Critical Review: Constraint-Induced Language Therapy (CILT); Comparison to Traditional Treatment Methods and the Efficacy of Modifications to the Original Approach.

Sarah Grund
M.Cl.Sc SLP Candidate 2011
University of Western Ontario: School of Communication Sciences and Disorders

This critical review examines efficacy of CILT in comparison to traditional treatment methods for adults with aphasia as well as the efficacy of modified versions of the original CILT protocol. Study designs include: individual series pre-post treatment (3), mixed randomized clinical trial (RCT) (2), mixed non-randomized clinical trial (NRCT) (2), mixed randomized block (1) designs. Overall, research supports that CILT is at minimum, as effective as traditional methods of language intervention and that certain modified versions are beneficial in achieving positive language outcomes.

Introduction

It has been estimated that there are over 100,000 people in Canada living with aphasia, 30,000 of whom reside in the province of Ontario alone (Aphasia Institute, 2010). As such, a number of methods of rehabilitation have been put forth to treat this growing population of adults with language impairment. One such method, introduced within the last decade, is Constraint-Induced Language Therapy (CILT) also referred to as Constraint-Induced Aphasia Therapy (CIAT).

CILT differs considerably from traditional methods of language intervention for adults with aphasia. Most conventional methods of language intervention employ the use of multi-modal methods of communication. Individuals are encouraged to use aids such as pictures, drawing, writing or gesturing in order to have their message understood and in order to enhance their understanding of others', when necessary. Modeled after principles of Constraint-Induced Movement Therapy, CILT emphasizes the forced use of verbal responses which are progressively shaped towards more complex and complete utterances. Compensatory strategies are discouraged as the goal of therapy is improved verbal language functioning (Raymer, 2009).

In a national American survey, 70% of individuals with communication disorders felt that others avoided interaction with them due to communication barriers (Aphasia Institute, 2010). It is clear that the need for effective language intervention methods is of great necessity.

Objectives

The primary objective of this paper is to critically evaluate the available literature regarding the efficacy of CILT in comparison to traditional methods, as well as the efficacy of modified versions of the original approach. Implications regarding the applicability of CILT in the clinical setting as well as suggestions for future research will be discussed.

Methods

Search Strategy

The research studies included in this review were obtained from computerized databases; CINAHL, SCOPUS, PubMed, and Medline using the following search strategy:

> ((Contraint-Induced Langauge Therapy) OR (Constraint-Induced Aphasia Therapy))

The search was limited to articles in the English language.

Selection Criteria

A total of 16 articles pertaining to the topic of CILT were obtained. Of the 16 studies; 2 compared CILT to conventional methods of language intervention and 6 investigated the efficacy of modified versions of the original CILT approach. The remaining articles, including brain-imaging investigations, were not included in this review, since they did not compare CILT to traditional interventions and/or did not investigate the effectiveness of a modified version of CILT.

Data Collection

Results of the literature search yielded the following types of articles congruent with the aforementioned selection criteria: individual series pre-post treatment (3), mixed randomized clinical trial (RCT) (2), mixed non-randomized clinical trial (NRCT) (2), mixed randomized block (1) designs.

Results

Efficacy of CILT versus Traditional Methods

Pulvermuller and colleagues (2001) conducted a mixed, double-blinded, RCT study comparing language skills in two groups of individuals with aphasia, who received either CIAT or conventional aphasia therapy (CAT). In total 17 participants [CIAT n =10 (M=6, F=4), CAT n= 7 (M=6, F=1)] were included in this study. The majority of participants in both groups were characterized as having a moderate degree of language impairment and were most frequently classified as having Broca's Aphasia.

Each group received a total of 32-34hrs of treatment, however the frequency, and number of hours of therapy per day varied. The participants in the CAT group received therapy over 3-5 weeks, where as the CIAT group received 10, 3-4hr intensive days of group therapy.

Analysis of data was completed via statistically appropriate repeated measures ANOVAs and revealed significant post-treatment differences between the groups on standard aphasia test measures, and measures of communicative effectiveness in everyday situations. This study concluded that intensive CIAT lead to a better outcome on language performance measures, then CAT administered over a longer treatment period.

