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Stress, Depression, Quality of Life, and Language Recovery in Constraint Induced Aphasia Therapy (CIAT)

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LOMA LINDA UNIVERSITY
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Stress, Depression, Quality of Life, and Language Recovery in Constraint Induced Aphasia Therapy (CIAT)

by

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A Dissertation submitted in partial satisfaction of
the requirements for the degree
Doctor of Philosophy in Rehabilitation Science

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Each person whose signature appears below certifies that this dissertation in his/her opinion is adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

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And, finally, I thank God for providing me the opportunity to help make man whole.

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ABBREVIATIONS

CIAT	Constraint Induced Aphasia Therapy
VA	Cerebral Vascular Accident
ASWAM	Abnormal Slow Wave Activity Mapping
GC's	Glucocorticoids
HPA	Hypothalamic-Pituitary Adrenal
HRQoL	Health-Related Quality of Life
IRB	Institutional Review Board
ELISA	Enzyme-Linked Immunosorbent Assay
WAB	Western Aphasia Battery
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation
PSS	Perceived Stress Scale
BDI	Becks Depression Inventory
QOLS	Quality of Life Scale
ANOVA	Analysis of Variance

ABSTRACT OF THE DISSERTATION

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by

Brian Sharp

Doctor of Philosophy, Rehabilitation Science
School of Allied Health Professions
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Dr. Paige Shaughnessy PhD, Chairperson

Traditional aphasia treatment approaches focus initially on restoration of language, but quickly move to use of alternative modes of communication when progress is slow. Constraint Induced Aphasia Therapy (CIAT), a more intensive form of treatment, is based on the concept of frequent, long sessions and forced use of the impaired language system. Prior to the present study, the relationship between CIAT and stress had not been explored; therefore, this study compared cortisol stress levels and improvement of language skills in two groups of subjects, all of whom presented with expressive aphasia. Ten subjects participated in CIAT, and received 10 days of intensive treatment over two weeks. Ten subjects received traditional aphasia treatment, and received six days of treatment over two weeks. The study also examined perceived stress, depression, and quality of life as variables that might influence candidacy for CIAT. All participants in each group provided salivary cortisol samples, and completed perceived stress, depression, and quality of life questionnaires pre-treatment, mid-treatment, and post-treatment. Language skills were assessed pre-treatment and post-treatment. Results showed that, at baseline and at the end of treatment, there was no difference between groups on measures of cortisol stress levels; however, at mid-treatment, cortisol stress

levels were significantly higher in the CIAT group. Participants in the CIAT group showed significant improvement on word repetition and overall aphasia quotient, whereas participants in the traditional treatment group showed no significant change. There were no significant changes in perceived stress scores, depression scores, or quality of life scores across time in either of the two groups. Implications for use of CIAT as a viable and effective treatment method for individuals with aphasia are discussed.

CHAPTER ONE

INTRODUCTION

Aphasia

Aphasia is a language disorder that is usually caused by a cerebral vascular accident (CVA, or stroke). Nearly one-third of individuals who suffer CVA will develop some degree of aphasia.[1-4] Aphasia typically signifies difficulty processing and expressing language;[5] thus, people with aphasia will need some type of speech and language therapy.

Traditional aphasia treatment focuses on models that use retraining (restoration of function) and compensation (use of alternative modes of communication). In traditional models, if stimulation and cueing do not restore functional communication quickly, patients are taught compensatory techniques.[5] Compensatory techniques typically include simple tools (communication boards, gestures, etc.), as well as more complex tools (electronic speaking devices, for example). According to traditional therapy models, when retraining is unsuccessful, tools that require the least amount of effort are preferred.[6] Additionally, the impact of limited time and resources for rehabilitation push clinicians to move quickly to use compensatory techniques, often at the expense of restoration of language function.[7]

It is a widely accepted notion that spontaneous recovery occurs in the first six months, with minimal spontaneous improvement up to one year post incident.[8] Conventional wisdom seems to promote compensatory techniques in order to facilitate

functional communication as rapidly as possible. However, recent research suggests that bypassing the impaired system may lead to learned non-use of the primary system.[9-10] Individuals who are repeatedly unsuccessful in their attempts to communicate quite naturally learn to avoid use of the impaired neurological pathway. This avoidance is called, "learned non-use." Ironically, avoiding the use of the impaired neurological pathway actually promotes chronic neurological impairment (in this case, chronic aphasia).[11]

The latest research in the fields of physical therapy and occupational therapy challenges traditional models, which seem to abandon restoration too quickly. Taub[12] suggests that, when individuals are forced to use the impaired system, they exhibit improved function, provided there is a high level of intensity (length of therapy session) and a high level of frequency (number of therapy sessions). Forced use of the impaired system, combined with high intensity and high frequency of treatment, seems to prevent or reverse learned non-use, according to Taub and others.[13-15]

Constraint Induced Aphasia Therapy (CIAT)

The concept of forced use, high intensity, high frequency was introduced to the field of aphasia therapy by Pulvermüller[6] and has been replicated by others, with verbal communication as the targeted outcome.[16-18] Forced use of the impaired communication system, with high frequency and high intensity therapy is now known as Constraint Induced Aphasia Therapy (CIAT).[6,19,20] Subsequent studies that compared CIAT with conventional therapy showed that CIAT resulted in greater improvement of language skills. .[6,9,11,17] In the Meinzer [20] study, participants demonstrated improved neurological

activity, confirmed by Abnormal Slow Wave Activity Mapping (ASWAM), as well as improved functional language performance on at least one subtest of a standard language test.[20] Meinzer suggests that CIAT may assist neural plasticity in the process of restoration of language function by restoring or reintegrating the language network.[20]

Even though there is evidence to suggest that CIAT is effective in restoring language function in individuals with aphasia, patients seem to be concerned about the demands of a constraint induced program, and clinicians seem to be skeptical of the approach, citing safety (possibly secondary to anxiety and stress) as a possible downside.[21] Research prior to this study has not addressed the issue of stress in patients during CIAT.

Stress

Stress, which may be triggered by internal or external factors, causes a psychophysiological response.[22] When the body is under stress, allostasis, the body's ability to adapt to environmental demands,[23] is threatened. When allostasis is threatened, undesirable changes may occur in the immune system.[24] Glucocorticoids (GCs), which are steroid hormones that have both enhancing and inhibiting effects on the immune system, inhibit pro-inflammatory cytokines, which, in turn, help to balance the immune system when it is under stress,[25] thus, keeping the immune system from overshooting.[26]

Glucocorticoids include the steroid hormone cortisol. An increase in cortisol levels may influence immune system modulation. Thus, increased levels of cortisol indicates psychophysiological stress.[27, 28] As stress increases, the production of cortisol increases via the hypothalamic-pituitary-adrenal (HPA) axis.[28]

Not all stress is harmful, and, cortisol levels normally fluctuate. However, failure to recover from stress is abnormal and potentially harmful. Recovery from stress (allostasis) occurs when the body is capable of maintaining stability. When the body is unable to maintain stability, *allostatic load* occurs. Allostatic load is defined as the wear and tear on the body created by stress.[29] In other words, allostatic load is the consequence of the body's inability to reestablish homeostasis from the stress.[30]

Stress Recovery Patterns

McEwen[31] refers to five (5) stress recovery patterns (labeled A through E for the purpose of clarity here). These patterns of allostatic load (abnormal recovery from stress) may affect the success of communication therapy. Examples of each pattern are given below.

Pattern A

Pattern A is the pattern for normal recovery.

Pattern B

Pattern B (Repeated Hits) is a pattern that causes allostatic load. It occurs when there are successive multiple novel stressors. This is chronic stress. Example: A variety of activities, at mixed levels of difficulty, is presented to a patient who is consistently performing poorly. Failure on item after item creates a succession of new stressors; thus, the patient has no opportunity to recover from stress.

Pattern C

Pattern C (Lack of Adaptation) also is a pattern that causes allostatic load. It occurs with failure to adapt to repeated occurrences of the same stressor. Example: A patient with aphasia is repeatedly presented with the same failed activity day after day. The failure creates stress, but recovery follows. Yet, upon presentation of the same activity the next day, the same stress response occurs when failure occurs. Failure to adapt to the stressful situation makes each failure an essentially new failure.

Pattern D

Pattern D (Prolonged Response) also is a pattern that causes allostatic load. It occurs when there is no recovery, which induces a prolonged state of stress. Example: A patient with aphasia continues to worry about failed responses to therapy tasks. No recovery from stress occurs.

Pattern E

Pattern E (Inadequate Response) also is a pattern that causes allostatic load. It occurs when there is diminished or no response to stress. Example: The patient with aphasia may exhibit no response to failure or success in therapy. This may be an indication that the immune system could eventually be compromised.

Depression

In addition to speech and language issues, as well as psychophysiological stress, there are psychological issues (here described as depression and quality of life) that need

to be considered when treating the patient who has aphasia. Reports of depression in individuals with stroke are inconclusive and contradictory.[32] However, most research indicates that 25% of people who suffer acute stroke will experience some form of depression within the first year, [33-35] with 33% experiencing symptoms of depression at some time post onset of stroke.[36]

Over one-third of individuals who suffer stroke also have some form of aphasia. Not unexpectedly, depression is high in this population. Sixty-to-70% of individuals with aphasia suffer some form of depression,[37] and this depression adversely impacts their quality of life. [38] Numerous factors contribute to depression in individuals with aphasia. In an attempt to delineate these factors, Hilari et al[39] used the General Health Questionnaire-12 item to measure psychological distress (as defined as depression and anxiety). The authors suggest that medical and psychological components may be predictors of psychological distress. [39] At chronological markers of immediate onset, three months, and six months post onset, predictors of depression and anxiety were: stroke severity; social support; and, loneliness and satisfaction of social networks, respectively.[39] Thus, as life goes on for individuals with aphasia, the factors that influence depression may change.

