Research Article

Musical Attention Control Training (MACT) in secure residential youth care: A randomised controlled pilot study

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**ABSTRACT**

With 75% of the population in secure residential youth care diagnosed with attention-related problems, these individuals might benefit from Musical Attention Control Training (MACT). The purpose of this randomised controlled pilot study was to determine the feasibility and preliminary effects of MACT on attention outcomes for youth in secure residential care. Because of the generally low treatment motivation of this population, a non-standardised music therapy intervention (NSMT) with similar goals was included to determine if attendance and effects varied between a standardised and non-standardised intervention. Participants (\(n = 6\)) were randomly assigned to MACT, NSMT or a control group (TAU). Both MACT- and NSMT-participants followed a six-week program of once-a-week music therapy sessions of 45 min. Outcomes in selective, focused, sustained and alternating attention were measured using the Trail Making Test A + B and the WISC-III Digit Span Forward and Backward, which were assessed at baseline and then at six and nine weeks. Results showed that both the interventions and the means of measurement were feasible in this population with an overall attendance rate of 97%. While attention outcomes varied with individual participants, the results demonstrate positive trends wherein more extensive research is necessary to further evaluate the effects.

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**Introduction**

Secure residential youth care in the Netherlands

In 2016, there were 1170 adolescents placed within a secure residential youth care setting in the Netherlands (Centraal Bureau voor de Statistiek, 2017). Secure residential youth care can be defined as an intensive form of specialized youth care, in which the freedom of the individual is temporarily restricted to prevent this person from withdrawing or being withdrawn from the necessary treatment. It differs from a youth detention (or correctional) setting in such way that these persons are not convicted for a legal offense (Nederlandse Instellingen voor Gesloten Jeugdzorg, Ministerie van Jeugd & Gezin en Ministerie van Justitie, 2008).

The population in secure residential youth care is defined by individuals with a combination of psychiatric symptoms, (mild) intellectual disability, substance abuse or behavioural problems as a result of past experiences (e.g. violence or sexual transgressive behaviour) (Jeugdzorg Nederland, 2013). School dropout occurs frequently, with 71 percent of the population regularly cutting classes (Nijhof, 2011) and 30 percent having no connection whatsoever with school or work prior to their placement in a secure residential youth care setting (Vermaes, Konijn, Nijhof, Strijbosch & Van Domburg, 2012).

Treatment in secure residential youth care

The highly complex mixture of behavioural disorders, associated problems and generally low motivation makes treatment for this population complicated. Multiple studies show that 69–80 percent of the population in secure residential youth care is diagnosed with an Attention Deficit Hyperactivity Disorder (ADHD), Attention Deficit Disorder (ADD), Oppositional Defiant Disorder (ODD), Conduct Disorder (CD) or a combination of these, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR or DSM 5, depending on the year the study was conducted) (Colins et al., 2010; Frick & Nigg, 2012; Schuit & Konijn, 2015; Smeijsters et al., 2012). Treatment therefore focuses on the dynamic characteristics of the individual to provide for their needs.

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Music therapy is a commonly used intervention in secure residential youth care in the Netherlands (Smeijsters & van den Braak, 2009). A study by Kennedy, Reed & Wamboldt (2014) about staff perceptions showed that allied health services such as music therapy are viewed as a valuable addition to the treatment program. According to Bruscia (2014), music therapy can be defined as “a reflexive process wherein the therapist helps the client to optimise the client’s health, using various facets of music therapy experience and the relationship formed through them as the impetus for change” (p. 36). Because of the dynamic characteristics of the clients in secured residential youth care the music therapist is constantly challenged. This way of working requires flexibility in the music therapist’s approach while keeping the main goals of the client in constant consideration.

Figures from the secure residential youth care setting in which the present study was conducted show that 48 percent of the population attended music therapy during their stay (Abrahams, Van Dooren, Koopman & Williams, 2014; Schuitj & Konjin, 2015). This was relatively high compared to other treatment options. For example: 7 percent of the population attend Cognitive Behavioural Therapy (CBT) and 39 percent attend Functional Family Therapy (FFT). These numbers suggest that music therapy is a program which is found interesting by this population and possibly contributes to the overall treatment motivation of adolescents placed within these settings.

