Equine-Assisted Activities and Therapies in Children with Cerebral Palsy

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Sungkyunkwan University School of Medicine

The First Riding Program

Samsung Electronics Equestrian Team, June 2001

朝鮮日報

001년 12월 4일 화요일 40판

말 타면서 척추장애 극복한다

삼성승마단 최명진 감독
이색 재활치료 도입해 화제

지난달 29일 척추 장애를 겪고 있는 손승욱(6)군은 경기도 군포시 부곡동 삼성전자 승마단 실내 훈련장을 찾았다. 조교사의 손을 잡고 말에 오른 손군은 25분 정도 말을 타면서 공을 주고 받고, 목청껏 소리도 질렀다.

손군이 참여한 프로그램은 삼성전자 승마단 최명진(崔明振·45) 감독이 국내에 처음 도입한 '재활치료승마'. 말을 타고 각종 놀이를 즐기면서 자연스럽게 근육을 발달시키고 유연성을 확보하는 과정이다.

최 감독이 이 같은 프로그램을 도입하게 된 것은 현역선수로 뛰던 90년대 영국에 있는 승마장 캠프를 지역 장애인단체가 사용토록 하는 것을 본 것이 계기가 됐다. 그는 영국 등 유럽에선 승마시합 전에 장애인들이 참여하는 승마 행사를 여는 것을 보고 "우리나라 장애인들에게도 언제가는 이런 기회를 주고 싶다"고 생각했다.

최 씨는 회사를 설득, 지난 9월 어린이 체격에 맞는 조랑말 두 마리를 새로 들여왔다. 삼성의료원 물리치료팀과 함께 지난 10월 18일부터 본격적으로 '재활치료승마'를 시작했다. 매주 화·목요일 오후3~5시 손군 외에도 4명의 어린이 환자를 대상으로 한다.

최씨는 "장애 어린이들이 말을 탄다는 것에 대한 기대가 커 정신적으로 도전적으로 변하게 되는 것도 큰 효과"라고 말했다. 문의 ☎(031)461-6637

/方龍哲기자 banghc@chosun.com

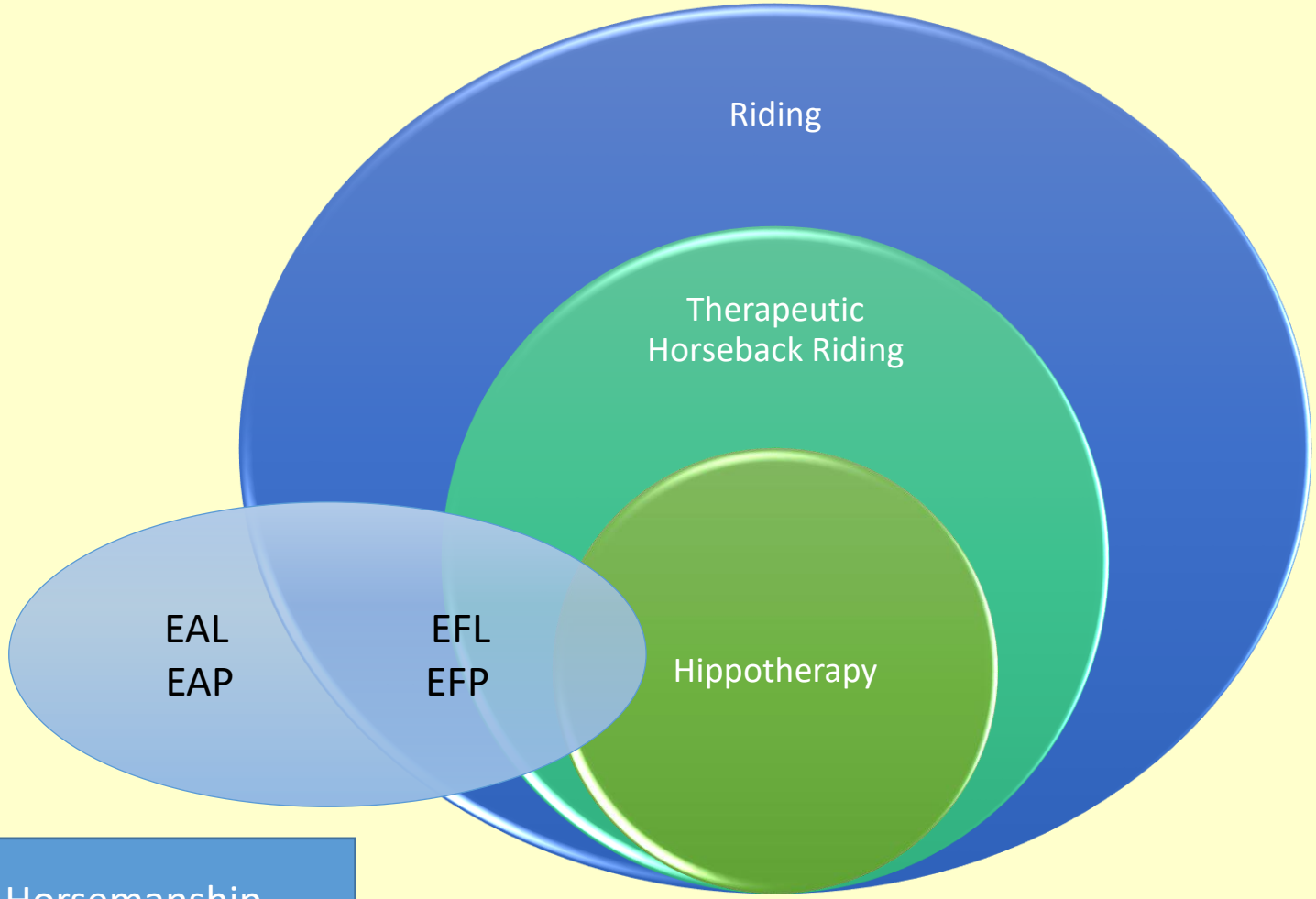
Myung-Jin Choi
Director of Samsung
Equestrian Team

- **In collaboration with Samsung Medical Center**
- **4 children with cerebral palsy**

Rehabilitation horseback riding 再活乗馬 Jaehwal Seungma

- "All activities" in which humans and horses work together to give cognitive, physical, emotional, and social well-being to people with disabilities and emotional problems

Terminology



Horsemanship activities

Definition and Classification of Cerebral Palsy, April 2006

- Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to nonprogressive disturbances that occurred in the developing fetal or infant brain

- The motor disturbances of CP are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior; by epilepsy, and by secondary musculoskeletal problems