The implications for providing therapy for individuals with chronic aphasia need to be considered here. Conventional wisdom dictates that treatment effectiveness begins to decline at about six months post onset; or, that a plateau in recovery is reached at this time. Presumably, the six-month line of demarcation is based on a long-held belief about neurological recovery rates. Pulvermuller[6] and Meinzer[17] demonstrated that, with CIAT, individuals recovered language function well after a year post onset of stroke. An

evidence-based systematic review of the effects of CIAT by Cherney, et.al. in 2008, showed similar results.[19] Issues of psychological stress, depression, and poor quality of life, brought about by the stroke, are seldom considered as factors that may affect neurological recovery; yet, as recent evidence shows, these are usually the critical factors in recovery. Chronic depression that persists beyond six months is a useful predictor of continual chronic depression, .[32] This is useful information when one considers treatment for aphasia and the impact of chronic depression on recovery of communication function, as well as the impact of one's ability to communicate on recovery from depression.

Quality of Life

Quality of life refers to one's perception of his or her position in life and how it relates to achievement of goals and expectations.[40] Similarly, health-related quality of life (HRQoL) refers to one's perception of his or her position in life related to adjustment of goals, as a result of a medical or health condition. [41] An unanticipated event such as stroke requires sudden and significant adjustments in life style. These adjustments affect one's psychological welfare and, subsequently, the perception of his or her quality of life.[42] Individuals with aphasia are at a higher risk for perceiving their life as having reduced value or worth, primarily because of the impact aphasia has on communication and social well being. Quality of life for individuals with aphasia revolves around level of independence, social relationships, and access to aspects of their environment.[44] Also, depression and decreased levels of communication ability are associated with health related diminished quality of life.[44] When all of the variables that contribute to poor

quality of life are considered, the relationship between aphasia and quality of life is apparent.[38]

CHAPTER TWO

CONSTRAINT INDUCED APHASIA THERAPY (CIAT): COMPARISON OF STRESS LEVELS AND LANAGUAGE RECOVERY

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Abstract

Background and Purpose – Constraint Induced Aphasia Therapy (CIAT) is a more intensive form of language treatment for aphasia as compared to traditional treatments. This study examined whether there are differences in cortisol stress levels between the two methods of aphasia treatment as well as effects on language skills.

Methods – A total of 20 participants with expressive aphasia were randomly placed into one of the two treatment groups. The CIAT group received 10 days of intensive treatment over two weeks. The traditional therapy group received 6 days of treatment over 2 weeks. All participants in each group provided salivary cortisol samples before treatment, at the mid-point of treatment, and at the conclusion of treatment. Language skills were assessed before treatment and at the conclusion of treatment.

Results – A significantly higher proportion of individuals in the CIAT treatment group had increased salivary cortisol stress levels when compared to the traditional treatment group at the mid-point of the program (80% versus 30% respectively, $p=0.03$). There was no significant difference in the proportion of individuals with increased cortisol stress by the end of the treatment. Language scores for word repetition and overall aphasia quotient significantly improved for the CIAT group when compared to the traditional group ($p=0.02$ each).

Conclusions – The CIAT treatment appears to initially create increased psychophysiological stress as compared to the traditional treatment. In spite of the initial increases in psychophysiological stress, participants appear to become conditioned to the challenge and ultimately have enhanced benefit from CIAT treatment.

Key Words: Aphasia, Stress, CIAT, Language, Cortisol, Allostatic Load

Introduction

Aphasia

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Traditional aphasia treatment has focused on models that use retraining (restoration of function) and compensation (use of alternative modes of communication). In traditional models, if stimulation and cueing do not restore functional communication, patients are taught compensatory techniques.[5] Classically, compensatory techniques include simple tools (communication boards, gestures, etc.), as well as more complex tools (electronic speaking devices, for example). According to traditional models, theoretically, when retraining is unsuccessful, tools that require the least amount of effort are preferred.[6] Additionally, the impact of limited time and resources for rehabilitation push clinicians to move quickly to use compensatory techniques, often at the expense of restoration of language function.[7] It is a widely accepted notion that spontaneous recovery occurs in the first six months, with minimal spontaneous improvement within one year post.[8] Conventional wisdom seems to promote compensatory techniques in order to facilitate communicative functionality as rapidly as possible. However, recent research suggests that bypassing the impaired system may lead to learned non-use.[9-10] Individuals who are repeatedly unsuccessful in their attempts to communicate quite naturally learn to avoid use of the impaired neurological pathway. This avoidance is called, "learned non-use." Ironically, avoiding the use of the impaired neurological

pathway actually promotes chronic neurological impairment (in this case, chronic aphasia).[11]

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psychophysiological response.[21] When the body is under stress, allostasis, the body's ability to adapt to environmental demands,[22] is threatened. When allostasis is threatened, undesirable changes may occur in the immune system.[23] Glucocorticoids (GCs), which are steroid hormones that have both enhancing and inhibiting effects on the immune system, inhibit pro-inflammatory cytokines, which, in turn, helps to balance the immune system when it is under stress,[24] thus, keeping the immune system from overshooting.[25]

Glucocorticoids include the steroid hormone cortisol. An increase in cortisol levels may influence immune system modulation. Thus, increased levels of cortisol may indicate stress.[26, 27] As stress increases, the production of cortisol increases via the hypothalamic-pituitary-adrenal (HPA) axis.[27]

Not all stress is harmful, and, cortisol levels normally fluctuate. However, failure to recover from stress is abnormal and potentially harmful. Recovery from stress (allostasis) occurs when the body is capable of maintaining stability. When the body is unable to maintain stability, *allostatic load* occurs. Allostatic load is defined as the wear and tear on the body created by stress.[28] In other words, allostatic load is the consequence of the body's inability to reestablish homeostasis from the stress.[29]

McEwen[30] refers to five (5) stress recovery patterns (labeled A through E for the purpose of clarity here). Pattern A is the pattern for normal recovery. Patterns B through E are patterns that cause allostatic load. Pattern B (Repeated Hits) occurs when there are successive multiple novel stressors. This is chronic stress. Pattern C (Lack of Adaptation) occurs with failure to adapt to repeated occurrences of the same stressor. Pattern D (Prolonged Response) occurs when there is no recovery, which induces a

prolonged state of stress. Pattern E (Inadequate Response) occurs when there is diminished or no response to stress.

These patterns of allostatic load (abnormal recovery from stress) may affect the success of communication therapy. For example:

Pattern B (Repeated Hits): A variety of activities, at mixed levels of difficulty, is presented to a patient who is consistently performing poorly. Failure on item after item creates a succession of new stressors; thus, the patient has no opportunity to recover.

Pattern C (Lack of Adaptation): A patient with aphasia is repeatedly presented with the same failed activity day after day. The failure creates stress, but recovery follows. Yet, upon presentation of the same activity the next day, the same stress response occurs when failure occurs. Failure to adapt to the stressful situation makes each failure an essentially new failure.

Pattern D (Prolonged Response): A patient with aphasia continues to worry about failed responses to therapy tasks. No recovery from stress occurs.

Patterns E (Inadequate Response): The patient with aphasia may exhibit no response to failure or success in therapy. This may be an indication that the immune system could eventually be compromised.

Methods

Participants

Participants in this study were recruited through local, outpatient speech-language pathology departments and local community stroke support groups. The participants

were recruited through the use of flyers that were given to speech-language pathologists and support group facilitators. The inclusion criteria for participation in the study were: (1) medical diagnosis of left hemisphere cerebral vascular accident (CVA) with an onset of six months or more; (2) diagnosis of aphasia at least six months prior to the study; (3) English as primary language; and, (4) non-verbal communication as either a primary or secondary form of communication.

Participants were excluded from the study if they were: (1) taking corticosteroid medications; (2) diagnosed with any neurological condition other than CVA; (3) diagnosed with a cognitive disorder that prevented participation in aphasia therapy; and, (4) diagnosed with a cognitive disorder that would prevent being able to answer questionnaires. The inclusion and exclusion criteria were sent to the referral sources to allow for pre-screening. Eligible participants were scheduled for an initial consultation with the principle investigator to complete an informed consent packet as well as a demographic information form. The initial consultation served as an opportunity to review the inclusion and exclusion criteria in order to determine candidacy for the study. Once enrolled, the participants were randomly assigned to one of two treatment groups.

A total of 20 participants were included in this study, 10 of whom were assigned to each of the two groups. Age range of participants was 50 to 70 years, with a mean age of 65.0 years (sd = ±5.6) for the traditional aphasia treatment group and 66.8 years (sd = ±3.6) for the CIAT group. Time post onset ranged from six to 27 months, with a mean of 11.5 months (sd = ±4.6) for the traditional aphasia treatment group and 14.0 months (sd = ±6.3) for the CIAT group.

Procedure

All procedures used in this study were reviewed and approved by the institutional review board (IRB) of Loma Linda University. As subjects were identified and placed on the pre- randomized list, groups of 2-3 subjects were created and treatment was initiated.

