

EFFECT OF THERAPEUTIC LISTENING ON ANXIETY AND GROSS MOTOR DEVELOPMENT IN CHILDREN WITH SPASTIC CEREBRAL PALSY

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ABSTRACT

Objective: Gross motor function delay as a motor development and anxiety as a socioemotional development are the core problems through the rehabilitation of a child struggle with cerebral palsy (CP). Using a unique approach for motivation and relaxation at the same time through the auditory sense is considered in varied clinical conditions. The purpose of this study was to determine the impact of 12-week combined physical therapy and music therapy program on gross motor development and anxiety levels of children struggle with spastic CP.

Methods: A total of 15 children struggle with spastic CP (grade 1 & 1+), age ranged (3-8 years) were assessed pre and post intervention. They all received tailored combined physical therapy in addition to passive music therapy program for 1 hour, 3 times/week over a period of 12 weeks. Thereafter, Gross Motor Function Measure (GMFM-88) was used to detect change across the gross motor development, Modified Yale Preoperative Anxiety Scale (m -YPAS) was used to detect change regarding anxiety level and Modified Ashworth Scale (MAS) was used to detect spasticity degree for participant selection.

Result: Post treatment values revealed significant improvement in the measured variables ($p < 0.05$), as there was improvement in the anxiety level where pre and post intervention result's mean \pm standard deviation respectively was (51.40 ± 23.68 and 23.41 ± 0.43 , $p < 0.05$). Additionally, the group showed a significantly greater improvement in GMFM-88 values where pre and post intervention mean \pm standard deviation respectively was (39.24 ± 21.25 and 64.22 ± 19.03 , $p < 0.05$).

Conclusion: Using music as a therapy in its passive live type can relieve anxiety thus enhancing gross motor development in children struggle with spastic CP.

Key Words: Anxiety; Cerebral palsy; Spastic; Gross motor development; Singing; Passive Music therapy.

INTRODUCTION

The explanation and categorization of cerebral palsy (CP), as well as the strategy to rehabilitation, have evolved during the last 25 years. CP is a mobility and posture disorder that causes activity limits due to non-progressive abnormalities in the fetus or infant brain, which can affect sensation, perception, cognition, communication, and behavior. **Chakraborty et al., (2020)**, CP rehabilitation could be a complex issue, including: first “temporal axis”: Habilitation/rehabilitation must start early as possible and be delivered continuously – a minimum of within the child’s first years of life – and intensively – consistent with individual needs – and be geared toward promoting skills that may support social participation and integration in adult life, second a “spatial axis”: Environments and contexts. Family, school, social affair places, and also the individual space must all be considered within the habilitation and rehabilitation plan, third a “individual axis”: specializing in the individual as an entire. rehabilitation must observe the individual as an active player, and not as a passive recipient of care, then the fourth “relational axis”: the standard of interpersonal relationships, focus is on people that, in numerous roles, be sure of the patient with CP, **Antonio et al., (2016)**.

Anxiety is a psychological, physiological, and behavioural state induced in animals and humans by a real or perceived threat to their well-being or survival. Increased arousal, expectation, autonomic and neuroendocrine activity, and certain behavioural patterns to assist in coping with adversity or surprise. Although it is a natural adaptive response, it can become pathological, impairing one's capacity to deal well with a variety of situations and even affecting one's physical health (e.g., formation of gastric ulcers). **Thierry, (2002)**, children with CP show more emotional and behavioral symptoms (depression, anxiety, and social, thought, and attention problems) and lower quality of life than others, **Levy-Zaks et al., (2014)**.

