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TWO INFANT STIMULATION APPROACHES FOR PARENTS' ACTION IN EARLY PRETERM INFANT CARE: AN EXPLORATORY STUDY

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ABSTRACT

There are some studies about different types of sensory-motor stimulation for preterm infants. Traditionally the stimulation is done directly, in which the physiotherapist is the center of the process. However, a series of research works have drawn attention to the importance of babies' protagonism for their motor development, which implies an orientation to parents. This study investigated two approaches of sensory-motor stimulation for parents to perform to their preterm infants. The aim of the present study was to investigate the effect of two different stimulation approaches in the development of preterm infants. One approach was directive, in which parents have performed a strict order of movements. The second approach was indirect, in which parents were oriented to provide a rich context for sensory-motor stimulation so that infants could experience the association between their movements and environmental consequences. Seventeen preterm infants accompanied by their caregivers were divided into two groups: Directive Group, n=10; and Indirective Group, n=7. Infants' development was followed for over six months by the Alberta Scale. Although no differences were identified between the groups over six months of intervention in the different dimensions of the Alberta scale. After the intervention, the indirective group reached more advanced stages of development than the directive group, suggesting positive influence of an enriched environment on preterm infant development. Freedom for the child and an environment in which he is a protagonist, does not prejudice the intervention of physiotherapy on the child's motor development.

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INTRODUCTION

Parents and caregivers have a fundamental role for structuring the environment where infants will experience and develop their tasks [1,2]. Parents' education is one single factor to impact early infant development. It is known that mother's education can be a powerful factor in infant mortality [3,4] but there is a lack of studies looking at how parents can positively influence the development of their infants [5]. Still, little is known about whether and how teaching parents can help them influence the development of their infants. The relationship between parents' education and early child development is even more important considering the preterm infants, whose livebirths happened before 37 weeks of completed gestation. In Brazil the prevalence of prematurity is considered high, 11, 7% in regard to all births, in comparison to middle-income countries, 9, 4%. According to the Report "Born too Soon", released by the World Health Organization in 2012, there is an increase in premature births in Brazil. Besides that, the survival rates of preterm infants have also been increasing in the last two decades. The challenge is how to create an environment

As parents spend long periods with their infants, if they have sufficient knowledge on how to intervene, the prospects for their development are good. Petkovic et al. [6] identified a strong correlation between sensory-motor integration, motor development and learning. These infants also benefit substantially from participating in early intervention programs. The success of these programs depends on a number of factors, among which is the interaction between multidisciplinary team and family, as well as the way in which the child stimulation context would be structured [7,8]. Blackburn and Harvey [9] argue that parents of preterm children often identify that they need more accurate guidance to manage their children's steps during crucial stages of development. In a systematic review, Vanderveen et al. [10] concluded that the guidance given to parents and the degree of parental involvement in the stimulation process of infants are crucial factors for minimizing harmful consequences. It is worth mentioning that the impact of this stimulation would also be related to the educational level of parents and to the socioeconomic level of the family. Øberg et al. [11] conducted a qualitative study after a randomized controlled trial to assess the physiotherapy performance of a preventive program and

parent's experience with the intervention with preterm infants (gestational age ≤ 32 weeks). The study provided information about how practical knowledge can be communicated to parents. Overall, parents instructed by the physiotherapist became more active during the intervention program. Analysis of clinical trials in the last 15 years has identified models of contemporary interventions emphasizing the role of premature infants' parents' involvement. Preventive intervention programs focused on the challenges faced by families, in order to help them adapt to the characteristics of the child and set an ideal developmental environment, were reviewed. It was found that interventions initiated at various points throughout childhood and which differed significantly not only in terms of timing but also in duration, intensity, range, and other dimensions produce immediate and long-term benefits. In general, intervention programs that happen earlier are more effective for child development, especially when combined with counseling and parents' education [2]. Nevertheless, there are gaps in how effective parents can be in the intervention and also what the theoretical bases for the intervention are. It is not clear which kind of intervention produces greater effect on infant motor development for orienting intervention, once it is common that intervention follows a command style [12]. In this pedagogical style, the teacher or physical therapist makes all the decisions, while the infant (in the present case) is only a responsive machine.

