Infant motor development: effects of a sensory-motor program on premature infants in ITC

ABSTRACT: The present study examined the effects of a physiotherapy approach to the treatment of premature newborn infants. There were two groups, each one including 7-premature infants were studied in terms of posture, reflexes, and muscle tone gains. The groups were named as Intervention (IG) and conventional (CG). There were four assessments occurring throughout the periods of intervention for the IG, and normal treatment for the CG. The instrument for evaluation was the Neurologic Assessment in the Pre-term Newborn Infant (NAPI). There were four evaluation sections. Results revealed a tendency of the IG to obtain more gains over the three factors studied, even which on some evaluation sections the CG revealed higher gains. However, the statistical analyses performed upon the scores of gains between groups with the three factors of development revealed that all significant differences found were related to the IG gains. Such gains were interpreted as motivated by the impact of the intervention upon the newborn infants of the IG. The stabilization in gains was justified as related to maturational development. The gains were presented as support for the necessity to use the sensory motor approach to the treatment of premature infants.

Keywords: Premature, sensory motor intervention, motor development

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RESUMEN

Desarrollo motor de bebé: efecto de un programa sensorio-motor en prematuros en unidades de CTI

El presente estudio investigó los efectos de cuidados fisioterapéuticos con estructuración psicomotora, sobre el desarrollo motor en recién nacidos prematuros. Catorce bebés internados en Unidades de Terapia Intensiva Neonatal, con edad gestacional entre 30 y 36 semanas, compusieron grupos denominados de intervención (GI) y convencional (GC). El grupo GI participó de un programa específico de intervención, mientras que el segundo fue mantenido bajo forma del tratamiento convencional. Durante el Programa, estos habían sido comparados en factores relativos a respuestas reflejas, tónicas y posturales a través del test Neurologic Assessment in the Preterm Newborn Infant (NAPI). Los resultados de las comparaciones de estas con respuestas normales del bebé, revelaron que el grupo de intervención evidenció una mejoras significativas en relación al grupo convencional, siendo que en algunas evaluaciones indicaron una estabilización en la evolución de los ganados referentes a los tres factores estudiados. Las diferencias principales entre los grupos habían sido interpretada como habiendo sido motivadas por el impacto del programa sobre el organismo de los bebés del grupo de intervención. La estabilización fue vista como decorrente de una fase de acomodación orgánica, presuponentemente asociada a factores maturacionales. Todas las significancias estadísticas reveladas estaban asociadas a ganados superiores del GI sobre el GC, hecho discutido como asociado al trabajo de intervención sensorio motriz aplicada sobre los bebés en el grupo que participó del programa de intervención.

Palabras clave: prematuridad, intervención precoz, madurez, desarrollo motor

THEORETICAL PRINCIPLES

Helders, et al (1998), for example, verified that one of the most disturbing privations, which an infant experiences in this situation, is related to the tactile-kinesthetic factor which is normally supplied in ambience of mother contact or by contacts of associated stimulation. Generally the balance of the infant’s environment is a desirable event, once it provides a bridge of interaction in the transitional process from a morbid state to more morbid one. The relative question to environmental balance is highly significant, due to the fact that the exacerbated quantity of stimuli normally includes a considerable percentual of negative events which consequently damage the clinical stability. Other factors previously mentioned in the literature such as factors highly harmful to health and recovery are the necessary medical actions which aggress the organism and which, to some extent, interfere in the balance (e.g.: intravenous medicine, aggressions motivated by mechnic ventilation, noise and high luminosity, to name a few). Added to these problems, they seriously reflect upon the infant’s behavioral components, including those which are made through standards of motor and reflex answers, which interact in the process of the general and motor development.

With the technological advance and development of research linked with the theme at issue, the hospital interventions have allowed a significant increase of premature newborn’s survival, including the ones very much under weigh (nearly 1000 grams,
however, at the expenses of prolonged and private hospital admission stay. According to Buchner et al (1988) affirm, whether on the one hand, the technology is an instrument of great importance in the rehabilitation of newborns, its proper use is an action which needs to be well administered.

