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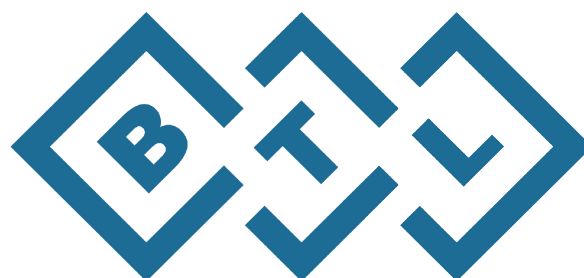


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Developing and validating the exercise protocol in early intervention treatment programs for early-term babies

Opracowanie i walidacja protokołu ćwiczeń w programach wczesnej interwencji dla wcześniaków urodzonych o czasie

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Abstract

Background. The aim of this study is to develop and validate a new exercise protocol for early intervention programs using VA cues and TVP stimulation for early-term babies. This includes evaluating the protocol and supporting its implementation in early intervention through expert content validation.

Methods. A five-point Likert scale was used to validate 10 online questions with the input of 15 experts. Reliability was tested in 30 babies aged between 3 and 6 months. A key challenge was to create a psychometrically reliable, practical, and efficient questionnaire for both clinical and research applications. This article outlines the guidelines used for the development and validation process, with a particular emphasis on developmental milestones. Various statistical techniques were employed to assess the validity and reliability of the questionnaire and ensure its psychometric quality. The exercise protocol was specifically designed for use with early-term babies.

Results. The Cronbach's alpha coefficient was 0.883, indicating an excellent level of internal consistency among the scale items.

Conclusion. Based on the Cronbach's alpha analysis, the developed exercise protocol is effective in reducing the risk of future developmental delays.

Key words

early intervention, VA cues, TVP stimulation, exercise validation, early-term babies

Streszczenie

Wprowadzenie. Celem badania było opracowanie i walidacja nowego protokołu ćwiczeń w ramach programów wczesnej interwencji z zastosowaniem stymulacji za pomocą VA cues i TVP u wcześniaków urodzonych na granicy terminu. Ocenie poddano skuteczność protokołu oraz możliwości jego wdrożenia, uwzględniając walidację treści na podstawie opinii ekspertów.

Metody. Zastosowano pięciostopniową skalę Likerta do oceny 10 pytań w badaniu online, które zostały zweryfikowane przez 15 ekspertów. Rzetelność narzędzia oceniano w grupie 30 niemowląt w wieku od 3 do 6 miesięcy. Największym wyzwaniem było stworzenie psychometrycznie wiarygodnego, praktycznego i efektywnego kwestionariusza, przydatnego zarówno w kontekście klinicznym, jak i badawczym. W artykule przedstawiono wytyczne dotyczące tworzenia i walidacji narzędzia, ze szczególnym uwzględnieniem kamieni milowych rozwoju. Do oceny trafności i rzetelności kwestionariusza zastosowano różne techniki statystyczne, aby zapewnić jego psychometryczną poprawność. Opracowany protokół ćwiczeń był dedykowany wcześniakom urodzonym o czasie.

Wyniki. Współczynnik alfa Cronbacha wyniósł 0,883, co wskazuje na bardzo wysoki poziom spójności wewnętrznej elementów skali.

Wniosek. Na podstawie analizy alfa Cronbacha można stwierdzić, że opracowany protokół ćwiczeń skutecznie zmniejsza ryzyko wystąpienia przyszłych opóźnień rozwojowych.

Słowa kluczowe

wczesna interwencja, VA cues, stymulacja TVP, walidacja ćwiczeń, wcześniaki urodzone o czasie

