2015 International Occupational Therapy Conference

Frontiers in Neurorehabilitation After Stroke

脑卒中后神經康复的前沿发展

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Vision for Occupational Therapy

美国作业治疗百年愿景与WFOT发展目标

AOTA'S Centennial Vision Statement

- By the year 2017, we envision that occupational therapy is a **powerful**, **widely recognized**, **science-driven**, and **evidence-based** profession with a globally connected and diverse workforce meeting society's occupational needs.

Approval by the AOTA Representative Assembly in April 2006

WFOT: Education and Research Vision

- "……Occupational therapists will participate in research and develop research opportunities in all countries in the world, and will **have access to information about research from all parts of the world**. The value of occupational therapy worldwide shall be recognized through **evidence based practice** supported by **research documentation**."

http://www.wfot.org/Education/EducationandResearch.aspx

The WHO Family of International Classification is Comprised of the Following Three Types of Classifications
世卫三大分类体系：由疾病、到残疾、再到治疗照护

Directions of Research and Practice Development in Evidence-based Neurorehabilitation
循证神经康复未来研究方向与实务

CENTENNIAL VISION

Moving Toward 2017: Progress in Rehabilitation Intervention Effectiveness Research

Doucet, B. M., Woodson, A., & Walford, M. (2014). Centennial vision - Moving toward 2017: Progress in rehabilitation intervention effectiveness research. *American Journal of Occupational Therapy*. *68*, e124-e148. doi: 10.5014/ajot.2014.011874

By the year 2017, we envision that occupational therapy is a powerful, widely recognized, science-driven, and evidence-based profession with a globally connected and diverse workforce meeting society's occupational needs.

Strategies
- Fostering **knowledge translation**
- Expanding **the number of participants**
- Conducting **research with a variety of populations**
- Publishing a larger number of **systematic reviews** of the literature
- **Quantifying and centering on occupation-focused practice**

Evidence-Based Stroke Guideline in Taiwan

以实证为基础脑卒中作业治疗服务准则：
2015年1月台湾职能治疗学会出版

Publisher: Taiwan Occupational Therapy Association (January 2015)

Paradigm Shift in Stroke Rehabilitation

脑卒中康复治疗派典转移

Conventional Therapy (Neurodevelopmental therapy)

- The Rood Approach
- Proprioceptive Neuromuscular Facilitation (PNF)
- The Brunnstrom Approach
- Neurodevelopmental Treatment (NDT)

Contemporary Therapy: Task-Oriented Practice to Facilitate Neuroplastic Change

- Constraint-induced Therapy (CIT)
- Bilateral Arm Training (BAT)
- Robot-assisted Therapy (RT)
- Mirror Therapy (MT)
- Combined Therapy

Radomski & Trombly Latham (2014)

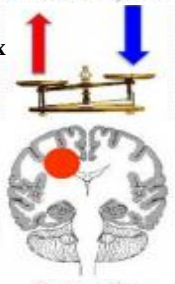
神经康复与修复的新观念

Post-stroke hemiplegia rehabilitation: Evolution of the concepts

Annals of Physical and Rehabilitation Medicine 57 (2014) 520–529

P. Marque [a,*,b], D. Gasq [b], E. Castel-Lacanal [a,b], X. De Boissezon [a,b], I. Loubinoux [a]

Stimulation of the injured cortex
刺激患侧脑皮质层
Constraint-Induced Therapy
（强制运动疗法：迫用偏瘫侧）
Robotics
（康复机器人疗法）
Virtual Reality
（虚拟现实）
Stimulating NIBS
（兴奋性非侵入式脑刺激：
如经颅电、磁刺激）



Restore the interhemispheric balance

Inhibiting the healthy cortex
抑制患侧脑皮质层
Immobilization (CIT)
（强制运动疗法：限制健侧）
Inhibiting NIBS
（抑制性非侵入式脑刺激）

Fig. 1. Principles of new rehabilitation techniques post-stroke. Neuroimaging [31,32] and electrophysiology [33] studies showed an imbalance of the interhemispheric equilibrium, responsible for an overactivation of the healthy hemisphere and under-activation of the injured hemisphere. The objective of these new rehabilitation techniques is to restore the interhemispheric balance by stimulating the injured hemisphere and/or inhibiting the healthy hemisphere (CIT: constraint-induced therapy; NIBS: non-invasive brain stimulation-rTMS, tDCS).
Adapted from Loubinoux et al. [31].