Reflexes of privation during a postponed stay falls upon the NICU. They can be appointed as being of physic and physical order. In the one of physical nature order are included in the loss of muscular tonus, due to postural maintenance and postural responses, level of reflexive activities, et all (Mello et alls, 1998; Kakebeeke et alls, 1999; Van-Der-Fits et alls, 1999).

Although, as can be observed in the literature of reference, an awful lot of studies about the theme have contributed to the development of intervention and rehabilitation techniques in the therapy of newborns, until present it seems to inexsit a methodology which best suits to the variety of correlate components and indispensable to a holistic view of the therapy. In other words, the emphasis of the present study is placed on the expectation which the method can conjugate some details of suitability of all the inconvenience which a prolonged hospital admission stay in the NICU exposes a newborn and can be hypothetically an efficient practice in the treatment of this individual, i.e., the raised question here is related to the possibility of a method which includes some tactile-kinesthetic stimuli, postural normalizations, stimulus to non-nutritive sucking, the favoring of circadian rhythm, namely, widely interactive, it can minimize or not the negative evolutions which a hospital admission stay of such gravity produces on the neuromotor development of newborn. Therefore, in the present study the chief objective is interwoven with the investigation of answers relative to this hypothetic notion.

**METHODS**

The sample for this study was selected in the NICU, in the state of Rio de Janeiro, was composed of 14 newborn varying between 30 and 36 weeks of gestational age. The evidence of ultrasonography transfontanelle (USTF) of normal aspect ruled out the possibility of the existence of any injury which inhibits the development of the central nervous system (CNS). These newborn have been subsequently separated into two distinguished groups, called intervention group (IG) and conventional treatment group (CG).

The first group comprises premature newborn who needed specific health care of a NICU, was submitted to a program of postural, tonal and reflex intervention from the date of hospital admission. The second group of newborn of the same characteristics proceeds without specific intervention, receiving the treatment commonly utilized in that hospital.

**Preliminary procedures**

The mensurations of the motor, reflex and postural responses of newborn began in the first week of life according to the state of a more favorable clinical stabilization, and were prolonged for more three week, without intervals of seven days during the assessments, amounting to four testing for each infant in both groups. The Neurological Assessment of the Preterm and Full-Term Newborn Infant (NAPI) was utilized for the mensuration, establishing then a score of motor, reflex and postural responses for each infant assessed. These data were considerer as baseline data.

**Intervention procedures: program of postural, tonal and reflex intervention**

This program is portrayed by a methodology which cover a series of interventive patterns of behavior and in many cases rehabilitative ones applied systematically to newborn at risk admitted in the NICU. It also aims at minimizing its harmful effects which a prolonged period of noise exposure, aching stimuli, tactile-kinesthetic privations, among others, which broadly affect the motor development of these newborn.

The group of infants submitted to this program was maintained in positionings of postural control in bed since the date of admission in the unit. With this, it sought to approach flexor physiological tonus to the parameter indicated to newborn at term (Bèziers: 1994). A pattern of symmetry was included between hemiparesis, maintaining the head constantly in the mean line in neutral position between flexion/extension, in the attempt of attenuating the primitive reflexive activity, besides improving the quality of ample movements characteristic of newborns (Van-der-Fits et alls:1999). The maintenance of postural control proceeded for the whole period of investigation, being later provided the infant with the experience of varied posture of dorsal decubitus, and aiming at the direction of symmetry and physiological flexion. In another stage of the program there was the implementation of non-nutritive sucking since the introduction of the diet of infusion pump through the stimulus of sucking of the examiner’s little finger, and later on a Nuck pacifier, suitable for premature infants. The use of pacifier, as a positive factor described by Woodson & Hamilton (1988), reduces the cardiac frequency of premature infants, and consequently the energetic expense. This naturally favored the infant’s perception to stimuli in other subsystems, among which the neuronal and sensitive ones.

