Original Article

The podalic proprioception channel to increase motor skills in blind children: Operational applications

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ABSTRACT

Most blind children, in particular those who have congenital blindness, require specific motor work programs to acquire autonomous movement. As highlighted by numerous scholars, orientation and mobility are acquired by blind children through gross motor activities such as playing. It is therefore essential that children with visual disabilities know their own bodies, topological concepts, lateralization, along with having auditory, tactile and olfactory skills as well as postural control. All this is made possible through the progressive increasing of their different skills, such as the coordination of their movements, discrimination of sounds, noises and smells, knowledge of the surrounding environment, as well as the ability to carry out sequences of movements and have the ability to move. This study aims to analyze the potential that podalic proprioception exercises can have on visually impaired subjects, by adopting a specific motor program that is used with able-bodied subjects, with the aim of demonstrating how the perceptual implications can also improve the quality of life of blind subjects. **Key words:** VISUAL IMPAIRMENT, MOTOR SKILLS, PROPRIOCEPTION, LEARNING, PLANTAR SUPPORT.

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INTRODUCTION

Blind children manifest significant orientation deficiencies in the environment and movement in space.

It has been pointed out how many visually impaired children have the tendency to have a few body rigid postures and defend themselves when faced with unfamiliar postures (Brambring, 2004).

In learning various forms of movement, visual feedback plays an important role. It allows for a control and constant adaptation of proprioceptive and kinesthetic information and leads to an automation of motor behaviours. The lack of this feedback involves a certain slowness in automating the movement patterns (Millar, 1994).

Blind children also seem to show a certain slowness in the development of manual activity and hearing-hand coordination as well as problems with the primary and exploration activities due to the lack of “visual guides” of movement and locomotion.

For this reason, the preparation of each type of intervention could prevent the occurrence of delays in particular developmental areas of the subject.

It might, therefore, be useful to develop an adjustment program to increase the forms of sensitivity and complementary exploration in blind subjects, promoting the quality of analysis of information coming from the outside, consolidating independent locomotion and allowing for the correction of inappropriate postures, that are unfortunately determined by the lack of visual control.

OBJECTIVE

The research aims to investigate the potential that podalic proprioception has on blind subjects, demonstrating how a more detailed perceptual involvement of this anatomical structure can effectively improve the quality of life of the individuals concerned.

It is proposed that an adequate podalic sensitization, in particular related to the conscious and controlled management of the contact with the ground, not only naturally commits and stimulates the nerve endings of the foot as well as the related physiological responses, thus activating cellular interactions in other nearby parts of the body, but also contributes to spreading overtime a more mature and improved awareness of one’s body in the surrounding space (Gallozzi, 2009).

It is well-known how the larger the surface of the body concerned with the inspection of the surrounding world and to discovering new sensations is, the greater the use of the afferent-efferent system in the development of new emotions is (Newell, 1991), experimenting and arousing sophisticated and different learning abilities in the individual.

The objective is to develop an adaptation program designed to recruit and increase complementary forms of exploration and sensitivity, useful and different from the qualities of distinction and detection that in cases of blindness are naturally amplified (Borserini, 2014).

It, therefore, adds to the auditory, olfactory, gustatory and tactile senses, concomitant and synergistic abilities, integrating, promoting and enriching the quality of the analysis of the information coming from the outside, disseminated and generated by the numerous elements and varied situations that surround and occur around us.

METHOD

The work program consists of an established formula that is part of the infant motor activities carried out with able-bodied children, based on a progressive exercise protocol involving a targeted increase of the difficulty.

The principle of application is in accordance with the learning abilities and kinematic qualities that young learners are able to guarantee, by implementing the steps of advancement of the challenges, when they show physical signs of improvement of the previously developed exercises (Pistoni, 2012).

Since playing and movement are the forms of maximum expression through which children offload their tensions in a natural way as well as reveal their bio-motor status and bio-physical conditions (Perrucca, De Canale, 2012), the motor project will be proposed under the form of playing and aimed at subjects aged between 6 to 12 years. 12 years old is the upper age limit within which children conclude their motorial learning. This means that from that moment, in the absence of any cognitive or socio-emotional deficits, the subject has acquired all the skills necessary to relate fully, through his own body, with the surrounding reality (Le Boulch, 1979).

It is therefore possible to recognize the twelfth year as the connecting link between the age of childhood and adolescence, entering the final stage of cognitive development, which will continue until adulthood (Le Boulch, 1975).

