

## **Critical Review: The Effectiveness of Self-Administered, Tablet Computer-Based Therapy in the Treatment of Chronic Aphasia**

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This study reports a critical review examining the efficacy of self-administered, tablet computer-based therapy for the treatment of patients with chronic aphasia. Study designs include two case studies, four case series, and a nonrandomized control study. The evidence gathered from these studies suggests that self-delivered therapy using an iPad or tablet, can be an effective treatment method for patients with chronic aphasia.

### ***Introduction***

With a technologically advancing world, there has been a shift towards incorporating technologies into therapy; specifically, there has been an increase in the use of tablets and iPads in speech-language pathology services (Atticks, 2012). Incorporating technologies into aphasia therapy may be useful for maximizing treatment gains, and providing services that are accessible; something that is becoming increasingly important as wait-lists grow and costs of services rise (Brandenburg, Worrall, Rodriguez & Copland, 2013). Self-administered, home-based services using technologies have the potential to improve treatment outcomes in patients with aphasia, and may provide patients with an increased sense of autonomy (Kurland, Wilkins & Stokes, 2014). Often, patients receive intensive therapy following a stroke, but after a period of time they are discharged from services, or the frequency of therapy is lessened greatly. Since patients have the potential to continue making improvements, opportunity to continue with treatment may optimize recovery (Helm-Estabrooks, Albert & Nicholas, 2004).

van de Sandt-Koenderman, suggested that with technological changes occurring, there will be a shift in the role of the speech-language pathologist to serve as an orchestrator of rehabilitation. In such a model, clinicians will guide patients through therapy and provide them assistance when necessary, but patients will complete therapy at their own pace and independently (2011). This modification to care would allow for greater autonomy for patients and free up time for clinicians to see more patients. Current treatment methods are not always accessible or feasible for every client, and alternative methods should be considered for these individuals. Prior to offering alternative services to these clients it is important to understand the evidence behind new technologies and make informed decisions whether these approaches to treatment are appropriate and

effective. Investigating the efficacy of incorporating self-administered therapy into practice is important for delivering the best patient-centered care possible.

### ***Objective***

The objective of this paper was to evaluate the effectiveness of self-administered, tablet computer-based therapy for the treatment of patients with chronic aphasia.

### ***Methods***

#### Search Strategy

Computerized databases including Web of Science and MEDLINE (ovid) were searched using the following search strategy: [(App) OR (Ipad) OR (tablet) AND (self) OR (home) AND (Aphasia) AND (treatment) AND (efficacy) OR (effectiveness) OR (outcomes)]. Google Scholar was also searched using the following search strategy: Allintitle: Aphasia treatment efficacy OR effectiveness OR outcomes App OR ipad OR tablet Reference lists of included articles were also reviewed.

#### Selection Criteria

Studies examined included interventions implementing self-administered, tablet-based therapy for the treatment of patients with chronic aphasia. Studies where patients completed home programs independently, but had supports were also included.

#### Data Collection

This literature search generated seven articles relating to the efficacy of self-delivered, tablet-based therapy for individuals with aphasia including a non-randomized control trial, four case series, and two case studies.

### ***Results***

#### Nonrandomized Control Trial Design

Nonrandomized control trials assign groups of people to different interventions using methods that are not random. They can be valuable for evaluating relative effectiveness of treatments. Since these designs are nonrandom, the credibility is weaker; thus, researchers should document circumstances clearly when using these designs.

**Des Roches, Balachandran, Ascenso, Tripodis & Kiran (2015)** conducted a nonrandomized control trial with patients who had a Traumatic Brain Injury (TBI) or Aphasia. Every 5<sup>th</sup> participant was assigned to the control group, resulting in a control group of 9 individuals, and an experimental group with 42. Participants completed 10 weeks of therapy on an iPad using the Constant Therapy iOS platform. There were 37 hierarchical therapy tasks targeting language or cognitive difficulties. All participants were appropriately assigned tasks based on their abilities and attended 10 weekly assisted sessions, where a clinician controlled the flow of events and provided feedback. The experimental group had additional scheduled sessions where they completed homework that was assigned by the clinician using the app, but they did so unassisted; the level of homework was determined based on the participants' performance in the session. The clinician was able to monitor and adjust therapy homework remotely as needed. The experimental group showed more positive changes at the end of therapy, than the control group; reinforcing that increased practice time improved outcomes. This study also looked at the types of tests participants used and the benefits that were gained from different tasks. They found that individuals with different severity levels at baseline had greater gains from different types of tasks. For example, individuals with different levels of cognitive and language impairments showed greater gains completing different tasks. These findings can be used to understand further which therapy tasks may not be appropriate for individuals with specific language and cognitive profiles. It also reiterates the importance of individualized therapy plans, even though the tasks may be self-administered. Finally, the researchers found that the experimental group showed more significant positive improvements on their standardized test scores than the control group did; thus, more practice resulted in greater changes.