Another worry of the program was favor the neurovegetative system of these premature infants, through the ambience between day and night, taking into consideration that the NIUC environment does not provide this luminosity variation. Consequently, it consisted of an unbalance factor and clinical instability. This was due to the turning-off of some of the lights in the unit, becoming thus a dimmed environment, and simultaneously, maintaining an apparatus such as sheets of thicker texture covering the bed, another action which diminishes the light incidence straight upon the infant, therefore the sleep cycle is favored.

With all the actions, the stimulus for contact with the mother’s lap after the clinical stability was made, allowing this way that the tactile-kinesthetic privations previously related was gradually reduced. In other words, what this program aims at achieving is a relative decrease of aggression suffered by the newborn during.
the period of hospitalization, placing emphasis on the quality of reflex, postural, tonus responses; this was due to the fact that the factors are essential in the process of a favorable global neuromotor development.

**Measure instruments**

As during the data collection phase, as during the post-program phase the measure instruments utilized were the tonus quality in repose and spontaneous movement, quality of reflex responses and movements, and postures adopted by the newborn, all examined through the NAPI.

The criteria of assessment included some signs of abnormalities such as the ones shown in the CHART 1. According to those criteria, the newborn (NB) were related to as having the result of the exam: normal, suspect or altered.

For the exam to considered normal, the NB might have to present normal muscular tonus for the gestational age, and not more than of sign of abnormality. The suspect one demonstrated two signs of abnormality or one sign of abnormality plus head control sub-optimum. And the normal one shows fall of head important plus torso hypotonia or 3 signs of abnormalities (Dubowitz et alls. 1984).

Once defined that the infant fell in one of this categories, it was submitted to a comparative study, relating the main motor characteristics to the respective group control.

The exam interpretation was conducted according to some guidelines of Neurologic Assessment in the Pre-term Newborn Infant (NAPI).

**Table 1 – Group average by evaluation area in the four stages of the motor, reflex and postural interventions**

<table>
<thead>
<tr>
<th>Analysed factors</th>
<th>Tonus</th>
<th>Posture</th>
<th>Reflexes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Assessment</td>
<td>IG 33.5</td>
<td>CG 27</td>
<td>IG 19.8</td>
</tr>
<tr>
<td>2nd Assessment</td>
<td>35.6</td>
<td>26.2</td>
<td>24.5</td>
</tr>
<tr>
<td>3rd Assessment</td>
<td>33</td>
<td>29.2</td>
<td>21.3</td>
</tr>
<tr>
<td>4th Assessment</td>
<td>33.8</td>
<td>33</td>
<td>22.8</td>
</tr>
</tbody>
</table>

Source: The author of this study

**Chart 1 – Signs of abnormalities and responses to be observed**

<table>
<thead>
<tr>
<th>Signs of abnormalities</th>
<th>responses to be observed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexor tonus of arm greater than the tonus of legs</td>
<td>Respect to the assessment of the premature’s tonus in the podo-cephalic direction</td>
</tr>
<tr>
<td>Abnormal head control</td>
<td>Traction to sit down, sat in prone</td>
</tr>
<tr>
<td>Increased palpitations plus startles</td>
<td>If they happen during the repose or active movement</td>
</tr>
<tr>
<td>Abnormal moro reflex</td>
<td>1st phase &gt; 2nd phase or vice-versa, 1st phase exacerbated or poor, 2nd phase exacerbated or poor</td>
</tr>
<tr>
<td>Thumb persistently adducted</td>
<td>If they never open or open during the active movement</td>
</tr>
<tr>
<td>Asymmetries</td>
<td>ACTR, Hemipareses, tonic difference between the right/left Hemipareses</td>
</tr>
<tr>
<td>Poor orientation</td>
<td>Difficulty in maintaining in the state 4 of the Brazelton’s scale</td>
</tr>
<tr>
<td>Abnormal eye movements</td>
<td>Nystagmus, conjugated deviations, doll’s head phenomenon</td>
</tr>
<tr>
<td>Irritability</td>
<td>Cry of difficult consolation</td>
</tr>
<tr>
<td>Maintained clonus</td>
<td>Ankles, fist and mandible</td>
</tr>
</tbody>
</table>