The last two-years of infancy are defined as operative-concrete, in which children develop the *representative* (mentally retrace the actions stored by comparing them with the final status of an event), *reversibility* (ability to mentally retrace the action returning to the initial situation) and *compensation* (decentralize their thoughts compensating for variances occurred) abilities (Vayer, P. 1987).

The exercises organized and divided by virtue of their characteristics, will constitute the body of the motor program, which, in a preordained and sequential order will progress towards increasingly elaborate and complex dynamics. The motor program modules aim to achieve the following objectives:

- Module 1: learning how to place the foot on the ground while standing still and sensitizing the body to the surrounding space with the principles of static destabilization.
- Module 2: application of the principles associated with ambulation, gait techniques and postural control with low intensity movements.
- Module 3: dynamic gait exercises to improve coordination and postural control with quicker movements.

It will be the teacher’s task, through his communication skills, to describe in a simple and direct way the positions that the body must assume, so that the postural input gives the appropriate feedback to automate and harmonize the motor patterns. This specific aspect is connected to the future potential for interaction of the young subjects with the outside world, by means of which, through the degree of motility and corporal expression constructed during the psychomotor training process, they will enjoy socialization skills and relationships with other individuals as well as the surrounding spaces in a less uninhibited and more pleasant way (Le Boulch, 2009; Pesci 2012).

APPLICATIVE MODULES

• **module1)** ***learning how to place the foot on the ground while standing still and sensitizing the body to the surrounding space with the principles of static destabilization***

This is the stage where useful exercises are provided to improve the contact and feelings of the foot with the ground. These basic principles are the basis of the inputs that imprint a healthy alignment of the body segments in relation to the perpendicular axis (foot-pelvis-shoulder-head (Pistoni, 2012.) The exercises will be proposed while still, through a playful strategy and with the use of various tools such as balls, wheels, sticks, through which children can learn the basic concepts of the *"triangle of the foot"* and the *"trapezoidal stance"* (Selby, Herdman, 2000), learning to distinguish the different types of placing the foot (with tips, with the plant, with the heel) and skillfully maintaining balance with respect to the surrounding space. The subsequent steps covered in the same module, relate to the movement of the upper limbs and trunk in the direction of the three-dimensional movement planes. This leads to the destabilization of the body and intensifies the neuromuscular tensions so as to maintain the posture under more difficult and different conditions (Pistoni, 2012). Upon refining these qualities, it will be possible to combine the use of the lower limbs. This implies the use of mono-podalic contact as well as getting used to more demanding structural stresses, which remain in spite of natural load and therefore adapted to the potential of children and determine substantial elevations of the operational complexity. In the final part of the module, the subjects carry out balancing exercises, walking on different surfaces and proprioceptive equipment (anatomical, elastic, soft platforms) so as to develop more advanced vestibular abilities.

• **module 2)** ***application of the principles associated with ambulation, gait techniques and postural control with low intensity movements***

During this stage, the motor process assumes is dynamic, focusing on learning ambulation skills. The light and delicate intensity of the actions through which each movement is carried out allows the subjects to acquire a valid command of the body in motion. The educational approach focuses on the assimilation of the fluid pitch alternating cycle (Bisciotti, 2003) as well as the subjects' ability to maintain the proper alignment of the torso and head in relation to the locomotor region while walking. The acquisition of a coordinated and opposed action of the upper limbs to the lower limbs is one of the focal points of the educational program (Pistoni, 2002). The following steps include gait exercises so as to further refine the kinematic qualities of children and increase their safety while walking normally. It is also worth highlighting that due to their functional characteristics, all the exercises described so far, included in both modules 1 and 2, produce in the subjects a natural load strengthening of the phasic and toned muscles. In particular, these tasks are reflected in central support chains of the body, by means of the stress of the stabilizer muscles which govern posture (Pistoni 2015; Muehlbauer et al. 2013).

Thanks to the strengthening of the core, which unequivocally contributes to the proprioceptive progress of the children, the motorial project hopes that the subjects, upon completing the two modules, acquire an automation of some appropriate behavioral attitudes, namely: maintaining an erect posture that respects the right physiological curves as well as a safe and comfortable posture during walking. These prerogatives positively affect the individual's emotional sphere, increasing his exploratory curiosity and self-esteem.

