTMS combined with sensory cueing (99.6±33.0) and rTMS alone (88.2±28.7) significantly reduced unilateral neglect than conventional rehabilitation (72.7±33.1) when measured using the conventional subtests of the Behavioural Inattention Test, but the combination was better than rTMS alone. Hemiplegic arm functions and activities of daily living improved in all patients across the three groups but no significant differences were found between the groups.

[1]Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR
[2]Department of Rehabilitation Medicine, West China Hospital, Sichuan University, China
[3]Institute for Disaster Management and Reconstruction, Sichuan University, China
[4]Department of Neurology, West China Hospital, Sichuan University, China

Corresponding author:
Kenneth NK Fong, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR.
Email: renkfong@polyu.edu.hk



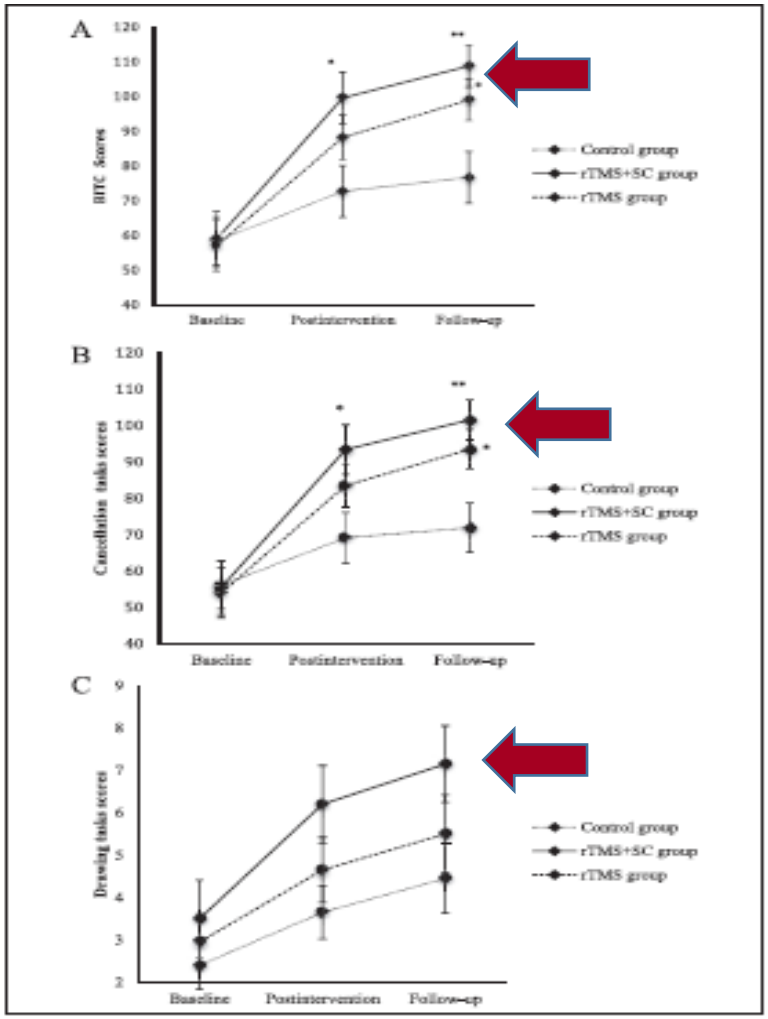


Figure 2. Conventional subtest scores for the BIT.
Note: (A) total score for the conventional subtests of the Behavioural Inattention Test; (B) scores for the cancellation tasks; (C) Scores for the drawing tasks. Error bars represent (SEM); Asterisks indicate *P* values <0.05 when compared with the control group; double asterisks indicate *P* values <0.01 when compared with the control group.

> 低频率 rTMS 结合感觉提示和单独 rTMS 明显减少单侧忽略，但组合比单独 rTMS 更有效

rTMS = repetitive Transcranial Magnetic Stimulation

Work done by Dr. Yang Yonghong, PhD

杨永红, 王鳳怡, 黄秋月, 左京京, **方乃权**. (2015). 感知提醒疗法治疗对脑卒中后单侧空间忽略患者的疗效观察.中华物理医学与康复杂志 (*Chinese Journal of Physical Medicine and Rehabilitation*), *37*(11), 817-820.

