Dear Editor,

Postural Reactions: An Elementary Unit for Development of Motor Control

The early motor behaviour of a child is influenced by the presence or absence of primitive reflexes. Primitive reflexes, upon which all other functions stand, are the first neurological functions to develop. Originating in the Central Nervous System (CNS), they are actions exhibited by normal infants in response to particular stimuli. Motor development has its beginnings in reflexive movement (Zafeiriou, 2004).

A reflex is an automatic movement performed without conscious volition and is usually initiated by sensory stimulation. As a building block of movement, it provides the first change in the distribution of muscle tone. Reflexes are essential for the development of head control and muscle tone, as well as sensory and motor development. Failure to appear at the appropriate age, or to persist beyond a certain age, implies some abnormal functioning of the nervous system.

As higher centres of the CNS system mature, reflex activity evolves into volitional movement, and the reflexes become integrated at anticipated times during the first year of growth. They never totally disappear however, and may emerge when the system is stressed. By four to six months of age, most primitive reflexes integrate/ modify and no longer evoke a stereotyped response. With developmental maturation of higher neural structure, the primitive reflexes become inhibited, diminished, integrated and postural reactions emerge.

Postural reactions are maturational motor skills that develop during the first year of life and form the basis for attainment of functional motor skills. These reactions automatically provide for maintaining the body in an upright position through changes of muscle tone, in response to the position of the body and its parts. Postural reactions respond to more global stimuli than primitive reflexes and last for a lifetime, in order to support movement and balance (Zafeiriou, 2004).

Cerebral palsy is a common cause of childhood physical disability and is characterised by weakness, poor selective motor control and abnormal motor sequences and synergies, resulting in absent or poorly developed postural reactions. This affects postural control and normal motor development. Cerebral palsy is a common problem, the worldwide incidence being 2 - 2.5 per 1000 live

births (Brogren et al, 1996). In the developing world, the prevalence of CP is not well established but estimates are 1.5 - 5.6 cases per 1000 live births (Mutch et al,1992; Brogren et al,1996; Donker et al, 2008).

In children with cerebral palsy, postural reactions have been reported as being either absent or poorly developed, affecting postural control and motor development (Brogren et al,1996; Brogren et al,2001; Donker et al,2008). The abnormal interaction between three systems - somatosensory, visual and vestibular - is believed to be the cause of abnormal postural reactions. The localisation of dysfunction within either sensory organisation or muscle coordination mechanism which affects development of postural reactions, has also been reported. Various researchers have considered the assessment of postural reactions as an important tool to assess the integrity of CNS in children with cerebral palsy. Postural reactions include righting reactions, equilibrium reactions and protective reactions.

Righting reactions support positioning of the head vertically in space, alignment of head and trunk, and alignment of trunk and limbs. Both head righting - which aligns the eyes with the horizon and the head with the trunk, and body righting - which contributes to movement around the body axis, are necessary to assume anti-gravity positions.

Equilibrium reactions provide balance when the centre of gravity is disturbed. They are more mature responses to regain balance than righting reactions, and include counter-rotation of the head and trunk away from the direction of displacement, and the use of the extremities. Higher centres of CNS have to mature for equilibrium reactions to develop. This begins at approximately 6 months and matures around the age of 4 years.

Protective reactions are required to prevent injury if the equilibrium reactions are unable to restore balance. Protective reactions emerge first to the front, then the side and then backwards.

Assessment of postural reactions can be done on a newly developed assessment system, the Postural Reaction Score Sheet, that has three components - Righting Reaction, Protective Reaction and Equilibrium Reaction. Righting reaction component consists of 6 subcomponents, viz. Righting Reaction Prone, Righting Reaction Lateral, Righting Reaction Flexion, Neck Righting on Body, Labyrinthine Righting and Optical Righting. The scoring is done on a 7-point ordinal scale. Protective reaction component consists of 4 subcomponents, viz. Protective Reaction Prone, Protective Reaction Forward, Protective Reaction Side

and Protective Reaction Backward. The scoring is done on a 7-point ordinal scale. Equilibrium reaction is assessed for slow and fast perturbation at two different tilt angles, in three different testing positions (lying, sitting and quadruped). The scoring is done on a 9-point ordinal scale using perturbation board.

Since assessment of primitive and postural reactions is the crucial part of motor examination, the strategies for early detection and intervention for cerebral palsy should focus on muscle tone, reflexes, asymmetry of response and postural reactions that can be useful quantitative and qualitative diagnostic and therapeutic tools (Mutch et al,1992). Assessment of postural reaction transitions (variability) over a period can provide important information for clinical decision-making and selection of appropriate treatment strategy (Burleigh,1994). The knowledge of reflexes and postural reactions in children with cerebral palsy is considered a prerequisite for developing successful therapeutic intervention. Therapy should also aim at development/modification of postural reactions within a functional context.

The currently available techniques like Roods, Neurodevelopmental Therapy (NDT), Sensory Integration and Proprioceptive Neuromuscular Facilitation (PNF) focus on normalising muscle tone, strengthening, positioning, improving and correcting positions, weight bearing/weight shifting in developmentally appropriate positions and providing movement exposures, but do not incorporate the principles of postural dynamics as elementary units for intervention. Recently a new treatment approach has evolved, viz. Neurofacilitation Developmental Reaction (NFDR), that incorporates dynamics of postural control and coordination dynamics as elementary units for intervention. The NFDR technique facilitates and reinforces structural and neuromuscular control by optimal positioning, neurofacilitatory orientation of body to stimulus using neurofacilitatory control points and grading support surface configurations at varying intensities, recruitment of trunk musculature by co-activation and reflex inhibition, facilitating postural reactions to elicit dynamic postural behaviour and sensorimotor movement experiences, both temporally and spatially. The NFDR approach is based on principles of postural dynamics with the aim of eliciting adaptive postural response. The intervention based on dynamics of postural control alters the order or control parameters by varying interaction dynamics, internal reference of correction, inter-limb and intra-limb coordination, stimulus characteristics (internal and external) and recruitment order with respect to support surface perturbations in stable and semi-stable positions. The

intervention based on dynamics of postural control as the key element, can serve as a therapeutic tool for modulating postural behaviour, thereby promoting motor development in children with cerebral palsy.

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