The maturational approach [13] contributed greatly to this pedagogical style in which motor development is seen as a gradual unfolding of predetermined patterns in the central nervous system. However, if we consider the theoretical advances on the study of development, the most appropriate pedagogical approach would be one in which the intervention allows the infant to explore tasks and environment. For instance, in the Neuronal Group Selection Theory the brain is organized dynamically in variable networks, making variation a normal feature of development [14]. From this perspective, the orientation for intervention would be one of discovery or guided discovery [12]. The teacher or the physical therapist provides tasks and environmental settings that allow the infant to produce different movements to a given end. We could say that, in the command style, the emphasis of the intervention is on the repetition of movements. In the guided discovery style, the focus is on the action infants will do once they are allowed the opportunity to explore the space.

For Hadders-Algra [15], child-oriented work, parenting, and programs driven by dynamic intervention contexts are major challenges for early intervention programs recently. The supremacy of infants active participation contexts compared to conditions in which they should only observe or perform motor tasks directed by those responsible for the stimulation. Intervention models oriented through these assumptions [16]. In addition, Zigler, Dirks & Hadders-Algra [17] pointed to the need for these intervention assumptions to be effective against family-centered models. In view of these findings about the role played by the active participation of infants in learning contexts, the aim of the present study was to investigate the effect of two different stimulation approaches in the development of preterm infants.

METHOD

Participants: Parents of seventeen Brazilian preterm infants took part in the study accompanied by their children. They were selected from a community health center. The exclusion criteria were (1) presence of Acquired Chronic Encephalopathy and diagnosed congenital malformations; (2) genetic syndromes or diagnosed contagious infectious disease of the mother or infant; (3) previous or current participation in any other intervention program. The infants were distributed randomly into two groups: Directive Group (DG); $n = 10$ and Indirective Group (IG); $n = 7$. The IG initially had ten participants but three parents chose not participate in the survey after the first orientation meeting. All enrolled parents read and signed an

informed consent. They accepted publishing the data. The project was submitted and approved by an Ethics Committee.

Instrument and Measures

Developmental diagnosis: The Alberta Motor Infant Scale (AIMS) is a standardized scale developed by Piper and Darrah in 1994 [18] used to assess the developmental status of infants. This scale evaluates motor development of term and preterm infants, between 0-18 months of age, identifying infants whose motor development is delayed [18]. The scale has 58 items divided in prone (21 items), supine (9 items), sitting (12 items) and standing (16 items) postures. The scale is valid for the evaluation of motor acquisition of Brazilian infants [19]. It is an observational measure of motor performance that takes into account concepts of motor development, such as neuromaturation, perspective of the motor dynamics and evaluation of motor development sequence. The scale is scored passed or failed. In the end, the points in each posture are summed in a total score of observed items. The AIMS has high inter-observer reliability (0.96 - 0.99) and test-retest (0.86 - 0.99), the sensitivity varies from 77.3 to 86.4% at 4 months and specificity is 65.5% at 8 months [20].

Evaluation of socioeconomic level: The evaluation of parents' socioeconomic level was based on the Brazilian Economic Classification Criterion developed at the School of Economics, University of São Paulo, Brazil, based on the Survey of Household Budget carried out by the Brazilian Institute of Geography and Statistics. For this, parents and relatives received a questionnaire in the first intervention session.

Level of education of parents: Parents who took part in the study had completed basic education (equivalent to North American High School) but not higher education, according to the Brazilian Economic Classification Criterion (BECC). This instrument uses the survey of domiciliary characteristics (presence and quantity of some household items of comfort and education level of the head of the family). According to the indicated item, a score of 0 to 7 points was attributed, which later added up to the score obtained in the other items (comfort, basic sanitation, and street paving).

Recall instrument: The recall instrument was a questionnaire to obtain more information about the infant's daily routine during the period of intervention. The items encompassed clothing, feeding patterns and stimulation exercises performed at home. Responses given to the last item served as a reference to evaluate whether or not parents followed the guidance given according to each stimulation approach.