Pre-Treatment Salivary Cortisol Testing

Once identified and placed in one of the two treatment groups, the participants were provided with a saliva cortisol collection package for pre-treatment levels. The saliva collection packet contained instructions from Salimetrics, (State College, PA) regarding how to collect saliva via the passive drool method (Saliva Collection and Handling Advice, 3rd Edition, Salimetrics, State College, PA) All participants and their caregivers reviewed the instructions and were asked to collect the sample at home at the appropriate times. Home collection was chosen in order to obtain a baseline assessment in the least stressful environment possible. The passive drool collection method at home required the participants to drool through a straw into a vial which was pre-coded with a sticker that contained their participant number followed by their sample number (1=pre, 2=mid, 3=post). All participants were instructed to collect the salivary samples at noon so as to control for diurnal variability. The participants were instructed to bring the saliva sample the morning of their language pre-testing. Once received, the salivary samples were double checked for volume, correct labeling and collection time. All samples were then placed in a -80C freezer in the Molecular Research Lab in the School of Allied Health Professions, Loma Linda University for storage prior to ELISA testing (Salimetrics, State College, PA).

Language Pre-Treatment Testing

The Western Aphasia Battery Test (WAB) was administered according to test protocol. Participants were given the following subtests: 1) spontaneous speech, 2) word repetition, 3) word finding, and 4) auditory comprehension. All of the scores were analyzed and an aphasia quotient score was obtained and recorded for each participant.

Treatment

The goal for the participants in the traditional aphasia treatment group was to produce functional communication by any means necessary. The participants in the traditional aphasia treatment group completed language activities, such as naming, picture description, sentence formulation and conversational speech. Various types of cueing were provided, and participants were allowed to use gestures or other non-verbal modes of communication in order to make communication easier. Treatment was conducted three times a week for two weeks, with each participant receiving 45-60 minutes per session for a total of six sessions. The total treatment time in the traditional aphasia treatment group ranged from five to six hours with an average of 5.5 hours.

The goal for the participants in the CIAT group was to produce verbal communication. The participants in the CIAT group complete language activities. The therapeutic activity consisted of a deck of 40 object cards with a total of 20 different pictures. There was one pair of cards for each target item/stimulus. This activity was also conducted with two-to-three participants in each group. In this activity the participants were instructed to request a card that they had in their hand from another person in the group. The request had to be made verbally without the use of any non-

verbal communication. A barrier was used to constrain non-verbal modes of communication. In order to ensure that each participant actually employed forced use, additional rule constraints were devised in order to raise the difficulty level of language activities and criteria for success. When participants reached performance levels of 80% or higher on verbal targets, new rule constraints were added or adjusted. The additions and adjustments changed the criteria for a correct response. For example, when a one-word target presented no challenge for the participant, an additional constraint increased the difficulty and criteria for success. The criteria for success were modified to requiring the participant to produce a verbal request at the phrase or sentence level. Additions and adjustments in constraint were continually fine tuned. CIAT treatment was conducted five times a week for two weeks, with each participant receiving 2.5 – 3 hours of treatment per session. The total treatment time in the CIAT group ranged from 25 to 30 hours with an average of 26.5 hours.

Mid-Treatment and Post-Treatment Cortisol Testing

Each participant underwent cortisol testing at the midpoint (conclusion of the first week) and again at the end of treatment (conclusion of the second week). For the traditional aphasia treatment group, midpoint testing occurred at noon after the third treatment session. The CIAT group received their midpoint testing at noon after the fifth treatment session. Participants provided a saliva sample collected using the passive drool method. Post-testing was conducted at the end of the treatment programs. Post-treatment testing was conducted for both groups at noon in order to maintain consistency with the

prior testing parameters. Participants provided a saliva sample collected using the passive drool method.

Language Post-Treatment Testing

The WAB was administered to participants in order to obtain receptive and expressive language scores as well as an aphasia quotient.

Data Analysis

Data were analyzed using SPSS version 20.0. One sample Kolmogorov Smirnov test was used to examine the distribution of the continuous variables. Chi-square Fisher Exact test was used to examine the differences in gender, marital status, and work status by treatment group. Differences in race by treatment group were assessed using Pearson's Chi-square. Mean age, time post onset, baseline cortisol levels, and language scores were compared between the traditional aphasia treatment group and the CIAT group using independent t-test. Changes in language subtest scores and aphasia quotients by treatment group were examined using Mann- Whitney U test. For cortisol levels, we calculated the percent change between pre- and mid-, pre- and post-, and mid- and post-testing; then, we calculated the number of participants who had an increase, no change, or a decrease at all times in both treatment groups. A Chi-square test of independence was used to examine differences in proportions of participants who experienced a percent change in cortisol level by treatment group. The level of significance was set at $p<.05$.

Results

There were no significant differences in mean age and time status post onset between treatment groups (Table 1). There were no significant differences between groups with regards to gender, marital status, race and work status ($p > .05$; Table 1).

Table 1. Frequency Distribution of Characteristics of Study Sample by Treatment Type (n=20)

Demographics	**Traditional N = 10**	**CIAT N = 10**	**P-Value**
Age in years (mean ±SD)	65.0, ± 5.6	66.8, ± 3.6	0.42*
Time post onset months (mean, ±SD)	11.5, ± 4.6	14.0, ± 6.3	0.36*
Gender			
Male	6 (60%)	7 (70%)	0.65 †
Female	4 (40%)	3 (30%)	
Married			
Yes	*7 (70%)*	6 (60%)	0.50†
No	*3 (30%)*	4 (40%)	
Race			
White	5 (50%)	4 (40%)	0.61‡
Black			
Other	3 (30%)	2 (20%)	
Work			
Yes	2 (20%)	4 (40%)	
No			
	2 (20%)	1 (10%)	0.50†
	8 (80%)	9 (90%)	

***:Mann-Whitney U-Test**
†: Fishers Exact Test
‡: Pearson Chi Square
CIAT: Constraint Induced Aphasia Therapy

Results revealed no significant difference in baseline testing of cortisol or language skills between the two groups ($p > .05$; Table 2).

Table 2. Mean (± SD) of Baseline Outcomes by Treatment Type (n=20)

Pre Testing Results	**Traditional N = 10**	**CIAT N = 10**	**P-Value §**
Cortisol	0.37 ± .19	0.21 ± .17	0.06
Spontaneous Speech	10.4 ± 3.5	9.0 ± 3.0	0.35
Repetition	5.7 ± 1.8	6.3 ± 1.2	0.39
Word Finding	5.2 ± 1.7	5.6 ± 1.3	0.55
Auditory Comprehension	7.6 ± 1.08	7.5± 0.9	0.88
Aphasia Quotient	57.6 ± 15.6	56.7 ± 12.0	0.89

§: Independent T-Test
CIAT: Constraint Induced Aphasia Therapy

Stress levels were examined between groups by comparing pre-treatment, mid-treatment, and post-treatment cortisol levels. As figure 1 illustrates, between baseline and mid treatment, 80% (N=8) of participants in the CIAT group showed increased cortisol levels, compared to 30% (N=3) in the traditional therapy group (χ^2=3.2, p=0.03). Between mid-treatment and post-treatment, 40% (N=4) of participants in the CIAT group showed increased cortisol levels, compared to 40% (N=4) in the traditional therapy group (χ^2=0.2, p=0.68). From pre-treatment to post-treatment, 50% (N=5) of the CIAT group showed increased cortisol levels, compared to 40% of the traditional aphasia therapy group (χ^2=0.1, p=0.50).

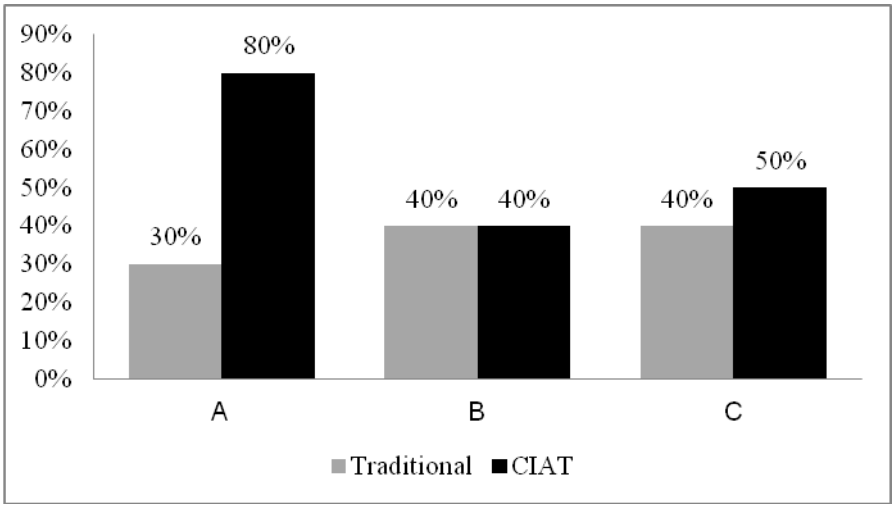

Figure 1. Percentage of subjects with increased salivary cortisol by treatment periods. (A) Pre Treatment to Mid Treatment, (B) Mid Treatment to Post Treatment, (C) Pre Treatment to Post Treatment

Observation of individual participants' cortisol levels (not shown in figure 1) revealed that 100% (N=10) of the participants in the CIAT group showed an increase at some point during treatment. Eight showed an increase during the first half of treatment. Two of those continued to show an increase during the second half, while the other six showed a decrease. Of the original 10, the remaining two showed an initial decrease during the first half of treatment, with a subsequent increase during the second half.