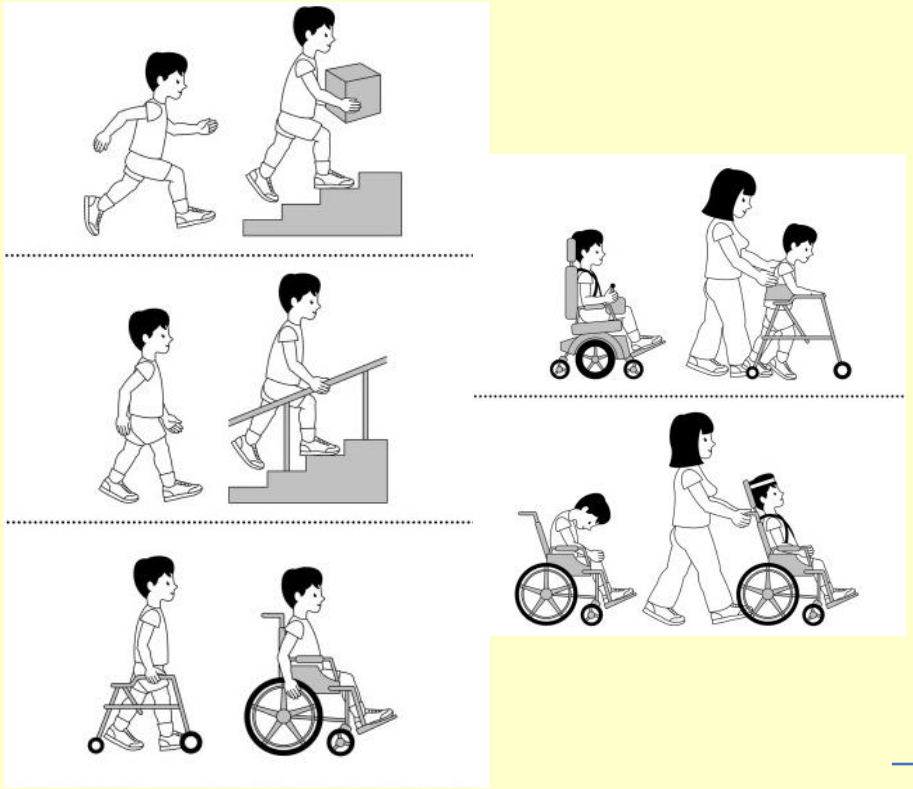
In many parts of the world, Children with CP

- Are hidden or shunned, no access to education or basic health care
- Have little voice is setting goals for their own lives
- Experience more frequent neglect or access
- Are passive recipients of treatments done to them
- Are removed from home and community for care
- Receive care that is not evidenced-based

Five key principles for therapy

- Intervention should aim to change a child's function
- Therapy should be directed by child & family goal
- Treatment should be in natural setting where possible (home & community)
- Children should be actively engaged in therapy
- Interventions should be grounded in basic science & evidence from clinical trials

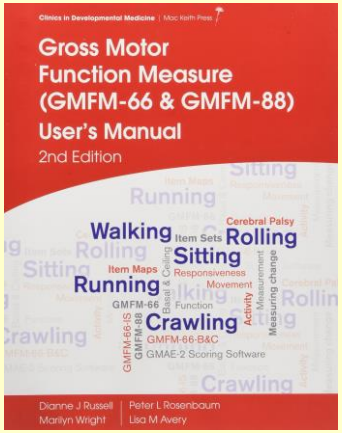
GMFCS (Gross motor function classification system)



Level	GMFCS
I	Walks without limitations
II	Walks with limitations
III	Walks using a hand-held mobility device
IV	Self-mobility with limitations; may use powered mobility
V	Transported in a manual wheelchair

Gross Motor Function Measure

Dianne J. Russell, Peter L. Rosenbaum, Marilyn Wright, Lisa M. Avery



GMFM RAW SUMMARY SCORE

DIMENSION	CALCULATION OF DIMENSION % SCORES	GOAL AREA (indicated with ✓ check)
A. Lying & Rolling	$\frac{\text{Total Dimension A}}{51} = \frac{\quad}{51} \times 100 = \quad\%$	A. ☐
B. Sitting	$\frac{\text{Total Dimension B}}{60} = \frac{\quad}{60} \times 100 = \quad\%$	B. ☐
C. Crawling & Kneeling	$\frac{\text{Total Dimension C}}{42} = \frac{\quad}{42} \times 100 = \quad\%$	C. ☐
D. Standing	$\frac{\text{Total Dimension D}}{39} = \frac{\quad}{39} \times 100 = \quad\%$	D. ☐
E. Walking, Running & Jumping	$\frac{\text{Total Dimension E}}{72} = \frac{\quad}{72} \times 100 = \quad\%$	E. ☐

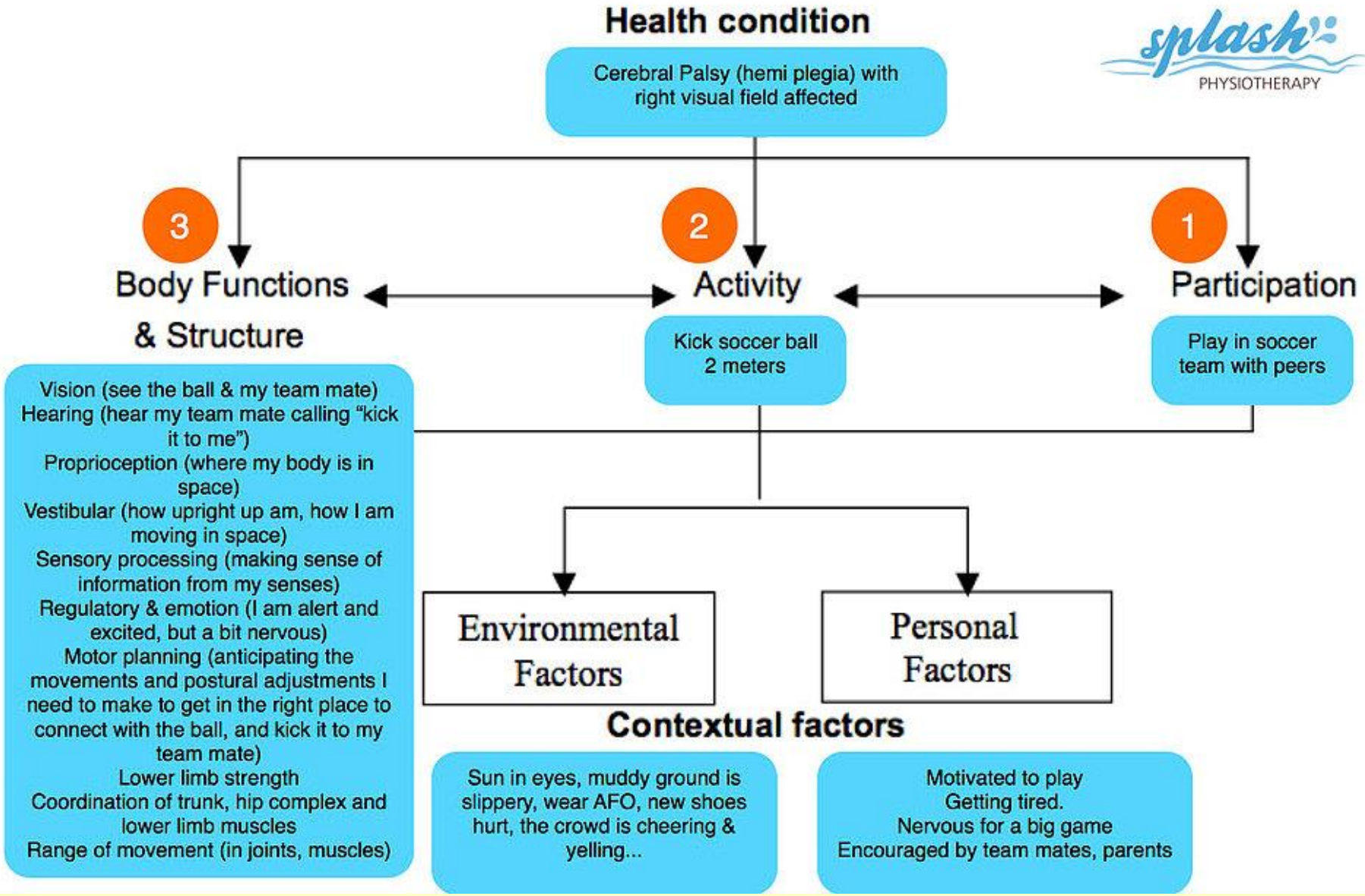
$$\text{TOTAL SCORE} = \frac{\%A + \%B + \%C + \%D + \%E}{\text{Total \# of Dimensions}}$$