中华物理医学与康复杂志 2015 年 11 月第 37 卷第 11 期 Chin J Phys Med Rehabil, November 2015, Vol. 37, No. 11

· 临床研究 ·

感知提醒疗法治疗脑卒中后单侧空间忽略的疗效观察

杨永红　王凤怡　黄秋月　左京京　方乃权

【摘　要】 **目的**　观察感知提醒疗法治疗脑卒中后单侧空间忽略的疗效。**方法**　采用单组小样本治疗前、后对照试验设计，共选取 5 例稳定期脑卒中后单侧忽略患者，在常规康复训练基础上辅以感知提醒干预（每天累计提醒时间为 3 h，每周治疗 5 d），持续治疗 2 周。分别于治疗开始前 2 周、治疗开始前 1 天、治疗结束后 1 天、治疗结束后 2 周及治疗结束后 4 周采用香港版单侧忽略行为测试常规子量表（BIT-C）对入选患者单侧空间忽略程度进行评定。**结果**　治疗前 2 周与治疗前 1 天时入选患者 BIT-C 评分[分别为（51.2 ± 11.0）分、（61.4 ± 12.1）分]差异无统计学意义（$P > 0.05$）；治疗结束后 1 天、治疗结束后 2 周及治疗结束后 4 周时入选患者 BIT-C 评分[分别为（101.4 ± 20.8）分、（106.6 ± 20.4）分和（92.4 ± 20.6）分]均较治疗开始前 1 天时 BIT-C 评分显著提高，其间差异均具有统计学意义（$P < 0.05$），并且以删除类任务评分的改善幅度较显著，病情越严重的患者在本治疗中获益越显著。**结论**　感知提醒疗法可改善脑卒中后单侧忽略患者对忽略侧空间的注意力，可望成为一种简便易行、尤其适用于急性期单侧空间忽略患者的辅助治疗方法，但还需大样本随机对照研究进一步验证其疗效。

【关键词】 脑卒中；　感知提醒；　单侧空间忽略；　单侧忽略行为测试

Sensory cueing in the treatment of unilateral spatial neglect

Yang Yonghong, Wang Fengyi, Huang Qiuyue, Zuo Jingjing, Fang Naiqaan. * Rehabilitation Medicine Center of West China Hospital, Sichuan University, Chengdu 610041, China*

Corresponding author: Yang Yonghong, Email: nicole308@126.com

【**Abstract**】 **Objective**　To investigate the effects of sensory cueing (SC) on unilateral spatial neglect after stroke. **Methods**　Five stroke survivors with unilateral spatial neglect underwent a tailored sensory cueing treatment (wearing a sensory cueing device 3 hours a day, 5 days a week for 2 weeks) in addition to their conventional rehabilitation. Two weeks before and one day before the treatment, and then one day, two weeks and 4 weeks after the treatment, all five patients were assessed using the Hong Kong edition of the behavioral inattention test (BIT-C). **Results**　No significant changes were identified in the average BIT-C ratings at the two time point before the intervention. However, the average score had increased significantly only one day after the start of the intervention, with further significant improvement at each of the succeeding 2 week intervals. The greatest improvement was in finishing cancellation tasks, and the most severely affected patient showed the greatest improvement. **Conclusion**　Sensory cueing treatment may be useful and feasible in reducing unilateral spatial neglect for stroke survivors. However, randomized and controlled trials with larger samples are needed to further verify its effects.

【**Key words**】 Stroke;　Sensory cueing;　Unilateral spatial neglect;　Behavioral inattention test

单侧空间忽略（unilateral spatial neglect，USN）又称单侧注意不能、单侧忽略，是脑损伤（如脑卒中、脑外伤等）后最常见的行为认知障碍之一，患者各种初级感觉功能可能完好无损，但却不能对大脑损伤灶对侧肢体或空间呈现的刺激（如视觉、躯体感觉、听觉以及运动觉刺激等）作出反应[1]。在右侧脑卒中患者中，USN 发生率从 13% 到 81% 不等，其发病率差异归因于受试者选择、病灶位置以及评估方法不同等因素[2]。单侧空间忽略是脑卒中后功能独立的重要预测因素，由于空间忽略存在，患者在完成各种空间相关作业活动时往往表现出对脑损伤对侧刺激无反应，严重影响了患者认知及运动功能康复，不利于他们重新获得独立自理能力。目前临床针对单侧空间忽略有许多治疗手段，但由于单侧忽略的异质性，现有治疗方法疗效均不够理想[3]。

Fong 等[4] 于 2011 年发明了一种感知提醒（sensory cueing，SC）装置，通过该装置能不断给予患者振动

DOI：10.3760/cma.j.issn.0254-1424.2015.011.005
基金项目：四川省卫生厅基金资助项目（140057）
作者单位：610041　成都，四川大学华西医院康复医学中心（杨永红、王凤怡、黄秋月、左京京）；香港理工大学康复治疗科学系（方乃权）
通信作者：杨永红，Email：nicole308@126.com

