Multisensorial stimulation in a vertical standing for visually impaired kids with CP

Martino Avellis PT - Ormesa srl , Foligno (PG), ITALY

Viviana Baiardi PT, Elisa Da Riva PT, Giovanna Tono PT, M.E. Reffo PhD
Robert Hollman Foundation, Cannero Riviera (VBO), Italy

Introduction

In many clinical descriptions of children affected by CP, we have to face visual impairments or blindness, with sensory deprivation and difficulties in the psychomotor area. The children with multiple disabilities and visual impairment have special needs because:

- they often undergo sensory stimuli from the outside world;
- it is difficult for them to adapt themselves to the stimuli and when they can, they can do it with inadequate modulation;
- the repertoire of movements is poor and not very functional;
- often closeness and repetitiveness are reinforced.

So, with these characteristics the postural care and postural choice become more important.

Kids affected by visual impairments find it particularly hard to keep an upright posture even with the aid of vertical stabilizers; this makes it more difficult for them to improve their trunk/head control and lower limbs loading. Their perception of motion and of their own bodies is also often altered. The multisensorial stimulation could be really important for visual impaired or blind kids to give them an experience of sensory perception and improve their compliance.

Materials and Methods

A group of 10 kids affected from CP as well as Dysmetabolic or Genetic Syndrome and visual impairments was involved in the Robert Hollman Foundation, an Italian and Dutch Foundation for caring kids with blindness as well as visual impairment in Cerebral Palsy.

We used the APP Multisensorial Standing for the trials, which is a vertical stabilizer that provides a sensory stimulation while the subjects keep the standing position.

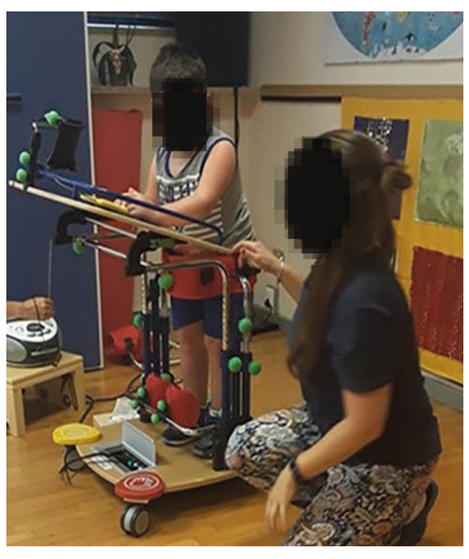
The multisensorial standing has an electronic hardware placed under the footplate that can be connected to devices (e.g., tablet, smartphone, PC, radio...) which provide to the kid audio and visual stimulation (if there's a screen or a monitor), while spreading the vibrations produced by the sound in the whole frame.

The age range was from 21 up to 48 months. The subjects group was splitted in two sub groups, according to these inclusions criteria:

- Children treated at Robert Hollman Foundation.
- Visual impairment with visus less of 2/10.
- Cerebral Palsy as well as other kind of pathologies with low psyco-motor skills (GMFCS II-V) and for all of these subjects the common denominator was CVI (Cerebral Visual Impairment).

In the sub groups were involved 50% males and 50% females.

Our aim was to analyze the differences in compliance, attention, motivation, gratification and performances between the two configurations (just with audio and with audio/pallestesic stimuli).



Each kid could handle a big switch (on/off) put on the standing's tray for six minutes; the switch was connected to a radio or tablet device, (turning on and off the radio depending on their feelings); if the subjects were unable to press the switch by themselves, we helped and assisted them. After that, the radio was connected to the Multisensorial Standing hardware, in order to produce, beside the audio stimuli, also the vibratory feedback. We looked at how many times the kids activated the switch, for how long time and how was their compliance.

Results

The data obtained showed that when the subjects were submitted to a whole sensory experience (with audio AND pallestesic stimuli), they decreased the numbers of switch activations, leaving for a longer time the switch enabled.