In the traditional aphasia therapy group, seven of the participants showed increased cortisol levels at some point during treatment. Three showed an increase in the first half of treatment; all three of these showed decreased levels in the second half. Four who had a decrease in the first half showed an increase during the second half. Thirty percent (N=3) of this group actually showed a continual decrease in cortisol levels during treatment.

The mean difference between pre-treatment and post-treatment scores on the Western Aphasia Battery were compared between groups using the Mann-Whitney U-Test. Participants in the CIAT had significant pre-test/post-test improvement compared to the traditional group in both word repetition (Table 3) and overall aphasia quotient (Table 3).

Table 3: Mean (± SD) Changes (post-pre) of Language Task Scores by Treatment Type

Language Tasks	**Traditional**	**CIAT**	**P-Value ***
Spontaneous Speech	5.54 (±2.67)	4.02 (±2.50)	0.14
Word Repetition	0.40 (±0.16)	0.70 (±0.27)	0.02
Word Finding	0.50 (±0.29)	0.76 (±0.27)	0.06
Auditory Comprehension	0.07 (±0.08)	0.10 (±0.11)	0.53
Aphasia Quotient	3.58 (±1.47)	5.72 (±2.13)	0.02

***: Mann-Whitney U-Test**
CIAT: Constraint Induced Aphasia Therapy

Discussion

The purpose of this study was to determine if Constraint Induced Aphasia Therapy (CIAT) increases stress significantly more than traditional aphasia treatment. Increases in cortisol reactivity represented increased psychophysiological stress. Percentages of increased stress are shown in Figure 1. Other studies have shown that CIAT achieves greater effects than traditional therapy approaches. Studies have shown that cortisol is a psychophysiological indicator of stress, and that it can be measured. To our knowledge, this is the first study that examined cortisol levels (as an indicator of

stress) during CIAT and traditional aphasia therapy. Analysis of cortisol levels in this study suggests that CIAT may increase stress during the initial week of treatment, compared with traditional aphasia treatment. However, by the end of the treatment, CIAT participants showed no significant difference in cortisol levels from the participants in the traditional aphasia treatment. In other words, CIAT participants showed increased stress initially, but were able to recover.

Additionally, the language testing provided information about stress and language treatment. The CIAT group did receive more hours of therapy, which may have impacted the increased language scores; however the purpose of the study was to determine if language skills can improve in a stressful therapy program. It appears that recovery of language may be stressful, but improvement is possible, provided stress recovery and the ability to adapt to the treatment occurs. It should be noted that stress management is influenced by many factors, including psychological factors, such as depression and quality of life. Those factors may play a significant role in one's ability to adapt to the CIAT program.

A limitation of this study was the sample size (20 participants). Although 10 subjects in a group does not present with enough power to generalize, the study has identified that stress management does play a role in recovery, and it is an important factor to consider when choosing a therapy procedure. Researchers must further examine the concepts of forced use, stress, and aphasia treatment to determine if there are psychological predictors that will allow clinicians to be better informed in their treatment choices.

Summary

This study has initiated the bridging of aphasia therapy and psychoneuroimmunology (the relationship between mind and body and the determinants of a healthy system). The CIAT treatment appears to initially create increased psychophysiological stress as compared to the traditional treatment. In spite of the initial increases in psychophysiological stress, participants appear to become conditioned to the challenge and ultimately have enhanced benefit from the CIAT treatment.

Acknowledgments

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CHAPTER THREE

CONSTRAINT INDUCED APHASIA THERAPY (CIAT) AND TRADITIONAL APHASIA THERAPY: A COMPARISON OF PERCEIVED STRESS, DEPRESSION, AND QUALITY OF LIFE

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Abstract

Background and Purpose – Perceived stress, depression, and quality of life can have an effect of an individual's recovery of language after stroke. This study examined differences between two types of aphasia treatment (Constraint Induced Aphasia Therapy and traditional aphasia therapy) on measures of perceived stress, depression, and quality of life. Additionally, this study examined differences in language improvement between the two groups.

Methods – Twenty participants with expressive aphasia were randomly assigned to one of two treatment groups. The Constraint Induced Aphasia Therapy (CIAT) group received 10 days of intensive treatment over two weeks. The traditional therapy group received six days of treatment over two weeks. All participants completed the Perceived Stress Scale (PSS), Becks Depression Inventory (BDI), and the Flanagan Quality of Life Scale before treatment, at the mid-point of treatment, and at the conclusion of treatment. Language skills were assessed in all participants on selected subtests of the Western Aphasia Battery before treatment and at the conclusion of treatment.

Results – There were no significant differences between the two groups on perceived stress scores ($p=0.94$), depression scores ($p=0.98$), or quality of life scores ($p=0.76$) across time. Language scores for word repetition and overall aphasia quotient significantly improved for the CIAT group, but there was no significant change for the traditional group ($p=0.02$ each).

Conclusions – Perceived stress, depression, and quality of life all impact one's ability to benefit from therapy. This study demonstrated that neither CIAT nor traditional

therapy caused significant changes (in either direction) in perceived stress, depression, or quality of life.

Key Words: Aphasia, CIAT, Language, Perceived Stress, Depression, Quality of Life.

Introduction

Aphasia

Aphasia is a language disorder that is usually caused by a cerebral vascular accident (CVA, or stroke). Nearly one-third of individuals who suffer CVA will develop some degree of aphasia.[1-4] Individuals with aphasia typically have difficulty processing and expressing language[5] and will need some type of speech and language therapy.

Traditional aphasia treatment has focused on models that use retraining (restoration of function) and compensation (use of alternative modes of communication). In traditional models, if stimulation and cueing do not restore functional communication, patients are taught compensatory techniques.[5] Classically, compensatory techniques include simple tools (communication boards, gestures, etc.), as well as more complex tools (electronic speaking devices, for example). According to traditional models, theoretically, when retraining is unsuccessful, tools that require the least amount of effort are preferred.[6] Additionally, the impact of limited time and resources for rehabilitation push clinicians to move quickly to use compensatory techniques, often at the expense of restoration of language function.[7] It is a widely accepted notion that spontaneous recovery occurs in the first six months, with minimal spontaneous improvement within one year post.[8] Conventional wisdom seems to promote compensatory techniques in order to facilitate communicative functionality as rapidly as possible. However, recent

research suggests that bypassing the impaired system may lead to learned non-use.[9-10] Individuals who are repeatedly unsuccessful in their attempts to communicate quite naturally learn to avoid use of the impaired neurological pathway. This avoidance is called, "learned non-use." Ironically, avoiding the use of the impaired neurological pathway actually promotes chronic neurological impairment (in this case, chronic aphasia).[11]

The latest research in the fields of physical therapy and occupational therapy targets traditional models, which seem to abandon restoration too quickly. Taub et al[12] suggests that individuals who are forced to use the impaired system exhibit improved function, provided there is a high level of intensity (length of therapy session) and a high level of frequency (number of therapy sessions). Forced use of the impaired system, combined with high intensity and high frequency of treatment seems to prevent or reverse learned non-use, according to Taub and others.[12-15] This concept of forced use, high intensity, high frequency was introduced to the field of aphasia therapy by Pulvermüller et al[6] and has been replicated by others, with verbal communication as the targeted outcome.[16-19] Forced use of the impaired communication system, with high frequency and high intensity therapy is now known as Constraint Induced Aphasia Therapy (CIAT).[6,20] Subsequent studies that compared CIAT with conventional therapy showed that CIAT resulted in greater improvement of language skills. .[6,9,11,17] In the Meinzer [20] study, participants demonstrated improved neurological activity, confirmed by Abnormal Slow Wave Activity Mapping (ASWAM), as well as improved functional language performance on at least one subtest of a standard language test.[20] Meinzer's findings suggest that CIAT may assist neural plasticity in the process of restoration of language

function by restoring or reintegrating the language network.[20] In addition to speech and language issues, there are psychological issues (here defined as perceived stress, depression, and quality of life) that need to be considered when treating the patient who has aphasia.

Stress

In response to acute or chronic forces (internal or external), the body's stress hormones trigger a physiological response that affects the immune system, which, in turn, may generate psychological stress. This is known as the "mind-body connection."[21]

Not all stress is harmful, however, failure to recover from stress is abnormal and potentially harmful. A pattern of abnormal recovery from stress leads to wear and tear on the body [21] and to psychological distress, often manifest as feeling stressed, feeling depressed, and experiencing poor quality of life[22].

Depression

Reports of depression in individuals with stroke are inconclusive and contradictory.[23-26] Reportedly, 25% of individuals who suffer acute stroke will experience some form of depression within the first year. [24-26] Furthermore, symptoms of depression may occur in 33% of individuals at any given time post onset of stroke.[27]

A large number (33 %) of individuals with stroke also have some form of aphasia. Accordingly, depression is high in this population. Sixty-to-70% of individuals with aphasia suffer some form of depression,[28] and this depression adversely impacts their quality of life. [29] Numerous factors contribute to depression in individuals with aphasia.