$$= \frac{+ \quad + \quad + \quad +}{5} = \frac{\quad}{5} = \quad\%$$

$$\text{GOAL TOTAL SCORE} = \frac{\text{Sum of \% scores for each dimension identified as a goal area}}{\text{\# of Goal areas}}$$

$$= \frac{\quad}{\quad} = \quad\%$$

Example of using the ICF-CY with the participation goal to play in a soccer game



https://www.splashphysiotherapy.com/single-post/2015/06/25/Participation-is-the-key-the-ICFCY-model

Current Neurology and Neuroscience Reports (2020) 20: 3
https://doi.org/10.1007/s11910-020-1022-z

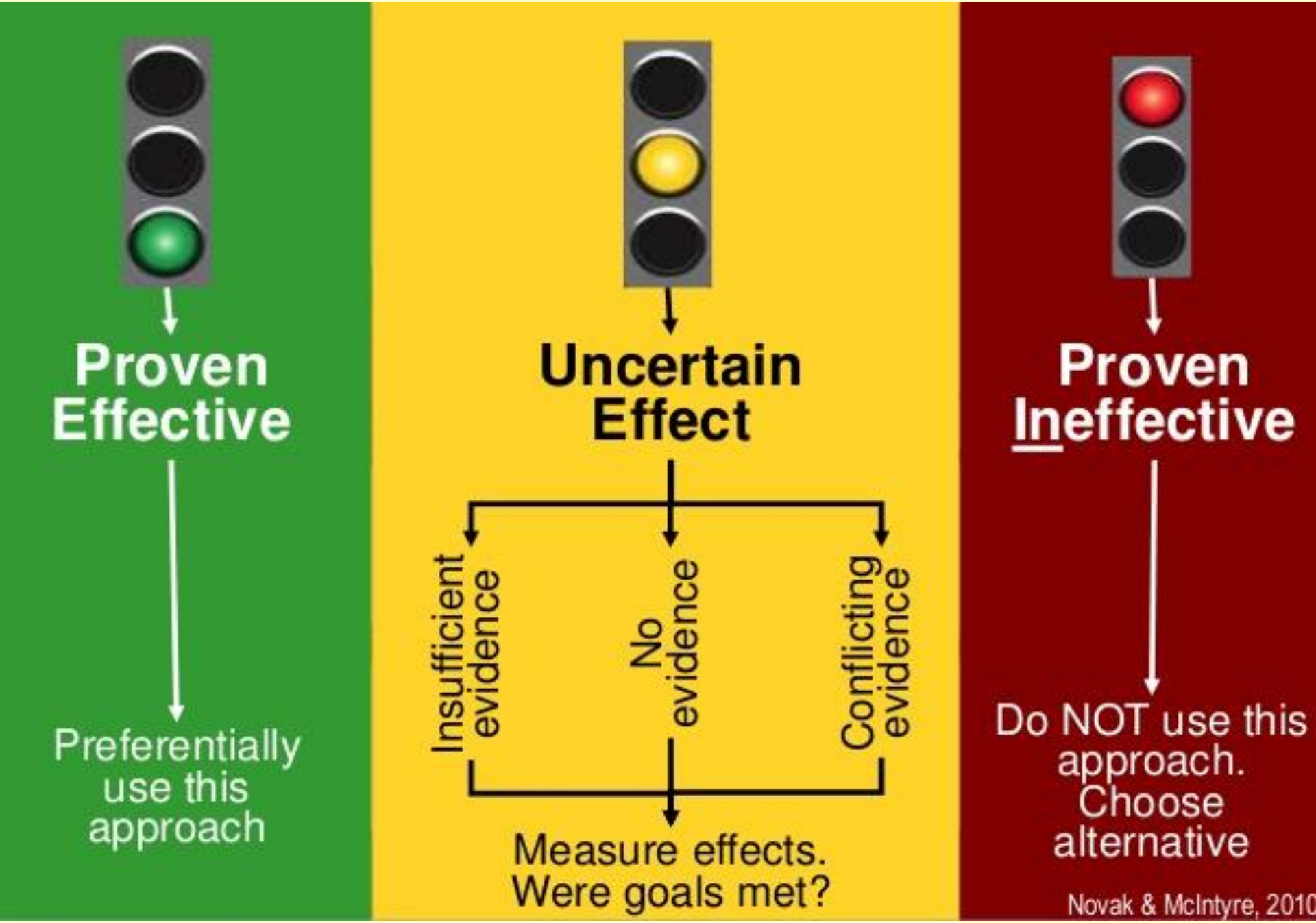
PEDIATRIC NEUROLOGY (WE KAUFMANN, SECTION EDITOR)