	MUSIC		MUSIC AND VIBRATION	
Group 1	SECS WITH HELP	SECS SELF	SECS WITH HELP	SECS SELF
B1	95	0	115	0
B2	14	22	36	29
B3	0	169	0	151
B4	0	114	0	197
B5	24	130	44	124
Group 2	SECS WITH HELP	SECS SELF	SECS WITH HELP	SECS SELF
B1	0	123	30	155
B2	0	319	26	215
B3	0	255	0	264
B4	0	30	0	158
B5	60	156	0	96
Average per secs	19,3	131,8	25,1	138,9
Delta%			30%	5%

The kids left the switch activated for a longer time, up to 30% more with the multisensorial stimulation configuration than with the simple audio stimulus, improving their compliance, too. It seemed that they wished to extend as much as possible that nice time.

Most of the children improved the awareness, alertness and the personal acceptance by adding the vibrations as stimulus with the music, showing this through smiles and vocals. Some of the subjects, beside vocals, tried to hold the beat and rhythm with the hands.

The more we proposed known songs and music, the better results we achieved. For most of the subjects the head control improved and some of them asked (through vocals) to have again the vibratory stimulus, so, even the feedback and the compliance were good for the kids.

Conclusions

Almost all of the visual impaired kids showed a better compliance holding the upright position for a longer time and with better awareness.

Clinical Relevance

This kind of stimulation during the upright position can improve the sensory perception, besides enhancing their motor skills (head control and handling tasks).

References

1. Sílvia Leticia Pavão, Fernanda Pereira dos Santos Silva, Geert J Savelsbergh, Nelci A C F Rocha (2014) Use of Sensory Information During Postural Control in Children With Cerebral Palsy: Systematic Review - December 2014 Journal of Motor Behavior 47(4):1-11 - DOI: 10.1080/00222895.2014.981498 – PubMed
2. Wang TH, Peng YC, Chen YL, Lu TW, Liao HF, Tang PF, Shieh JY. (2013) A home-based program using patterned sensory enhancement improves resistance exercise effects for children with cerebral palsy: a randomized controlled trial. Neurorehabil Neural Repair. Oct;27(8):684-94. doi: 10.1177/1545968313491001. Epub 2013 Jun 10
3. Ego A, Lidzba K, Brovedani P, Belmonti V, Gonzalez-Monge S, Boudia B, Ritz A, Cans C. Visual-perceptual impairment in children with cerebral palsy: a systematic review. Dev Med Child Neurol. 2015 Apr;57 Suppl 2:46-51. doi: 10.1111/dmcn.12687. PMID: 25690117 Review.

Thanks to all the team involved in the study and to the Robert Hollman Foundation

ORMESA®
• MADE IN ITALY SINCE 1980 •
ormesa.com

Walk and grow up!
The influence of gait on cognitive development

Martino Avellis PT - Ormesa srl , Foligno (PG), ITALY

Introduction

When we think of an activity like walking, we think of something dynamic and our attention keeps focus on biomechanical issues Therefore, when faced with any problem regarding walking in early intervention, we usually consider pattern, stability and balance. By its nature the posture is a continual oscillation around the desired attitude. The external torques tend to disrupt this “idle state” and determine a series of small adjustments to bring the body into the balance condition; the internal torques deliberately change the “state of balance” and result in a series of small movements.

However, there is a range of non specific movements that can influence heavily the posture like strong spasticity, dystonia, athetosis, corea, etc.

In CP, the physiological mechanisms of the gait pattern are often altered. When patients are affected by spasticity, dystonic patterns, sensory disturbances, tendons retractions, or structured deformities, we can observe, in their behaviour, the occurrence of internal compensations (kinematic and/or postural changes). Usually, if the patients need it, we can provide them with external compensations (orthosis and/or technical aids). So, in our mindset, technical aids provide the kids with the biomechanical support that they need in order to compensate the missing skills.

However, we have to consider the differences between kids and adult patients. The first are still growing up: they associate work with “fun”, and their self-esteem is a “work in progress”. Adults, on the other hand, are mature individuals, with a consolidated self-esteem, and hearing the word “work” they immediately think about their jobs.

Materials and Methods

Several authors pointed out the correlation between the motion/locomotion and the cognitive development, which can depend from:

- Spatial perception
- Depth visual perception
- Initiative
- Social factors
- School performances

The spatial seeking and the object permanence start with the increased vivacity and expressiveness; they represent, for the newborns, the first experience of movement and locomotion (for children affected by neurological diseases) make easier the development of these capacities. Allowing walking with a proper gait trainer can help to develop this skill, because moving in safety allows the kids to improve spatial exploration experiences (Kermoian & Campos, 1998).

