



Original Article

The immediate effects of keyboard-based music therapy on probe reaction time

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Abstract [Purpose] This study examined the immediate effects of keyboard-based music therapy on Probe Reaction Time. [Subjects and Methods] Probe Reaction Time was determined in 10 subjects by self-evaluation before and after music therapy intervention. The Probe Reaction Time was separately measured 4 times. [Results] After completion of music therapy intervention, the Probe Reaction Time in the 10 subjects was significantly decreased. [Conclusion] The results suggest that keyboard-based music therapy is an effective and novel treatment, and should be applied in clinical practice.

Key words: Music therapy, Keyboard playing, Probe reaction time

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INTRODUCTION

Music Therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program¹⁾. Therapy may include singing, playing instruments, improvisation, creative musical activities, and others. The positive effects of music therapy are increasingly recognized in the field of rehabilitation medicine, especially for use in physical therapy to assist in functional recovery. Music can be used not only to help patients receiving traditional physical therapy methods, but also through playing of instruments, which is considered improvisational music therapy, and brings diversity and novelty to the therapy session.

Music therapy is increasingly used for brain injury and neuro-rehabilitation researches. But after retrieving medline and related PT magazines such as “Journal of Physical Therapy Science”, “Doctor of Physical Therapy”, “Journal of Physical Therapy Education”, there are few reports on music therapy combined with physical therapy applied in rehabilitation. In fact, improvisation, especially keyboard-based technique, is very suitable for patients with hand dysfunction. Recent research reported that music could be a key component in neuromuscular rehabilitation for stroke victims and spinal cord injuries to improve limb movement deficits²⁾.

Hand rehabilitation physical therapy for spinal cord injury patients is based on structured exercise, and provides therapy at a level customized for the patient with real-time accurate feedback on the patient’s performance³⁾. The physical therapy exercises are designed in the form of challenging games and asking the patients to perform to the best of their ability, often to the point of fatigue. Keyboard playing is a new therapeutic music exercise used to facilitate functional non-musical outcomes, i.e., training and retraining of motor control abilities and hand muscle recovery.

Probe Reaction Time (P-RT) is a reliable and useful evaluation of conscious reaction⁴⁾. P-RT employs a dual task. Dual tasks are used to measure the ability to react when one carries out a task while engaged in another. Dual tasks can be used to assess performance in a functional virtual environment, and to facilitate a return to the community. P-RT measures the fastest

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response time in the reaction to an external stimulus⁵). The purpose of this research was to observe the immediate effects of keyboard-based music therapy on P-RT in normal individuals, and to explore effective methods that include both physical hand exercises and playing techniques to help spinal cord patients recover hand function.

SUBJECTS AND METHODS

Ten recruited subjects (mean age, 26.4 ± 3.1 years; average height, 170.0 ± 5.6 cm; mean body weight, 64.5 ± 7.2 kg) were selected at random among medical interns, and all were independent for activities of daily living. Subject characteristics are detailed in Table 1. The purpose and contents of this research were explained to the subjects, and all provided informed consent to participate in this study. All experimental procedures were described and were approved by the Research Ethics Committee of China Rehabilitation Research Center (IRB no. 2015-zx-09).

Subjects sat in low chairs with shoulders and backs straight, and placed the right hand comfortably on a keyboard. P-RT was tested in each subject 4 times as follows. First, before the keyboard playing intervention, baseline P-RT data were measured. Then, P-RT was measured a second time at the beginning of the keyboard playing intervention. The subjects were guided by the music therapist to continue practicing keyboard playing for about 20 minutes. In the 16th through 19th minutes of practice, P-RT was again tested while playing. P-RT was measured a final time after the keyboard playing intervention was completed.

The music used for the intervention was the “Ode to Joy” by Beethoven. The melody used in this research comprised 8 bars with a 4/2 beat in C major.

P-RT was tested using a digital audio player/recorder (RIO Japan). The recorder was used to present a stimulus signal to a subject. The subject’s vocal response was recorded through a microphone. A digital audio player/recorder was used to record the subject’s vocal response to the stimulus signal.

The sounds “yoi” and “pi” were prerecorded on the RIO player. “Yoi” gave notice that the test would begin, and “pi” was the stimulus signal. The subjects were required to respond to the auditory cue “pi” by loudly saying “pa” as quickly as possible. The data were processed using Digion-Sound 5 (Digion, Japan) software. The data were downloaded to a PC, and the time between the auditory stimulus of “pi” and the response of “pa” was evaluated as the P-RT⁵).

To determine the main effect of the music intervention, one-way analysis of variance with the Bonferroni correction was used; the factor was the P-RT. The data were analyzed using SPSS Ver. 17.0 (SPSS Inc. US) for Windows.

RESULTS

The P-RT data showed significant differences ($p < 0.05$) in the subjects’ self-evaluation. The results are shown in Table 2. At the beginning of keyboard playing, the P-RT was significantly delayed. With increasing familiarity with the music, the P-RT was approximately equal to the baseline P-RT measurement before any intervention. After the music therapy intervention was completed, the P-RT in the 10 subjects was significantly decreased.

DISCUSSION

In this research, keyboard-based music therapy was used as an intervention method to improve P-RT. The intervention effect of keyboard playing is of great significance. Compared with traditional therapy methods, keyboard playing offers many advantages. First, music, as an acoustic expression of art, has the unique aesthetic function of helping people feel relaxed and joyful. Second, keyboard playing, with combined melody, tone, rhythm, and other elements of music, is an interesting way to practice hand muscle function, making traditional PT more diversified, and enhancing motivation of engagement. Finally, using P-RT to observe the subjects’ reaction was one of the most convenient and rapid methods to evaluate the efficacy. Therefore, keyboard-based music therapy is an effective and novel treatment method, and should be applied in clinical practice.

Table 1. Subject characteristics

	Mean \pm SD (N=10)
Age (yrs)	26.4 ± 3.2
Height (cm)	170.0 ± 5.6
Weight (kg)	64.5 ± 7.2

Table 2. Comparison at different points of playing (ms)

a. Before music therapy (MT)*	383.2 ± 81.5
b. At 1–3 min of MT**	753.0 ± 208.8
c. At 16–19 min of MT*	513.3 ± 133.1
d. After MT	323.7 ± 53.4

* $p < 0.05$, ** $p < 0.01$, $d < c^* < b^{**} < a^*$

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