Hilari et al[30] used the General Health Questionnaire-12 item to measure psychological distress (as defined as depression and anxiety). The authors suggest that medical and psychological components may be predictors of psychological distress. [30] At chronological markers of immediate onset, three months, and six months post onset, predictors of depression and anxiety were stroke severity, social support, and loneliness and satisfaction of social networks, respectively.[30] Thus, as life goes on for individuals with aphasia, the factors that influence depression may change. The implications for aphasia therapy in chronic aphasia need to be considered here. Conventional wisdom dictates that treatment effectiveness begins to decline at about six months post onset; or, that a plateau in recovery is reached at this time. Presumably, the six-month line of demarcation is assumed because of some notion about neurological recovery rates. Issues of psychological stress, depression, and poor quality of life, brought about by the stroke, are seldom considered as factors; yet, as recent evidence shows, these are usually the critical factors in recovery. Pulvermuller et al[6] and Meinzer et al[17] demonstrated that, with CIAT, individuals recovered language function well after a year post onset of stroke. An evidence-based systematic review of the effects of CIAT by Cherney, et.al. in 2008, showed similar results.[19] Chronic depression that persists beyond six months is a useful predictor of continual chronic depression, .[23] This is useful information when one considers treatment for aphasia and the impact of chronic depression on recovery of communication function.

Quality of Life

Quality of life is an individual's perception of their position in life and how it

relates to their goals and expectations.[31] Health-related quality of life (HRQoL) is an individual's perception of their position in life related to their goals as a result of a medical or health condition. [32] When an individual suffers a stroke, there are major, unanticipated life adjustments that have to be met. These changes in an individual's lifestyle affects their psychology, and subsequently the perception of their quality of life.[33] Individuals who have aphasia resulting from a stroke are at a higher risk for low perception of life quality due to the social impact aphasia has on communication. Research has found that quality of life for stoke patients with aphasia revolves around level of independence, social relationships and access to aspects of their environment.[34] Health Related Quality of Life (HRQoL) has also been associated with depression and high levels of communication disability.[35] Considering all of these variables which contribute to poor quality of life we now know that there is a relationship between aphasia and compromised quality of life.[29]

Methods

Participants

Participants in this study were recruited through local, outpatient speech-language pathology departments and local community stroke support groups. The participants were recruited through the use of flyers that were given to speech-language pathologists and support group facilitators. The inclusion criteria for participation in the study were: (1) medical diagnosis of left hemisphere cerebral vascular accident (CVA) with an onset of six months or more; (2) diagnosis of aphasia at least six months prior to the study; (3)

English as primary language; and, (4) non-verbal communication as either a primary or secondary form of communication.

Participants were excluded from the study if they were: (1) taking corticosteroid medications; (2) diagnosed with any neurological condition other than CVA; (3) diagnosed with a cognitive disorder that prevented participation in aphasia therapy; and, (4) diagnosed with a cognitive disorder that would prevent being able to answer questionnaires. The inclusion and exclusion criteria were sent to the referral sources to allow for pre-screening. Eligible participants were scheduled for an initial consultation with the principle investigator to complete an informed consent packet as well as a demographic information form. The initial consultation served as an opportunity to review the inclusion and exclusion criteria in order to determine candidacy for the study. Once enrolled, the participants were randomly assigned to one of two treatment groups.

A total of 20 participants were included in this study, 10 of whom were assigned to each of the two treatment groups. Age range of participants was 50 to 70 years, with a mean age of 65.0 years (sd = ±5.6) for the traditional aphasia treatment group and 66.8 years (sd = ±3.6) for the CIAT group. Time post onset ranged from six to 27 months, with a mean of 11.5 months (sd = ±4.6) for the traditional aphasia treatment group and 14.0 months (sd = ±6.3) for the CIAT group.

Procedure

All procedures used in this study were reviewed and approved by the institutional review board (IRB) of Loma Linda University. As subjects were identified and placed on

the pre-randomized list, groups of two- to -three subjects were created and treatment was initiated.

Pre-Treatment Testing

All participants completed the Cohen Perceived Stress Scale (PSS). This scale has been found to be a valid and reliable questionnaire which determines the degree an individual finds life situations stressful.[37] The Becks Depression Inventory (BDI) was also given. This questionnaire has been found to be valid and reliable in screening for post stroke depression.[38] Finally, the Flanagan Quality of Life Scale (QOLS) was given. This questionnaire has been found to be a valid and reliable indicator of an individual's perception of their quality of life when dealing with a chronic medical condition.[39] The participants and the caregivers were given directions necessary for completing all three questionnaires. The questionnaires were completed at home. The completed surveys were brought to the first session.

The Western Aphasia Battery Test (WAB) was administered according to test protocol. The WAB is a standardized test of aphasia. The WAB has been found to be valid and reliable when differentiating aphasia from normal language.[40]

Participants were given the following subtests of WAB: spontaneous speech; word repetition; word finding; and, auditory comprehension. All of the scores were analyzed and an aphasia quotient was obtained and recorded for each participant.

Treatment

The goal for the participants in the traditional aphasia treatment group was to

produce functional communication by any means necessary. The participants in the traditional aphasia treatment group completed language activities, such as naming, picture description, sentence formulation and conversational speech. Various types of cueing were provided, and participants were allowed to use gestures or other non-verbal modes of communication in order to make communication easier. Treatment was conducted three times a week for two weeks, with each participant receiving 45-60 minutes per session for a total of six sessions. The total treatment time in the traditional aphasia treatment group ranged from five to six hours with an average of 5.5 hours.

The goal for the participants in the CIAT group was to produce verbal communication. The participants in the CIAT group completed language activities. The therapeutic activity consisted of a deck of 40 object cards with a total of 20 different pictures. There was one pair of cards for each target item/stimulus. This activity was also conducted with two-to-three participants in each group. In this activity the participants were instructed to request a card that they had in their hand from another person in the group. The request had to be made verbally without the use of any non-verbal communication. A barrier was used to constrain non-verbal modes of communication. In order to ensure that each participant actually employed forced use, additional rule constraints were devised in order to raise the difficulty level of language activities and criteria for success. When participants reached performance levels of 80% or higher on verbal targets, new rule constraints were added or adjusted. The additions and adjustments changed the criteria for a correct response. For example, when a one-word target presented no challenge for the participant, an additional constraint increased the difficulty and criteria for success. The criteria for success were modified to requiring

the participant to produce a verbal request at the phrase or sentence level. Additions and adjustments in constraint were continually fine tuned. The CIAT treatment was conducted five times a week for two weeks, with each participant receiving 2.5 – 3 hours of treatment per session. The total treatment time in the CIAT group ranged from 25 to 30 hours with an average of 26.5 hours.

Mid-Treatment and Post-Treatment Testing

The participants completed the PSS, BDI, and QOLS at mid-treatment (conclusion of the first week) and again at the end of treatment (conclusion of the second week). Participants in the traditional aphasia treatment group completed the mid-treatment questionnaires at noon after the third treatment session. Participants in the CIAT group completed their mid-treatment questionnaires at noon after the fifth treatment session. Post-treatment questionnaires were completed at the end of the treatment programs. Post-treatment questionnaires were completed for both groups at noon in order to maintain consistency with the prior testing parameters.

Language Post-Treatment Testing

The WAB was administered to participants in order to obtain receptive and expressive language scores as well as an aphasia quotient.

Data Analysis

Data were analyzed using SPSS version 20.0. One sample Kolmogorov Smirnov test was used to examine the distribution of the continuous variables. Chi-square Fisher's

Exact test was used to examine the differences in gender, marital status, and work status by treatment group. Differences in race by treatment group were assessed using Pearson's Chi-square. Mean age, time post onset, perceived stress, depression, quality of life, and language scores were compared between the traditional aphasia treatment group and the CIAT group using independent t-test. Changes in language subtest scores and aphasia quotients by treatment group were examined using Mann- Whitney U test. Changes in psychometric measures of perceived stress, depression, and quality of life were examined by comparing pre-treatment, mid-treatment, and post-treatment questionnaire scores. A mixed factorial Analysis of Variance (ANOVA) was conducted to examine differences in psychometric measures between the two treatment groups over time. The level of significance was set at $P<0.05$.

Results

There were no significant differences in mean age and time status post onset between treatment groups (Table 1). There were no significant differences between groups with regards to gender, marital status, race and work status ($p > .05$; Table 1).

Table 1: Frequency Distribution of Characteristics of Study Sample by Treatment Type (n=20)

Demographics	Traditional N = 10	CIAT N = 10	P-Value
Age in years (mean ±SD)	65.0, ± 5.6	66.8, ± 3.6	0.42*
Time post onset months (mean, ±SD)	11.5, ± 4.6	14.0, ± 6.3	0.36*
Gender			
Male	6 (60%)	7 (70%)	0.65 †
Female	4 (40%)	3 (30%)	
Married			
Yes	*7 (70%)*	6 (60%)	0.50†
No	*3 (30%)*	4 (40%)	
Race			
White	5 (50%)	4 (40%)	0.61‡
Black			
Other	3 (30%)	2 (20%)	
Work			
Yes	2 (20%)	4 (40%)	
No			
	2 (20%)	1 (10%)	0.50†
	8 (80%)	9 (90%)	

***:Mann-Whitney U-Test**
†: Fishers Exact Test
‡: Pearson Chi Square
CIAT: Constraint Induced Aphasia Therapy

Results revealed no significant difference in baseline testing of perceived stress, depression, quality of life, or language skills between the two groups ($p > .05$; Table 2).

