

# Outcome Of Developmental Therapy In Children With Cerebral Palsy

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<sup>1,2,3,4,5</sup> Conception of study

<sup>1,2,3,4,5</sup> Experimentation/Study conduction

<sup>1,2,3</sup> Analysis/Interpretation/Discussion

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## Abstract

**Introduction:** Cerebral palsy (CP) is a non-progressive disorder of motor and posture with associated delayed development in areas of cognition, perception, behavior, and sensation, due to insult to the immature brain. Improvement in all developmental domains of CP patients depends upon the early institution of rehabilitation programs involving all multidisciplinary approaches. The portage early education program (PEEP) is a worldwide, effective, and early interventional method, for developmentally delayed children.

**Objective:** To determine the outcome of developmental therapy in children with CP by using PEEP.

**Study Design:** Experimental research design (within the group)

**Settings:** The Children's Hospital and the Institute of child health Multan.

**Methodology:** 156 patients of 2 to 10 years of age, both gender from January 2020 to December 2020, diagnosed as CP were enrolled for this study. All children were assessed by using PEEP and GMFM (Gross Motor Function Measure) twice 6 months apart. A trained clinical psychologist administered PEEP to all the children. All the Patients were advised regular weekly sessions at the hospital by a multidisciplinary team and at least 2 hours per day for continuation of these therapies at home. At the end of 6 months, we found that all families had not followed this. The patient who visited > 2 times/month were considered compliant and those who visited < 2 times/month were considered non-compliant. Data were analysed by using SPSS version 16. Paired t-test was used to compare the developmental outcome of compliant and non-compliant groups.

**Results:** Out of 156 participants, 58(37%) were in compliant, and 98(63%) were non-compliant. Male subjects were prominent 42(72.41%) and 67(68.37%) respectively. Most of the participants belonged between 3-6 years of age in both groups 28(48.29%) and 51(52.04%) respectively. Spastic quadriplegia (26(44.83%), 57 (58.16%)), and level 5 on GMFM 24(42.86) and 52(53.06%) respectively were common presents in both patient groups. The mean comparison of DQ of Compliant CP Children at the initial stage and after six months in areas of GM, C, SH, S, L, and GMFM was found statistically significant.

**Conclusion:** CP children should be on regular follow-up for developmental therapy for a long time for better outcomes. PEEP is an excellent system for the assessment, training, and rehabilitation of children with delayed development.

**Keywords:** Cerebral palsy, portage early education program, Delayed development, Multidisciplinary approach.

## Introduction

CP is a broad-spectrum disorder with a prevalence of 1.5-5 cases per 1000 live births. 1 It is a non-progressive disorder of motor and posture, resulting from any insult to an immature and growing brain. This insult may be ischemic or infectious resulting from hypo-perfusion injuries, pre- or post-maturity, periventricular or intraventricular hemorrhages, traumatic injuries, metabolic derangement, and abnormal structure of the brain.2,3 CP is classified as pyramidal/spastic, extrapyramidal, hypotonic, and mixed type in geographical classification, while as level 1-5 according to gross motor function classification system (GMFC system)1,2

Along it has abnormal motor development, CP children have other manifestations like behavior issues, intellectual and learning disabilities, epilepsy, musculoskeletal abnormalities, visual and hearing deficits, and nutritional and gastrointestinal problems.1,2,4. Due to this multisystem involvement, consequences of the disease change with time which result in the activity limitation of the CP children in different areas of daily life5.

CP children need a multidisciplinary approach for their intervention and a portage early education program (PEEP) is the best tool for the rehabilitation of children with special needs. Although it began in Great Britain, now being practiced worldwide due to its scientific, interesting, coherent, and operable nature.6 PEEP is based on the theory that contact with the external environment and interaction between genetic and acquired environment influence the structural and functional development of the human brain.7,8,9 Portage checklist is an ideal instrument for assessing and training, used in structured teaching settings, involving individualized intervention and also emphasizing the importance of family/parents in therapy for early and better outcomes of children with delayed development8. Portage has five development key areas applied from 0 to 6 years of mental age. These are gross motor (GM), cognition(C), self-help (SH), socialization(S) language(L) along with Infant stimulation. Each area had a specific checklist according to age. The GMFM is a reliable, valid, responsive, and psychometrically sound effective outcome tool for measuring gross motor levels in CP children following interventions. 8

Although studies about intervention in global developmental delay and autism are present in the literature studies on the outcomes of children with CP

are surprisingly few.6 This study was planned to observe the role of intervention in children with cerebral palsy, applying the PEEP through a combination of institution- and home-based services.

## Methodology

This experimental research design study was carried out in the outpatient department (OPD) of the Developmental and behavioral pediatric department of the children Hospital and the Institute of child health (CH&ICH) Multan. We enrolled 156 Patients with abnormalities of tone, movement, and posture; diagnosed as cerebral palsy, of 2 to 10 years of age, both gender from January 2020 to December 2020 by convenient sampling.