In a mixed NRCT study, Maher et al. (2006) compared language skills in two groups who received either CILT or a similarly intensive traditional aphasia treatment (TAT) that allowed all modes of communication. Participants included 9 [CILT n =4 (M=3, F=1), TAT n= 5 (M=3, F=2)] adults with moderate aphasia and significant word retrieval deficits. Appropriate selection criteria were employed. The two groups only differed in that, the participants in the TAT group were able to use mult-modal communication, where as those in the CILT group were restricted to using only speech.

Analysis of data, using both non-parametric and parametric statistics revealed that both groups demonstrated significant pre/post treatment gains, but that there were no significant effects of group. Both groups showed improved performance on such measures as: the Boston Naming Test, the Action Naming test and the Western Aphasia Battery Aphasia Quotient. This study concluded that CILT participants showed more consistent improvements, but that "it would be premature to conclude that applying constraints principles provides an advantage over intensive traditional approaches to aphasia therapy" (p 850).

Strengths and Limitations

In the first study, by Pulvermuller et al 2001, individuals were randomly assigned to each treatment condition and groups did not differ significantly in terms of age, gender, aphasia type and severity. Random assignment and equality of the two groups increases the confidence that group differences are attributable to the variable under question and not to a third unforeseen difference between the groups, thereby adding to the external validity of the results. The participants, as well as the evaluating clinicians, were blinded to the treatment group, limiting the effect of the participants' or clinicians' expectations, or beliefs from influencing the results, thereby adding to the internal validity of the present study's findings. Conclusions are limited, since the therapy materials, activities and procedures of the CAT group were not thoroughly explained. As well, the therapy frequency and duration varied between treatment groups. Therefore it is unclear whether treatment results are attributable to constraints and forced used of the spoken modality or due to differences in the delivery of treatment between groups. Maintenance of treatment gains and generalization of therapy gains outside of the clinic were not evaluated.

The majority of the limitations in the first study were addressed in the article by Maher et al. 2006. In this study, the only difference between the treatment groups was that participants in the CILT group were restricted to the use of spoken language. The therapy tasks and activities in both groups remained consistent across conditions and were administered in a similarly intense manner, allowing one to separate the effects of mass practice versus the use of constraints. It is unclear if both participants and evaluators were blinded to treatment condition. In addition the use of matched groups leaves the potential for treatment effects to be attributable to a third unforeseen factor.

The overall strengths of both studies is inherent in their prospective designs, however both studies are limited in their ability to generalize to a broader population. The majority of participants in both studies were males, who presented with moderate language impairment.

The research provided by Pulvermuller and colleagues (2001), provides a strong degree of evidence in support of the efficacy of CILT. However, in their comparison to conventional therapy methods it is difficult to conclude whether or not the differences seen are attributable to the treatment intensity or the therapy itself. Therefore it is in the opinion of this author that this study provides a minimum to moderate degree of evidence when comparing CILT to traditional methods. In the subsequent study by Maher et al. (2006) great care was taken to control all confounding variables so that one could see the impact of constrained and forced

use of the spoken modality. This study provides a strong degree of evidence for both the efficacy of CILT and in the comparison of the approach to traditional methods.

Efficacy of Modifications to the Original Approach

Meinzer et al. (2005) conducted a mixed NRCT study comparing language skills in groups who received either CIAT or CIAT-plus, which included written language and training in everyday communication. Twenty-seven participants (F=11), were included in this study. Group assignment could have introduced a third unknown variable or difference between the groups as the first 12 patients were assigned to CIAT and the next 15 to the CIAT-plus condition. Characteristics of the participants including aphasia type and severity were well described.

Frequnecy and duration of treatment was equal among both groups however, the CIAT-plus group was given additional exercises to be performed at home and were encouraged to engage in verbal communication outside of therapy as often as possible. Both standardized and subjective outcome measures were used to measure change.