Due to the nature of this study participants could not be blinded to the group they were assigned. Participants were excluded from the study if they had dementia or Parkinsons, and 13 participants dropped out of the study. Participant dropout is concerning because it is possible this is due to selective attrition which impacts the validity of the study. Experimental

groups and control groups differed significantly in a number of ways, including: the time post onset, and on their PAPT scores at baseline which was used to measure semantic access. Groups did not differ significantly for any other test scores at baseline, or for their ages.

Experimental groups were encouraged to practice for at least 6 hours a week at home, however compliance ranged from 0 hours, to 17 hours and 5 minutes of practice a week. Interestingly, a correlation was found between increased compliance at home and low scores on the R-WAB Aphasia Quotient; suggesting those with lower scores had increased compliance. Understanding the factors that influence compliance is critical for determining who a self-delivered program is appropriate for. Another limitation to this study, was that participants were required to attend weekly in person sessions; while this was a good control for the researchers, it makes these findings less applicable to those who live in remote settings or areas where it isn't possible to come in for direct therapy.

Detailed information regarding the app and hierarchy of cues was provided; this is valuable for reproducibility and for investigating the connection between specific tasks or cues and outcomes. However, due to the differences in group size between then experimental and control groups, it cannot be confirmed whether a control group containing the same number of participants would have had individuals make significant changes. It was also found that initial composite scores were related to outcomes in both cognition and language; suggesting that the level of cognition and language an individual has entering therapy will impact the effectiveness of therapy; these finding limits who this approach may be applicable to. Appropriate statistical analyses were conducted to determine the effectiveness of therapy and compare the group outcomes.

Altogether, this study provides suggestive evidence for the use of self-delivered, tablet-based therapy for the treatment of aphasia. The results indicated that individuals with aphasia did benefit from use of a home program using an iPad. Further, patients with greater impairments at the start of treatment made greater gains than those with less severe cognitive and language impairments. While patients completed the home program at their own pace and without assistance, it is important to consider that the clinician was able to access and change the program remotely to fit each individual client's needs. While this may be an important function in treatment

programs moving forward, it may be questioned whether this is truly a self-delivered therapy.

#### Case Series Design

Case series follow multiple people through a particular period or treatment. They can be valuable for evaluating specific outcomes. A limitation of case series, is that they are not comparative; meaning there is no control group to compare outcomes to if there was no treatment.

**Kurland, Liu & Stokes (2018)** conducted a case series evaluating the effectiveness of a tablet-based home practice program with weekly telepractice support for the treatment of chronic aphasia. Twenty-one participants completed two weeks of intensive language therapy, followed by a 6-month home practice program, where participants completed tasks on a tablet independently. Weekly teletherapy sessions were conducted to check in on patient progress and encourage continued practice. The program was found to be effective for all participants; however, aphasia severity influenced the effectiveness of treatment. All participants made gains in picture naming during the 6-month period, however, the authors reported a greater level of protection from deterioration in performance after the treatment period for participants with mild or moderate aphasia. Pictures that were not treated in the 2-week period preceding the home program were noted to improve during the 6-month period regardless of the participants' severity. Interestingly, these untreated pictures showed less pronounced decays than treated pictures for individuals with moderate or severe aphasia.

The authors provided detailed demographic and clinical information on all of the participants, however selection criteria to participate were not clearly indicated. Tests used, procedural information and scoring were clearly described, thus increasing reproducibility. A limitation to this study was that compliance was not monitored directly, so the authors relied on self-report to measure time spent practicing. The authors also reported that their study could have been improved by changing the study design; participants complained that the practice period was too long which led to boredom and low compliance. All participants in this study received the same treatment regardless of the severity of their aphasia and whether they had co-occurring Apraxia of Speech (AOS) or not. The authors relayed that this limited the results of the study because they were not able to treat individuals differently or determine how those differences influenced outcomes. Another constraint to this study was that the effectiveness of

the telepractice check-ins was not assessed so it cannot be determined whether they were a critical aspect to the treatment plan or not. A final limitation to this study was that positive changes observed from primary outcome measures were not always generalized to more functional changes. There was significant variability in the gains individuals made through the study period. Participants with AOS and severe aphasia only made small gains for the primary outcome measures. Appropriate statistical analyses were used to determine the effectiveness of therapy and a qualitative analysis of errors was also conducted.

Overall, these findings provide compelling evidence for the use of self-delivered, tablet-based therapy for the treatment of aphasia. All of the participants made gains in picture naming abilities over the 6-month period, supporting that this can be an effective therapy tool for individuals with aphasia.

**Kurland, Wilkins & Stokes (2014)** directed a case series investigating the efficacy of using an iPad-based home practice program, following intensive language therapy for treatment of naming difficulties. Five participants completed the 6-month program which included practicing word retrieval for actions and objects. The results indicated that participants were able to maintain the gains they made in previous treatment by practicing autonomously; additionally, they were able to make gains on new words that had not previously been practiced.

