Critical Review:

What is the evidence that melodic intonation therapy is effective at rehabilitating expressive language in patients with severe non-fluent aphasia?*

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This critical review examines the efficacy of unmodified melodic intonation therapy (MIT) at rehabilitating expressive language in patients with severe non-fluent aphasia. Three articles including two single-subject AB designs and a parallel group Random Control Trial design are reviewed. Overall, the evidence gathered from this review is suggestive that MIT is effective at improving expressive language in patients with severe non-fluent aphasia. Recommendations for clinical practice and future research are provided.

Introduction

Melodic Intonation Therapy (MIT) is a speech and language rehabilitation strategy which entails altering the prosody of phrases and sentences by creating simple pitch, rhythm, and stress patterns. It is a structured technique that can be delivered to a variety of neurogenic conditions, however it is most commonly used to rehabilitate expressive language abilities in people with non-fluent aphasia. In the unmodified protocol, patients repeat prosodically-altered phrases that are verbally presented by the clinician in order to improve the patient's fluency in connected speech (Zumbansen, Peretz, & Hebert, 2014). An additional aim of MIT is to facilitate production of propositional speech, which is the intentional expression of thought (Jackson, 1915). Although MIT has been formally used for over 40 years, systematic reviews often include not only traditional MIT but several other variations, which makes it difficult to determine MIT's efficacy (Hurkmans, de Bruijn, Boonstra, Jonkers, et al., 2012; Van der Meulen, Van de Sandt-Koenderman, & Ribbers, 2012). Traditional MIT is most often used 6 or more months after the stroke (Norton, Zipse, Marchina, & Schlaug, 2009). Modified versions have been created to treat patients during the acute phase immediately following stroke (Baker, 2000). MIT has also been modified to accommodate patients who are physically incapable of tapping as per traditional methods (Hough, 2010).

While many studies present evidence that various versions of MIT lead to speech and language gains in patients with non-fluent aphasia, there is significant debate surrounding how and why this technique works. In an attempt to better understand the underlying mechanisms of why MIT leads to speech and language gains, it has been suggested that Broca's aphasia involves different levels of language disorder: Donnan and colleagues (1999) proposed that this neurogenic condition is characterized by initial mutism, speech dyspraxia, and agrammatism; Zumbansen et al. (2014) identified that anomia, agrammatism, and apraxia of speech (AOS) are the primary symptoms which are unique to this aphasia type. A review of the literature indicated that different components of MIT are argued to target different symptoms of non-fluent aphasia: specifically, it has been proposed that the exaggerated rhythm of MIT facilitates greater intelligibility by lessening the effects of AOS (Zumbansen et al., 2014), whereas melodic intonation of speech improves propositional speech by targeting agrammatism (Naeser & Helm-Estebrooks, 1985). These postulations were made with the assumption that singing and music are predominantly processed by the right-hemisphere, while speech is primarily processed and controlled by the left hemisphere (Stewart, Walsh, Frith, & Rothwell, 2001). It has been proposed that MIT recruits homologous language regions in the right-hemisphere to compensate for damaged structures in the language-dominant left-hemisphere (Sparks, Helm, & Albert, 1974). However, Belin and colleagues (1996) found that repetition of words with MIT reactivated Broca's area and the left pre-frontal cortex while deactivating the homologue of Wernicke's area in the right-hemisphere. Thus, it remains unclear how MIT neurologically facilitates speech and language gains in patients with non-fluent aphasia.

* This paper was created as a required assignment for the CSD9639 Evidence Based Practice for Clinicians course at Western. While it has been evaluated by course instructors for elements of accuracy and style, it has not undergone formal peer-review.

The primary aim of this systematic review is to determine the efficacy of traditional MIT at rehabilitating expressive language in patients with severe non-fluent aphasia. Since it remains unclear how the underlying mechanisms of this therapy benefit expressive language, and because many variations of this technique are widely used for this purpose, it is clinically important to verify that the unmodified form of this therapy is appropriate for this population for this specific purpose. The findings of this review may contribute to the field's understanding of which aspects of Broca's aphasia are targeted by MIT (i.e. anomia, AOS and agrammatism) and how (i.e. through rhythm, hand-tapping, prolonging vowels, slower tempo, or intoned speech) and therefore suggest whether this technique may be more appropriate for treating patients with aphasia, apraxia of speech, or both. This knowledge may inform the development of future therapy programs through utilizing certain strategies from MIT to target specific symptoms of speech and language profiles.

Objectives

The primary objective of this paper is to critically review the existing literature on the effectiveness of traditional MIT at rehabilitating expressive language in patients with severe non-fluent aphasia. The secondary objective of this paper is to provide evidence-based recommendations for clinical practice and for future research.