Our Ongoing Research in Stroke Neurorehabilitation (Prof. Lin and Colleagues) 林克忠教授神经康复科研梯队

Clinical Trials

- **Efficacy**
  1. Constraint-Induced Therapy (CIT)
  2. Bilateral Arm Training (BAT)
  3. Robot-Assisted Therapy (RT)
  4. Mirror Therapy (MT)

Comparative Efficacy Research

- **Comparative Efficacy**
- Possible Mechanisms

Combined Therapy

- CIT + Trunk Restraint
- CIT + Eye Patching
- RT + CIT
- RT + Electrical Stimulation
- MT + Afferent Stimulation
- MT + Transcranial Direct Current Stimulation (tDCS)
- Bilateral and Unilateral Approaches

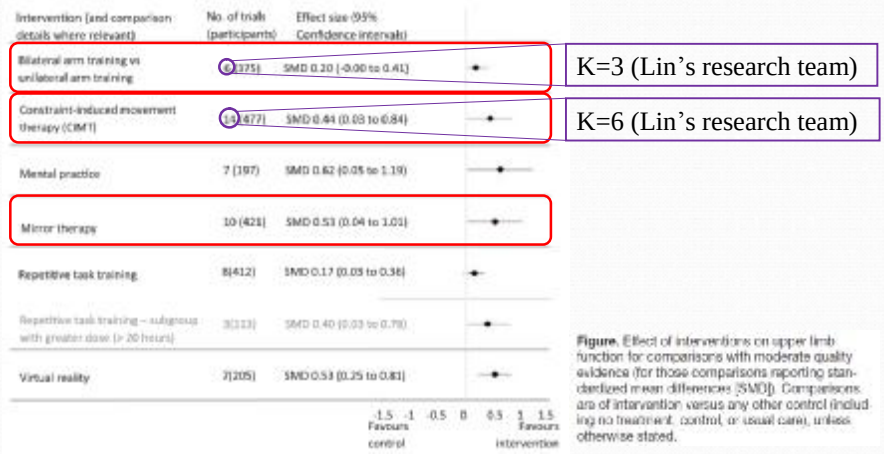
Outcome Measurement Research

- **Predictive and Metric Study**
  1. What are the good indicators of clinically meaningful change after treatment?
  2. Who are good responders to the treatments?

Higher Functioning Patients

Moderate-to-Low Functioning Patients

Contemporary Stroke Rehabilitation
当代脑卒中康复治疗



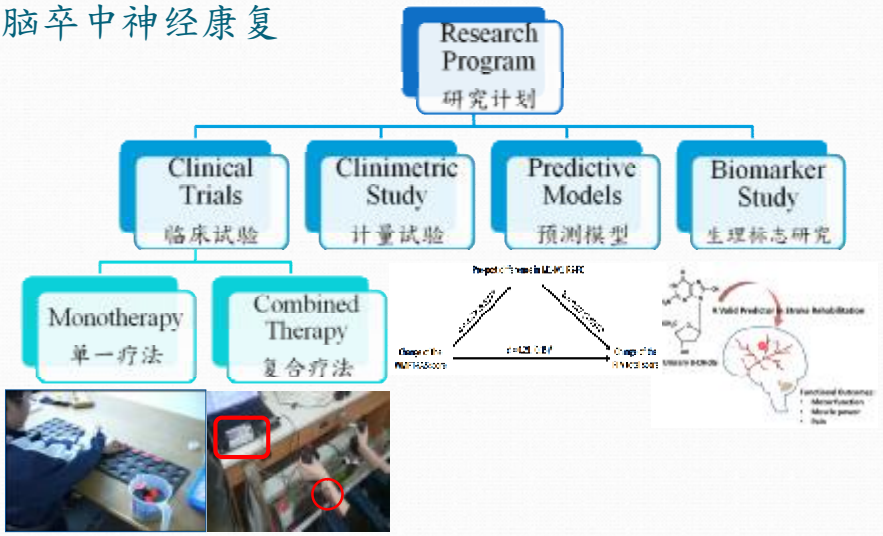
K=3 (Lin's research team)

