Sitting and Protective Reaction: In Cerebral Palsy Child

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ABSTRACT

The purpose of this study was 1- to assess and compare between sitting position for spastic cerebral palsy children with quadriplegia and diplegia 2- to assess protective reaction from sitting position for spastic cerebral palsy with quadriplegia and diplegia. Thirty subjects with cerebral palsy, both sexes were included in this study (seventeen males, thirteen females). All subjects, were diagnosed with cerebral palsy as quadriplegia with a mean age of 8.77±2.72, and diplegia, with a mean age of 8.80 ± 3.08, in quadriplegic patients, the muscle tone in four limbs ranged from moderate to sever while in diplegic child their muscle tone ranged from mild to moderate in the lower limb while in the upper limb are only mild affected according to Ashwar scale. Results for assess sitting position in quadriplegic and diplegic child, there was significant difference in head and trunk control, arm function while there was no significant deference in foot control. There was complete absent of protective reaction in quadriplegic child, while in diplegic child it was present but not complete.

INTRODUCTION

Cerebral palsy may be the most common pediatric condition treated by physical therapist[31]. Despite improvement in neonatal care, it would seem that the incidence cannot be reduced below the approximate level of two of 1000 live births[1].

The ability to maintain adequate postural control is thought to be a prerequisites for gaining independent movement needed for self-care, work, and recreational activities of daily living[8,22,26].

Stuberg and his colleagues (1988)[27] used the term "simple" for measures in a clinical setting that are practical, inexpensive and easy to use. Hoark (1985)[11] emphasized the importance of a basic understanding of what the use of different measures indicates, in order to make assessments valid, sensitive and useful. Video cameras are commonly available in the clinic[27]. Video filming may allow for quantitative analysis of qualitative movement changes[9].

The appearance of postural reaction in sequence, beginning after 2 to 3 months age, is easier to elicit clinically and can provide great insight into the motor potential of young infants. These movements are much less stereotyped than the primitive reflexes, and they require a complex interplay of cerebral and cerebeller cortical adjustment to a barrage of many sensory input. They are easy to elicit in the normal infant, but are markedly delayed in their appearance in the infant with nervous system damage. The quality of postural mechanisms will also be altered in way that is specific to different subtypes of cerebral palsy[16].

Cerebral palsy is classified both anatomically and physiologically. The anatomic classification depends on the number of the limbs involved. Quadriplegia involves all four extremities equally, diplegia involves the lower extremities more than the upper ones[7]. Show an impairment of the trunk and four limbs, mostly in the upper extremities quadriplegia or in the lower extremities diplegia[29].

Clinical outcome measures may be designed to distinguish among groups of individuals on a set of characteristics, to predict future outcome or prognosis, and to evaluate change within and between individuals over a time[3].

SUBJECTS AND METHODS

This study included a sample of convenience, consisting 30 subjects with cerebral palsy, was recruited from different children rehabilitation centers, both sexes were included in this study (seventeen male, thirteen female), All subjects, were diagnosed with cerebral palsy as quadriplegia (15 subject 9 male and 6 female) with a mean age of 8.77±2.72, and diplegia, (15 subject 8 male 7 and female) with a mean age of 8.80±3.08, quadriplegic patients their muscle tone in four limb ranged from moderate to sever while in diplegic child their muscle tone ranged from mild to moderate in the lower limb while in the upper limb are only mild affected, all the child were referred for physical therapy by pediatrician.

A-Instrument used in this study

Recording and displaying system including video camera, videotape and television with flat screen, as well as adapted chair, and bench. A VHS videotape player with stop-action capabilities and television monitor were used to record the data.

B-Assessment

Testing was conducted in a quiet and non-distracting environment. The children were assessed in a warm and comfortable room with the parent/parents present[21]. All measurement were obtained by a researcher during a single session for each patient, the test was administered in organized order.

1- Sitting Assessment Scale (SAS):

Sitting Assessment Scale was designed to assess postural control and functional performance in different sitting position. It is composed of five items, assessed with a score from 1 to 4 (1= none, 2=poor, 3=fair and 4=good) pertaining to head, trunk and foot control and arm and hand function. Postural control was defined as attainment of postural alignment of head and trunk against gravitational forces above the supporting surface and adjustment of body parts in relation to each other. In this study the SAS assessment was limited only to the original sitting position[18].