Attention

In everyday functioning the human nervous system processes sensory input constantly. The brain is capable of selecting, encoding and directing neural activity to the stimuli of greatest interest. Attention is thus a key cognitive skill: it helps direct our awareness towards a specific aspect in our environment while excluding competing aspects (Strait & Kraus, 2011). Without attention, a person would not be able to think, learn, remember, communicate or solve problems (Petersen & Posner, 2012). Consequently, attention is a primary condition for proper cognitive functioning (Klein & Lawrence, 2011). There are three essential ways in which the brain controls attention. The first is to select and focus. In order to complete a mental task, a person must tune out all the other things competing for its attention and focus on the task at hand. Secondly, the brain can sustain attention, for as long as needed to complete a task. Sustained attention is also known as concentration. Thirdly a person can alternate attention, which means focusing on different processes in sequence (Thaut & Gardiner, 2014).

Attention related problems are quite common in secure residential youth care. While ADHD is characterised by age-inappropriate symptoms of inattention, impulsiveness and hyperactivity (American Psychiatric Association, 2014), these properties are also associated with the development of ODD and CD (Burt, Krueger, McGue & Iacono, 2001; Collins et al., 2010; Mash & Wolfe, 2013). Some neurobiological studies suggest that the cause of ODD and CD is associated with a poorly developed working memory. Attention is a cognitive skill closely related to our working memory (Roden, Grube, Bongard & Kreutz, 2014; Särkämö et al., 2014; Schoorl, van Rijn, de Wied, van Goorzen & Swaab, 2017). A study by Kane et al. (2007) found that a lower working memory capacity correlates with an increased chance of mind-wandering when daily tasks become more challenging.

Music and attention

Music interventions are often attributed to influence educational skills such as reading, language and mathematics, social skills and cognitive abilities (Dumont et al., 2017). However, recent studies found contrasting effects. A study by Cogo-Moreira et al. (2013) found a positive association between math grades and music training whereas Yang et al. (2014) found no relation between the two. First language skills were also included in both studies and show the same contrasting results. As a possible explanation, the difference in teaching and language family (Portuguese and Chinese) were presented. Interestingly, the study by Yang et al. (2014) reported positive findings on second language development between musician and non-musician children. In relation to social skills, Schellenberg et al. (2015) suggests that children (8–9 years old) who attend music groups in schools show larger increases in prosocial behaviour and sympathy compared to children in the control group. However, this effect was limited to children with poor social skills before the start of the program.

In recent years, researchers have also become increasingly interested in the use of music to influence cognitive skills, including attention (Dumont, Syurina, Feron & van Hooren, 2017; Kraus & Chandrasekaran, 2010; Wang, Ossher & Reuter-Lorentz, 2015). By comparing brain development between musicians and non-musicians it is known that musical training strengthens auditory processing. This implies that a musician’s nervous system is fine-tuned in extracting sounds from complex environments and could indicate an improved control over auditory processing compared to non-musicians (Pallesen et al., 2010). A study with 102 children (7–12 yo) showed that children who can synchronize to a driving beat during music class were more attentive and performed better on an attention control task compared to those who were less capable of synchronizing. According to teachers, the first group also showed fewer ADHD-like behaviors (Khalil, Minces, McLoughlin & Chiba, 2013). Research by Wolfe and Noguchi (2009) demonstrates how music can maintain attentiveness when children actively participate in music activities, regardless of whether this is actual music-making or listening to music. Moreno, Lee, Janus and Bialystok (2015) report that short-term music training resulted in functional brain changes which persisted after one year. Wilson (2013) suggests that the immediate plasticity, induced by active music making could prime the brain for future neuroplastic changes. These findings suggest that music training can be accompanied by neuroanatomical changes that could in turn contribute to cognitive-behavioural differences. Multiple studies report that children who received music training (on an average of 6.1 years) perform better in a series of working memory tasks (Bergman Nutley et al., 2013; Lee, Lu & Ko, 2007; Portowitz, Pepper & Downton, 2014; Roden et al., 2014; Zuk et al., 2014). This suggests that individuals with formal music training show advantages in abilities directly related to music, which are also transferable to other general cognitive abilities (Jaschke, Eggermont, Honing & Scherder, 2013). As an explanation, Schellenberg (2005) states that music lessons train multiple cognitive skills simultaneously, including attention, fine-motor skills, emotional expression and abstract reasoning.

Music therapy and attention

Research on arts therapies in secure residential youth care in the Netherlands shows that music therapy focusses mainly on emotion, interaction, self-image and cognition. Through empowerment and a music/product centered approach, a therapeutic alliance is established (Smeijsters et al., 2012). A study by Shuman, Kennedy, DeWitt, Edelblute and Wamboldt (2016) showed that group music therapy can affect mood states of adolescents with several mental health disorders.

Although available research suggests that music could possibly help to improve attention skills, the findings on the contribution of music therapy to these specific skills is considerably less evident. A literature study on this subject produced limited results for the specific target population. A systematic review by Daykin, De
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