Statistically appropriate, analysis of data using repeated measures ANOVAs, and paired t-tests, revealed that both groups had significantly improved language function, and quality and amount of communication that remained stable after follow-up. No significant effect of group was found on the standardized measures. The group who had received CIAT- plus demonstrated a more pronounced increase in their quality and amount of communication after therapy, as evaluated by their relatives.

In an individual series, pre-post treatment design Faroqi-Shah et al. (2009) investigated the addition of grammatical constraints to the original CILT protocol. They compared language outcomes in four individuals, who received either CILT (original) or CILT plus the addition of constraints/shaping on production and judgment of tense morphology (CILT-grammatical).

Analysis of data using statistically appropriate methods, such as the Wilcoxon signed ranks test and McNemar's change test, revealed that overall minimal improvements were obtained in severity test measures for all participants. Individuals that took part in the CILT-G condition improved on an elicited verb inflection test, where as individuals in the CILT-O did not. It was also found that changes in morphosyntactic abilities did not generalize to narrative speech. This study concluded that CILT was minimally effective for agrammatic individuals and that the addition of morphosyntactic constraints did not lead to significant improvements in functional outcomes. However, the small sample size may have lacked the appropriate power to detect small differences.

Szaflarski and colleagues (2008) used an individual series, pre-post treatment design to evaluate the effectiveness of a modified version CIAT, administered over a shorter treatment duration. Three male participants with varying degrees of impairment and aphaisic presentation were included in this study. The modified version of CIAT included the addition of a hierarchy for semantic, syntactic and phonological language production that was individualized to each participant. Treatment procedures and hierarchical adjustments were not describe in the study, nor were they consistent between participants and therefore are not replicable.

No control or comparison group was used to evaluate the modified version of CIAT and post-treatment scores on the BDAE-3 and BNT were compared in terms of percentage of improvement without stating statistical significance or effect sizes (ie. scores for auditory comprehension improved 41% from pre-test measures).

The authors concluded that data revealed substantial improvements in only one week of treatment. However due to the inadequate procedural description of treatment modifications and lack of statistical analyses, conclusions are at best only suggestive.

Kirmess & Maher (2010) investigated the language outcomes in 3 individuals in the early phase of recovery from aphasia who received CILT with slight modifications in the treatment schedule. In contrast to the original CILT protocol, daily treatment ranged from 1.15-3hrs and was not always able to be administered in groups. In addition, it was sometimes necessary for treatment to be administered at bedside or in shorter 45 minutes session due to physical fatigue.

Results were analyzed in terms of effect sizes and revealed an overall improvement on language assessments for all participants with a greater improvement seen in expressive speech tasks. Effect sizes were stated to "exceed the level of .63 for untreated recovery and therefore provide support for the effect of treatment on expressive tasks" (p730). The study concluded that CILT can be applicable in early aphasia recovery with adjustments made to accommodate the unique demands of the inpatient rehabilitation setting. However, the limited sample size, and lack of a control group limits the generalizability of these findings.

In a mixed randomized block design study Meinzer et al. (2007) compared two groups who received CIAT by

either an experienced therapist or layperson. Four groups, comprised of 2-3 participants each, were treated by experienced professionals and 4 groups were treated by relatives trained in CIAT. The majority of participants presented with mild to moderate language impairments and 11 of the 20 participants were classified as having Broca's Aphasia.

Using appropriate statistical analyses, data revealed significant language improvements in both groups, with no significant between group differences. This study concluded that CIAT can be effectively administered by trained laypersons.

Berthier and colleagues (2009) used a double-blinded, mixed RCT study, to compare language outcomes in groups who received either CIAT alone or CIAT plus the drug memantine. Participants included 27 adults with varying classifications and severity of aphasia.

Analysis of data, using appropriate statistical methods, revealed that CIAT lead to significant improvements in both groups, which was even greater in the group who received the drug. This study concluded that both memantine and CIAT alone improved aphasia severity, but that the best outcomes were achieved when CIAT and memantine were used together.

Strengths and Limitations

In summary, half of the above studies used a small sample size in order to investigate the efficacy of modified versions of CILT (Kirmess et al., 2010; FaroqiShah et al., 2009; Szaflarski et al., 2008). Small N designs limit the conclusions and generalizability of the findings. In addition random assignment was only carried out in two of the studies (Berthier et al., 2009; Meinzer et al.,2007). Without randomization there is the potential for pre-treatment differences to exist between groups which could account for post-treatment effects (Dollaghan, 2007).