Traditional interventions consist of a combination of sensory integrative, gross motor, fine motor, and perceptual-motor activities, **Polatajko et al., (1995)**, task-oriented strategies: practicing real-life activities with the goal of building expertise; process-oriented strategies: particularly created kinesthetic tasks. **Blank et al., (2012)**, perceptual motor skills refer to a child's growing ability to engage with his surroundings through the use of both his senses and his motor abilities This is defined as a process in which perceptual motor skills are developed by combining visual, auditory, and tactile sensory capacities with emerging motor capabilities. **Frost et al., (2015)**, music listening, where someone is listening to live or recorded music, is defined passive because no music engagement or active participation is involved. Though some classify therapeutic music listening alone as a therapy from clinical music therapy, music listening is classified

as one of the many techniques used in music therapy. **American Music Therapy Association, (2015)**, children with hemiplegic CP use feedback in a comparable manner to children with typical development when learning new skills with their less involved hand, but show less accuracy and consistency. When children were given frequent feedback, they retained more of the motor skill they had learned; however, more trials with augmented feedback may be needed in children with CP. Finally, the use of feedback to supplement instruction should be tailored to the person, based on the most current motor learning principles, and the intervention results should be monitored on a regular basis. **Burtner et al., (2014)**, accordingly, we hypothesized that passive music therapy intervention would improve anxiety level and gross motor development level in children struggle with spastic CP who are rehabilitating physical therapy program.

METHODS AND MATERIALS:

Participants

A total of 15 children struggle with spastic CP (mean age: 4.87 years old) were recruited from the outpatient clinic of the faculty of physical therapy at Cairo university. The age of children ranged from 3 to 8 years old (early childhood). None of the patients underwent a music therapy program within the last 6 months. The degree of spasticity was 1 and 1+ according to Modified Ashworth Scale. **Bohannon and Smith (1987)**, anxiety level was assessed by Modified-Yale Preoperative Anxiety Scale and gross motor developmental delay was assessed by Gross Motor Function Measure-88. Children struggle with deafness and auditory perceptual disorders were not included.

Procedures

Gross motor function measurement-88

Delayed milestone was assessed using different domains of GMFM-88, a standard measurement tool for evaluating children struggle with CP that include 88 items categorized into five categories: 1) Lying and rolling, 2) sitting, 3) crawling and kneeling, 4) standing, and 5) walking, running, and jumping. **Adrienne, (2017)**, it was used pre and post intervention to detect gross motor development change.

Modified Yale Pre-Operative Anxiety Scale

The (m -YPAS) contains of 5 items (activity, vocalizations, emotional expressivity, state of apparent arousal, and use of parent). Every item has Likert-type response options reflecting behaviors. Children's behavior was graded from 1 to 4 or 1 to 6 (depending on the item), with higher numbers means the highest severity within that item. **Jenkins et al., (2014)**, internal reliability, interrater reliability, and convergent validity are all significant features of the m-YPAS test. **Zeev et al., (1997)**, it was used pre and post intervention to detect anxiety level change.

Intervention

For 50 minutes to 1 h\ 3 times\ week over 12 weeks, 15 children received a designed Physical Therapy program that tailored for every individualized case in the group according to the score of gross motor development through the GMFM-88 scale, to facilitate one of the following milestones: Rolling, Sitting, Creeping, Standing& Walking. By training the child the missed tasks of the targeted milestone according to GMFM-88, combined with music therapy program when children received a music listening program (live singing) according to the preferred song to each child as an auditory feedback. The received music during physical therapy session was utilized by two ways according to the aim of the task: Task for stability : The live singing began and continued as long as the child was stable , and stop when the child lost his stability, then the child was helped to maintain the static position and again the live singing was continued .By this way the child was encouraged to maintain stability as much as possible (A way of behavior modification). - Task for mobility: The live singing was begun at the end of each right step during the segmented functional task for 10 to 15 seconds (A way of reinforcement) Types of the played music were differentiated between: Popular Arabian music for children, popular Arabian music for adults, or the Religious one for children that their parents refused them to listen to any other type of music for traditional, religious, or other concerns.

Data analysis

Results are expressed as mean \pm standard deviation or number (%). Comparison between mean values of variables measured at pre- and post-treatment was performed using paired t test. Percent improvement = [(pre-treatment - post-treatment)/pre-treatment] x 100. Statistical Package for Social Sciences (SPSS) computer program (version 19 windows) was used for data analysis. P value \leq 0.05 was considered significant.