The depth visual perception is another important step for cognitive development: it’s not present at the birth, since it develops from the 4thmonth of age. It allows to wide the spread of the visual field, essential for the motor experiences and movement (Berenthal, Campos & Kermoian, 1992).

The lack of initiative makes the kid passive and totally dependent. The effects could be negative even at long term due the lack of curiosity and difficult in planning and target reaching. The movement and motion make easier the initiative (Butler, 1991).

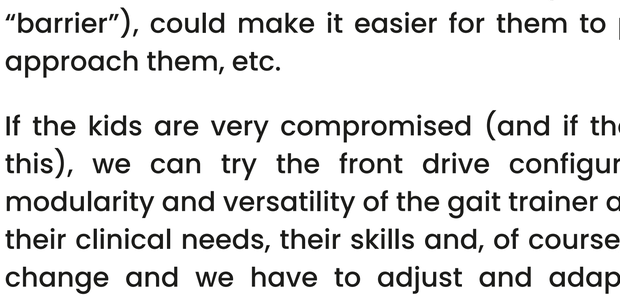
The lack of initiative makes the kid passive and totally dependent.

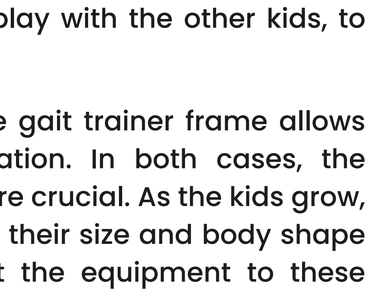
The effects could be negative even at long term due the lack of curiosity and difficult in planning and target reaching. The movement and motion make easier the initiative (Butler, 1991).

Antoniuk & Cooper (2010) describe how children with lacking independent mobility are more passive; they don’t develop psychologically or motorically when the movement experiences are not his own, i.e., his movement experience is through being carried, pushed in a chair, transferred and passively positioned.

Stimulating as much is possible movement, for this reason, is really important.

That’s why it’s so crucial to choose the proper gait trainer and the proper layout, according to the clinical needs of the users. In particular, it is really important that the kids’ posture is well stabilized during walking. This means that we need to focus on the balance of the pelvis (does the pelvis shift on the frontal plane or not?), on the position of the center of gravity (should the trunk move backward or forward?) on the length of the steps length (should the hips move more in flexion or extension?). All of this is only possible if the gait trainer is adjustable and complete. How? For example, offering to the users different configurations (both front and rear drive) as well as different components.





Conclusions

But as we choose the right configuration, we should also keep in mind that a gait trainer can provide an opportunity to improve the cognitive skills of the kids. In some cases, for example, we could propose the rear drive version, which especially favours social interaction, because the absence of a frame in front of the kids (something that can seem like a “barrier”), could make it easier for them to play with the other kids, to approach them, etc.

If the kids are very compromised (and if the gait trainer frame allows this), we can try the front drive configuration. In both cases, the modularity and versatility of the gait trainer are crucial. As the kids grow, their clinical needs, their skills and, of course, their size and body shape change and we have to adjust and adapt the equipment to these changes, focusing on our main main goal: offering the kids the best possible quality of life.

References

1. Kermoian R., Campos JJ., (1988) Locomotor experience: a facilitator of spatial cognitive development Child Dev. Aug;59(4):908-17
2. Paleg G., Livingstone R. (2015) Outcames of gait trainer use in home and school settings for children with motor impairments: a sistematic review Clinical Rehabilitation Vol. 29 (11), 1077-1091
3. Marrus N, Eggebrecht AT, Todorov A, et al. (2018) Walking, Gross Motor Development, and Brain Functional Connectivity in Infants and Toddlers Cereb Cortex. Feb 1;28(2):750-763
4. Wright-Ott C. (2018) Walking to Learn: The Power of Support Walker Mobility The 34th International Seating Symposium, Vancouver (CAN)
5. Campos JJ., Bertenthal B.I., Kermoian R., (1992) Early Experience and Emotional Development Psychological Science, Vol. 3 (1), 61-64
6. A.Ferrari, G.Cioni (2010) The spastic forms of Cerebral Palsy. A guide to the assessment of Addaptive Functions