Table 2: Mean (± SD) of Baseline Outcomes by Treatment Type (n=20)

Pre Testing Results	**Traditional N = 10**	**CIAT N = 10**	**P-Value §**
Perceived Stress	21.4 ±8.3	21.7 ± 8.7	0.94
Depression	36.5 ± 8.1	36.6 ±10.3	0.98
Quality of Life	67.6 ±18.3	64.8 ±22.0	0.76
Spontaneous Speech	10.4 ± 3.5	9.0 ± 3.0	0.35
Repetition	5.7 ± 1.8	6.3 ± 1.2	0.39
Word Finding	5.2 ± 1.7	5.6 ± 1.3	0.55
Auditory Comprehension	7.6 ± 1.08	7.5± 0.9	0.88
Aphasia Quotient	57.6 ± 15.6	56.7 ± 12.0	0.89

§: Independent T-Test
CIAT: Constraint Induced Aphasia Therapy

Psychometric measures of perceived stress, depression, quality of life were examined between groups by comparing pre-treatment, mid-treatment, and post-treatment questionnaire scores. As figure 1 illustrates, there was no significant difference between baseline, mid treatment, and post treatment scores for perceived stress, depression, and quality of life between the two groups.

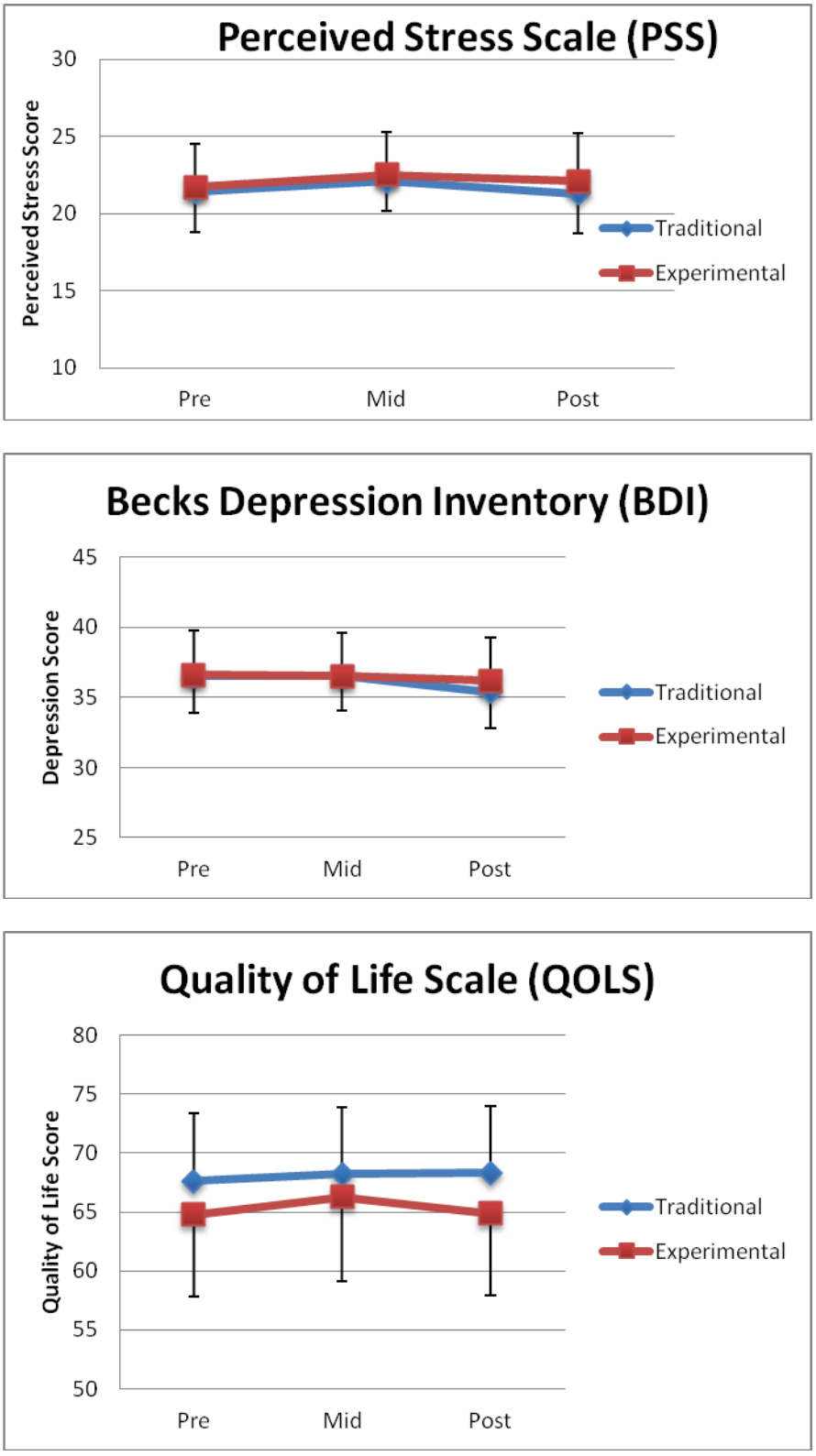

Figure 1. Mean ± SD of psychometric measures by treatment group over time

The difference between pre-treatment and post-treatment scores on the Western Aphasia Battery was compared between groups using the Mann-Whitney U-Test. Participants in the CIAT had significant pre-test/post-test improvement compared to the traditional group in both word repetition (Table 3) and overall aphasia quotient (Table 3).

Table 3: Mean (± SD) Changes (post-pre) of Language Task Scores by Treatment Type

Language Tasks	**Traditional**	**CIAT**	**P-Value ***
Spontaneous Speech	5.54 (±2.67)	4.02 (±2.50)	0.14
Word Repetition	0.40 (±0.16)	0.70 (±0.27)	0.02
Word Finding	0.50 (±0.29)	0.76 (±0.27)	0.06
Auditory Comprehension	0.07 (±0.08)	0.10 (±0.11)	0.53
Aphasia Quotient	3.58 (±1.47)	5.72 (±2.13)	0.02

***: Mann-Whitney U-Test**
CIAT: Constraint Induced Aphasia Therapy

Discussion

The purpose of this study was to compare Constraint Induced Aphasia Therapy (CIAT) with traditional aphasia therapy on participants' perceptions of stress, depression, and quality of life. Studies have shown that Constraint Induced Aphasia Therapy, a more frequent and intense form of therapy, achieves greater results than traditional therapy approaches. Furthermore, surveys have shown that stroke patients exhibit increased stress and depression, and decreased quality of life on measures of satisfaction. Individuals with aphasia show even greater stress and depression and less quality of life on the same

measures of satisfaction. The question asked in this study, then, was: does CIAT influence stress, depression, or quality life in an even more negative direction?

On initial measures of perceived stress, depression, and quality of life, the two groups in this study did not differ significantly, neither was there a significant difference within groups for either of the two groups. In fact, at no time (initial, mid-treatment, or post-treatment) was there a significant difference between groups or within groups on any of the three measures. In other words, CIAT did not increase participants' perception of their own stress levels; it did not increase participants' self reports of depression, nor did it decrease their impressions of their quality of life.

Participants in the CIAT group showed greater improvement on language scores, but, one could argue that this would be the expected outcome, since this group received more therapy in the same amount of time. The purpose of this study was not to determine which therapy approach would yield greater improvement on language scores; rather, the purpose of the study was to determine 1) whether or not improved language scores could be demonstrated, even though the therapy environment may be stressful, and 2) whether or not the more stressful therapy environment would produce negative psychological (i.e., perceived stress, depression, quality of life) effects. It has already been established that loss of language leads to stress, depression, and decreased quality of life. This study clearly demonstrates that, while the recovery of language (the therapy process) may be stressful, CIAT is no more stressful than traditional therapy nor the loss of language ability. It should be noted that many psychological factors, such as perceived stress, depression and quality of life play a significant role in one's ability to adapt to any therapy program.

A limitation of this study was the sample size (20 participants). Although a group of 10 subjects does not present with enough power to generalize, the study identified that neither treatment approach appeared to have negative psychological effects on the participants. It could be argued that, since all participants were recruited from hospital or community programs, they may have been predisposed to show a prior level of confidence or desire to improve. In this case, if the participants already demonstrated a positive mindset, it could explain why there was consistency in how they answered the questionnaires.

Summary

This study compared two models of aphasia therapy (Constraint Induced Aphasia Therapy and traditional aphasia therapy) on measures of participants' perceptions of stress, depression, and quality of life. Participants in CIAT were not significantly different from participants in the traditional therapy group on these measures.

Acknowledgments

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CHAPTER FOUR

CONCLUSION

Discussion

The purpose of this study was to examine the stress related impact of Constraint Induced Aphasia Therapy (CIAT) on individuals with aphasia. Traditional aphasia treatment approaches focus initially on the restoration of language, moving quickly to alternative methods when progress is slow, in an attempt to achieve functional language as quickly as possible. Constraint Induced Aphasia Therapy (CIAT) is more intensive, more frequent, and targets forced use of the impaired language system. This new approach has great promise, particularly since several studies have demonstrated recovery of language function in subjects. However, the high intensity, high frequency, and constraint nature of this therapy approach lends itself to criticism, concern, and worry over the potentially negative impact of assumed increased stress. Prior to this study, there has been no investigation into the relationship between CIAT and stress. To our knowledge, this is the first study that examined psychophysiological stress (measured by cortisol), perceived stress (measured by the Perceived Stress Scale, depression (measured by the Becks Depression Inventory), and quality of life (measured by the Flanagan Quality of Life Scale) in individuals who participate in CIAT. Neither have there been studies of the effects of therapy-induced stress on recovery of language function, which this study does.