RESULTS

The mean value of m-YPAS measured before and after treatment was 51.40 ± 23.68 and 23.41 ± 0.43 , respectively. There was a statistical significant decrease in its value measured at post treatment when compared with its corresponding value measured at pre-treatment with t value= 4.559 and p value = 0.001. The percent decrease in its value was 54.46% (**Table 1; Fig.1**).

Table (1): Comparison between mean values of m-YPAS measured before and after treatment.

| Variable | Pre Treatment | | Post Treatment | | % of Improvement | Within Group | |
|----------|---------------|-----------------|----------------|---------------|-------------------------------|--------------|-----------|
| | Mean | (\pm SD) | Mean | (\pm SD) | | t-value | P-value |
| mYPAS | 51.40 | (\pm 0.23.6) | 23.41 | (\pm 0.43) | -54.45 $\downarrow\downarrow$ | 4.559 | 0.001 (S) |

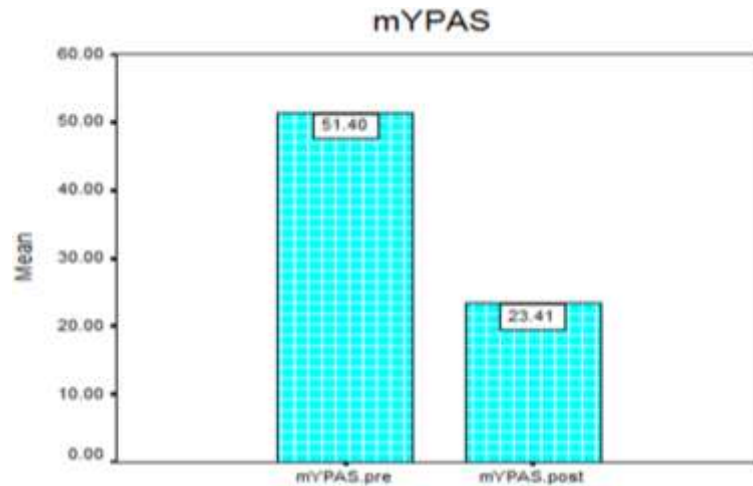


Fig. 1: Mean values of m-YPAS measured before and after treatment.

The mean value of GMFM 88 measured before and after treatment was 39.24 ± 21.25 and 64.22 ± 19.03 , respectively. There was a statistical significant increase in its mean value measured at post-treatment when compared with its corresponding value measured at pre-treatment with t value= 6.521 and p value = 0.001. The percent increase in its value was 63.65% (Table2; Fig.2).

Table (2): Comparison between mean values of GMFM 88 measured before and after treatment.

| Variable | Pre Treatment | | Post Treatment | | % of Improvement | Within Group | |
|----------|---------------|----------|----------------|----------|------------------|--------------|-----------|
| | Mean | (±SD) | Mean | (±SD) | | t-value | P-value |
| GMFM 88 | 39.24 | (±21.25) | 64.22 | (±19.03) | 63.65 ↑↑ | 6.521 | 0.001 (S) |

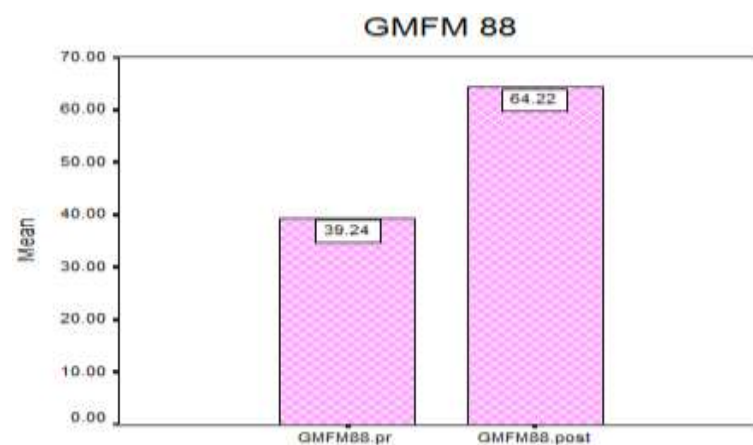


Fig. 2: Mean values of GMFM 88 measured before and after treatment.