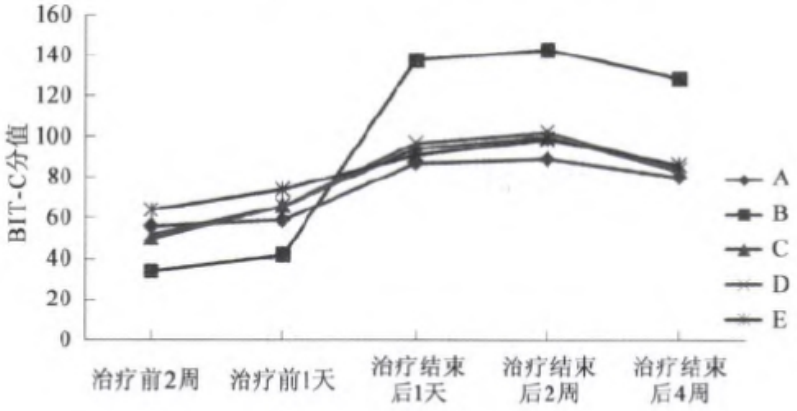


图 2　5 例患者治疗前后各时间点 BIT-C 分值比较

> 单側忽略在3次的評估内得到改善，最严重的忽略患者表现出最大的改善。

Work done by Dr. Dong Anqin, PhD

DEVELOPMENTAL NEUROREHABILITATION
http://informahealthcare.com/pdr
ISSN: 1751-8423 (print), 1751-8431 (electronic)
Dev Neurorehabil, Early Online: 1–9
© 2014 Informa UK Ltd. DOI: 10.3109/17518423.2014.988104
informa healthcare

RESEARCH ARTICLE

Remind to move – A novel treatment on hemiplegic arm functions in children with unilateral cerebral palsy: A randomized cross-over study

An-Qin Vicky Dong[1,2] & Nai-Kuen Kenneth Fong[1]

[1]Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR and [2]Department of Occupational Therapy, Guangdong Provincial Work Injury Rehabilitation Hospital, China

Abstract

Objective: To investigate the effects of 'remind to move' treatment on hemiplegic arm function in children with unilateral cerebral palsy (CP). *Methodology:* Twelve students with unilateral CP aged 6–18 were recruited from a special school and randomly assigned into two groups. Participants in the experimental group underwent a 3-week sensory cueing treatment followed by a 3-week sham treatment. Participants in the waitlist group completed the sham treatment first followed by the sensory-cueing treatment. There was a 4-week washout period between treatments. *Results:* Both functional hand use and arm impairment level significantly improved after the 3-week sensory cueing treatment for the combined sample between groups. However, no significant carryover effects were found for either treatment. *Conclusion:* Three weeks of 'remind to move' treatment is useful in improving hemiplegic arm function and quantity of hand use in children with unilateral CP but the long-term carryover effect requires further investigation.

Keywords
Developmental nonuse, hemiplegia, sensory cueing, unilateral cerebral palsy, upper limb task practice

History
Received 15 August 2014
Revised 10 November 2014
Accepted 12 November 2014
Published online 30 December 2014

Introduction

Cerebral palsy (CP) is a common group of childhood motor and postural impairments. Its prevalence ranges from 1.5 to more than 4 per 1000 live births or children worldwide [1–6]. Hemiplegia, characterized by a clinical pattern of unilateral motor impairment, is a common type of CP, accounting for about one-third of all children with unilateral CP [7]. It involves the upper more than the lower extremity, with symptoms of spasticity, weakness and sensory deficits, as well as difficulty with the timing and coordination of reaching and grasping during precision movements [8].

When growing up, children with unilateral CP often learn strategies to manage daily tasks (such as play) with the less affected hand. They may gradually neglect their more affected hand due to a lack of normal sensorimotor experiences and negative experiences of using it, even if the impairment is only mild [9–11]. This phenomenon in children is referred to 'developmental nonuse or disregard' [12], which is akin to the learned nonuse reported in the literature on adults who have sustained a stroke [13]. Such learned nonuse may be a different phenomenon in children who sustain an early brain lesion, despite the appearance of similar behavioral mechanisms of reinforcement of the uninvolved hand and suppression of use of the involved hand as have been identified in adults [14]. Unlike an adult who suffers neurological impairment later in life, a child with hemiplegia has not experienced normal arm movement, leading to the development of motor arm function that is already inhibited. Rehabilitation must, therefore, create an opportunity, experience, and environment in which such children can learn how to use their involved arm, as well as reverse the behavioral suppression of the use of the affected arm and reinforce its use to perform even the simplest task, such as stabilizing an object [12, 15].