Procedures: The AIMS was applied three times over a period of four months. The first evaluation (EV1) was done before the guided intervention when infants were between five and eight months old. The second evaluation (EV2) took place two months after the first one. Finally, the third evaluation (EV3) took place two months after the second. At the moment of the first evaluation, parents of both groups were instructed to perform exercises with their infants. For both groups, it was stressed the importance of the stimulation practice. One physical therapist demonstrated what has to be done and how. Parents also received an illustrative and explanatory guide for the stimulation practice at home. Parents were encouraged to make questions and clarify any doubts they might have during the instruction meeting. The instructions and guide were substantially different for each group.

Directive Group (DG): Exercises and maneuvers followed the developmental sequence of motor patterns. This sequence was proposed by neuro-maturational approach, in which one particular reactive response of the infant must only be elicited once it shows itself. The focus was on orienting responses from head and trunk; grasping responses and limb righting responses. Indirective Group (IG): The exercises and maneuvers were based on what the infant could do within a context. This meant, for instance, to show a toy to capture the infant's attention and move it around to embed the

orienting response to an action. Another example would be to present a safe small toy into the infant's egocentric space (defined by the head/eyes and the hand) to elicit reaching and grasping responses. Parents were encouraged to vary infant's postures (i.e. prone, upright, etc.) and also objects, in order to create different conditions for the infant to explore space and events. Parents of both groups were oriented to perform the routine once a day for 15 minutes, whenever possible. In spite of the differences given by the stimulation approach, both guides emphasized some motor goals to be achieved or to be pursued such as to sit, to crawl, change to standing, standing with support, and start walking with support and without support.

Data analysis: The non-parametric Analysis of Variance Friedman test was conducted to analyze the degree of variance between the scores, percentiles, and categories of postures (prone, supine, sitting and standing) of AIMS. The post hoc Wilcoxon test was used when appropriate with level of significance of $p < 0.05$. The Wilcoxon Signed Rank Test was also used to check for intra-group differences.

the second to the third assessment, infants had their age corrected between 9 and 13 months. Infants in the IG were always a few points ahead from infants in the DG. The Supine Posture also improved over the four months period though the increase was slightly less marked in comparison to prone posture (Figure 1C). Both groups presented similar trends, though the former showed a greater progression from the first (score 5.6) to third (score 8.44) evaluations. The IG group presented mean scores higher than the scores presented by the DG in all three moments of evaluation, however, their improvement in the supine posture was less evident. In regard to the sitting posture, the DG presented more marked progress than the IG (Figure 1D). Infants in the DG had an initial mean score of 5.80 ± 3.60 , progressed to 9.40 ± 3.10 at the second assessment and ended with a mean score of 11.67 ± 1.00 . The IG showed better mean scores in the first two assessments but showed less marked progress in regard to third evaluation with a mean score of 11.29 ± 1.80 . The standing posture had the lowest mean scores for the first and second evaluations in comparison with the other dimensions for both groups (Figure 1E).