• **module 3)** ***dynamic gait exercises to improve coordination and postural control with quicker movements***

The third module with its operational sequences is aimed at individuals who have acquired an acceptable movement ability. The exercises are remarkably dynamic. It is no coincidence that the term – dynamic – although not entirely appropriate, is intended to indicate something that moves quickly. It is precisely the characteristic of speed that makes the exercises more difficult and challenging, especially in relation to the ability to maintain the body stable during the actions. It is worth mentioning the importance that the educator plays in this ongoing project, regarding the teaching skills of the concepts contained in the program and how to teach the students in the application of biomechanical principles in a pragmatic way (Novak, 2001).

The burden and implicit liabilities of the teachers prove extremely important and critical to maintaining intact the desire of the subjects to experiment and try new increasingly difficult and demanding challenges. At this point, the exercises are all characterized by an aerial phase, with it allowing for a relatively long moment of flight, reasonably lasting, which is very similar to the dynamics of running. The evidence is macroscopic: the propulsion expressed through the feet is greater than that manifested in the exercises during the first two modules. In the automation of normal walking, there is a unquestionably smaller space between the feet and the contact time with the ground is reduced, while in the last module, the thrust is more energetic, reactive and elastic. It shows how, the kinesthetic steps that govern gait, intensify, develop, modify, and are conducive to learning more sophisticated locomotor praxis, almost being able to run and control at the same time their body at relevant intensities (Pistoni, 2004).

USE OF TECHNOLOGICAL EQUIPMENT

During the setting up of the project, it is proposed to use some technological equipment, making it possible to collect the information about the subjects more analytically and reliably. Personal specifications to be introduced as individual data in the observation grid and possess evaluation parameters over time. Considering that the subject are blind children, it is worth taking into account that maintaining balance is already heavily compromised by the lack of the visual system and the natural references for the proper postural alignment remain entrusted to the somatosensory and vestibular systems (Winter, Patla & Frank, 1990). Every detection, even if minimum, can be crucial in achieving the wellbeing of the children. Sophisticated aids will support the attentive eye of the educator, assisting and improving the interpretations of the movement analysis, with them being capable of capturing even microscopic details. A *force* platform will be used, with it providing an *baropodometric* assessment (Bruscoli, 2015) based on the quality of placing the feet on the floor. The technological aid investigates possible pressure changes while walking and highlights any functional deficits of the subjects. The images transmitted during the *posturographic* examination could also be of interest, by means of which the operators can control the posture and structure of the subject, highlighting any postural abnormalities over time, making it possible to modify any imbalances while moving. The use of the *darthfish* software further improves the movement analysis, with specially stationed cameras, which allow for a real-time assessment and, in particular, to study on video the performance of the subjects. This system makes it possible to access the recording by means of the *rewind procedure* of each motor act, allowing to carefully study the alignment of the body segments thanks to the *slow motion* mode, while also including the optional *motion capture*, which is useful for further study and focusing on the condition of the subjects, providing highly accurate measurements, and offering undoubtedly reliable reports.

CONCLUSION

Due to its structural characteristics and proprioception qualities, the foot acts as a fulcrum and mediator for each locomotor activity (Pistoni, 2003), with movement being the main way to express oneself, communicate and understand (Canevaro, 2007).

These considerations lead to implementing a motorial project that produces an improvement in the proprioceptive capacity of the foot, with it having a positive influence on the daily habits of blind children and improving their quality of life.

Learning how to walk properly leads to healthy body control in space, increases the safety and self-esteem in individuals, while also ensuring the formation of a person's social availability (Pertica, 1996).

The individual aware of his possibilities, together with a firm and decided behaviour, is therefore facilitated in interpersonal relationships and exploring the surrounding elements. This project applies methods useful for creating walking models to be used more intensely than normal walking. Learning these techniques is important for inclusion and belonging within peer groups. A mature and capable attitude is seen as an index of consideration and appreciation, therefore, no longer as deficits to be pitied, but as a limit to comply with and accept. In fact and what would be the most welcome milestone, the blind should be appreciated for their different abilities and compared by their individuality, in the same way and at the level of every other child. It is therefore no coincidence that inclusion in sports clubs and other contexts where there are numerous members strengthen the spirit of social cohesion, insertion and inclusion. This highlights how movement education can have a positive impact on the lifestyle of blind subjects, exalting the attentive quality and the elaboration processes of the information that have a central role in the formation of personal identity (Toffano, Martini, 2004).

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