Rehabilitation for children with unilateral CP focuses on improving the functional performance and actual use of the more affected arm. Constraint-induced movement therapy (CIMT), which involves intensive, repetitive, and task-specific forced use of the involved arm while the other one is constrained, has emerged as a plausible approach to improving the capacity of the more affected limb [8, 15–17]. Numerous randomized controlled trials have consistently demonstrated that CIMT is superior to standard care at lower dosages in improving upper limb (UL) function in children with unilateral CP [9, 10, 12, 18–28]. In contrast, minimal differences in training effects have been found when comparing CIMT to an equivalent dose of intensive bimanual arm training or goal-directed occupational therapy [23, 26, 29]. A recent review also indicates that both CIMT and bimanual arm training produce similar improvements in the bi- and unimanual capacities of the affected arm and in overall functional performance [30]. This indicates that

Correspondence: Nai-kuen Kenneth Fong, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Hong Kong SAR. E-mail: nakfong@polyu.edu.hk

Dong, V. A., **Fong, K. N. K.** (2016). Remind to move - A novel treatment on hemiplegic arm functions in children with unilateral cerebral palsy: A randomized cross-over study. *Developmental Neurorehabilitation*, *19*(5), 275-283.

- 学生 (6-18 岁) 在特殊学校有单侧 CP(N=12)
- 交叉设计: 3 周 RTM 后3周假組4周冲蚀 (Washout)
- 手部用量
- 手部損傷
- 手功能效率

Work done by Dr. Dong Anqin, PhD

Dong, V. A., **Fong, K. N. K.**, Chen, Y., Tseng, S. S. W., & Wong, L. M. S. (2017). Remind-to-move' treatment versus constraint-induced movement therapy for children with hemiplegic cerebral palsy: a randomized controlled trial. *Developmental Medicine & Child Neurology*, *59*(2), 160-167.

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY ORIGINAL ARTICLE

'Remind-to-move' treatment versus constraint-induced movement therapy for children with hemiplegic cerebral palsy: a randomized controlled trial

VICKY ANQIN DONG[1] | KENNETH N K FONG[1] | YUN-FENG CHEN[2] | STELLA S W TSENG[3] | LOUISA M S WONG[4]

1 Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR. 2 Guangzhou Rehabilitation Experimental School, Guangzhou, China. 3 Hong Kong Red Cross John F. Kennedy Centre. 4 Hong Kong Red Cross Princess Alexandra School, Hong Kong SAR.

Correspondence to Kenneth N K Fong at Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR. E-mail: rosfong@polyu.edu.hk

PUBLICATION DATA
Accepted for publication 18th June 2016.
Published online

ABBREVIATIONS

BOTMP-II	Bruininks–Oseretsky Test of Motor Proficiency (2nd version)
CFUS	Caregiver Functional Use Survey
CIMT	Constraint-induced movement therapy
JTHFT	Jebsen-Taylor Hand Function Test
RTM	'Remind-to-move'

AIM To evaluate 'remind-to-move' (RTM) treatment by comparing it with constraint-induced movement therapy (CIMT) and conventional rehabilitation of the upper extremity in children with hemiplegic cerebral palsy (CP).

METHOD Seventy-three children (44 males, 29 females; mean age 11y 8mo, standard deviation [SD] 3y 1mo) – with 20, 38, and 15 in Manual Ability Classification System levels I, II, and III respectively – were recruited from three special schools and randomly selected for an RTM (n=25) or CIMT (n=24) programme (for 75h over 3wks) or for conventional rehabilitation (n=24). The Jebsen–Taylor Hand Function Test, the Bruininks–Oseretsky Test of Motor Proficiency (Subtest 3), the Caregiver Functional Use Survey, and arm movement duration captured by accelerometers were used at the baseline, post-test, and 1-month and 3-month follow-ups.

RESULTS Both the RTM and CIMT treatments achieved significant gains in manual capacities and spontaneous hand use immediately after the intervention compared with conventional rehabilitation, but there were no significant differences between the two interventions.

INTERPRETATION The RTM treatment demonstrated similar therapeutic effects with CIMT in manual dexterity and functional hand use, but both interventions were superior to conventional rehabilitation. RTM is recommended as an alternative treatment for the hemiplegic upper extremity in children with CP.

Children with hemiplegic cerebral palsy (CP) are characterized by motor impairments mainly lateralized to one side of the body, with greater upper limb than lower limb involvement; these impairments may further limit the daily activities and school participation of children with hemiplegic CP.[1] Such children often learn strategies to manage bimanual activities with the unaffected hand only, and gradually develop non-use of the more affected hand. This phenomenon, usually referred to as 'developmental disregard',[2] may lead to asymmetrical motor development and the failure of development of the more affected extremity because of a lack of spontaneous hand use in everyday life.