Methods

Search Strategy

Computerized Databases including PsycINFO and PubMed were searched. The following key terms regarding this topic were used to retrieve relevant articles: (traditional melodic intonation therapy) AND efficacy AND ((severe non-fluent aphasia) OR (left-hemispher* stroke) OR (cerebral vascular accident)). Reference lists from retrieved articles were also used to find other related articles for review.

Selection Criteria

Papers were selected based upon specific inclusion criteria: all papers reported cases or studies of participants who had severe non-fluent aphasia as a result of left-hemisphere cerebral vascular accident. Additionally, the papers specifically documented traditional MIT as opposed to modified versions. Some measure of expressive language was used as an outcome measure.

Data Collection

Results of the literature search yielded three articles that met the selection criteria described above. Two studies reported the outcomes single subject A-B designs (Albert, Sparks, & Helm, 1973; Wilson, Parsons, & Reutens, 2006), and one study was a parallel group RCT (Schlaug, Marchina, & Norton, 2008).

Results

Albert, Sparks, and Helm (1973) investigated the outcomes of three single subject A-B studies conducted on the effects of MIT on verbal expression in three adult participants who have severe non-fluent aphasia. Each participant had received regular speech therapy prior to receiving MIT with no change in speech or language function. The subjects each participated in unison singing of sentences with therapist and progressed to repeating sentences in normal speech prosody as the melodic aspect of the program was faded. To examine outcome measures, patients were asked to answer confrontation questions. Measures including the number of items in patients' expressive vocabulary, utterance length, degree of grammaticality, articulation, and prosody were assessed. Each participant demonstrated gains in propositional speech, producing 4-5 word sentences of good grammatical structure following treatment with MIT.

A strength of this article is that it documents pre-treatment language abilities for all participants which is useful for identifying which unique communication profiles may benefit from this treatment. However, this article has several drawbacks: it is greater than 40 years old, thus the results are not current and the literature review in the introduction is out of date. Additionally, the descriptions of results do not indicate whether statistical analyses were used to examine the significance of changes in the outcome measures due to therapy. Since the statistical power of the results is unknown, the claim that MIT is effective at rehabilitating expressive language in this population may not be valid. The article also lacks details regarding the exact therapy materials that were used to treat each participant. It is therefore not possible to determine whether each of these studies were similar in terms of stimuli. The use of different therapy materials would impact the outcomes and interpretations of results, making it inappropriate to draw valid comparisons between participants' performance. The lack of this information also makes precise replication

of these studies impossible, and the claim that traditional MIT was implemented cannot be verified. Furthermore, although the participants were matched in terms of aphasia type and severity, the single-subject design of each of the reported studies means the findings may only be generalized to other patients with similar pre-treatment profiles.

Overall, this study provides equivocal evidence that MIT is effective at rehabilitating expressive language in patients with severe non-fluent aphasia.

A parallel group RCT by **Schlaug and colleagues (2008)** investigated expressive language outcomes in two patients with severe non-fluent aphasia who were randomly assigned to receive MIT or Speech Repetition Therapy (SRT). Each participant worked one-on-one with the same therapist for 1.5 hours/day, 5 days/week. Interventions for both participants were identical. Quantitative data of spontaneous speech were collected using appropriate standardized tests including Boston Naming Test (BNT; Kaplan, Goodglass, & Weintraub, 2001) and a matched subset (30 images) of the Snodgrass-Vanderwart color pictures (1980). A conversational interview and descriptions of complex pictures were appropriately used to assess the patients' expressive language. The patient in the MIT group showed greater significant improvement on measures of speech output and confrontational naming than the patient receiving SRT. The researchers concluded that the melodic intonation and left hand tapping are the critical elements of MIT.

There are many strengths to this study. The treatment program and assessment materials were described in great detail, thus allowing for accurate replication for future studies. Patients were similar at baseline regarding expressive and receptive language abilities. Appropriate variables were considered, controlled for and assessed using evidence-based materials. Additionally, this study used a Random Control Trial (RCT) design which means that experimental conditions were theoretically identical aside from the intervention. It can therefore be inferred that any significant differences between participant outcomes were due to the intervention (Greenhalgh, 2010). A weakness is the failure to report which statistical analysis was used. Thus, it cannot be evaluated whether appropriate/valid statistical analyses were conducted to support the researchers' claims.

Overall, this study presents suggestive evidence that MIT is effective at rehabilitating expressive language in patients with severe, non-fluent aphasia.

Wilson, Parsons, and Reutens (2006) examined the outcomes of a single subject design in which a patient with severe non-fluent aphasia participated in 3 experimental conditions: unrehearsed verbal production, rehearsed verbal production, and rehearsed verbal production with melody (MIT). The researchers used a levelled-system to analyze the subject's accuracy of target phrase productions for each condition. Appropriate use of t-tests and ANCOVA revealed that the target phrases were more commonly produced without a prompt and were more likely to be complete utterances in the MIT condition than others. However, the authors found that four weeks of intensive MIT did not appear to facilitate the participant's spontaneous propositional speech. The researchers concluded that combining melody and speech through rehearsal promoted separate storage and/or access to the phrase representation.