DISCUSSION

The main goal of the study was to determine the effect of using listening in a therapeutic form (Passive live music therapy by singing) on anxiety level during physical therapy sessions due to stranger fear or any related causes, showing its influence on the gross motor development level in children who struggle with cerebral palsy (CP). Accordingly, our results revealed significant improvements in anxiety relieving and gross motor development levels in our participants. The current study confirms that the anxiety can be relieved in children struggle with spastic CP using music and physical therapy combined program.

The stated relieve in anxiety level by music therapy suggested changes in learning capacity which allowed for improved gross motor function in these children. We believe that the significant improvement in the varied domains of the GMFM-88 occurred simultaneously with the relieve in anxiety level. Moreover, these results support the efficacy of 12 weeks of music combined with physical therapies intervention enhanced the gross motor development level in children with spastic CP, thereby relieving anxiety. These results are consistent with those of **Permaida, (2012)**, who suggested that giving music therapy to children with cerebral palsy is effective in reducing anxiety, depression, and frustration. Other effects can increase feelings of pleasure, calm, and feel empowered. Music therapy is an inexpensive and easy procedure, is also safe to use. **Vinolo-Gil et al., (2021)**, reinforced our results using physiotherapy combined with music therapy can be useful in improving motor function in patients with cerebral palsy in general, allowing them to perform voluntary motions more easily. **Tze-Hsuan et al., (2013)**, further reinforced our results: For children with cerebral palsy, combining neurologic music therapy with functional resistance training may result in better increases in gross motor capacity.

Considering voice as an instrument, and the enthusiasm of our participants not only to be passive listeners, but also to actively try to sing, **Marrades-Caballero et al., (2018)**, stated that: In order to develop motor control, musical training with instruments allows for interrelationships between movement, emotions, and cognition for task-based learning. **Vaajoki et al., (2012)**, stated that non-pharmacologic pain relief, such as music therapy, alleviates patients' pain and anxiety.

Regarding physical changes as we mentioned in chapter 2 that anxiety is not just a feeling, but also accompanied by physical and mental changes, Listening to relaxing music reduces biochemical markers of stress **Lai, and Li (2011)**, depression, and disability **Siedliecki and Good (2006)**, promotes sleep and relaxation **Su et al., (2012)**, improves quality of life **Lee et al., (2010)**, comfort, and analgesia **Li et al., (2012)**, reduces heart rate, blood pressure, body temperature, respiration rate, and

pain (Deng, and Cassileth 2005 and Korczak *et al.*, 2013), and stimulates electroencephalographic waves, which are related to endorphin release, relaxation, pain relief, and lowered blood pressure and heart rate Demir,(2012).

Study limitations

The first limitation is when the therapist was affected by sore throat. While the second one was when the therapist is emotionally not good, it was such a struggle to sing and encourage the child, But the surprise is that the newborn link between the caregiver and the child due to singing give the child a real opportunity to feel the other's state even if the child was blind due to the acoustical memory as said: "In relation to Sound and Soundscape investigations, acoustical memory significantly affects our judgements and emotions too". Rychtarikova, (2015), and thanks to their unique brain plasticity: "Despite the fact that blind persons have the same hearing apparatus as sighted people, they are usually better at processing auditory information; plasticity of brain helps to people with visual impairment to develop extra abilities in processing of auditory cues Rychtarikova, (2015). The third one is the small sample size. The fourth is absence of blindness 'Although blinding is necessary in research to reduce bias, it is difficult to do so with music-based therapies, especially live music' Alexandra *et al.*, (2021).