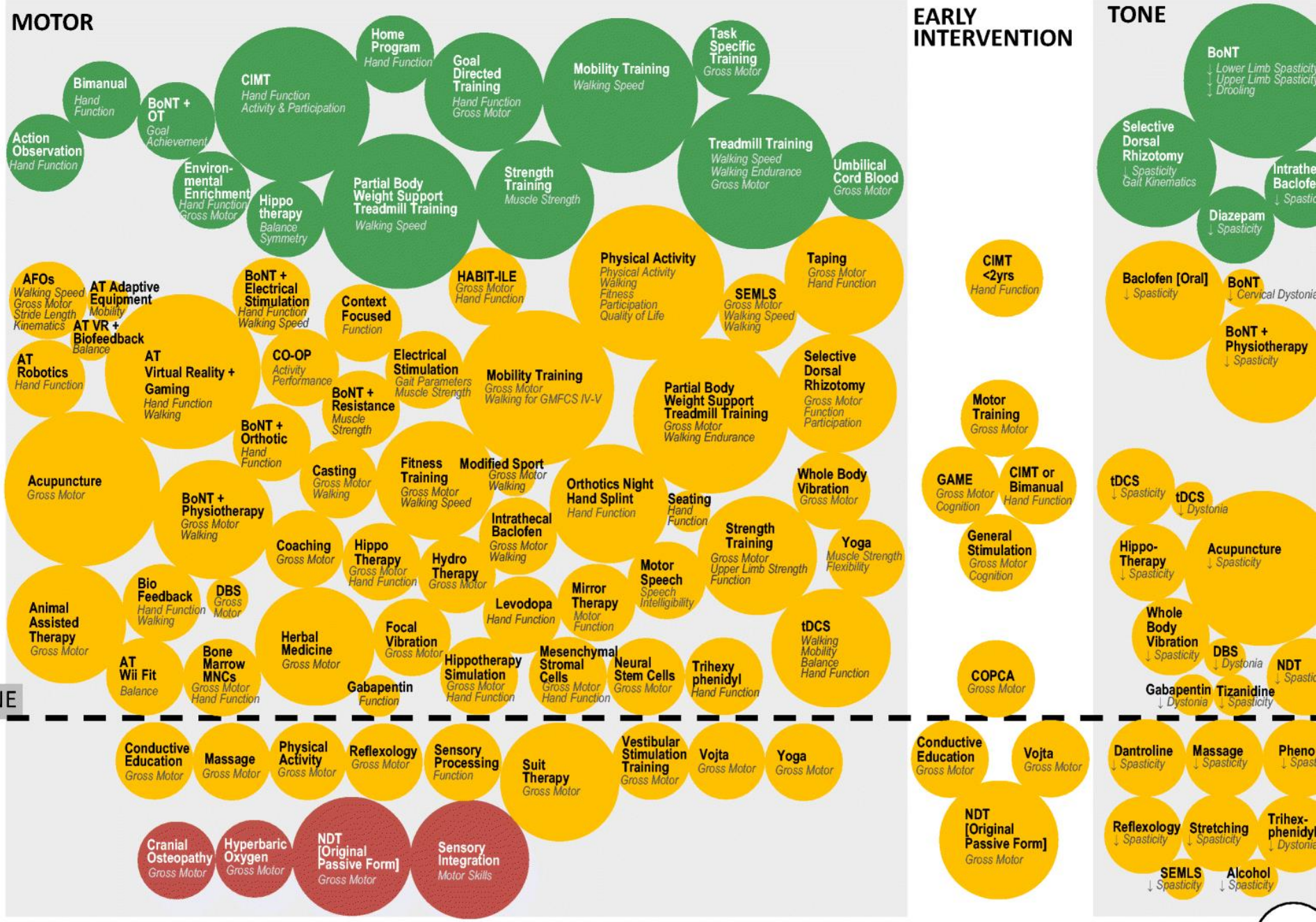
Check for updates

State of the Evidence Traffic Lights 2019: Systematic Review of Interventions for Preventing and Treating Children with Cerebral Palsy

Iona Novak[1] · Catherine Morgan[1] · Michael Fahey[2,3] · Megan Finch-Edmondson[1] · Claire Galea[1,4] · Ashleigh Hines[1] · Katherine Langdon[5] · Maria Mc Namara[1] · Madison CB Paton[1] · Himanshu Popat[1,4] · Benjamin Shore[6] · Amanda Khamis[1] · Emma Stanton[1] · Olivia P Finemore[1] · Alice Tricks[1] · Anna te Velde[1] · Leigha Dark[7] · Natalie Morton[8,9] · Nadia Badawi[1,4]

Published online: 21 February 2020

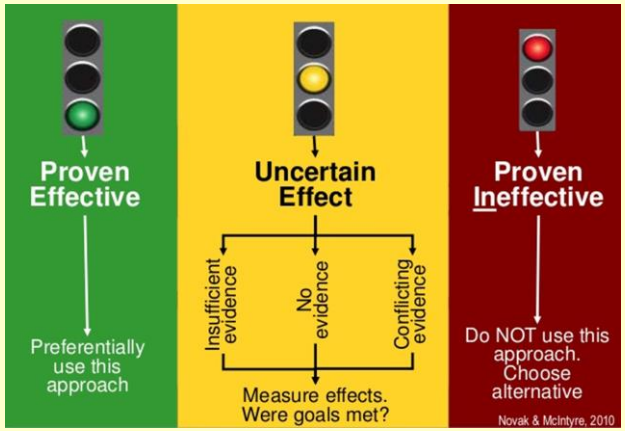

Proven Effective
Preferentially use this approach
Uncertain Effect
Insufficient evidence
No evidence
Conflicting evidence
Measure effects. Were goals met?
Proven Ineffective
Do NOT use this approach. Choose alternative
Novak & McIntyre, 2010



LEGEND: AFOs= Ankle Foot Orthoses; AT= Assistive Technology; BoNT= Botulinum Toxin; CIMT= Constraint Induced Movement Therapy; CO-OP= Cognitive Orientation to Occupational Performance; COPCA= Coping with and Caring for infants with special needs - a family centered program; DBS= Deep Brain Stimulation; GAME= Goals Activity Motor Enrichment; NDT= Neurodevelopmental Therapy; OT= Occupational Therapy; SEMLS= Single Event Multi Level Surgery; tDCS=Transcranial Direct Current Stimulation

Hippotherapy, Animal assisted therapy, and Hippotherapy simulation

- Balance, Symmetry : **Green**
- Gross motor function: Yellow
- Hand function: Yellow
- ↓Spasticity (H): Yellow
- Self care/function: Yellow



Randomized Controlled Trial > J Altern Complement Med. 2015 Jan;21(1):15-21.
doi: 10.1089/acm.2014.0021. Epub 2014 Dec 31.

Effect of hippotherapy on gross motor function in children with cerebral palsy: a randomized controlled trial

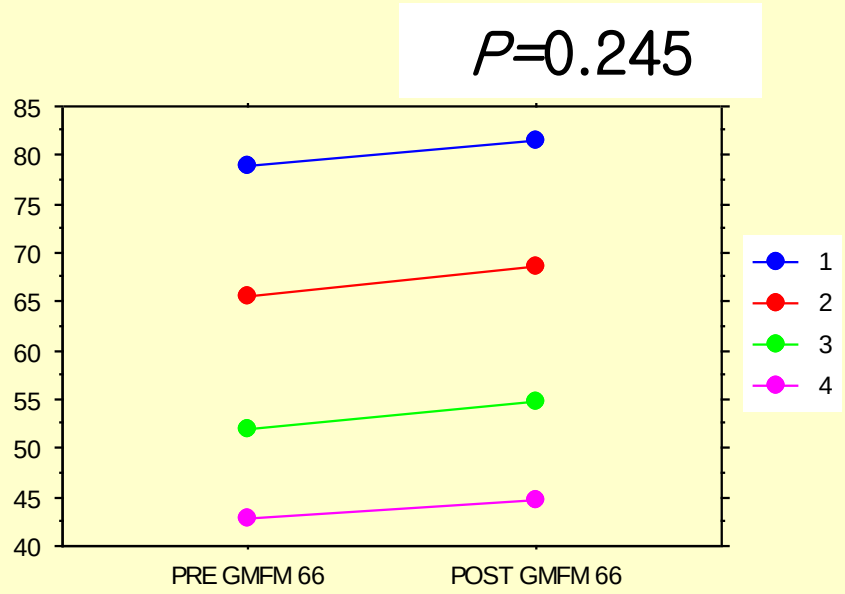
Jeong-Yi Kwon [1], Hyun Jung Chang, Sook-Hee Yi, Ji Young Lee, Hye-Yeon Shin, Yun-Hee Kim