In order to make it possible to calculate angle on photographs, anatomical landmarks were marked on the children with pieces of adhesive paper. These were placed as follows: **(1)** in front of the ear; **(2)** at the center of the palpable part of the humeral head; **(3)** on the lateral humeral epicondyl; **(4)** on the ulnar styloid process; **(5)** on the greater trochanter, used as an approximate marking point for the fulcrum at the ischial tuberosities; **(6)** on the convexity of the lateral epicondyle of the femur and **(7)** on the lateral malleolus.

The children were seated in their own daily used adapted chair. Line of gravity was posterior to the fulcrum at the ischial tuberosities seat surface inclination was mean

8° (range 0°-15°), and back rest inclination was mean 101° backwards (range 90°-130°) they had a level, cut-out table in front of them. The distance between the center of the camera and the center of the child's chair was 3.8meter. Crosses marked on the floor were used to indicate the center of the table, camera and chair. The camera stood at right angles to the child position, facing forward.

Child s parent or by a researcher sat in front of the child, holding a toy or familiar object in front of the child to encourage the child to hold up the head. The adult moved the toy to the left and to the right in standardized way in order to encourage the child to turn the head to the sides. The child was asked to: **(a)** reach out to grasp, hold and release the toy and **(b)** support himself or herself with forearm or hand against a table and carry out the same simple operation as in (a). These tasks were repeated various times during the 5-minute sequence depending on the individual child's capability to perform the task.

2-Protective extension reaction:

Protective extension reaction was defined as, push to one side in sitting, and observe effort to stop falling with lateral propping (Morgan, Aldag, 1996). Response are scored on a 0/3 scale, the categories assigned these value are: Zero= does not initate, One= initates (<10% task), Two= partially completes (10 - <100% task) and three= completes an activity independent (Russell, Rosenbaum and Gowland, 1993).

Adhesive paper were taped to the child clothing over C7-L5 vertebrae in addition to the pervious in SAS and clothing was taped to the skin at these point to prevent marker movement.

The subject was sitting in the same place of the adapted chair, and keep his /her hands on the thigh. The researcher push the patient at the level of the shoulder to test protective extension reaction in the following direction, sideward (to the right, to the lift), forward and lastly backward. To realize reliability of the evaluation process, three trials were recorded for each variable and mean was calculated.

RESULTS

Both groups were considered matched as insignificant statistical differences existed between the mean of their age and sex.

A- Sitting assessment scale (SAS):

As regards the sitting assessment scale in both groups there was a highly significant difference between both groups as for head control (HC) in the quadriplegic group it was 2.80±0.41 and in the diplegic group it was 3.80±0.56 (P<0.05) (Table 1) and Fig (1).

For the trunk control (TC) in the quadriplegic group it was 2.67±0.49 and in the diplegic group it was 3.40±0.83 (P<0.05) (Table 1) and Fig (1).

As regards the arm function (AF) in the quadriplegic group it was 1.00±0.11 and in the diplegic group it was 3.67±0.90 (P<0.05) (Table 1) and Fig (1).

And for the hand function (HF) in the quadriplegic group it was 1.00±0.12 and in the diplegic group it was 2.80±0.56 (P<0.05) (Table 1) and Fig (2).

As regards the foot control (FC) comparison between both groups revealed no significant difference as in the quadriplegic group it was 1.60±0.51 while in the diplegic group it was 1.67±0.82 (P>0.05) (Table 1) and Fig (2).

Table (1): Comparison between Quadriplegic and Diplegic groups as regards the parameters of SAS

Parameter	Quadriplegic	Diplegic	T	p
HC	2.80±0.41	3.80±0.56	5.92	0.001(S)
TC	2.67±0.49	3.40±0.83	2.95	0.001(S)
FC	1.60±0.51	1.67±0.82	0.235	0.818 (NS)
AF	1.00±0.11	3.67±0.90	11.48	0.001(S)
HF	1.00±0.11	2.80±0.56	12.44	0.001(S)

S= Significant.
NS= Non significant.

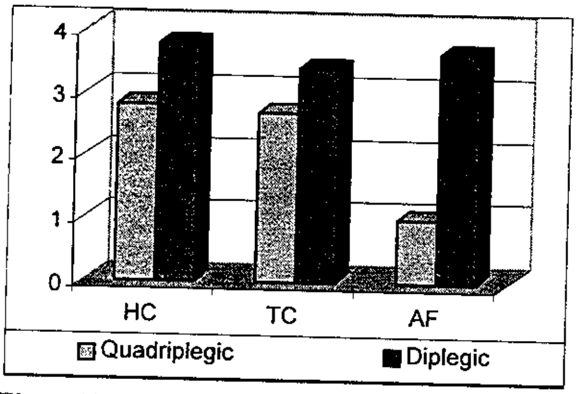

Fig. (1): Shows the comparison between Quadriplegic and Diplegic groups as regards the head control, trunk control and arm function.