Constraint-induced movement therapy (CIMT) is a moderate-to-strong evidence-based intervention in children with hemiplegic CP.[3–7] CIMT involves a restraint on the unaffected hand along with forced use of the affected hand, thereby improving the unilateral capacity of the latter. Regarding the action mechanism of CIMT, recent evidence suggests that the repetition of practice, immediate feedback during treatment, and enjoyable and functional shaping activities designed to promote a child's engagement – rather than the use of a restraint that immobilizes the unaffected hand – are key elements for causing a change of cortical activation,[8–10] and for sustaining improvements in upper limb functions.[6,11] Despite its benefits, CIMT has been criticized for being difficult to implement clinically because of the restraint selection, time of restraint, children's tolerance and compliance, treatment dosage, safety considerations, and the generalization of unilateral capacity to real-life activities that require the spontaneous use of both hands.

Recently, 'remind-to-move' (RTM) treatment was developed in response to the potential limitations of CIMT.[12,13] RTM treatment involves two key elements: sensory cueing on the affected arm and repetitive bimanual coordination and/or unimanual practice. A portable sensory cueing wristwatch device, worn on the affected arm instead of a restraint on the unaffected hand, is set up to emit continuous sensory cues to increase the user's attention on the affected hand, and to remind the user to be aware of and use the affected hand intensively. Our two preliminary studies showed that RTM treatment is useful in improving the children's arm motor functions and functional hand use.[14,15] RTM treatment has been used for improving arm

© 2016 Mac Keith Press
DOI: 10.1111/dmcn.13216

>What this paper adds:

- UL 功能的改进表明，RTM 处理和 CIMT 对手部效率有相似的影响。
- RTM 和 CIMT 治疗比常规康复更能自发地使用受影响的手。
- RTM 在輕中度障礙可以替代 CIMT