Affiliations + expand

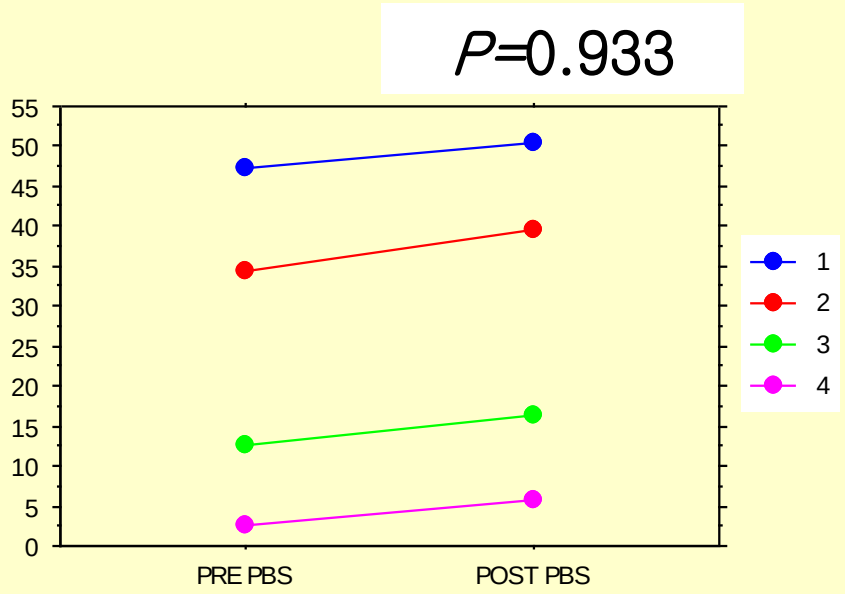
PMID: 25551626 DOI: 10.1089/acm.2014.0021

Interaction between GMFCS Levels

GMFM-66



PBS (Pediatric Balance Scale)



Differences in improvement on all three measures (GMFM-88, GMFM-66, and Pediatric Balance Scale) significantly differed between groups after the 8-week study period.

Dimensions of GMFM-88 improved significantly after hippotherapy varied by GMFCS level: dimension E in level I, dimensions D and E in level II, dimensions C and D in level III, and dimensions B and C in level IV.

Factors Influencing Motor Outcome of Hippotherapy in Children with Cerebral Palsy

Yeo Seung Mi[1] Lee Ji Young[2] Shin Hye Yeon[2] Seo Yun Sik[2] Kwon Jeong Yi[1]

[1] Department of Physical and Rehabilitation Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea
[2] Samsung Equestrian Team, Bugok dong, Gunposi, Gyeonggido, Republic of Korea

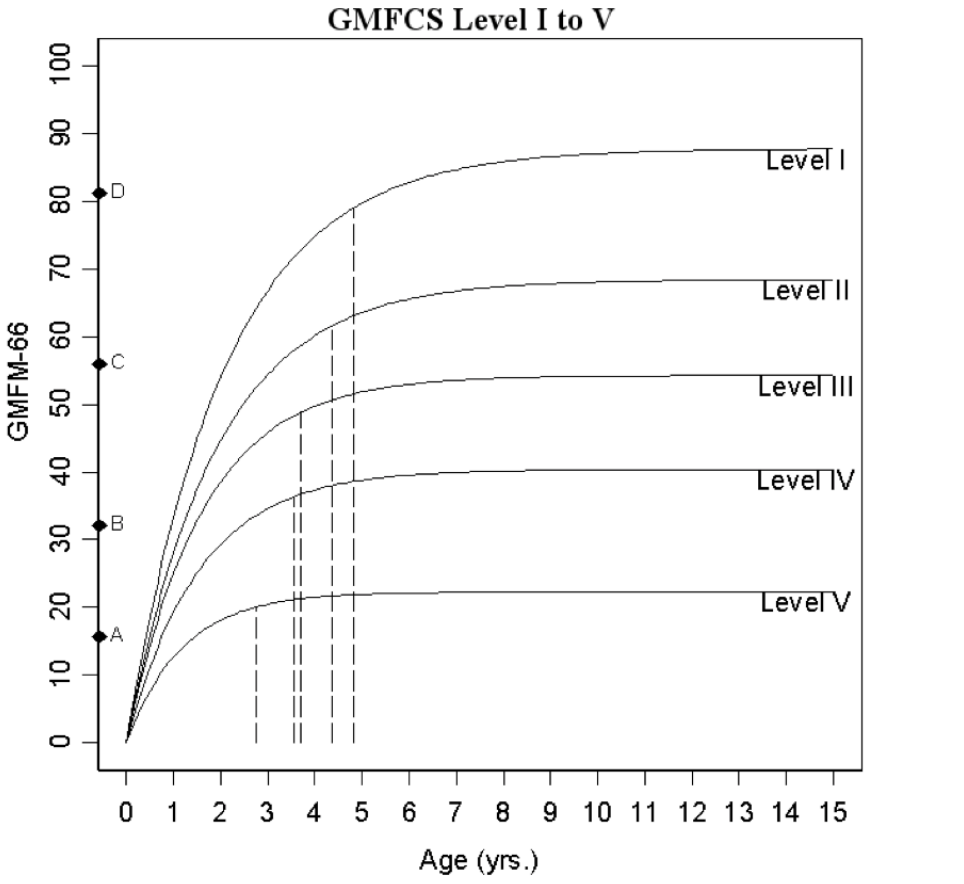
Address for correspondence Kwon Jeong Yi, MD, PhD, Department of Physical and Rehabilitation Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, 81 Irwon-ro, Gangnam-gu, Seoul 06351, Korea (e-mail: jeongyi.kwon@samsung.com).

Neuropediatrics 2019;50:170–177.

- The children with CP, GMFCS level I–III, with relatively poor postural control in sitting might have a greater chance to improve their GMFM-66 scores through hippotherapy. This supports the hypothesis that hippotherapy is a context-focused therapy to improve postural control in sitting

Sex, age, CP type, and distribution were not factors influencing gross motor outcome of hippotherapy.