Increases in cortisol reactivity represents increased psychophysiological stress. Analysis of cortisol levels in this study suggested that CIAT may increase stress during the initial phase of treatment, whereas traditional aphasia therapy does not. However, by the end of the treatment, CIAT participants showed no significant difference in cortisol levels from the participants in the traditional aphasia therapy. In other words, CIAT participants showed increased stress initially, but were able to recover, and, at the end of therapy, were no more stressed than participants in traditional therapy.

Individuals with aphasia exhibit stress and depression and diminished quality of life on measures of satisfaction. In this study, on initial measures of perceived stress, depression, and quality of life, the two groups did not differ significantly, neither was there a significant difference within groups. In fact, at no time (initial, mid-treatment, or post-treatment) was there a significant difference between groups or within groups on any of the three measures. In other words, CIAT did not increase participants' perception of their own stress levels; it did not increase participants' self reports of depression, nor did it decrease their impressions of their quality of life.

This study examined the relationship between aphasia therapy, psychoneuroimmunology (The relationship between mind and body and the determinants of a healthy system), and psychology. The study demonstrated that CIAT initially caused increased psychophysiological stress, whereas the traditional therapy did not. In spite of initial increases in psychophysiological stress, however, CIAT did not appear to alter those participants' perception of stress, depression, or quality of life. Therefore, in spite of the initial increases in psychophysiological stress, and contrary to popular criticism, CIAT did not appear to be harmful to individuals participating in the more intense

constraint therapy. Thus, the results of this study indicate that individuals can participate in CIAT, an approach that has been proven to be effective in restoring language, without fear of increasing stress levels.

Participants in the CIAT group showed greater improvement on language scores, but, one could argue that this would be the expected outcome, since this group received more therapy in the same amount of time. The purpose of this study was not to determine which therapy approach would yield greater improvement on language scores; rather, the purpose of the study was to determine 1) whether or not improved language scores could be demonstrated, even though the therapy environment may be stressful, and 2) whether or not the more stressful therapy environment would produce negative psychological (i.e., perceived stress, depression, quality of life) effects. It has already been established that loss of language leads to stress, depression, and decreased quality of life. This study clearly demonstrates that, while the recovery of language (the therapy process) may be stressful, CIAT is no more stressful than traditional therapy nor the loss of language ability, itself. It should be noted that many psychological factors, such as perceived stress, depression and quality of life play a significant role in one's ability to adapt to any therapy program.

A limitation of this study was the sample size (20 participants). Although a group of 10 subjects does not present with enough power to generalize, the study has answered some important questions about CIAT and the affect it has on the participant. The study identified that neither treatment approach appeared to have negative psychological effects on the participants. It could be argued that, since all participants were recruited from hospital or community programs, they may have been predisposed to

show a prior level of confidence or desire to improve. In this case, if the participants already demonstrated a positive mindset, it could explain why there was consistency in how they answered the questionnaires.

Researchers must further examine the concepts of forced use, stress, and aphasia treatment to determine if there are psychological predictors that will allow clinicians to be better informed about their treatment choices.

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APPENDIX A

INFORMED CONSENT FORM

LOMA LINDA UNIVERSITY

School of Allied Health Professions

INFORMED CONSENT

TITLE: **APHASIA THERAPY AND STRESS**
INVESTIGATOR: Brian Sharp, M.S. CCC-SLP

For ease of reading, the word "you" or "your" will be used throughout this document to refer to the person who may enter the research program.

1. WHY IS THIS STUDY BEING DONE?

The purpose of this graduate research project is to determine if stroke patients have more stress with one type of therapy compared to another. One type is a new longer and more frequent therapy sessions that only allows the person to talk. The other type is a regular, shorter session that allows the stroke patient to communicate in whatever way is the easiest. Another purpose is to see if answering questionnaires will help us better understand the stress that the stroke patient is feeling.

The rationale for this study is based on research that has found a link between improved language recovery and frequent/intensive language therapy that forces the individual to communicate only using verbal speaking. In addition, research has found a link between high levels of stress and difficulty with brain function recovery. We are trying to find out how hard we can push a stroke patient without putting them under too much stress.

You are invited to participate in this research study because you have suffered a stroke and you use at least one other non-verbal type of assistance in order to communicate effectively. These criteria mean that you are a good candidate to help us compare these two different types of therapy. You are also invited to participate in this study because you have or are currently receiving speech therapy for your expressive language difficulty known as aphasia.

Approximately 40 subjects will participate in this study at Loma Linda University. Your participation in this study may last up to 21 days.

A Seventh-day Adventist Institution
DEPARTMENT OF COMMUNICATION SCIENCES AND DISORDERS | Loma Linda, California 92350
(909) 558-4998 · *fax* (909) 558-4305 · www.llu.edu

2. HOW WILL I BE INVOLVED?

Participation in this study involves the following:

- **Number Assignment:** You will receive a number which will be used as your study identifier for all testing procedures.
- **Random Assignment:** The computer will assign you to one of two groups by chance. The chance of being in either study group is 50%.
- **Demographic Information:** Upon admission to the study you will be asked to provide the following demographic information.
  - Age/Gender
  - Relationship to Caregiver (if applicable)
  - Race
  - Marital Status
  - Religious Participation
  - Current/Prior Occupation
  - Smoking History
- **Western Aphasia Battery:** This evaluation will require you to answer or complete items that test understanding and spoken language. This evaluation will be given before and after the study to measure your progress in one of the two therapy programs.
- **Flannagan Quality of Life Questionnaire:** You will be given a 16 item questionnaire asking about your perception of your quality of life during the research period. The survey will be given prior to participation, at the halfway point, and at the conclusion. The halfway point will be after the 5th treatment session for the Constraint Induced Language Therapy group, and after the 2nd treatment session for the conventional language therapy group.
- **Becks Depression Inventory:** You will be given a 21 item questionnaire asking about your perception of depression during the research period. The survey will be given prior to participation, at the halfway point, and at the conclusion. The halfway point will be after the 5th treatment session for the Constraint Induced Language Therapy group, and after the 2nd treatment session for the conventional language therapy group.
- **Cohen Perceived Stress Scale:** You will be given a 10 item questionnaire asking about your perception of stress during the research period. The survey will be given prior to participation, at the halfway point, and at the conclusion. The halfway point will be after the 5th treatment session for the Constraint Induced Language Therapy group, and after the 2nd treatment session for the conventional language therapy group.
- **Saliva Testing:** You will have your saliva tested for stress levels. This testing will occur before the program, at the halfway point, and at the conclusion. The halfway point will be approximately 10 minutes after the 5th treatment session for the Constraint Induced Language Therapy group, and approximately 10 minutes after the 3rd treatment session for the conventional language therapy group. This testing will be conducted by using a

swab and wiping it in the mouth to collect saliva. This swab will then be labeled with your assigned number in order to protect your identity. The swab will then be placed in a freezer for safety, prior to being analyzed. At the conclusion of the testing the swabs will immediately be disposed of at Loma Linda University.

- **Constraint Induced Language Therapy (CILT):** This is one of the language therapy programs in which you may be placed. This therapy program will consist of picture card and conversation activities using only communication by mouth. This therapy will be given 5 days a week for 2 weeks. Each day, the therapy session will take 2-3 hours.
- **Conventional Language Therapy (CLT):** This is one of the therapy programs in which you may be placed. This therapy program will consist of picture card and conversation activities using a variety of types of communication. Individuals in this group will be allowed to use letter/picture boards, gestures, computers, and communication by mouth. This therapy will be given 3 days a week for 2 weeks. Each day, the therapy session will take one hour.
- **Focus Group:** You will be able to participate in a focus group allowing for open discussion about your perception and feelings regarding participation in the various therapy groups.
- **Additional Responsibilities:** If you agree to participate, you will be responsible for coming to scheduled appointments. You will also be responsible for informing the investigator of any illness that may occur during the research period.

3. WHAT ARE THE REASONABLY FORESEEABLE RISKS OR DISCOMFORTS I MIGHT HAVE?

The committee at Loma Linda University that reviews human studies (Institutional Review Board) has determined that participating in this study exposes you to minimal risk. The therapy you are undergoing may have other risks which your physician will explain to you separately. The risks include:

1) Breach of confidentiality
2) Breach of privacy
3) Increased stress
4) Frustration
5) Mental fatigue

In order to prevent or minimize these risks, the following measures are being taken:

1) All data/results will be anonymous.
2) Only information pertaining to the study will be collected.
3) Subjects will be monitored for stress and allowed a break if needed.
4) Spouses or caregivers will be allowed to provide support.
5) Subjects will be monitored for fatigue and allowed a break if needed.

4. WILL THERE BE ANY BENEFIT TO ME OR OTHERS?

You may benefit if you are in either group as you will be receiving additional speech therapy services. In addition, the information learned from this study will benefit others in the future. This additional information will allow speech therapists to better understand stroke patients and the patient's ability to handle stressful therapy. This research will also help speech therapists better identify the most appropriate treatment plan for stroke patients.

5. WHAT ARE MY RIGHTS AS A SUBJECT?

Participation in this study is voluntary. Your decision whether or not to participate or withdraw at any time from the study will not affect your ongoing medical care/relationship to your doctors and will not involve any penalty or loss of benefits to which you are otherwise entitled. You may get a second opinion about your decision to be in this study from another doctor at your own cost.