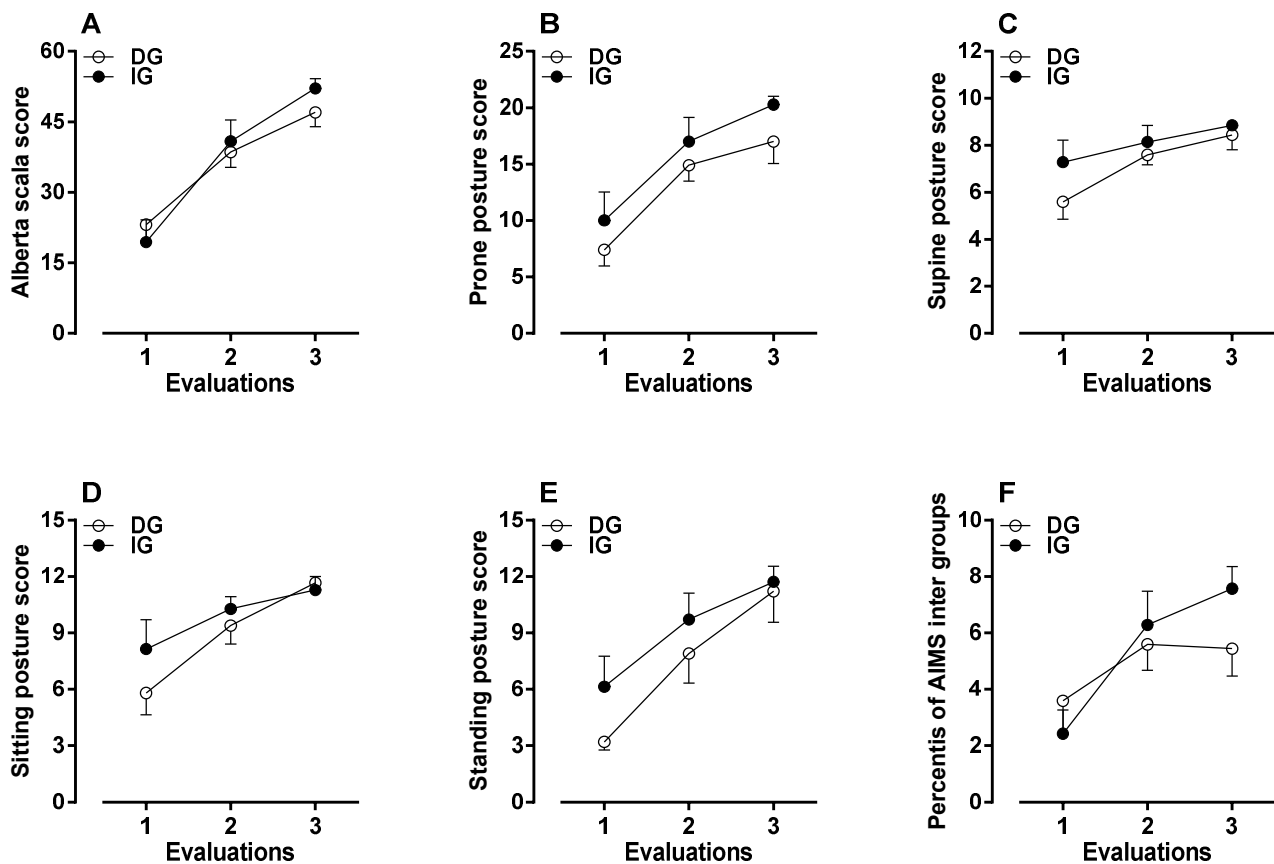


Figure 1. Values presented in mean \pm DP according to evaluation period of IG (Indirective group) and DG (Directive group). Panel A: Alberta scale score. Panel B: Prone posture score. Panel C: Supine posture score. Panel D: Sitting posture score. Panel E: Standing posture score. Panel F: Percentis of AIMS inter groups

RESULTS

Infants in the two groups showed similar progression over the four months period (Figure 1) ($Z = 44.434$; $p < 0.001$). The IG was slightly better after the third evaluation ($p = 0.018$). In the first valuation, the DG presented an average score of 23.10 ± 10.00 , while the IG had an average score of 19.43 ± 12.40 . At second evaluation, the DG advanced to an average score of 38.60 ± 10.30 and IG for an average 40.86 ± 11.9 . Finally, in the third evaluation, the DG reached an average score of 47.00 ± 9.10 , but the IG reached the average score of 52.14 ± 5.30 . No differences between all four dimensions (prone, supine, sitting and standing) were found between groups. The Prone Posture improved for the two groups (Figure 1B). It is worth remarking that from the first to the second evaluation, the infants had their ages corrected between 5 and 7 months. In the same vein, from

From the second to third assessments there has been sharp increase in the mean scores as all infants approached 9 to 13 months of age. Considering the percentiles to see how well infants were in regard to the normal distribution of the reference sample, a striking difference between the two groups (Figure 1F) was shown. The IG group had a sharp increase in the AIMS percentiles ($Z = 28.212$) groups, $p < 0.001$). The locus of difference was between the first and third assessments for IG ($Z = -2.733$, $p = 0.006$) and in the third assessment between the two groups ($Z = -2.878$, $p = 0.004$).