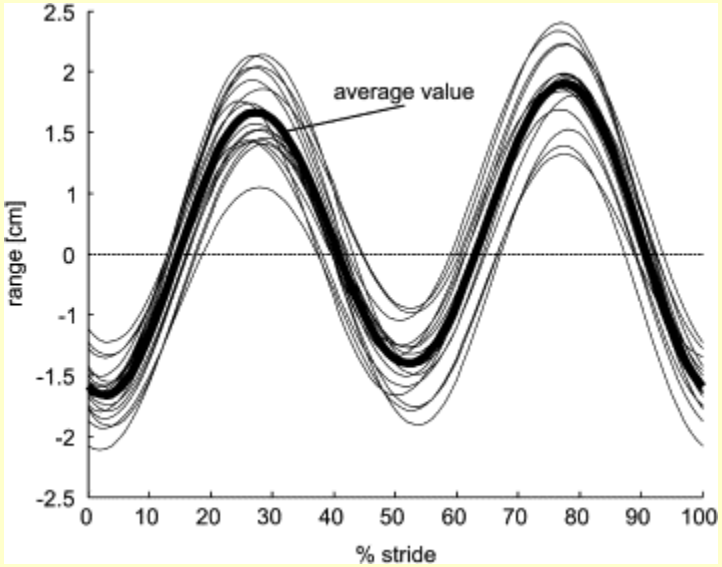
Hippotherapy can be an effective therapy for some school-aged children with little potential of further improvement in GMFM scores.



This graph shows the observed and predicted GMFM-66 scores for children in GMFCS Levels I through V. The curved solid lines indicate average performance. The horizontal dotted lines on the right of the figures indicate the band expected to encompass 50% of children's limits of development. The solid vertical lines indicate the average age-90 (the age in years by which children are expected to reach 90% of their motor development potential). The dotted vertical lines indicate the bands expected to encompass 50% of age-90 values around the average. The absence of 50% bands in level IV and level V indicates low variation in age-90 values.

Locomotor impulses are…

- "The effects of the movement of the horse while walking and are transformed in the body of the rider."
- 90 to 110 impulses a minute (1.5–1.8Hz)

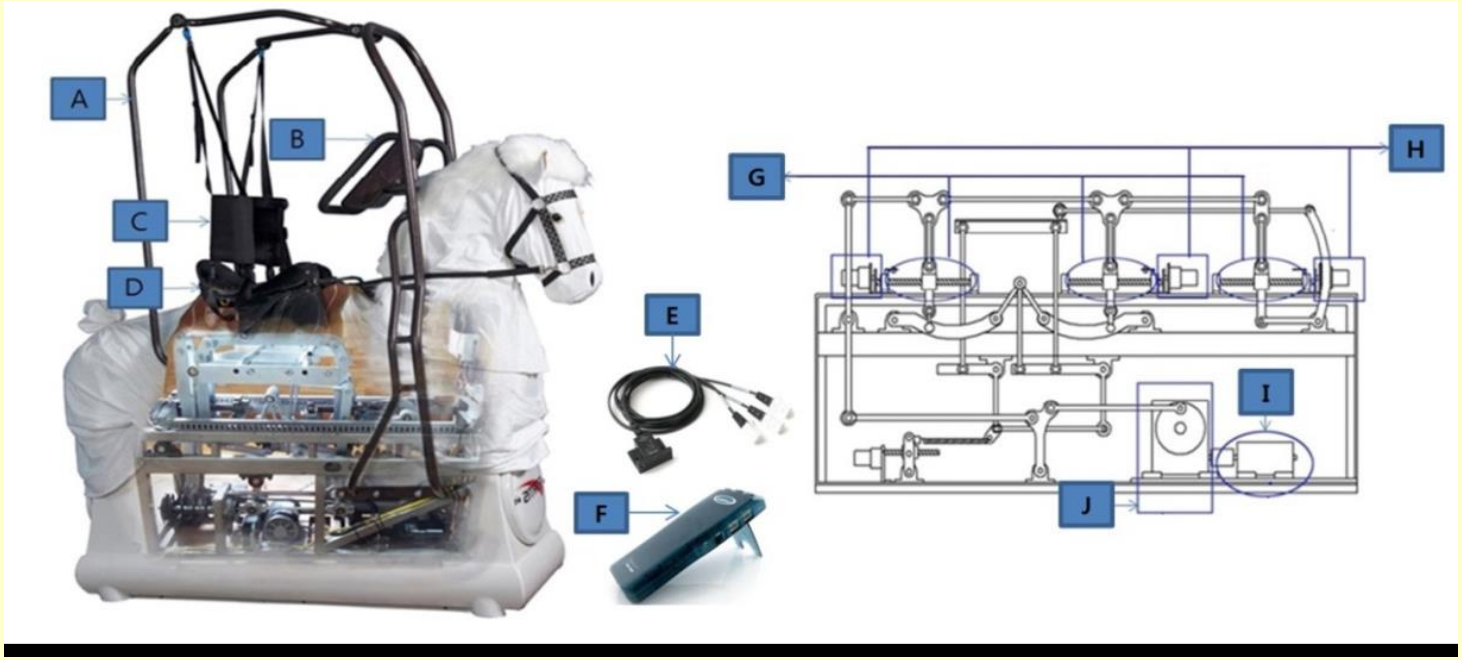


Children could have experienced approximately 2700 to 3300 repetitions of forced use postural challenge during 30-min riding

Janura M, Peham C, Dvorakova T, Elfmark M. Hum Mov Sci. 2009 Jun;28(3):387-93.

Comparison between the robo-horse and real horse movements for hippotherapy

Bio-Medical Materials and Engineering 24 (2014) 2603–2610



The mean resultant accelerations for a real horse and robotic horse were 3.22 m/s^2 and 0.67 m/s^2, respectively, accounting for almost five times greater acceleration in the real horse than the robotic horse.

Effect of EAAT

Physical

- Gait improvement
- Facilitating movement of the pelvis, lumbar spine and hip.
- Normalization of muscle tone
- Improving posture control
- Increasing endurance, symmetry, and body perception

Cognitive, Social-personal, Emotional

- Improving self-esteem
- Increasing self-confidence
- Improving concentration
- Improving communication skills
- Educational effects
- Improving peer relationships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ORIGINAL ARTICLE

Effects of Hippotherapy on Gait Parameters in Children With Bilateral Spastic Cerebral Palsy

Jeong-Yi Kwon, MD, PhD, Hyun Jung Chang, MD, MS, Ji Young Lee, PT, Yumi Ha, MD, Peter K. Lee, MD, PhD, Yun-Hee Kim, MD, PhD

Objectives: To evaluate the effects of hippotherapy on temporospatial parameters and pelvic and hip kinematics of gait in children with bilateral spastic cerebral palsy.

Design: Nonrandomized prospective controlled trial.

Setting: Outpatient therapy center.

Participants: Children (N=32) with bilateral spastic cerebral palsy, Gross Motor Function Classification System level 1 or 2.

Intervention: Hippotherapy (30min twice weekly for 8 consecutive weeks).