K=6 (Lin's research team)

Figure. Effect of interventions on upper limb function for comparisons with moderate quality evidence (for those comparisons reporting standardized mean differences [SMD]). Comparisons are of intervention versus any other control (including no treatment, control, or usual care), unless otherwise stated.

Pollock, A., Farmer, S. E., Brady, M. C., Langhorne, P., Mead, G. E., Mehrholz, J., & van Wijck, F. (2015). Cochrane overview interventions for improving upper limb function after stroke. *Stroke, 46*, e57-e58.

Stroke Neurorehabilitation
脑卒中神经康复



Clinical Trials（临床试验）

由单一疗法启始

- Efficacy Research 疗效研究
  - Monotherapy 单一疗法
    - CIT（强制运动疗法）
    - BAT（双侧上肢练习）
    - RT（康复机器人疗法）
    - MT（镜像疗法）
  - Combined Therapy 复合疗法
    - CIT + Trunk Restraint（强制运动疗法+躯干局限）
    - CIT + Eye Patching（强制运动疗法+视觉遮蔽）
    - RT + CIT
    - RT + Electrical Stimulation（康复机器人疗法+电刺激）
    - MT + Afferent Stimulation（镜像疗法+体感觉刺激）
    - MT + Transcranial Direct Current Stimulation（镜像疗法+经颅直流电刺激）
    - Bilateral and Unilateral Practice（单双侧练习）

Constraint-induced Therapy (CIT)

强制运动疗法

Principles 治疗原则	**Constraining the non-affected side movement** **Facilitating the affected side movement**
Possible Mechanisms 可能机转	1. Facilitate affected hemispheric activation 2. Increase synapse connective intensity 3. Overcome “learned non-use（习得废用）”
Applicability 适用性	Patients with mild-to-moderate motor impairments after stroke (or child with cerebral palsy)

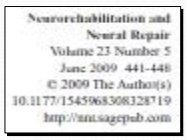
Bilateral Arm Training (BAT)

双侧上肢练习

Principles **治疗原则**	**Normalizing interhemisphere interaction** **Facilitating the coupling effects**
Possible Mechanisms **可能机转**	1. Ipsilateral corticospinal pathway 2. Mediation of the cortical inhibition and disinhibition
Applicability **适用性**	Patients with chronic, mild-to-moderate motor impairments after stroke

Comparative Efficacy Research of CIT vs. BAT

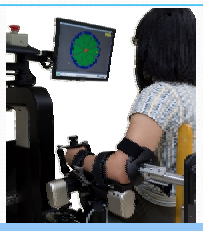
单、双侧练习之疗效对比研究



Study Findings and Messages

- Bilateral arm training (BAT) may uniquely improve proximal upper limb motor impairment（近端运动损伤）, and is a better option if improvement of force generation（力量产生）is the goal.
- Constraint-induced therapy (CIT) may produce greater functional gains for the affected upper extremity and is more appropriate for improving functional ability（运动能力）and use of the affected arm（患侧手使用量）in daily life.
- These findings emphasize the need to take domains of outcome measures into consideration when comparing stroke rehabilitation programs.