A strength of this study is the detailed analysis of the patient's communication profile, history, prior experience with music training, and participation in previous speech and language therapies. This information provides relevant details regarding which patients may benefit from MIT. Additionally, the scoring system used to measure outcomes is thoroughly explained and supported by previous research (Lum & Ellis, 1994). Stimuli across conditions were accurately matched for word length and number of syllables. Statistical analyses used to evaluate the results were appropriately employed and reported. Furthermore, the pre- versus post-treatment design allows for direct observation of within-participant change resulting from specific intervention method. Spontaneous recovery was identified as a potential confounding factor and was controlled for by including the unrehearsed experimental condition. However, the single participant had extensive pre-morbid musical training; it is unclear how this prior experience may have influenced his susceptibility to the musical components of MIT. Thus, the authors' interpretation that the use of pitch in MIT resulted in longer-term effect of facilitating phrase production is questionable and cannot be readily generalized to patients within this population who may not share this extensive musical background.

Overall, this research provides suggestive evidence that MIT effectively rehabilitates expressive language in patients with severe non-fluent aphasia.

Discussion

Overall, the studies present suggestive evidence that MIT is effective at rehabilitating expressive language in patients with severe non-fluent aphasia. However, the collective limitations of these studies must be carefully considered. Firstly, only one study specified how the patient was classified as having severe non-fluent aphasia. Wilson and colleagues (2006) reported that the Boston Diagnostic Aphasia Examination was used to determine the type and severity of the patient's aphasia. The other two papers did not explain what criteria were used to determine the subjects' aphasia profile. Secondly, several studies lacked explicit detail regarding the method and statistical analyses that were used. Although the outcomes for each patient being treated with MIT in the studies by Albert et al. (1973) and Schlaug et al. (2008) showed improvements in expressive language, the researchers did not include specific information regarding the test materials and statistical analyses that were used; this warrants caution in accepting these results as valid. Furthermore, the stimuli that were used for MIT training and testing were not explicitly recorded in these studies, making it difficult to determine if the studies' interventions were similar. Finally, the single-subject design of two studies (Albert et al., 1973; Wilson et al., 2006) means that these results may only be generalized to patients with pre-treatment communication profiles and music training that are similar to the participants'.

Conclusion

Despite the studies' limitations, results of each showed improvements in patients' expressive language abilities. Although the statistical power of two of the studies (Albert et al., 1973; Schlaug et al., 2008) is unknown, the results indicate that this may be an appropriate intervention to consider when designing a treatment plan for patients with severe non-fluent aphasia.

The evidence from this review suggests that MIT may be effective for patients who have previous musical training (Wilson et al., 2006). Schlaug and colleagues (2008) identified melodic intonation of phrases and hand-tapping as the critical elements of MIT that facilitate expressive language gains. The authors asserted that rehearsal of target phrases was crucial in facilitating speech production for both melodic and non-melodic phrases.

Clinical Implications

There are no universally accepted methods for treatment of non-fluent aphasia against which other interventions can be tested (Stahl & Kotz, 2014). Criteria for determining treatment efficacy for this population have also not been established. Most clinicians use a combination of techniques to rehabilitate expressive language in patients with severe non-fluent aphasia. The results of this systematic review are clinically important because they reveal that MIT may be another treatment to consider when planning long-term rehabilitation for patients with severe non-fluent aphasia. It is necessary to have many treatment options for patients of this population because there are many different ways in which a patient can present as severely non-fluent. Since Broca's aphasia is argued to include anomia, agrammatism and AOS, severely non-fluent patients can vary greatly in their communication profiles in terms of how severely each language aspect contributes to their overall expressive language abilities (Zumbansen et al., 2014). This variability makes it necessary for clinicians to have access access to many different therapy methods in order to find one that most appropriately fits a given patient's specific communication profile. Although it remains unclear how MIT neurologically facilitates speech and language gains in patients with severe non-fluent aphasia, the evidence that it does facilitate expressive language gains in this population is suggestive.

Future Research Suggestions

Further research should be conducted to enhance the evidence for the efficacy of MIT at rehabilitating expressive language in patients with severe non-fluent aphasia. Such investigations should stipulate what criteria were used to diagnose the type and severity of the patients' aphasia. Outcome measures such as Correct Information Units, number of syllables per phrase, and some measure of grammatical correctness of the patients' utterances should be used to assess changes in patients' ability to produce rehearsed and propositional phrases. Details regarding treatment schedule and homework should be included. A control condition should be used to ensure that results cannot be accounted for by spontaneous recovery of expressive

language skills. A description of which statistical analyses were used to assess the significance of pre- to post-treatment changes should be included to indicate the statistical power of the results.

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