Source: The authors of the study

**Data treatment**

The pre- and post-program data were treated through descriptive and inferential statistics. In the descriptive approach the units of interest were the mean and intragroups standard deviation. In order for the references to be conducted relative to the comparison between groups, a Kruskall-Wallis non-parametric variance analysis was utilized for each factor in the study, with subsequent variations of the detected significance for each main analysis. The index of defined significance for the test of hypothesis was the conventional for the studies of this nature, namely, alpha = or < 0.05.

**PRESENTATION AND RESULT DISCUSSION**

The averages of both groups of intervention and convention are shown in the table 1, for all modalities investigated.

These results revealed that the effects of the program of motor, reflex and postural intervention were significantly favorable to the participant group of this program. This fact can be inferred from the analysis together with the aforementioned table. Comparing to the several assessments conducted during the course of the Interventive Program, it can be noticed that the effects of it refer to the tonus fact were remarkable during the first stage (1st assessment), stabilizing, in tendency, relatively to the 2nd and 3rd stages and, returning to increase in the fourth stage of assessment. In the item posture, the same tendency did not occur. That is, the scores in this factor indicate that the groups developed approximately equal relatively to the 1st and 3rd assessments, a better development for IG in the 2nd, whereas CG revealed slightly better in the fourth assessment. Concerning with the reflex factor, the tendency of greater gain return to present, but only in terms of the 1st and 2nd assessments, being the CG slightly better when analysed the 3rd and 4th assessments.

It can be observed, as a detail, that only in regard with the posture and reflex factors, in the 3rd and 4th assessments respectively, the CI did not prove to be better in gain than the CG. In the others, and in all the factors handled, the CI obtained a better result. It is worth observing here the fact that when the first assessment about the factors of the study was conducted, the program had
already been initiated. This may explain the disparity between the scores of the groups.

Scrutinizing the scores of groups relatively to each factor of study, it was verified that in relation to the tonic responses, the gains for the CI group verified between the 1st and 2nd assessments were in term of 6.5%, from the 2nd to 3rd there was a decrease of 8.0% and from the 3rd to the 4th, again some gain in terms of 2.5% were evidenced. Considering the same factor, for the GC group the results were expressed by a loss of 3.2%, gains of 13.1%, when assessed from 1st to 2nd, 2nd to the 3rd and 3rd to 4th assessments, respectively. These results are shown, in comparative terms, in the Figure 1.

The results related to the quality of postural responses demonstrate a significant gain in the IG relatively to 1st to 2nd assessment in terms of 24%, whereas the group CG obtained a small decrease of 4.5%. From the 2nd to the 3rd assessment the IG demonstrate a loss of 15.5%, whereas the CG maintains a gain of 15%. In the last result, namely, the last assessment (3rd to the 4th assessment) was observed a retaking in gain by IG approximately 7.5%, and the CG revealed the tendency of gradual increase, with gain of 13.5%. These specific results are plotted in the figure 2 below.

Figure 1 - Results of the assessments of the muscular tonus responses of the groups CI and CG in the four assessments conducted

![Figure 1](image1)

Figure 2 - Results of the assessments of the postural responses of the groups CI and CG in the four assessments conducted

![Figure 2](image2)

Figure 3 - Results of the assessments of the reflex responses of the groups CI and CG in the four assessments conducted

![Figure 3](image3)

In what concerns with the data of the reflex responses, properly plotted in figure 3, it was observed that the factor more homogeneous between the functional gains studied in both groups, for this homogeneity in mean terms was noticed through the assessments conducted. In the variation of 1st from the 2nd testing, the GI obtained gains of 8.0% and the GC of 8.5%. In the responses of the 2nd to 3rd testing, there was a loss in the GI of 8.0%, whereas the GC remained with a gain of 13%. From 3rd to 4th testing, the retaking of gains of the CI was of 5.5%, and the GC maintained the gains of roughly 4.5%.