Robot-Assisted Therapy (RT)
康复机器人疗法

	Unilateral Arm Training 单肢练习	Bilateral Arm Training 双肢练习
Proximal Emphasis 强调近端		
Distal Emphasis 强调远端	 **InMotion 3** Interactive Motion Technologies (U.S.)	 **Bi-Manu-Track** Reha-Stim Co. (Germany)

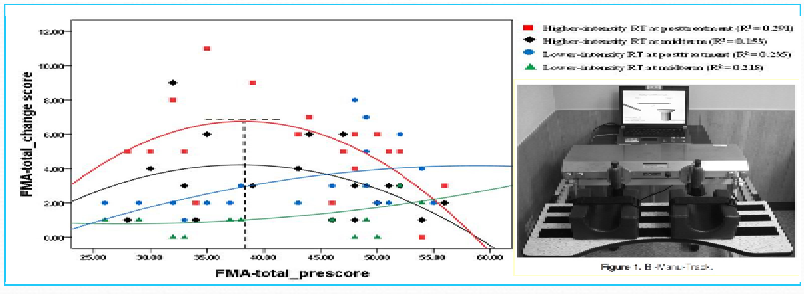
Dose-Response Relationship of RT
康复机器人疗法之剂量反应关系

Dose–Response Relationship of Robot-Assisted Stroke Motor Rehabilitation
The Impact of Initial Motor Status

Yu-wei Hsieh, PhD; Ching-yi Wu, ScD; Keh-chung Lin, ScD; Grace Yao, PhD; Kuen-yuh Wu, PhD; Ya-ju Chang, PhD

Stroke

(*Stroke 2012*;43:2729-2734)



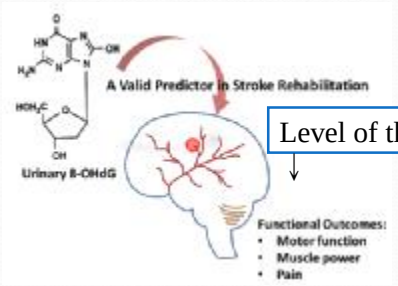
- **Patients with moderate motor deficits（中度运动损伤）tended to have more motor improvements after the higher-intensity robot-assisted therapy.**
- **The patient's level of motor impairment should be considered when planning for robot-assisted stroke rehabilitation.**

探索有意义的生理标志

Int. J. Mol. Sci. **2014**, *15*, 6504-6516; doi:10.3390/ijms15046504

The Reliability and Predictive Ability of a Biomarker of Oxidative DNA Damage on Functional Outcomes after Stroke Rehabilitation

Yu-Wei Hsieh [1,2], Keh-Chung Lin [3,4], Mallikarjuna Korivi [1,2], Tsong-Hai Lee [5], Ching-Yi Wu [1,2,*] and Kuen-Yuh Wu [6]



Level of the 8-OHdG ↓

- Motor function ↑ 运动功能 ↑
- Muscle power ↑ 肌肉力量 ↑
- Pain ↓ 痛觉 ↓

Clinical Trials（临床试验）

开展有效的复合疗法

- Efficacy Research（疗效研究）
  - Monotherapy（单一疗法）
    - CIT（强制运动疗法）
    - BAT（双侧上肢练习）
    - RT（康复机器人疗法）
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    - RT + Electrical Stimulation（康复机器人疗法+电刺激）
    - MT + Afferent Stimulation（镜像疗法+体感觉刺激）
    - MT + Transcranial Direct Current Stimulation（镜像疗法+经颅直流电刺激）
    - Bilateral and Unilateral Practice（单双侧练习）

CIT + Trunk Restraint
强制运动疗法合并躯干局限

April 2012
Volume 92 Number 4 Physical Therapy
Research Report

Constraint-Induced Therapy With Trunk Restraint for Improving Functional Outcomes and Trunk-Arm Control After Stroke: A Randomized Controlled Trial