Introduction

In several disciplines, such as business, psychology, economics, and biology, the terms growth and development often refer to two related but different ideas [1]. Growth is the term used to describe an organism's rise in size or mass [2]. Cell division and an increase in the total number of cells are two processes that occur during growth in living things [3]. Development is the set of adjustments and changes that an organism goes through during its life cycle. Changes in behavior, structure, and function are all included in this, as is the development of new abilities or skills [4]. Developmental milestones are significant accomplishments or capacities that kids usually obtain at different phases of their development [5]. During routine check-ups, pediatricians use these milestones as benchmarks to evaluate a child's development [6]. It's crucial to remember that there is a range in what is deemed usual and that individual children may hit these milestones at somewhat different periods [7]. The following are some typical developmental benchmarks that apply to various domains. Cognitive Development: Thinking, reasoning, and problem-solving skills are measures to gauge a child's mental development [8]. This covers significant events, including the acquisition of language, memory, and academic success [9]. Motor Development: When observing a child's motor abilities, look for both gross motor skills, like walking and crawling, and fine motor skills, like hand-eye coordination and writing [10]. Social and Emotional Development: This includes assessing a child's capacity for relationship building, emotional expression, and social cue comprehension [11]. Global developmental delay (GDD) refers to significant delays in two or more developmental domains, such as gross or fine motor, language, cognitive, or social skills. Prevalence of the global estimates suggests a prevalence of GDD ranging from 1% to 3% among children [12]. Recent reports indicate a much higher prevalence of GDD at 6.4% among children in Turkey [13]. The prevalence of GDD is reported to be even higher in the UAE, with estimates at 8% [14]. In India, various studies have reported a wide range of prevalence rates for GDD, spanning from 3% to 13%. GDD is reported to be approximately 30% more common in boys compared to girls. However, this gender difference tends to diminish with increasing age. Depending on adaptive functioning, there are four levels of GDD severity: mild, moderate, severe, and profound [15]. In early childhood special education and healthcare, early interventions remain a critical preventive and mitigating technique [16]. Therefore, policymakers and practitioners must address systemic challenges and biases within systems to promote equitable access to resources and advance well-being. This narrative review aimed to summarize new findings and current studies on early childhood treatments and pinpoint areas for future development in the field.

Description

Basics of consideration: Using the VA cues and the TVP stimulation to prevent further developmental delay [17]. Creating the exercise protocol: To create a new exercise protocol that should be selected for the appropriate cues and exercise design for their month-wise [18].

Recognize the importance of the idea: framing the exercise protocol by using VA cues and TVP stimulation is effective in treating developmentally delayed people and preventing further developmental delay [19]. Decide on the format for distributing the questionnaire: The purpose of this exercise protocol framing is to quantify significant cognitive associations related to the developmental milestones of early-term babies [20]. The exercise protocol is framed and quantified using ten questions based on the importance of appropriate cues and stimulation applied in the intervention. Questionnaire items were selected based on relevance, analysis from previous studies, and consistency. Format the item: Questions are developed by close-ended question types. A 5-point Likert scale was used to interpret the question. Framing question: The question is framed to be simple, easy to follow, and straightforward, specifying the month and the cues selected in the exercise protocol for 3-month, 4-month, and 5-month early-term babies. According to the survey results of the KEIDDAP questionnaire, there is less knowledge about early intervention among parents [21]. Finalize the planned section of the form: After framing the exercise protocol, use appropriate closed-ended questions with specification: Send the question to 15 experts, 5 Pediatric physiotherapists, 5 early intervention therapists, and 5 occupational therapists with more than 10 years of clinical experience online. Introductory pilot analysis: It is desirable to check the exercise protocol of a small sample of respondents before doing a pilot test of the workout routine of the targeted respondents.

Methodology

A preliminary exercise protocol was developed based on existing literature, best practices, and research goals, serving as the foundation for expert evaluation. The content validation process involved 15 experts, each with over 10 years of clinical experience. Experts were categorized into three groups: pediatric physiotherapists, early intervention therapists, and occupational therapists, with five members from each group. They participated in an online survey to validate the questionnaire using a 5-point Likert scale (CVI). Expert review helps identify implicit issues in data quality and collection, ensuring clinical relevance and alignment with previous research. The exercise protocol incorporates visual-auditory (VA-Cues) and tactile, vestibular proprioception (TVP) stimulation. It includes month-wise exercises using visual cues like colorful rattles and moving toys, along with auditory cues such as anklet sounds, glass bangles, and Puja bells. Designed for 60-minute sessions on alternate days over three months, the protocol supports gross and fine motor skill development. Inspired by Hemmeter et al.'s pyramid model, it aligns with early intervention frameworks to enhance coordination and developmental progress in infants aged 3 to 6 months.

Exercise Protocol (Early Intervention)

3rd Month

The exercise protocol incorporates visual stimulation with bright-colored toys and auditory cues like pooja bells, bangles, and anklets. Parents facilitate reaching and grasping toys while assisting with gentle upper and lower limb movements. Tummy time and joint proprioception techniques are introduced to enhance core strength. Sessions last 1 hour, 5 times weekly.