The majority of the above mentioned studies, did however, employ the use of a control group with which to compare treatment effects (Berthier et al., 2009; FaroqiShah et al., 2009; Meinzer et al., 2005; Meinzer et al., 2007). Control groups limit the potential for confounding variables to be accountable for treatment outcomes. All but two studies (Meinzer et al., 2005; Szaflarski et al., 2008), adequately described the procedural and methodological structure and all used appropriate outcome measures. In addition to including objective standardized measures, many of the studies attempted to include measures with which to evaluate functional communicative improvements.

Meinzer et al. (2007) and Berthier et al. (2009) both conducted research studies that provided a strong degree of evidence in support of modifications to the original CILT protocol. Faroqi-Shah and colleagues (2009) provided a moderate level of evidence, but found that both the original and modified versions of CILT may not be beneficial in treating agrammatism. Modifications made for an acute care setting (Kirmes et al., 2010) and service delivery over a shorter one week duration (Szaflarski et al., 2008) provided moderate and minimal evidence respectively. Finally, it was shown that the addition of training in everyday communication to the original CILT protocol did not result in significant differences in treatment outcome (Meinzer et al, 2005). This study provided a minimum to moderate degree of evidence as the modifications to the original approach were not fully described.

Discussion and Conclusions

Overall, the above research supports that CILT is at minimum, as effective as traditional methods of language intervention for adults with aphasia. It has been shown to yield positive treatment outcomes in specific domains of language functioning such as: increasing an individual's number of words, utterances and sentences (Maher et al., 2006; Szaflaraki et al., 2008), increasing the amount and quality of their communication (Meinzer et al., 2005; Pulvermuller et al., 2001), improving their performance on the Boston Naming Test (Maher et al., 2006; Pulvermuller et al, 2001), and improving their overall aphasia severity, post-treatment (Berthier et al., 2009; Maher et al., 2006; Meinzer et al., 2005; Meinzer et al., 2007; Pulvermuller et al., 2001).

Modified versions of CILT such as: the introduction of a cortical activity and cognitive enhancing drug (Berthier et al., 2009), and administration of therapy sessions by a trained layperson (Meinzer et al., 2007) have been shown to be beneficial in improving language functioning. In addition, studies have provided suggestive evidence that CILT can be modified to accommodate the demands of an acute care setting (Kirmess et al., 2010), as well as be administered over a shorter treatment duration (Szaflaraki et al., 2008) and still be efficacious in improving performance on standardized language assessment measures. However, it should noted that neither the original nor modified versions of CILT produced significant functional gains for agrammaticism and thus may not be applicable for morpho-syntactic or grammatical language goals (Faroqi-Shah et al., 2009). Attention should also be drawn to the fact that the majority of participants in the above mentioned studies were classified as having Broca's or nonfluent aphasia of moderate severity.

Future research investigating the degree to which CILT provides functional therapeutic gains for differing aphasiac presentations, as well as the efficacy of such treatment delivered in a less intensive manner would be beneficial. In addition, larger scale studies which investigate carry-over of treatment gains into everyday communication, and long-term follow-up are needed to evaluate the functionality and maintenance of therapeutic improvements.

Clinical Implications and Recommendations

As with many areas in communication sciences and disorders, additional research investigating the efficacy of CILT and modified versions of the approach would be beneficial in evaluating its clinical applicability. In evaluating the current body of available research, it is clear that CILT provides improvement in certain domains of language functioning and overall aphasia severity. However, one should take care to note that CILT has not yet been shown to provide a therapeutic advantage over traditional methods of language intervention and as such may not always be the best treatment method for all clients. The intensive nature of the treatment, therapeutic context, awareness of the treatment enhancing domains (expressive in nature ≠ a grammaticism), client aphasiac profile, as well as the specific goals of each client should be taken into consideration when evaluating the clinical application of this intervention method.

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