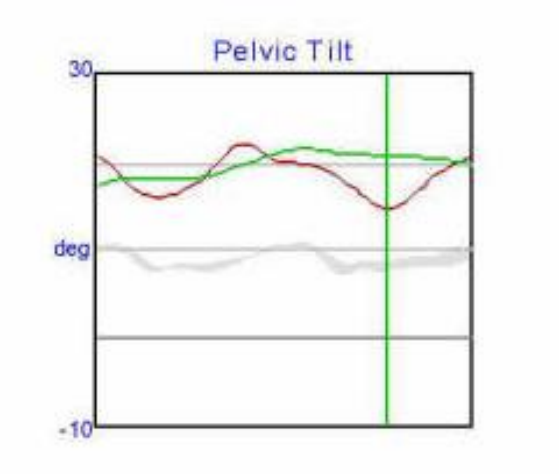
Main Outcome Measures: Temporospatial parameters and pelvic and hip kinematic parameters in 3-dimensional motion analysis, Gross Motor Function Measure (GMFM)-88, and score for dimensions D (standing) and E (walking, running, jumping) of the GMFM, GMFM-66, and Pediatric Balance Scale (PBS).

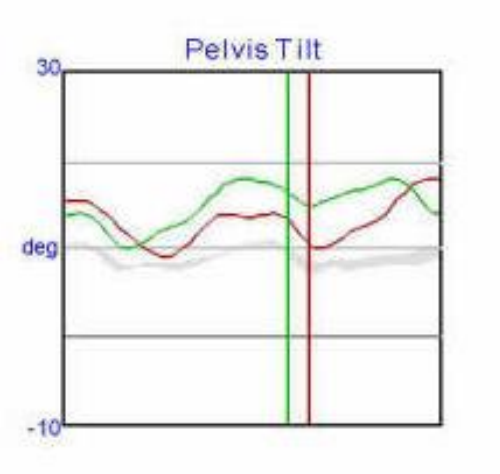
Results: Hippotherapy significantly improved walking speed, stride length, and pelvic kinematics (average pelvic anterior tilt, pelvic anterior tilt at initial contact, pelvic anterior tilt at terminal stance). Scores for dimension E of the GMFM, GMFM-66 and PBS also increased.

Conclusions: Hippotherapy provided by licensed health professionals using the multidimensional movement of the horse may be used in conjunction with standard physical therapy for improvement of gait and balance in children with bilateral spastic cerebral palsy.

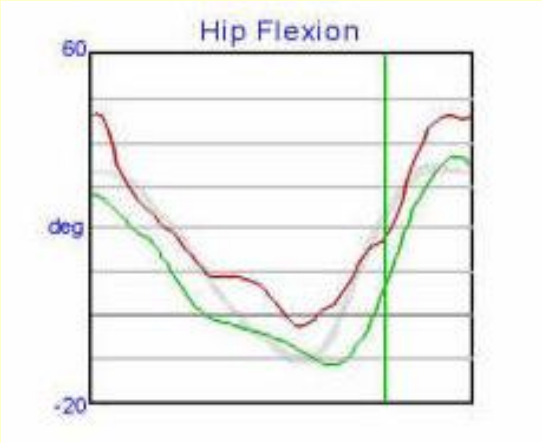
Improvement of Pelvic Anterior Tilt

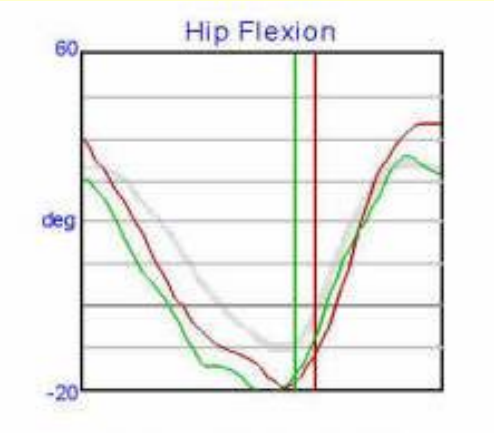
Pelvic tilt





Hip flexion





pre

post

Effect of Equine-Assisted Activities on Cardiac Autonomic Function in Children with Cerebral Palsy: A Pilot Randomized-Controlled Trial

In-Kyeong Park, MA,[1] Ji Young Lee, PT, MS,[2] Min-Hwa Suk, PhD,[3] Soojin Yoo, PhD,[4] Yong-Gon Seo, PhD,[5] Jea-Keun Oh, PhD,[6] and Jeong-Yi Kwon, MD, PhD[7]

Abstract

Objective: Children with cerebral palsy (CP) have an impaired cardiac autonomic function. Attenuated heart rate recovery (HRR), which is a valuable prognostic parameter for autonomic nervous system, is known to be associated with an increased risk of cardiovascular events and all-cause mortality. However, only few studies have observed the effects of exercise on the cardiac autonomic function in children with CP. The purpose of this pilot study was to examine the effects of equine-assisted activity (EAA) program on cardiac autonomic function in children with CP.

Design: A single-blinded, parallel, two-arm pilot trial with 1:1 randomization to the EAA or control group.

Setting: A tertiary university hospital and a local arena.

Subjects: Twenty-six children with CP (Gross Motor Function Classification System Levels I–II).

Intervention: Each lesson of the EAA program for the EAA group was conducted for 40 min twice a week, and the whole program duration was 16 weeks (a total of 32 sessions).

Outcome measures: A graded exercise test was performed to measure the resting heart rate (RHR), HRR, and peak oxygen uptake (VO_{2peak}) on both groups before and after the 16-week period.

Results: The autonomic nervous function measured by the response of HRR improved at 1 min ($p < 0.009$), 3 min ($p < 0.001$), and 5 min ($p < 0.004$) only in the EAA group. RHR significantly improved in the EAA group ($p < 0.013$), whereas the VO_{2peak} did not significantly differ between the two groups.