Ching-yi Wu, Yi-an Chen, Keh-chung Lin, Ching-ping Chau, Yu-ling Chen

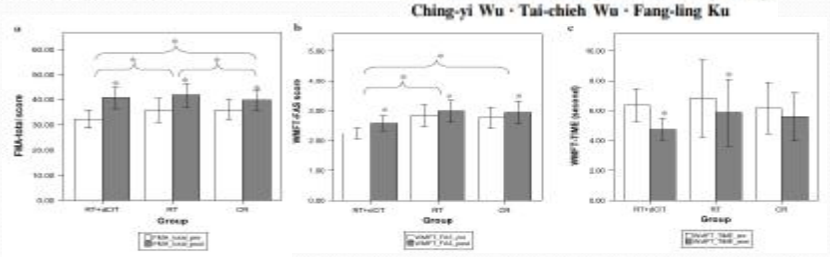
Motor Function 运动功能	Kinematic analysis (reaching task) • Joint angle of arm ↑
Daily Function 日常生活功能	Motor Activity Log ↑ Frenchay Activity Index ↑
Quality of Life 生活质量	Stroke Impact Scale •Hand function (grasping) ↑

RT + CIT（康复机器人疗法+强制运动疗法）

TECHNIQUES IN CLINICAL SCIENCE
J Neurol (2014) 261:1037–1045
DOI 10.1007/s00415-014-7345-4

Sequential combination of robot-assisted therapy and constraint-induced therapy in stroke rehabilitation: a randomized controlled trial

Yu-wei Hsieh · Keh-chung Lin · Yi-shiung Horng · Ching-yi Wu · Tai-chieh Wu · Fang-ling Ku



	RT + CIT	RT	Control Treatment
Pre-to-post change	↑	↑	↑
FMA	↑ ↑		
WMFT- functional ability	↑ ↑		

Mirror Therapy (MT)
镜像疗法

Principles **治疗原则**	Using mirror to reflect the image of the non-affected upper extremity, through visual illusion（视幻觉）to facilitate the sensory and motor function on the affected extremity
Possible Mechanisms **可能机转**	1. Mirror visual feedback（镜像视觉回馈）replaces the diminished or lost proprioception. 2. Recruiting mirror neurons in the premotor cortex and somatosensory cortex
Applicability **适用性**	•Acute to chronic stage post stroke or brain injury •Mild-to-severe impairments •Precaution: MT may cause dizziness in patients with brain stem stroke


镜像疗法改善运动与感觉障碍

Archives of Physical Medicine and Rehabilitation 2013;94:1023-30

Effects of Mirror Therapy on Motor and Sensory Recovery in Chronic Stroke: A Randomized Controlled Trial

Ching-Yi Wu, ScD, OTR,[a,b] Pai-Chuan Huang, ScD, OTR,[a] Yu-Ting Chen, MS, OT,[a] Keh-Chung Lin, ScD, OTR,[c,d] Hsiu-Wen Yang, MS, OT[a]

Improving motor and sensory functions **镜像治疗改善运动与感觉功能**	Fugl-Meyer Assessment: distal part ↑（近端功能提升） Kinematic analysis (reaching task): 1.Movement quality ↑ （运动质量提升） 2.Movement time ↓ （运动时间减少） 3.Trunk compensation ↓ （躯干代偿减少） 4.Trans-joint coordination of arm ↑ （跨关节协调度提升） Nottingham Sensory Assessment Temperature sense ↑ （温度觉提升）

镜像疗法合并感觉刺激提升运动与移位功能

Neurorehabilitation and Neural Repair
2014, Vol. 28(2) 153–162

DOI: 10.1177/1545968313508468
nnr.sagepub.com
SAGE

Combining Afferent Stimulation and Mirror Therapy for Rehabilitating Motor Function, Motor Control, Ambulation, and Daily Functions After Stroke

