COMPARISON OF THE EFFECT OF GAMETHERAPY VERSUS CINESIOTHERAPY ON FUNCTION, RANGE OF MOTION OF UPPER LIMBS, AND BRAIN ACTIVITY IN CHILDREN WITH DOWN SYNDROME: A CROSSOVER, PLACEBO-CONTROLLED, DOUBLE-BLIND CLINICAL TRIAL.

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INTRODUCTION

Down Syndrome (DS) is a genetic condition characterized by a chromosomal abnormality[1,2]. There is a variability of deficits in the learning process and in the development of motor skills with a delay in the acquisition of basic motor milestones, impacting[3,5] selective motor control, compromising motor acquisitions and the functional independence of the individual[4].

In the field of assessments, there is currently the use of human movement analysis of upper limbs (UL)[6]., the kinematics of upper limb movement in children has already been addressed in several studies[6, 7] with excellent results, the association of

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brain activity assessment with the use of electroencephalogram can provide a comprehensive evaluation of motor adaptation through the simultaneous study of biomechanical and electroencephalographic evidence, being able to clarify how the motor and brain activity of individuals with neurological diagnoses differs from normal movement patterns during the preparation, execution, and post-execution phases of a task[8].

Given all the deficits mentioned in the field of rehabilitation, we have classical kinesiotherapy applied to the improvement of motor function in individuals with DS. we have classical kinesiotherapy with kinesiotherapy that generates beneficial[9] effects, and currently, we have the use of gametherapy with the purpose of promoting movement repetition through functional and motor training[10].

Thus, the objective of the present study is to conduct a comparative analysis between the effects of ten sessions of upper limb gametherapy training and kinesiotherapy on the functionality, movement pattern (spatio-temporal parameters, kinematics), and brain and muscle activity of children with Down syndrome.

METHODOLOGY

The present study adheres to the Guidelines and Regulatory Norms for research involving human beings. The study has been approved by the Ethics Committee of the Evangelical University of Goiás - UniEVANGÉLICA, number XXXXXXXXX. This is a cross-sectional, placebo-controlled, double-blind study with children with Down syndrome aged 6 to 12 years selected from the Association of Parents and Friends of Exceptional Individuals of Anápolis - APAE. The participants will be randomly divided into two groups:

Group 1 (G1) - Upper limb gametherapy training;

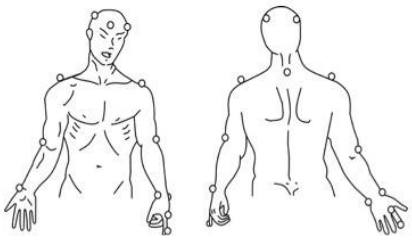
Group 2 (G2) - Kinesiotherapy of the upper limbs.

Evaluation Protocol

Upper limb assessment - Three-dimensional movement analysis

The kinematics of upper limb movement will be evaluated using the SMART-D 140 system (BTS, Milan, Italy), with eight cameras sensitive to infrared light, a sampling frequency of 100 Hz, and a video system synchronized with the SMART-D system. Passive markers will be positioned on anatomical reference points directly on the skin with specific adhesive tape, following the SMARTup protocol: the experimental setup (figure 1). A total of 18 markers measuring 15 mm in diameter will be used to identify the position of the head, trunk, and upper limbs.

Figure 1 - Placement of markers for three-dimensional analysis using SMARTup: the experimental setup.

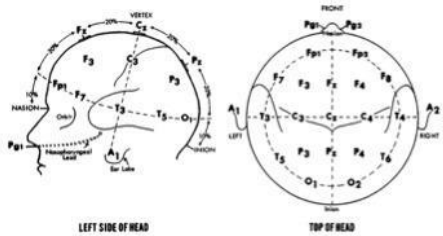


Source: manual.

Evaluation of brain activity - Electroencephalogram

The brain activity will be investigated using electroencephalography (EEG), which will in turn occur during the three-dimensional analysis of the reaching task and the assessment of muscle activation using EMG. For this, the volunteer will be seated in an upright position in a chair in front of the table where the reaching task will be performed. The BrainNet BNT36 device with 36 configurable channels (32 AC and four DC) and a 16-bit analog-to-digital converter will be used for EEG signal acquisition. The electrodes will be positioned according to the guidelines of the 10/20 EEG system (figure 2).

Figure 2: Positioning of electroencephalography electrodes based on the 10-20 system



Source: manual.

Motor function assessment - box and block scale

With the aim of evaluating and quantifying the participant's gross manual dexterity and skills, the test allows for the observation of the time and endurance in its execution. The test is simple and consists of transporting small wooden cubes from one side to the other for one minute. These blocks must be moved from one end to the other.

Intervention Protocol

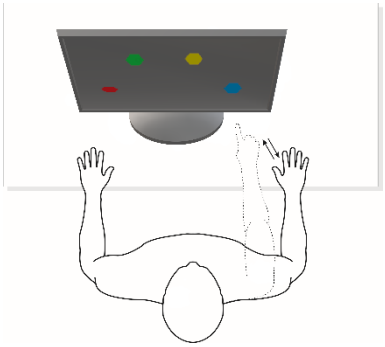
Kinesiotherapy

Based on the neuro-evolutionary Bobath concept, a structured protocol with five activities will be applied, starting with sliding tapping to activate inactive musculature for 30 seconds; stretching of the biceps brachii, triceps brachii, and brachioradialis performed in 3 sets of 30 seconds each, free active exercises for strengthening with a ball where the child will pick up the ball, perform the forearm pronation movement followed by a 45° elbow flexion and a 90° shoulder flexion in 3 sets of 15 repetitions, free active exercises for strengthening shoulder abduction and adduction in 3 sets of 15 repetitions.

Gametherapy

Involving the use of a Touch monitor, a playful memory game - GENIUS, developed by the Research and Technological Applications in Rehabilitation Group (PATER) at the School of Arts, Sciences, and Humanities of the University of São Paulo - EACH / USP, part of a software package that includes a variety of games focused on rehabilitation, composed of the display of figures in random order, so that the child and adolescent will be guided to touch only those indicated in the corner of the screen, thus performing a motor task of manual reach associated with a cognitive task of memorization and attention (figure 3). The records will be made after each session with the final score of errors and correct answers and the advancement of the difficulty level.

Figure 3 - playful memory game - GENIUS



Source: *the author.*

EXPECTED RESULTS

The impact of the presented study refers to the potential of this innovative research in the context of the rehabilitation of this population, both as an intervention and as a method for evaluating therapeutic outcomes, standing out for its originality involving innovative techniques in the field of research and rehabilitation of the involved population.

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