Figure 1: Flow diagram of the recruitment and randomization procedure

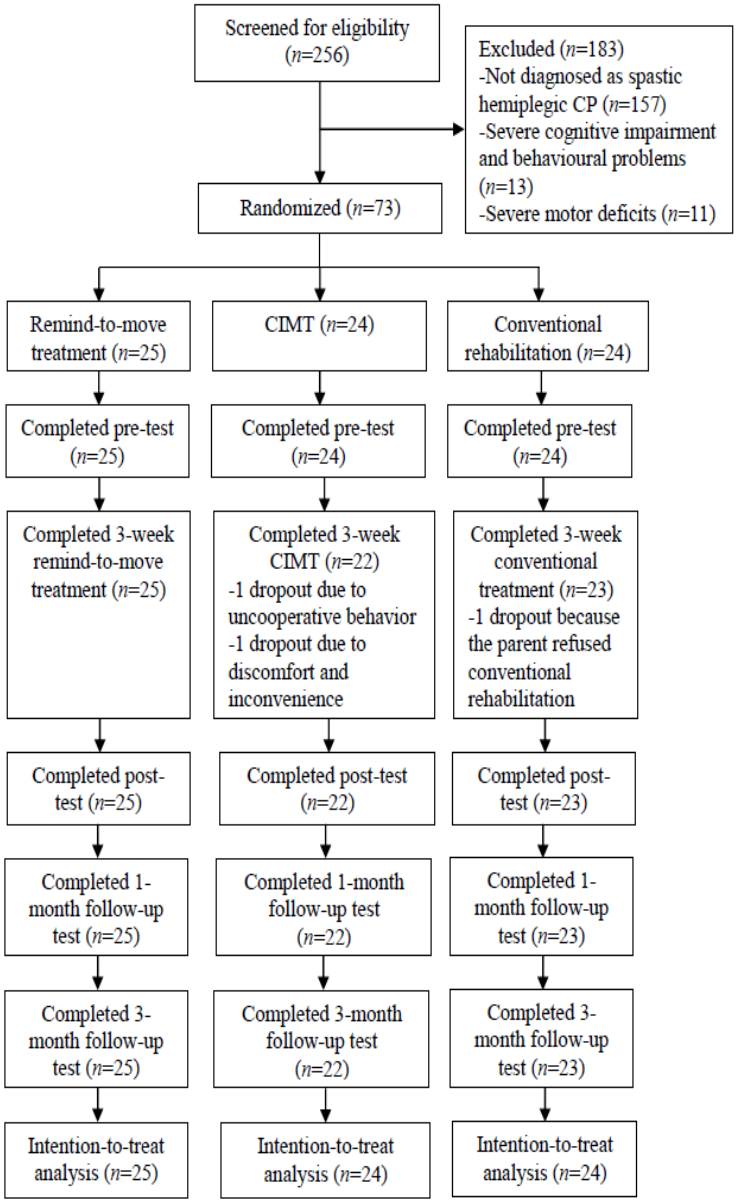


Figure 2: Mean changes