



# Rapid Syllable Transitions (ReST) treatment for Childhood Apraxia of Speech: The effect of lower dose-Frequency



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## ABSTRACT

This study investigated the effectiveness of twice-weekly Rapid Syllable Transitions (ReST) treatment for Childhood Apraxia of Speech (CAS). ReST is an effective treatment at a frequency of four sessions a week for three consecutive weeks. In this study we used a multiple-baselines across participants design to examine treatment efficacy for four children with CAS, aged four to eight years, who received ReST treatment twice a week for six weeks. The children's ability to acquire new skills, generalize these skills to untreated items and maintain the skills after treatment was examined. All four children improved their production of the target items. Two of the four children generalized the treatment effects to similar untreated pseudo words and all children generalized to untreated real words. During the maintenance phase, all four participants maintained their skills to four months post-treatment, with a stable rather than rising profile. This study shows that ReST treatment delivered twice-weekly results in significant retention of treatment effects to four months post-treatment and generalization to untrained but related speech behaviors. Compared to ReST therapy four times per week, the twice-weekly frequency produces similar treatment gains but no ongoing improvement after the cessation of treatment. This implies that there may be a small but significant benefit of four times weekly therapy compared with twice-weekly ReST therapy.

**Learning outcomes:** Readers will be able to define dose–frequency, and describe how this relates to overall intervention intensity. Readers will be able to explain the acquisition, generalization and maintenance effects in the study and describe how these compare to higher dose frequency treatments. Readers will recognize that the current findings give preliminary support for high dose–frequency CAS treatment.

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## 1. Introduction

Childhood Apraxia of Speech (CAS) is a complex speech disorder that affects movement control required for accurate articulation of speech sounds and production of prosody (American Speech-Language-Hearing Association, 2007). There is general agreement that children with CAS are perceived to have inconsistent phonetic errors in words over multiple productions, lengthened and disrupted co-articulatory transitions, and more equal stress in multisyllabic words and phrases (American Speech-Language-Hearing Association, 2007). CAS is a persistent speech impairment (Lewis, Freebairn, Hansen,

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Iyengar, & Taylor, 2004) and children with CAS are reported to have slow response to therapy (Aram & Nation, 1982; Hall, Hardy, & LaVelle, 1990).

One intervention approach that has been shown effective for CAS is Rapid Syllable Transitions (ReST) treatment (Murray, McCabe, & Ballard, 2012b). ReST uses a high dose–frequency (4 sessions a week for 3 weeks) to target the key problems of CAS (Murray, McCabe, & Ballard, 2012c). However, high dose–frequency protocols are often impractical in clinical settings due to various logistical challenges. The purpose of the current study was to evaluate the effectiveness of a lower dose–frequency of ReST (2 sessions a week for 6 weeks) that may be more feasible for implementation in clinical environments.

### 1.1. Treatments for Childhood Apraxia of Speech

Although a number of treatments exist for CAS, (see Murray, McCabe & Ballard, 2014) there is a paucity of high-level evidence supporting treatment efficacy (Morgan & Vogel, 2008; Watts, 2009). Most of the evidence supporting interventions for CAS comes from case studies and case-series designs, which are limited in their application to the population as a whole (Kazdin, 2011). To date, only one randomized controlled trial (RCT) has been conducted in this field (Murray et al., 2012c). The RCT compared the efficacy of the Nuffield Dyspraxia Programme–Third Edition (Nuffield) and Rapid Syllable Transition Treatment (ReST). Both treatment approaches resulted in significant gains on treated speech behaviors and generalization of treatment effects to untreated behaviors. Murray et al. suggests that, with intensive treatment, both approaches stimulated significant change in speech skills but the ReST treatment resulted in stronger retention of skill long-term.

ReST is based on principles of motor learning derived primarily from studies of limb motor-learning (Schmidt & Lee, 2011) and the protocol has been described in detail previously (Murray et al., 2012b). ReST treatment consists of high intensity practice of randomly presented pseudo words, with varying phonetic structure and lexical stress. Using pseudo words enables the children to practice motor planning and programming on word-like forms without interference from previously incorrectly learned plans. During practice, only delayed low-frequency ‘knowledge of results’ feedback is provided to combine active learning through self-evaluation. These various principles of practice and feedback structure tend to generate stronger retention and generalization of trained skills for both limb and speech motor learning (Maas et al., 2008; Schmidt & Lee, 2011). Efficacy of ReST has also been demonstrated in a number of single-case design studies (Ballard, Robin, McCabe, & McDonald, 2010; McCabe, Macdonald-D’Silva, Van Rees, Ballard & Arciuli, 2010). All studies to date have employed a therapy regimen of 1 h a day for 4 days a week over 3 weeks. However, it is not currently known whether this high dose–frequency is necessary for efficacy.

### 1.2. Intensity of treatment

Speech–language pathology treatment is generally recommended at a higher frequency and for a longer duration for CAS than for other speech disorders (American Speech–Language–Hearing Association, 2007; Hall, Jordan, & Robin, 1993; Skinder-Meredith, 2001). Many treatments have demonstrated some level of efficacy in high intensity formats (see Murray et al., 2014 for a review), however it is not yet known whether comparable gains can be achieved for similar amounts of therapy delivered with lower frequency (e.g. twice-weekly for 6 weeks).

In order to provide efficient and effective speech–language pathology services for children in general, and those with CAS specifically, it is essential to determine optimal treatment intensity (Baker, 2012). As noted by Law, Zeng, Lindsay, and Beecham (2012) providing too many treatment sessions wastes scarce resources, but providing too few sessions risks diluting the intervention’s effect. In the past few years speech–language pathologists have become increasingly aware of the importance of controlling a treatment’s intensity (e.g. Baker, 2012; Ukrainetz, 2009).

To facilitate comparisons of intensity across intervention approaches, Warren, Fey, and Yoder (2007) proposed a formula for calculating intervention intensity. The formula takes into account (a) dose—the ‘active ingredient’ in the treatment such as the number of productions by a client or the number of teaching episodes per session, (b) dose form—the type of activity in which the dose is delivered including the context (e.g. individual vs. group) as well as the type of activity (e.g. focused practice on a motor skill vs. incidental practice during play), (c) dose–frequency—the frequency of the therapy, normally measured in number of sessions per week, month or school term, (d) total intervention duration – the length of the treatment, generally in weeks or months, to determine the cumulative intervention intensity – a product of dose, dose–frequency, and total intervention duration. For example, in previous studies of the ReST treatment (Ballard et al., 2010; Murray et al., 2012c), participants produced 100 responses per session, had four sessions per week across a three-week period for a cumulative intervention intensity of  $100 \times 4 \times 3 = 1200$  trials.

A greater amount of therapy (‘cumulative intervention intensity’) is generally associated with superior outcomes for motor learning tasks (Schmidt & Lee, 2011) and for a range of speech and language impairments. This was demonstrated in children with CAS by Namasivayam (2013), who showed that twenty sessions of ‘specialized motor treatment’ across 10 weeks resulted in stronger gains than ten sessions across the same period.

#### 1.2.1. Dose–frequency

Even when the *amount* of therapy (‘cumulative intervention intensity’) is constant, the spacing of the sessions (‘dose–frequency’) can affect the treatment outcome, (e.g. Allen, 2013; Barratt, Littlejohns, & Thompson, 1992). There has been

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