4th Month

Activities remain similar, emphasizing visual and auditory stimulation, reaching, grasping, tummy time, and proprioception, along with assisted limb movements. Sessions continue for 1 hour, 5 times weekly.

5th Month

The protocol advances to prone pivoting, creeping over obstacles, sitting with trunk bending, mirror-based visual tracking, and hand-to-mouth coordination. Sessions remain for 1 hour, 5 times weekly.

Exercise Protocol (Parental Education)

3rd Month

Parents use colourful toys, musical objects, and textured materials to enhance sensory engagement. Face-to-face play and frequent verbal interactions are encouraged, along with toys that promote reaching and grasping. Sessions last 1 hour, 5 times weekly.

4th Month

High-contrast picture books stimulate visual interest, and parents guide babies in tracking moving objects. Activities include singing, narrating daily tasks, responding to baby sounds, and practicing rolling movements. Sessions continue for 1 hour, 5 times weekly.

5th Month

Light-up toys, mirrors, and music-based rhythmic activities

are introduced. Noise-making toys are placed out of reach to encourage creeping, and interactive games like peek-a-boo are incorporated. Sessions last one hour and occur five times weekly.

Results

Interest in framing a developmental protocol for early-term babies, and validation of the frame of the question

Results: on the basis of the online survey

Develop a questionnaire

- I. Selection of professional board
- II. Identify the dimensionality of the construct.
- III. Define exercise protocol format
- IV. Define exercise protocol

Online survey

Preliminary pilot testing: After the experts' results were received, 2-3 exercises were modified, and the questionnaire was sent back to them. The exercises were modified due to difficulties in administering them and other practical problems.

Test-retest: The corrected exercises were again sent for the expert's opinion and finalized with that. The test-retest system measures the consistency of exercise results administered to the same group of people at two different times.

Validation: After receiving the experts' replies, the questions were marked according to the 5-point Likert scale.

Table 1. Cronbach's Alpha of the Item

Item	Mean if Item Deleted	SD if Item Deleted	Item-Total Correlation	Cronbach's Alpha if Item Deleted
q1	41.9333	15.924	0.655	0.874
q2	42.0667	14.495	0.672	0.867
q3	42.3333	14.238	0.469	0.889
q4	42.4667	11.838	0.759	0.866
q5	42.0000	16.000	0.518	0.879
q6	42.2667	14.638	0.580	0.874
q7	42.2667	12.781	0.857	0.850
q8	41.9333	15.638	0.763	0.869
q9	41.9333	16.067	0.601	0.876
q10	42.0000	15.143	0.798	0.865

These 10 questions were framed for the exercise protocol content validation. Item 3 has the lowest corrected item-total correlation (0.469), indicating it correlates less strongly with the total scale score compared to other items. Item 7 has the lowest Cronbach's Alpha if deleted (0.850), suggesting that removing this item would have the most detrimental effect on the overall scale reliability. Items 4 and 10 have relatively high corrected item-total correlations and high Cronbach's Alpha if deleted, indicating they contribute significantly to the scale's reliability and overall measurement. Imagine if a new scale is created to evaluate how well VA cues and TVP stimulation work in addressing developmental delays in early-term infants.

Discussion

Early intervention in developing and validating exercise pro-

ocols for early-term babies (37–38 weeks of gestation) is crucial for addressing developmental delays. Research suggests that the most significant progress occurs within the first two years, particularly in the first year [22]. Higher intervention intensity correlates with more significant child gains, with university-led interventions outperforming community-based ones [23]. This study designed a 60-minute intervention protocol, benefiting children with moderate developmental delays due to faster motor learning and lower brain involvement impact. Fidelity of implementation improves child behavior and reduces parental stress [24, 25]. While some studies emphasize interventionist expertise over dosage, the proposed protocol is simple, realistic, and effective in gross motor development. Comparing validation results with existing research highlights its feasibility and alignment with motor learning strategies, ensuring practical clinical application.

Conclusion

In conclusion, the development and validation of the exercise protocol represent a significant milestone in early intervention treatment programs for early-term babies, offering promising avenues for enhancing the long-term health and developmental trajectories of this vulnerable population. Moving forward, continued research and implementation efforts are warranted to refine and optimize early intervention strategies, ultimately improving outcomes for early-term infants and their families.

Limitations of the study

The sample size is small, and the long-term benefits of the protocol's effectiveness were not monitored.

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