The children having degenerative brain disorders, myopathies, neuropathies, an inborn error of metabolism, chromosomal abnormalities, severe hearing deficit, and did not give consent, were excluded. These disorders were diagnosed on clinical features, examination findings, and available investigations. Parents/guardians were detailed about the study and prior written consent was taken. For all CP children, a detailed history was taken from parents/guardians. Their socioeconomic status was noted. A complete neurological examination was done in all CP patients to determine the type. Developmental assessment of the patients was done by using PEEP and functional severity of motor function was also assessed by using GMFM. A trained and expert clinical psychologist with more than 10 years of experience working with PEEP, administered and assessed each child in a quiet room with peaceful surroundings to evaluate their abilities, defects, interests, and learning enthusiasm. All patients were assessed according to checklist items to find developmental age and quotient in all areas She assessed the mental age in all 5 domains and individualized training programs (IEPs) were developed according to each child's development levels. The occupational therapist assessed each child for GMFM level. Sessions were started to overcome deficits by a psychologist, speech therapist, occupational and physiotherapist. The sessions/training program was performed on every visit to the hospital for 30 minutes, during which parent/family was also trained. During sessions, the psychologist addressed improving cognition, socialization, and self-help, the speech therapist worked to increase oral communication, while the

physiotherapist and occupational therapist worked to improve gross motor and fine motor function respectively. Parents were advised to spend at least 2 hours per day on the continuation of these therapies/activities at home. After 6 months the resulting effects were Re-evaluated by a psychologist and occupational therapist. Although all the families were advised of a weekly visit to the hospital and full complaints for therapy at home, at the end of 6 months we found that all families had not followed this. The patient who visited > 2 times/month and continued therapy at home, were considered and labeled compliant and those who visited < 2 times/month, and did not continue therapy at home, were labeled non-compliant.

The study was approved by the institutional ethical committee. No conflict of interest was involved in this study. No financial support was provided by the institution or pharmaceutical company.

All the information was recorded on performed Performa. Data were analyzed by using SSPS version 16. Paired t-test was used for comparing the developmental outcome of compliant and non-compliant patients, after measuring PEEP at initial registration and after 6 months. P<.05 was considered statistically significant and a 95% confidence interval was used.

**Results**

A total number of 156 participants were included in this study. The mean and SD age of all participants was 30.69±20.19. The compliant patients group consisted of 58(37%) children and non-compliant 98(63%). Male subjects were more prominent than females in both groups; 42(72.41%) and 67(68.37%) respectively. Most of the participants were of 3-6 years of the age range in both groups 28(48.29%) and 51(52.04%) respectively. The majority were of poor socioeconomic status 36(62.06%) and 59(60.20%) in both groups. The age groups and gender distribution of the participants were statistically significant (p-value < 0.05) (Table-1).

The mean comparison of the DQ in areas of GM, C, SH, L, and GMFM of both compliant and non-compliant patients measuring PEEP, initial visit, and after six months are shown in Table III. (Table-3).

**Table-1** Basic characteristics of participants (n=156)

| Characteristics               | Compliant Patient group | Non-compliant patient Group | P-value |
|-------------------------------|-------------------------|-----------------------------|---------|
| <b>Total patients</b>         | N (%)                   | N (%)                       |         |
| 156                           | 58(37)                  | 98(63)                      |         |
| <b>Gender</b>                 |                         |                             |         |
| Male                          | 42(72)                  | 67(68)                      | 0.047   |
| Female                        | 16(27)                  | 31(32)                      |         |
| <b>Age group distribution</b> | 29.17±19                | 32.21±21                    |         |
| 2-4years                      | 14(24)                  | 11(11)                      | 0.048   |
| >4-7years                     | 28(48)                  | 51(52)                      |         |
| >7-10years                    | 16(3)                   | 36(37)                      |         |
| <b>Socioeconomic status</b>   |                         |                             |         |
| Poor                          | 36(62)                  | 59(60)                      | 0.37    |
| Average                       | 04(7)                   | 11(11)                      |         |
| Middle                        | 18(31)                  | 28(29)                      |         |

Spastic quadriplegia was commonly present in both patient groups (26(44.83%), and 57 (58.16%)) respectively. The majority of participants 24(42.86) and 52(53.06%) respectively belonged to level 5. (Table-2)

**Table-2** Types of CP and GMFM levels (n=156)

| Type of CP                      | Compliant patients Group (n=58) N (%) | Non-compliant patients Group (n=98) N (%) |
|---------------------------------|---------------------------------------|---|
| <b>Spastic Quadriplegia</b>     | 26(44.83%)                            | 57(58.16)                                 |
| <b>Spastic Diplegia</b>         | 17(29.13)                             | 21(21.43)                                 |
| <b>Spastic Right Hemiplegia</b> | 10(17.24)                             | 13(13.27)                                 |
| <b>Spastic Left Hemiplegia</b>  | 05(8.6)                               | 07(7.14)                                  |
|                                 | <b>GMFM level</b>                     |   |
| <b>Level 2</b>                  | 08(13.79)                             | 07(7.14)                                  |
| <b>Level 3</b>                  | 11(18.96)                             | 13(13.26)                                 |
| <b>Level 4</b>                  | 15(25.86)                             | 24(24.49)                                 |
| <b>Level 5</b>                  | 24(42.86)                             | 52(53.06%)                                |