from baseline in JTHFT and BOTMP-II Subtest 3 scores

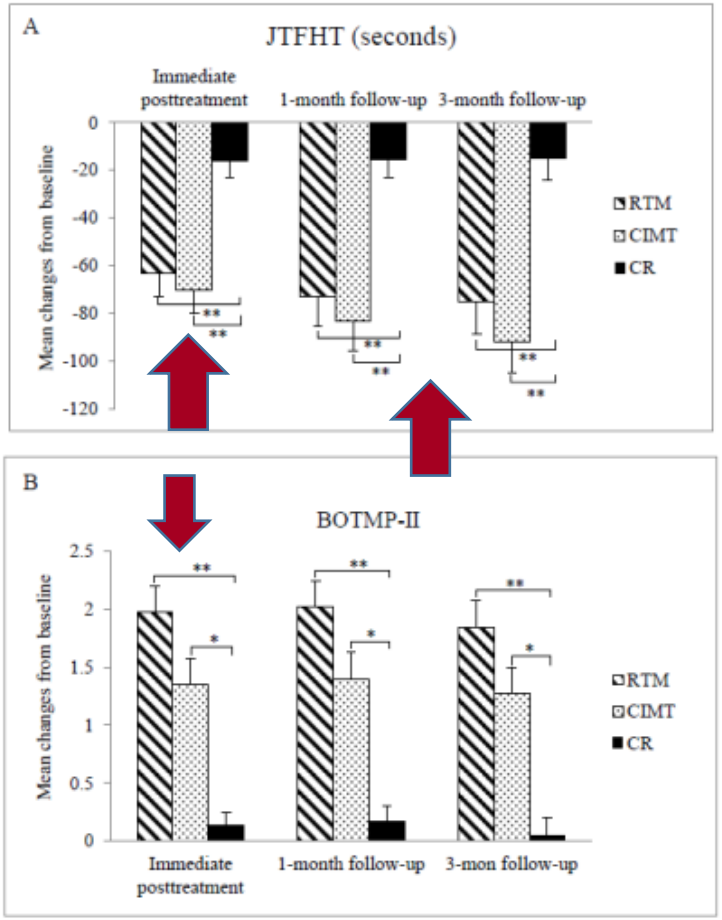
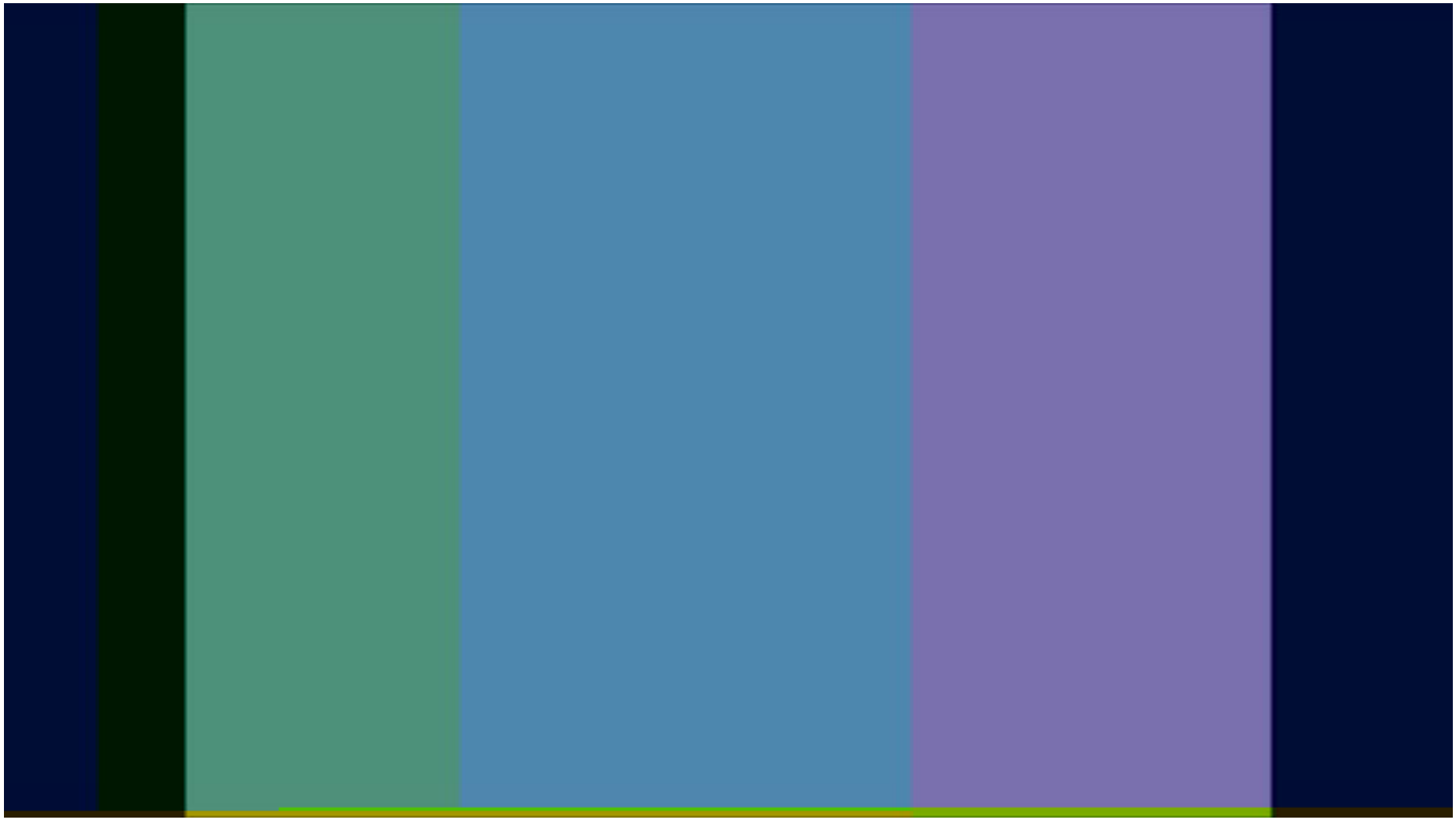