Likewise, your study doctor or the study sponsor may withdraw you from the study for any reason without your agreement or may stop the study entirely.

If you decide to withdraw from the study, you must notify the study doctor or study staff immediately at (909) 558-4998, extension 86750.

6. WILL I BE INFORMED OF SIGNIFICANT NEW FINDINGS?

During the study, we may learn new things about the risks and benefits of the study. If such information might affect the willingness of individuals to be in the study, we will share this information with you. At the conclusion of the study you will also be provided with the results of the study.

7. WHAT OTHER CHOICES DO I HAVE?

During this study, you will have the choice as to whether or not you wish to continue. Since this therapy is in addition to any therapy you may be receiving, alternative additional therapy is not available.

8. HOW WILL INFORMATION ABOUT ME BE KEPT CONFIDENTIAL?

Efforts will be made to keep your personal information confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. You will not be identified by name in any publications describing the results of this study.

Subject Initials _____
Date _____

Consent Version Date: _____

Loma Linda University
Adventist Health Sciences Center
Institutional Review Board
Approved 7/25/11 Void after 7/24/2012
5110141 Chair R. L. Rutledge MD

All of your test results will be labeled with the number which is given to you at the start of the study. The results, scores, and demographic information will be recorded using your participant number. This information will be stored on a secure, password protected, server at Loma Linda University. This information will be stored on this server for a period of no less than 3 years.

Your rights regarding permission to use your health information are described on the attached "Authorization for Use of Protected Health Information" form.

9. WHAT COSTS ARE INVOLVED?

There is no cost to you for participating in this study. The researchers will be responsible for all costs associated with therapy and testing.

10. WILL I BE PAID TO PARTICIPATE IN THIS STUDY?

You will not be paid to participate in this research study.

11. WILL STUDY STAFF RECEIVE PAYMENT?

The study staff will not receive payment for this project.

12. WHO DO I CALL IF I HAVE QUESTIONS?

If you wish to contact an impartial third party not associated with this study regarding any questions about your rights or to report a complaint you may have about the study, you may contact the Office of Patient Relations, Loma Linda University Medical Center, Loma Linda, CA 92354, phone (909) 558-4647, e-mail patientrelations@llu.edu for information and assistance.

13. SUBJECT'S STATEMENT OF CONSENT

- I have read the contents of the consent form and have listened to the verbal explanation given by the investigator.
- My questions concerning this study have been answered to my satisfaction.
- I have received a copy of the California Experimental Subject's Bill of Rights and have had these rights explained to me.
- Signing this consent document does not waive my rights nor does it release the investigators, institution or sponsors from their responsibilities.
- I may call Brian Sharp during routine office hours at (909) 558-4998, extension 86750 or during non-office hours at (951) 377-9447.

Subject Initials _____
Date _____
Page 5 of 7
Consent Version Date: _____

Loma Linda University
Adventist Health Sciences Center
Institutional Review Board
Approved 7/25/11 Void after 7/24/2012
5110141 Chair R. L. Rasmussen

- I hereby give voluntary consent to participate in this study.

I understand I will be given a copy of this consent form after signing it.

Signature of Subject | Printed Name of Subject

Date

Subject is physically unable to sign because _____.

Printed name of Subject

I attest that the above named subject has indicated their consent to participate in this study.

Signature of Witness | Printed Name of Witness

Date

14. INVESTIGATOR'S STATEMENT

I attest that the requirements for informed consent for the medical research project described in this form have been satisfied – that the subject has been provided with a copy of the California Experimental Subject's Bill of Rights, that I have discussed the research project with the subject and explained to him or her in non-technical terms all of the information contained in this informed consent form, including any risks and adverse reactions that may reasonably be expected to occur. I further certify that I encouraged the subject to ask questions and that all questions asked were answered. I will provide the subject or the legally authorized representative with a signed and dated copy of this consent form.

Signature of Investigator | Printed Name of Investigator

Date

Attachment 1: Study Flow Chart

CILT Group	Week 1 Visit 1	Week1 Visit 5	Week 2 Visit 10	Post Study	***CLT Group***	Week 1 Visit 1	Week 1 Visit 3	Week 2 Visit 6	Post Study
Language Testing	X		X		**Language Testing**	X		X	
Saliva Testing	X	X	X		**Saliva Testing**	X	X	X	
Stress, Depression, Life Quality, Surveys	X	X	X		**Stress, Depression, Life Quality, Surveys**	X	X	X	
Focus Group				X	**Focus Group**				X

APPENDIX B

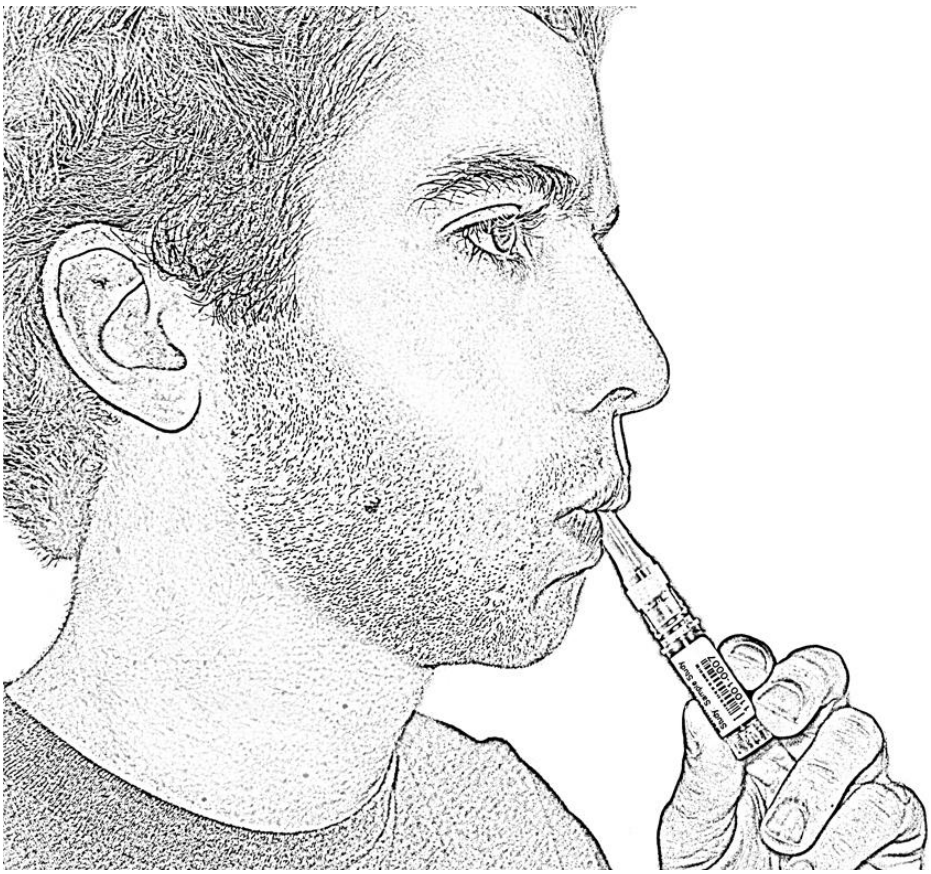
SALIVARY COLLECTION INSTRUCTIONS

Instructions for Collecting Saliva

1. Instruct participants to allow saliva to pool in the mouth. Some find it helpful to imagine eating their favorite food. At this time, unwrap the Saliva Collection Aid (SCA) and insert it into the top of the cryovial.

2. With head tilted forward, participants should drool down the SCA to collect saliva in the cryovial. (It is normal for saliva to foam, so we advise using a vial with twice the capacity of the desired sample volume.)

3. Repeat as necessary until sufficient sample is collected. **Reserve some air space in the vial to accomodate the expansion of saliva during freezing**. Collection of samples to be analyzed for multiple analytes may require longer cryovials



APPENDIX C

COHEN PERCEIVED STRESS SCALE (PSS)

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name _____ Date _____

Age _____ Gender (*Circle*): **M F** Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Please feel free to use the *Perceived Stress Scale* for your research. The PSS Manual is in the process of development, please let us know if you are interested in contributing.

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1690 Woodside Road, Suite #202
Redwood City, CA 94061 USA
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e-mail: mindgarden@msn.com
www.mindgarden.com

References

The PSS Scale is reprinted with permission of the American Sociological Association, from Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*, 386-396.

APPENDIX D

BECKS DEPRESSION INVENTORY (BDI) SIMULATED ITEMS

Beck Depression Inventory® (BDI®) and Beck Depression Inventory®–II (BDI®-II) Simulated Items

Unhappiness

0	I do not feel unhappy.
1	I feel unhappy.
2	I am unhappy.
3	I am so unhappy that I can't stand it.

Changes in Activity Level

0	I have not experienced any change in activity level.
1a	I am somewhat more active than usual.
1b	I am somewhat less active than usual.
2a	I am a lot more active than usual.
2b	I am a lot less active than usual.
3a	I am not active most of the day.
3b	I am active all of the day.

Information concerning the BDI®-II is available from:
NCS Pearson, Inc.
Attn: Customer Service
19500 Bulverde Road
San Antonio, TX 78259
Phone: (800627-7271
Fax: (800) 232-1223
Web site: www.psychcorp.com
Email: clinicalcustomersupport@pearson.com