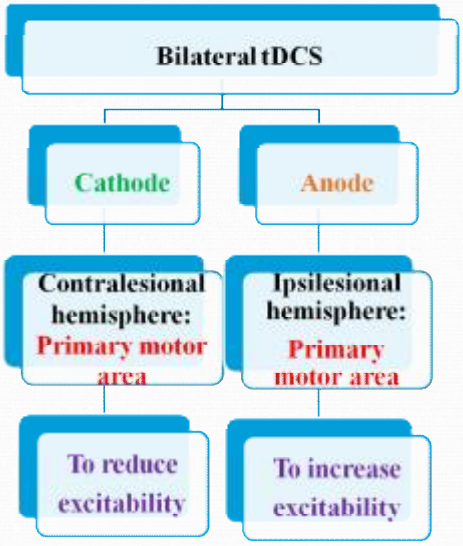
Keh-chung Lin, ScD[1,2], Pai-chuan Huang, ScD[3], Yu-ting Chen, MS[3], Ching-yi Wu, ScD[3], and Wen-ling Huang, MS[4]

	MT + Afferent Stimulation	MT
Motor function 运动功能	Fugl-Meyer Assessment ↑	Fugl-Meyer Assessment ↑
	Kinematic analysis (reaching task) •Angle of shoulder abduction ↓ （肩关节外展角度↓）	Kinematic analysis (reaching task) •Angle of shoulder abduction ↓ （肩关节外展角度↓）
	Box and Block Test： •Finger dexterity ↑ （手指灵巧度↑）	
	10 meter walk test： •Velocity ↑（速度↑） •Stride length ↑（步长↑）	

Transcranial Direct Current Stimulation (tDCS)
镜像治疗合并双侧经颅直流电刺激

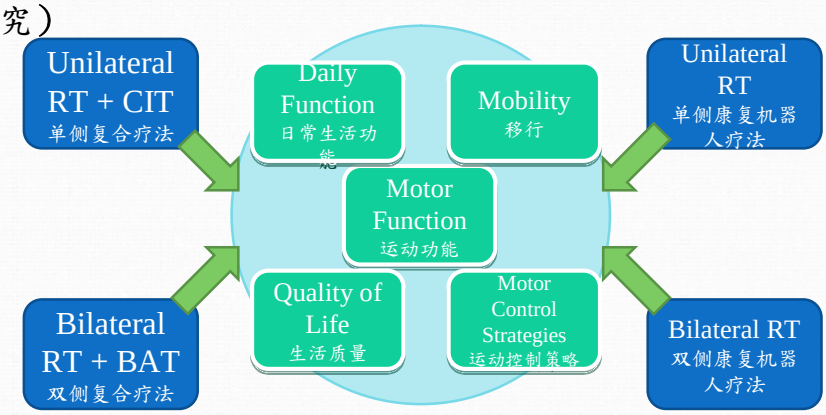
Stimulator

HDCstim
(The Magstim Company Ltd., UK)



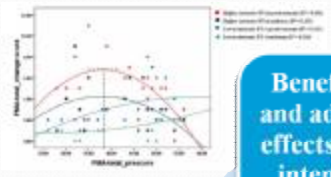
Ongoing Study（进行中研究）

Unilateral vs. Bilateral Approaches to Hybrid Stroke Rehabilitation（单、双侧复合疗法于中风康复之研究）



Future Directions for Frontier Research

前沿科研的后续方向

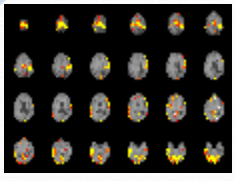


Beneficial and adverse effects after intensive therapy

Real-life measures of outcome

Markers predictive of treatment outcome

Brain mechanisms of plastic change



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  - NSC-102-2314-B-182-001
  - NSC-102-2628-B-182-005-MY3
  - MOST-102-2314-B-154-MY2
- Health Research Institutes in Taiwan （台湾卫生研究院）
  - NHRI-EX102-9920PI
  - NHRI-EX102-10010PI
  - NHRI-EX104-10403PI