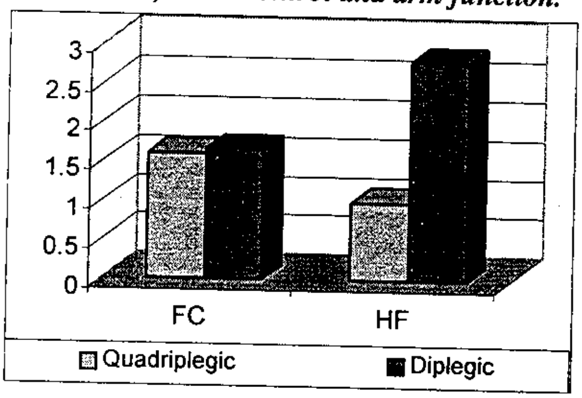

Fig. (2): Shows the comparison between Quadriplegic and Diplegic as regards the foot control and hand function

B- Protective reaction:

In quadriplegic child it was found to be completely absent (did not initiate) in all parameters (right, left, forward and backward) while in diplegic children it was found, but it was not complete as for the right it was 1.60±0.51, left 1.60±0.83, forward 2.20±0.86 and for the backward it was 1.00±1.00 (Table 2).

Table (2): Protective reaction parameters in quadriplegic and diaplegic groups.

Parameter	Quadriplegic	Diplegic
Right	0	1.60±0.51
Left	0	1.60±0.83
Forward	0	2.20±0.86
Backward	0	1.00±1.00

C- Relation between sitting and protective reaction:

Correlating the sitting measured by the sitting assessment scale (SAS) parameters with the measured protective reaction ones revealed that no correlation between both was found in the quadriplegic patients as the protective reaction was completely absent in this group, while in the diplegic group it revealed that there was a positive significant correlation in most of the parameters as in the head control (HC) and protective reaction toward right r=0.74 and P=0.002 and toward the left r=0.74 and P=0.002. While for the forward r=0.68 and P=0.005 and for protective reaction backward there was a positive correlation existed but was not statistically significant as r=0.38 and P=0.16 (Table 3).

Correlating trunk control (TC) and protective reaction toward right showed a significant positive correlation as r=0.67 and P=0.007. While for the left r=0.67 and P=0.007. For the forward r=0.68 and P=0.005 while for the backward r=0.43 and P=0.11 which was not significant (Table 3).

For the foot control (FC) and protective reaction, toward the right r=0.42 and P=0.12 which was not significant and the left r=0.42 and P=0.12 which was also not significant. As regards the forward r=0.51 and P=0.05 and for the backward r=0.79 and P=0.001 (Table 3). No correlation because we test protective reaction for the upper limb.

Considering the arm function (AF) and protective reaction, toward right r=0.77 and P=0.001 and for the left r=0.77 and P=0.001. And for the forward r=0.83 and P=0.001 while for the backward r= 0.39 and P=0.14 which was not significant (Table3).

As far as the correlation between the hand function (HF) and protective reaction parameters no significant correlation was found as for the right r=0.12 and P=0.66 and for the left r=0.12 and P=0.66. While for the forward r= 0.24 and P=0.39 and for the backward r=-0.13 and P=0.65 (Table 3).

Table (3): Correlation of SAS and protective reaction parameters in diplegic patients

		HC	TC	FC	AF	HF
Right	R P	0.74 (0.002)	0.67 (0.007)	0.42 (0.12)	0.77 (0.001)	0.12 (0.66)
Left	R P	0.74 (0.002)	0.67 (0.007)	0.42 (0.12)	0.77 (0.001)	0.12 (0.66)
Forward	R P	0.68 (0.005)	0.68 (0.005)	0.51 (0.05)	0.83 (0.001)	0.24 (0.39)
Backward	R P	0.38 (0.16)	0.43 (0.11)	0.79 (0.001)	0.39 (0.14)	0.13 (0.65)

DISCUSSION

A major challenge for clinicians working with young children with disabilities to measure outcomes of intervention programs[2]. Indeed, infant assessment provides a baseline from which changes associated with growth, maturation or training programs can be estimated or measured in children with cerebral palsy[20].

Physical therapy systems require careful evaluation of primitive reflexes and postural reaction mechanisms as an essential prerequisite to treatment, movement patterns that are responses to sensory stimuli may be perpetuated, if they are used repeatedly. Hence, one major avenue of intervention is the inhibition of these reflexes patterns and facilitation of more functional postural mechanisms[4].