The above mentioned results define very important relations for this discussion. The most outstanding and, maybe, of major representativeness in terms of the objectives of these study is what refers to the disparity between the scores of the groups when the first assessment was conducted. On having in mind that this assessment occurred after a considerable period from the beginning of the application of the program, the differences may be interpreted as deriving from the impact of work on the newborn’s tonic and reflex functions of the group involved in the program. The same tendency, nevertheless, was not observed in terms of the posture factor. This impact is well defined by inferential statistics utilized so as to test the differences between the groups, which revealed a significant superiority of the group GI over the GC with p < 0.001, integrally to the four assessments conducted independently over the tonus and reflex factors. Next tests indicated to be, that significance, tied to the contrasts of the means of gains between the groups in the 1st and 2nd assessments, both (p < 0.001) and the 3rd assessment (p < 0.05) for the tonus factor. The integrated significance verified in the reflex factor was relative to the contrasts of the means between the groups in the 1st and 2nd assessments, being p < 0.001 for the 1st and p < 0.05 in the 2nd contrast. Although, yet corresponding to the reflex factor, the group GC revealed greater gains than the group GI in the contrasts of the 3rd and 4th assessments, these did not prove to be different statistically.

All in all, the results now portrayed demonstrated the great importance that an early treatment plays a role in the newborn in NCUs. In the first analysis, this study proves to be providential in effects over the newborn’s development, once it immediately allows the newborn a greater condition of integration with the environment than the newborn treated conventionally. The postnatal period is considered to be one of the most fertile for the normality of the motor perceptive development, the earlier the newborn is able to have its sensory motor apparatus suitable for the environmental responses, the greater are the gains in perceptive motor advance. For this, it urges that the alert state as well as the tonic, postural and reflex conditions, among other, be suitable for the impact of environmental stimulation and predisposed to the accomplishment of corresponding responses. In terms of the present study, what can be verified is the fact that only for newborn included in the group IG, the conditions nearly adequate for the development of this functions were present since its admission in the NCU. The newborns treated through the conventional format took time to dispose the same conditions, and even so, in alternations which...
during the period of development of the interventive program prove to be limited in relation to the group GI.

In the second analysis, not less important analysis, what can also be inferred is that the process of maturation of the nervous system (NS) needs to be taken into account in terms of the results observed through the development of this study. Certainly, this study permeates many of behavioral modifications of the groups. It can be measured up to the point this variant influenced the results observed. In the case, for example, of greater tendency of the group CG to gradually evolve in reflex, tonic and postural functions, comparatively to the group IG can be an indicative of the effects of cerebral maturation differentiated between them. What occurs, nevertheless, is that the parallel effect of this variable came to be initially slower for the group GC. In other words, retarding the global developmental process of the group, undesirable condition to the harmonic development and full of activities of interaction, that the dialectics of developmental process of the newborn commends and requires.

CONCLUSION

Furthermore, form the detailed analysis of the results empirically worked on this study, it is verified that four weeks of intervention of premature newborn admitted to NICU seems to be a shorter span of time so that it can define real influences which the proposed intervention is made necessary before long the first days of hospital admission, providing the sensorial, tonic, postural and reflex systems with analogous conditions that the home ambience experienced by normal newborn experience.

Once known the interferences which the environment provides the newborn developmental process, and the advantages of the group IG over the CG to receive effectively the stimuli deriving from this interaction. It urges to suggest that further research in this direction can utilize an analogous program with a longer interval for the proposed interventions. Studies of this type, certainly, will be able to offer more foundations to define the proportions of the feasibility and advantages which this method can have or not over other correlated newborn treatment.

REFERENCES