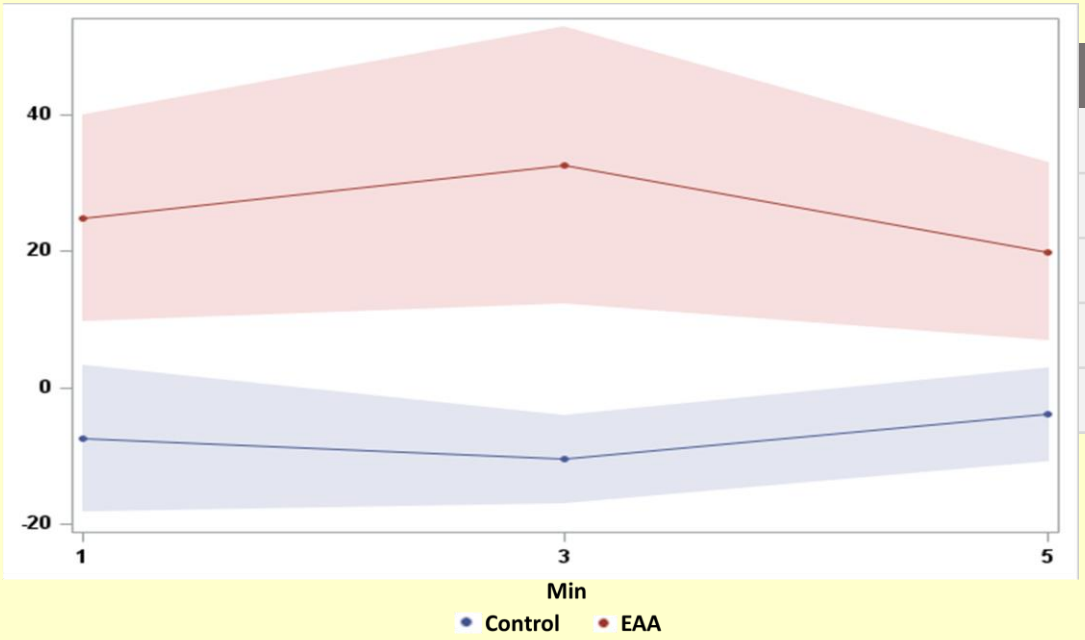
Treadmill

Electrocardiogram

Respiratory mask

***p<.001

Heart rate recovery



	Control	EAAT	*p*
Resting HR	0.75 ± 11.5	-11.01 ± 8.01	0.006 †
HR peak	1.1 ± 7.01	2.63 ± 8.44	0.620
HRR1	-7.46 ± 17.68	24.86 ± 24.99	0.004 †
HRR3	-10.51 ± 10.62	32.53 ± 33.63	0.002 †
HRR5	-3.88 ± 11.33	19.89 ± 21.67	0.008 †

Resting HR↓

Heart rate returned to the baseline level rapidly in EAAT group

Ahn *et al. BMC Pediatrics* (2021) 21:135
https://doi.org/10.1186/s12887-021-02597-0

BMC Pediatrics

RESEARCH ARTICLE Open Access

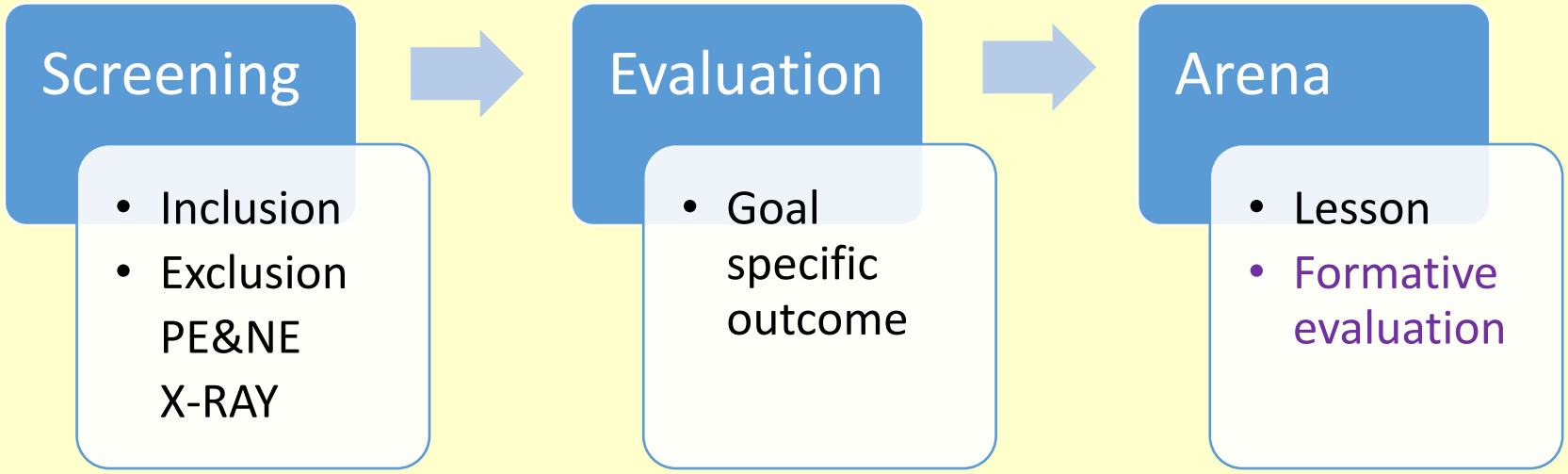
Effects of equine-assisted activities on attention and quality of life in children with cerebral palsy in a randomized trial: examining the comorbidity with attention-deficit/hyperactivity disorder

Bomi Ahn[1], Yoo-Sook Joung[1*], Jeong-Yi Kwon[2], Dong Ik Lee[1], Soohwan Oh[1], Byoung-Uk Kim[1], Jung Yoon Cha[1], Ji-Hae Kim[1], Ji Young Lee[3], Hye Yeon Shin[3] and Yun Sik Seo[3]

- Children with CP in the exercise group were more capable to sustain their attention longer.

- Those with CP and ADHD showed an increase in attention and perceived to have better social skills after receiving 16 weeks of EAA compared to those in the control group.

Process in SMC



The Screening Tool for Equine Assisted Activities and Therapies in Children and Adolescents : A Convergence Study with the Delphi Method

Journal of the Korea Convergence Society Vol. 9. No. 5, pp. 203-218, 2018

- **Prerequisites for executing the EAAT**
  - Able to wear a protective headgear that is certified for equestrian use from ASTM-SEI or other equivalent international bodies
  - The combined weight of the equipment and participant does not exceed 20% of the equine's weight
  - Able to control one's head and neck position

Contraindications (20 items)

- If cardiopulmonary diseases cause an excessive challenge to do horseback riding
- Hemorrhagic disease such as hemophilia
- Uncontrolled seizure or a recent change in frequency/aspect of seizure
- Cranial defects
- Extreme behaviors that make participation in the equine environment unsafe
- Non-union fracture
- Major surgeries within 3 months such as tenotomy, osteotomy or selective dorsal rhizotomy
- Atlantoaxial instability
- Fragile bones such as achondroplasia, osteogenesis imperfecta or osteoporosis
- Long bone tumors or spine tumors
- Complete spinal cord injury above T-6
- Severe spine curvature or joint contracture that hinder upright posture on the saddle or any risk of aggravation of these conditions after horseback riding

Contraindications (20 items)

- If the allergic reaction from the equine environment is significant enough to cause a loss of function or discomfort in other environment, and access to emergency care is not available
- Decreased function, sustained fatigue or pain after horseback riding
- The use of T-cannula
- The use of Foley catheter
- No appropriate size of the helmet or equipment for a participant
- In case skin damage or lesion on weight bearing surfaces that come into contact with equipments
- If a degree of the potential risk exceeds its latent advantage in horseback riding and when the information is inadequate to make decision to start horseback riding
- If a physician in charge cautioned not to do horseback riding

Novelty Effect

- Novelty effects refer to the elation and energy that ensue from a new and exciting experience (Shadish et al., 2002).

- Equine approaches are especially vulnerable to novelty effects because interacting with a horse is probably an unusual and exciting experience for most individuals.

Experimenter Expectancies

- When an experimenter is not blinded to the participant's condition, experimenter expectancies become plausible concerns

- An additional concern regarding the role of experimenter bias focuses on the subjective ratings of treatment outcome completed by therapists in many of these studies