Figure 2A Mean changes and error bars in the time taken to complete six unimanual tasks of the Jebsen-Taylor Hand Function Test (JTFHT), from baseline to immediately after the intervention and in the 1- and 3-month post-test JTHFTs. Less time taken indicates better performance.

Figure 2B Mean changes and error bars in the scores for the manual dexterity subtest of BOTMP-II, from baseline to immediately after the intervention and in the 1- and 3-month post-tests. Higher scores represent better performance.

Abbreviations: RTM, remind-to-move treatment; CIMT, constraint-induced movement therapy; CR, conventional rehabilitation.

*p<0.05; **p<0.001



Second generation 第二代

Local users: 15 public hospitals in Hong Kong
(from records of PTech on 20 Feb 2018)

Pok Oi Hospital
Tuen Mun Hospital

Northern District Hospital
Prince of Wales Hospital
Shatin Hospital

Kowloon Hospital
Queen Elizabeth Hospital
Kwong Wah Hospital

Princess Margaret Hospital
Caritas Medical Centre

United Christian Hospital
Haven of Hope Hospital

Pamela Youde Nethersole Eastern Hospital
Queen Mary Hospital
Tung Wah Hospital

Estimated number of local users 估计本地用户数目

> 本港42间公立医院中, 15 正使用该装置及RTM 治疗

> 每间医院3单位 X 15 = 45 件

> 26周 (2 周/病人) X 45 件 = 1,170 香港中风病人/年

NGO partners

- Jockey Club Elaine Field School, SAHK
- 耀能協會賽马会田伊玲学校

- Hong Kong Red Cross JFK Centre
- 香港红十字会肯尼迪中心

- Hong Kong Red Cross Princess Alexandra School
- 香港红十字会亚历山公主学校

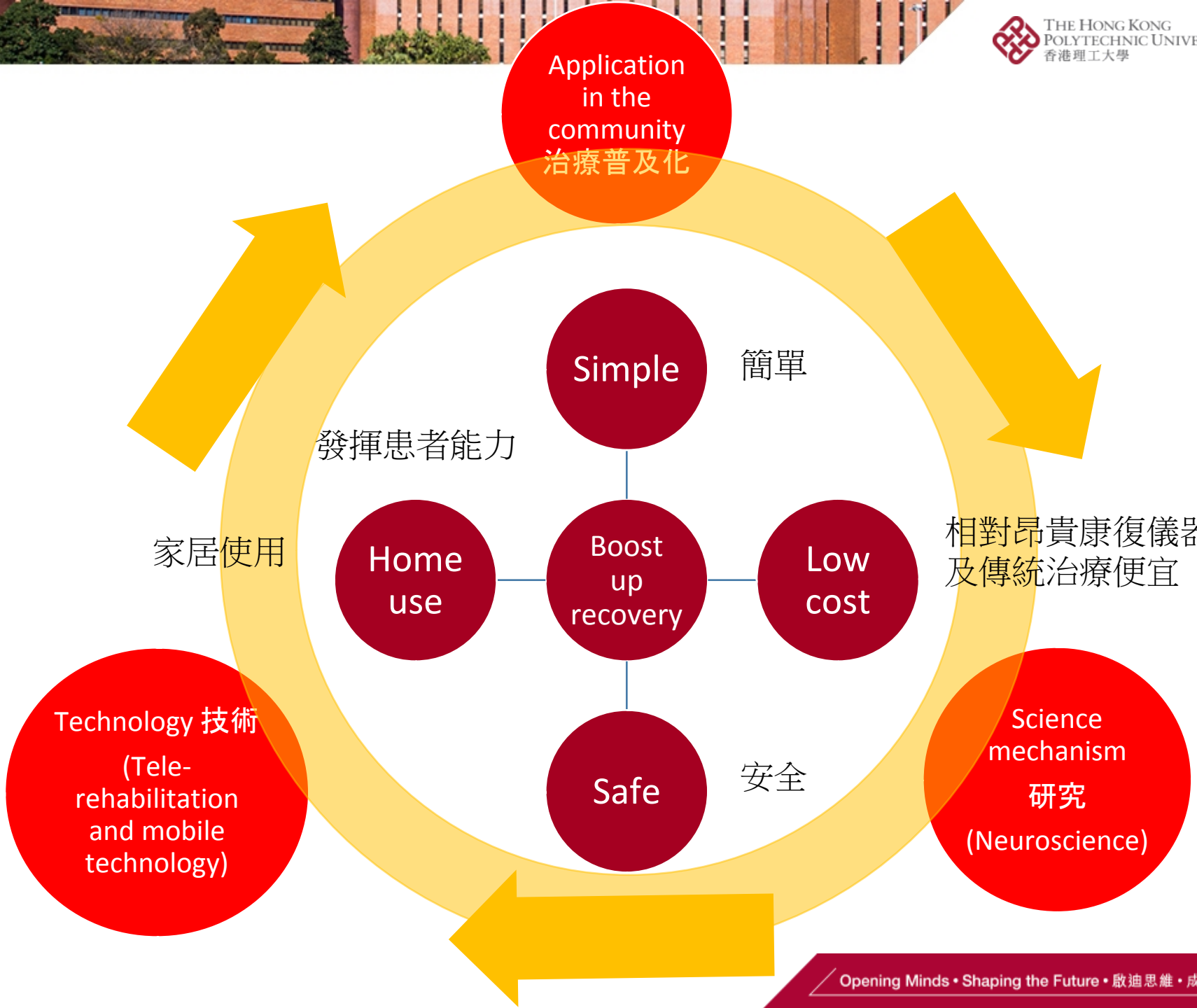
Collaboration with other universities/institutions

Kessler Institute for Rehabilitation, New Jersey;
Physical Medicine & Rehabilitation, Rutgers New Jersey Medical School,
Rutgers University, USA

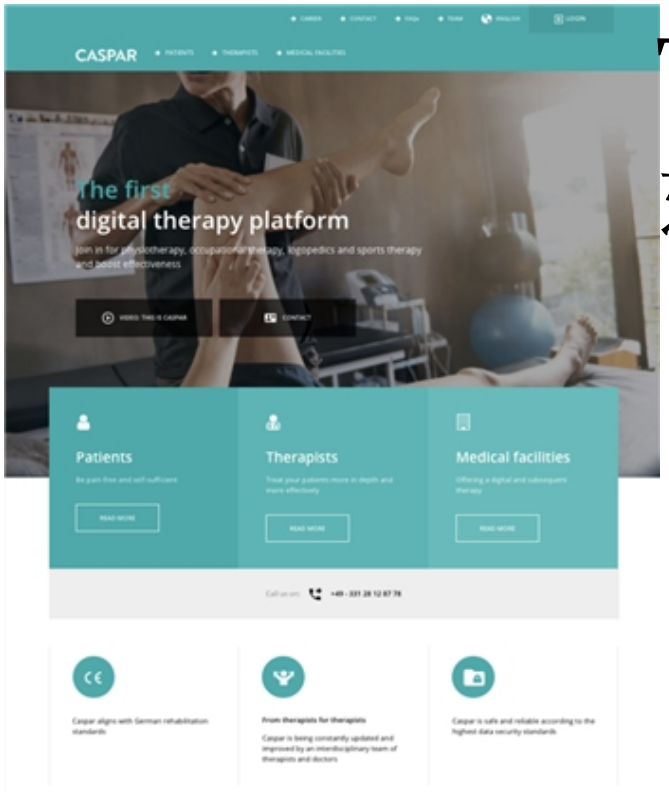
The Caspar Health Limited, a German-based company for tele-rehabilitation

Singapore Institute of Technology (SIT) Singapore

Guangzhou First People's Hospital, Guangzhou, China;
Panyu Central Hospital, Guangzhou, China;
West China Hospital, Chengdu, China


Application in the community
治療普及化
Simple
簡單
發揮患者能力
家居使用
Home use
Boost up recovery
Low cost
相對昂貴康復儀器及傳統治療便宜
Safe
安全
Technology 技術
(Tele-rehabilitation and mobile technology)
Science mechanism
研究
(Neuroscience)

Third generation 第三代



Tele-rehabilitation
遠程康復

Caspar system

Thank you for your attention

Questions and Answers session

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Opening Minds • Shaping the Future
啟迪思維 • 成就未來