DISCUSSION

The objective of the present study was to investigate the possible impacts of two types of stimulation on infants' motor development

process, performed by their parents or caregivers. The two stimulation approaches contributed to infant development. However, if we consider the AIMS' total score and percentiles there has been an advantage for the IG. One possible explanation is that infants can have a richer environment to explore in the Indirective approach. It is important to note that the activities proposed by the directive approach were aimed at achieving developmental typical motor patterns. By contrast, the Indirective approach used environmental and social devices to build a context for the experience. In this way, reflex and spontaneous movements that infants perform would be associated with environmental and social consequences. This is the key for the emergence of actions in early infant development. In general, the two approaches contained the same motor objectives, such as strengthening neck and trunk muscles (in prone position), weight transfer (rolling in) strengthening abdominal muscles (sit in the pull position and pants) and, in the course of the processes, both favor the obtaining of three basic criteria for the motor evolution of both groups. Possibly the Indirective approach could be performed more effectively through the assessment dimensions of cognition and social aspects such as sense of security, confidence infants that are beyond the scope of this work.

Both groups of intervention responded and gave the recalls by the questionnaire. In DG, it was observed that parents or caregivers were limited to filling the spaces with alternatives, without making additional comments. However, in the return of evaluations, they had more questions about manipulation. By contrast, in relation to the parents or caregivers of IG, they wrote us recall what the infant held differently, or toyed with something different, based on what has been proposed or suggested in the approach. These parents also had some comments about the infant experience in any activity carried out within the proposed approach, a fact that makes us suppose that the parents of the two groups sought to follow the given guidelines. These identified differences suggest that, in fact, stimulating contexts were different. Regarding postures, changes in the prone and sitting positions identified in the groups may be associated to the impact of intervention. In the first evaluation, children were aged between 5 and 8 months corrected age. In the third evaluation, children were aged between 9 and 12 months corrected age. At this stage, the guidelines given were that the mothers of both groups, each within their approach, would train rolling with their infants on the 5th and 6th month; sitting between the 7th and 8th months; dragging at the 8th month (periods which coincide with the completion of EV1). From the 9th month, which coincides with the period in which EV3 was performed, mothers were instructed to carry out the training of the cat posture with their infants, but it is possible that, because of prematurity, they have reinforced by a time greater training of sitting. Importantly, both the drag and the crawl are variations of pronation posture.

One possible explanation for a good performance of infants in the prone and sitting positions in the face of Indirective approach is that it had to be richer in sensory stimulus both in the exercises and in the postures compared to the directive approach. In contrast, the Directive approach, being more manipulative allowed the parent or caregiver to have greater physical contact with the infant. In a study developed by Osorio et al. [21] aimed at identifying the relationship between stimulation and motor development at home for children 36 months of age, the total stimulation home was significantly associated with better performance in global and fine motor skills. They concluded that the static balance, locomotion to visual-motor integration would be associated with particular stimulus aspects at home, such as the interaction between parents and children, verbal reinforcement of the child's positive actions and the establishment of limits. In this case, when the child had the opportunity to participate in a context which was not merely manipulated, but had the ability to exploit it, the possibility of effective gains in these dimensions would be higher. Another study that corroborates our results verified the effect of multi-sensory stimulation (auditory, tactile, visual and vestibular) neuromotor development in premature infants [22]. In this work, fifty infants were distributed into two groups: control group and study group. The study group received sensory stimulation and

the control group received routine neonatal care. The study found that children stimulated in enriched environment had higher neuromotor scores compared to the control group.

This study also supports the work done by Ayad et al. [23], evaluating three groups of infants: A (control), B (study) and C (preterm infants), where the caregivers were asked to perform an improved handling and positioning activities with their infants 15 min daily. The specific activities involved encouraging and helping children by placing them in the prone position on the floor while the caregivers encouraged raising their heads. Another activity was the pull to sit slowly while helping to keep their heads straight and incentive to seek the middle line in the sitting position. According to the authors, these activities provide enhanced perceptual-motor experience from positions in order to promote the skills, including strength, postural control, and average hand line behaviour. These activities have also involved a certain amount of social interaction between caregivers and children. With regard to the scores of pronation postures, supine, sitting and standing, [19] analyzed the scores related to these dimensions and identified a wide range of variation in scores between the postures, with lower scores in prone and standing. These results contradict our study because one of the positions in which children showed significant improvement was pronation. Fleuren et al. [24] also identified lower scores of preterm infants in the prone posture assessment with AIMS. On the other hand, Pin et al. [25] evaluated the development of premature infants 0-18 months of age in the postures of AIMS and found that, from 4 to 8 months, the best performance was in the prone position and, to 12 months, in sitting postures pronation, which corroborates our results.