CONCLUSION

The present study showed significant improvement in anxiety and gross motor function levels in all our participants and, after a regular physical therapy program that included the facilitation of the targeted milestone (Rolling, Sitting, Crawling, Standing, Walking), combined with passive music therapy program (singing) in children struggle with spastic CP, suggesting passive music therapy as a useful intervention for relieving anxiety and enhancing the level of gross motor function during physical therapy sessions for them.

RECOMMENDATIONS

This study shows that passive music therapy combined with physical therapy program can aid in relieving anxiety and improving motor function in children struggle with spastic CP. Thus, passive music therapy is recommended as part of a rehabilitation program for such children. This study's results can help individuals with CP who have anxiety problems (cry, refuse to participate in the session, clinging to his parents) or to improve gross motor function level.

Source of funding

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Conflict of interest

The authors have no conflicts of interest to declare.

Ethical approval

This study was approved by the Ethical Committee faculty of physical therapy, Cairo University y (NO:P.T.REC/012/002297) on 3 March 2019.

Authors contributions

SMM conceived and designed the study, conducted research, provided research materials, and collected and organized the data. MSM analyzed and interpreted data, wrote the initial and final drafts of the article and provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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تأثير استخدام العلاج بالاستماع علي مستوي التوتر و التطور الحركي للأطفال المصابين بالشلل الدماغي

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أهداف البحث: تعتبر التأخر الحركي علي مستوي الجانب الجسدي و التوتر علي مستوي الجانب النفسي من أهم المضاعفات الرئيسة للأطفال الذين يناضلون من أجل تأهيلهم بسبب اصابهم بالشلل الدماغي التشنجي . ويعد استخدام المؤثرات السمعية أسلوباً فريداً لحل تلك المشكلتين في مختلف الدراسات السريرية القوة والقدرات الحركية في العديد من الحالات السريرية. ويهدف هذا البحث لتحديد تأثير تدخل العلاج باستخدام الموسيقى كجزء من التأهيل الي جانب برنامج العلاج الطبيعي لمدة 12 أسبوعاً علي مستوي التقدم الحركي و النفسي من ناحية التوتر عند الأطفال المصابين بشلل دماغي تشنجي.

طرق البحث: تم اختيار ما مجموعه 15 من الأطفال المصابين بالشلل الدماغي التشنجي بدرجة (1 و +1) علي المقياس التشنجي و أعمارهم تتراوح بين (3-8 سنوات) ،حيث تلقوا برنامج العلاج الطبيعي المصاحب لبرنامج العلاج الموسيقي الاستماعي المحدد لكل طفل لمدة ساعة واحدة، 3مرات /الأسبوع على مدار 12 أسبوعاً. بعد ذلك، تم قياس مستوي التوتر مقياس (يل) وقياس مستوي التقدم الحركي بمقياس الوظيفة الحركية (الإجمالية-88) قبل و بعد التدخل العلاجي.

النتائج: أظهرت قيم ما بعد العلاج تحسناً كبيراً في المتغيرات المقاسة لصالح النسب ما بعد التدخل العلاجي، فكان هناك تحسناً علي مستوي التوتر حيث النسبة بين القياس قبل و البعد العلاجي علي الترتيب (51.40 ± 23.68 and 0.43 ± 23.41) وكان هناك أيضاً تحسناً كبيراً ملحوظاً في قيم قياس الوظيفة الحركية الإجمالية-88 بالمقارنة بين النسبتين قبل و بعد التدخل العلاجي علي الترتيب 39.24 ± 21.25 و 19.03 ± 64.22

الاستنتاجات: يمكن أن يكون لاستخدام الموسيقى لهدف علاجي بنوعها الاستماعي الحي تأثير ايجابي علي خفض مستوي التوتر و بالتالي رفع مستوي النمو الحركي عند الاطفال المناضلين للتأهيل بسبب الشلل الدماغي التشنجي.