Postural mechanisms, are not true reflexes, in the sense that they are based on the multiple input modalities, usually acting in concert, and they require cortical integrity, that is not present in the born. In brain damaged infant, postural mechanisms appear later than usual, if at all, and are less effective[4], as in quadriplegic child in these study where there were absent of protective reactions. Functionally, the postural mechanisms serve the purposes indicated by their descriptive subgroups: righting, protection, and equilibrium; thus, they underlie the evolution of normal motor skill development[15].

Children with cerebral palsy were encouraged to take an active part in daily life, while spending a major portion of their time sitting in the various type of chairs. This requires that the chair and positioning be arranged to ensure optimal function sitting position in which postural control is such that the child can obtain the maximum degree of independent function when moving the arm and hands[18].

From the clinical observation for this child group the neuropathological consequences of cerebral palsy, such as spasticity and presence of primitive reflexes, contribute to absent development of protective reaction and poor sitting in quadriplegic child as measured by SAS.

The result obtained from the present study to assess sitting and the protective reaction could be explained by, the child with cerebral palsy has an impact on early sensorimotor development, diminishing active shoulder, trunk, pelvic, and hip stability necessary for graded righting and balance reaction, especially during backward weight shifting in sitting[10].

Active head centering with chin truck, which has crucial connection to symmetrical shoulder, trunk, pelvis and hip postural activity, seems more involved in combining balanced deep muscle control as foundation these movements. As an alternative explanation, imposition of a foreign experience on the infant with altered sensory body image may make the combination of symmetrical and sustained head, shoulder, and trunk muscle activation especially difficult to achieve and sustain[12].

Sitting is a dynamic activity and studies show that sway and weight bearing patterns in sitting in children with cerebral palsy vary as function of their physical status as well as activities in which engage[14]. These come in agree with our result, as there is significance difference between diaplegic and quadriplegic child in all parameter of SAS except foot control.

The factors could explain these discrepancies: the severity of impairment and the criteria used for the classification in addition to the age of the children[28] in these study could be excluded because there was no significance difference between both groups.

To create a reliable and valid method for assessment of postural control and function in sitting for children with cerebral palsy, complex factors such as spasticity and persisting tonic reflex as well as hypotonous and lack of postural reactions must be analyzed[18,19].

We observed in these study for the quadriplegic child are generally affected by spasticity and persisting tonic neck reflexes, in contrast to this hyper tonicity, there is often hypotonuse of the trunk which lead to poor trunk control as revealed by Mytr and Von Wendt (1990)[19]. Children sitting with the trunk and head flopped forward usually are unable to correct themselves because the lack righting or equilibrium reactions[13]. However, in this seemingly stable position, hypotonuse of the trunk is frequently replaced by hypertonouse and tonic reflexes particularly tonic labyrinthine reflexes when the child sits with the head against the neck support, or asymmetrical tonic neck reflex when the child try to turn the head to one side. In such position, they must struggle against gravity to

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الملخص العربي

الجلوس ورد فعل الحماية عند الأطفال المصابين بالشلل المخي التصلبي

تهـدف هـذه الدراسة إلى تقييم ومقارنة وضع الجلوس في ثلاثين طفل من الأطفال المصابين بالشلل المخي التصلبي في حالات الشلل الرباعي والشلل الرباعي من نوع شلل الطرفين السفليين اكثر من الطرفين العلويين بالإضافة إلى تقييم وضع رد فعل الحماية . فـي هـذه الدراسة تم تقييم الأطفال بقياس وضع الجلوس بالإضافة إلى اختبار الحماية برد الفعل في الاتجاهات الأربعة ، وقد تم استخدام كاميرا الفيديو لتسجيل القياسات والاختبارات . وقد أظهرت هذه الدراسة فروق ذو دلالة إحصائية في وضع الجلوس بين المجموعتين عند (وضع تحكم الرأس ، الجذع ، وظيفة الساق العليا ، اليد) وعدم وجود فروق ذات دلالة إحصائية في تحكم القدم .
كمـا أظهرت الدراسة عدم وجود الحماية برد الفعل في حالات الأطفال المصابين بالشلل الرباعي في كل الاتجاهات بينما أظهرت الدراسة وجـود الحمايـة بـرد الفعـل فـي الـنوع الأخر من الشلل بصورة غير كاملة بالإضافة إلى ذلك وجود فروق ذات دلالة إحصائية بين المجموعتين.