Results also indicated that children of DG and IG progress in their percentile values. The infants were aged 5-8 months corrected age of EV1 to EV2, where the main guidelines were rolling, training of sitting and dragging in EV3 infants had corrected age between 9 to 12 months where the guidelines were crawl, transfer to standing with support, and early gait training with support. This may have occurred because the children have been well trained in their exercises and parents have performed the exercises every day, keeping the same frequency, which is explained. Besides that, parents were very concerned and eager with motor development of their children and were, thus, very committed to the approaches. Although mothers were still anxious in the third evaluation, but at this stage is the desire of the acquisition of standing posture, the training of walking with support. With regard to the analysis of intra percentiles group, DG, showed no significant differences between percentiles during the three assessments. On the other hand, IG presented percentage differences between EV1 and EV2 and between EV1 and EV3, which reflects that only the IG were capable of making consistent change in infants' percentiles. It is important to note that the activities proposed by the directive approach were drawn up based on the maturational theory, with targeted exercises, in which infants were manipulated all the time to achieve the typical motor development patterns. By contrast, the Indirective approach enabled the use of other environmental devices that could contribute to the development of infants in a more playful and less manipulative way. For this approach, tactile, vestibular and proprioceptive, visual and auditory systems were considered for sensorimotor stimulation. Thus, a possible explanation for better IG's performance percentiles is that a more stimulating environment would be better for the infant's development, confirming one of the premises raised in this work.

Treyvaud et al. [26], in order to assess the relationship between the home environment and the initial results of development, examined 166 preterm infants in a tertiary maternity hospital to explore if an ideal home environment could promote resilience. Their study concluded that an environment to promote cognitive and socio-emotional would be characterized by greater possibility of choices for children in learning contexts similar to others [27-30]. Overall, it can be said that once parents have knowledge on how to stimulate their infants, they will do so, irrespective of the intervention approach. One interesting finding that needs to be pursued further is that the action and context-oriented approach that we have called Indirective seems to cause more positive impact on infant development. Indirective

approach puts the infant at the center of the intervention. It also encourages parents to interact with infants, exploring what they can do which, in turn, gives infants the opportunity to explore their resources. The study has many implications that warrant an integrated approach between health, psychology, and education. On the one hand, early care with preterm infants cannot be in charge only of physicians and physical therapists to conduct. It needs to involve parents. Physical therapy can guide parents to become co-therapists, hence making them active participants in a process that, likewise, aims at making infants subjects of their own development. On the other hand, health professionals need to consider educational psychology issues, because helping parents to become co-therapists involves some understanding of how infants organize their actions and tasks and how environmental constraints can be manipulated to yield different psychological effects

CONCLUSION

Our results showed that engaging parents in the intervention will impact the development of their infants, irrespective of the stimulation approach adopted. However, the action and context-oriented approaches had the edge over the Directive approach oriented by traditional neuro-maturational theory. The Indirective approach has the advantage of facilitating the interaction between infant and parents. The Directive approach puts too much emphasis on the repetition of given motor patterns disregarding the role of action and context. We believe that new studies are necessary to develop new ways to educate parents for promoting their infants' [31] and also to increase the efficiency of the Indirective approach to impact infant motor development. Other intervention studies need to be conducted, comparing different physical therapy approaches and guidance for parents, taking the impact of these different programs might have on other dimensions of infant behavior and parents' infants interaction into account. In addition, these studies should also seek to identify if there are associations between the way this intervention happens and the educational level and the economic condition of the families, since these are variables that can contribute substantially in the process of the development of the infants. It is fundamentally understood that research of this nature meets the demands for research in the field of educational and developmental psychology, once they focus on elements such as intervention time and heterogeneity [32]. At the same time, they are based on a paradigm of complexity, since it presupposes the richness of interactions that are established in the intervention contexts and in non-linear conceptions about the process of human development

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