**Table-3** Comparison of the developmental profile of compliant and non-compliant children initially and after six months of follow-up (n=156)

| Domains       | COMPLIANT PATIENTS GROUP |                         |                  |         |         | NON-COMPLIANT PATIENTS GROUP |                         |              |         |         |
|---------------|--------------------------|-------------------------|------------------|---------|---------|------------------------------|-------------------------|--------------|---------|---------|
|               | Initial (n=58)           | After six months (n=58) | CI (95%)         | t-value | P-value | Initial (n=98)               | After six months (n=98) | CI (95%)     | t-value | P-value |
| Gross motor   | 22.61±3.87               | 28.86±4.94              | -25.46 to -11.14 | -5.20   | <0.01   | 19.11±3.27                   | 24.27±4.16              | -5.49-1.89   | 3.952   | 0.11    |
| Cognition     | 19.30±3.31               | 29.93±5.13              | -26.90 to 1.87   | -7.06   | <0.01   | 15.91±2.72                   | 20.86±3.57              | -13.46-4.43  | 4       | 0.23    |
| Self help     | 18.77±3.21               | 29.12±4.99              | -30.95 to 18.19  | -7.83   | <0.01   | 22.14±3.79                   | 26.15±4.48              | -7.34-2.53   | 4.14    | 0.4     |
| Socialization | 23.35±4.0                | 29.12±4.99              | -23.37 to 9.37   | -4.76   | <0.01   | 18.75±3.21                   | 25.78±4.42              | -16.038-3.75 | 4.901   | 0.12    |
| Language      | 22.28±3.82               | 28.64±4.91              | -29.03 to 14.93  | -6.34   | <0.01   | 15.19±2.60                   | 20.76±3.56              | 18.15-10.94  | 5.72    | 0.6     |
| GMFM          | 0.62±0.10                | 0.93±0.16               | 0.90 to 1.39     | 9.53    | <0.01   | 0.55±0.09                    | 1.0±0.17                | 0.44-0.95    | 5.49    | 0.012   |

## Discussion

PEEP is an effective tool for early childhood interventional service for preschool children with special needs like CP at the International level. Appropriate early intervention is critical for children with CP. However, in the present study, we found that a considerable number of parents did not consult a physician when they noticed a developmental delay in their child because they did not realize the consequences of delayed development and the importance of early intervention.

The current hospital-based study showed that all the CP children have delayed development in all developmental domains (GM, SH, C, S, L), The children who regularly visited the hospital and whose parents/attendants continued therapies at home on a

daily basis, showed good improvement. These findings were similar to others as, Xiumei Liu also found that the 6-month PEEP intervention both at the hospital and home led to a significant increase in DQ values across 5 domains (GM, FM, AD, L, and PS) in CP children in a comparative study done in China.<sup>9</sup> They also found PEEP as an effective therapeutic tool for children with delayed development. Sorensen, Kristian also described the better outcome of cerebral palsy with regular intervention in a longitudinal study conducted in Norway like the results of our study.<sup>10</sup> Another article showed the summary of evidence-based works for improving activities, functional level, and behavior of CP children and adolescents with regular intervention like ours<sup>11</sup>. Iona Novak also described the impotence of intervention in CP children<sup>12</sup>. Some other studies also favored that early and regular rehabilitation results in the better outcome

in CP children<sup>13,14,15</sup> In our study we used PEEP at the hospital and home, while A researcher in Lebanon used PEEP only for home therapy training and also found portage as an effective tool for home therapy alone for children with special needs.<sup>16</sup>

Physiotherapy was a part of other interventions in the current study, which resulted in overall improvement of children. A study done in the National Institute of Rehabilitation Medicine (NIRM) Islamabad described that only early and regular physiotherapy results in an improvement in GM functions in CP<sup>17</sup>, this can be explained by that recruited child had only gross motor delay, while our study population had a delay in other domains too. While Heilkam et al described no significant improvement in infant outcome with only physiotherapy intervention, family quality of life improved.<sup>18</sup>

This study showed improvement in children in whom family/ parents were dedicatedly involved, which is supported by another study done in South India by Muthukaruppan et al<sup>19</sup>. Sorensen also showed the improvement of CP children through parenteral involvement. (9). The study by Muthukaruppan also described the importance of the family's role in the intervention for the improvement of children with delayed development.<sup>20</sup> The age groups, and gender distribution of both groups' participants were statistically significant in our study which is similar to another<sup>19</sup>. But no significance was found regarding age and gender in a study done in china<sup>9</sup>.

Limitations of this study include that National data to compare PEEP intervention in CP is not available. The current study is of limited time duration. Although our result showed positive effects with only 6 months' implementation of PEEP, further research is needed to ascertain whether these effects will last and whether a longer duration of the intervention is necessary.

## Conclusion

Children with CP should be on regular follow-up for developmental therapy in all developmental areas for a long time for a better outcome as these children has not only delayed development in the motor system but also in cognition, socialization, language and self-help. Although PEEP is an excellent system for the rehabilitation of children with delayed development, culturally adapted assessment tools for development must be designed and used for assessment and training.

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