Inclusion criteria for this study was not reported, however demographic information for all participants was documented. One weakness of this study, was that 3 of the original participants did not participate, however reasons for not participating were reported by the authors. Due to the small sample size, the findings cannot be generalized to a broad population. Materials and procedures were described in detail, increasing the reproducibility of the study. Practice compliance was self-reported by participants which is important to have noted, however a tracked compliance would have increased the validity of the study. A limitation to the study was the app itself; participants were unable to increase the task demand which led to boredom and the desire for more challenging tasks; particularly for those with milder aphasia. This weakness reinforces that while self-administered therapy may be feasible, having check-ins or remote monitoring by clinicians, may be a critical component to treatment. The authors did an excellent job of providing clear visual data as well as both quantitative and qualitative data on the treatment plan and outcomes.

Altogether, these findings provide suggestive evidence for the use of self-delivered, tablet-based therapy for the treatment of aphasia. All of the participants made gains in picture naming abilities over the 6-month period, supporting that this can be an effective therapy tool for individuals with aphasia.

**Lavoie, Bier & Macoir (2018)** conducted a case-series evaluating the efficacy of using a smart tablet for self-administered treatment of functional word naming difficulties in post-stroke anomia. Four patients with post-stroke aphasia participated in an ABA design study, with multiple baselines for naming. Participants completed self-administered treatment four times a week at home for four weeks. Performance was compared for trained functional words, trained random words, untrained words they had been exposed to, and untrained words with no exposure. All participants showed significant improvements on both trained word sets and gains were maintained for 2 months post-treatment. Additionally, generalization to conversation was noted for 2 participants.

Detailed information on each participant was provided including: demographic information, living situation, previous treatment and test scores. To participate, individuals had to meet specific inclusion and exclusion criteria. As such, generalization to other populations may be difficult. The authors failed to provide information on participants who were excluded from the study, including the number of participants who were excluded or the reasons behind their exclusion. Preparation, procedures and scoring were explained thoroughly, improving reproducibility of the study. Further, word lists were measured to be equivalent in terms of performance on the initial naming task, degree of usefulness judged by the participant, syllable length, and lexical frequency, improving the validity of the study. A research assistant blind to the study was used to record conversational samples using the words provided; this removes the possibility for bias during the sample.

Visual and statistical analyses were used to ensure treatments were completed and to assess patient progress. Appropriate statistical analyses were used to determine if there were significant changes following treatment for each list, and to compare performance between lists in different phases of treatment.

Overall, these findings provide compelling evidence for the use of self-delivered, tablet-based therapy for

the treatment of aphasia. Patients with word naming difficulties appear to benefit from this form of treatment, and maintain these gains for 2 months following treatment. Interestingly, including functional words chosen by the client into treatment did not impact outcomes.

**Stark & Warburton (2018)** directed a case series to evaluate the feasibility and effectiveness of self-delivered speech therapy through the use of an I-Pad. Participants included 10 patients between the ages of 54 and 87, with chronic expressive aphasia and intact comprehension. Inclusion criteria for this study were very specific; including only patients who had: left MCA-territory stroke, aphasia, no neurodegenerative conditions prior to the stroke, British English speakers and at least one-year post-stroke; thus, results cannot be generalized to a wide population. The detailed selection criteria are also a strength of the study though, as it increases the reproducibility of the study. Specifically, the one-year post-stroke is a strength of the study, because it increases the reliability that the changes observed post-treatment can be attributed to the language intervention and not spontaneous recovery. A weakness of this study was that group 1 had significantly higher CAT scores at baseline than and group 2 did.

In the study, patients were given an Ipad with an app called Language Therapy by Tactus Therapy Solutions©, and the mind-game Bejeweled© by PopCap downloaded on it. A cross-over study was used to compare the mind-game and the therapy app. Patients were told to complete 20 minutes on the app each day for 4 weeks. They were pseudo-randomly assigned to Group 1 or Group 2 conditions. Groups did not differ significantly in age, time since stroke or years of formal education; which supports the validity of the results. Group 1 used Bejeweled for the first 4 weeks, and group 2 used the language therapy app for the first 4 weeks. Then the groups switched conditions for the following 4 weeks. Expressive language was measured using the Comprehensive Aphasia Test (CAT) and conversation units (CUs), and rate of speech were measured using the cookie theft picture task. Measurements were taken at baseline and following each 4-week interval. Appropriate statistical analyses were conducted to measure outcomes and appropriate procedures were followed.

The researchers found that there were significant improvements on four of the six CAT subtests, as well as increased CUs and rate of speech following use of the therapy app. Those who had more severe rating at baseline on the CAT showed more

significant improvements from therapy. These findings suggest this may be a more appropriate treatment method for more severe cases of aphasia; alternatively, it could suggest that the tests to measure changes from the treatment aren't sensitive enough to detect changes in more mild cases. The crossover design allowed the researchers to ensure that improvements on the CAT were not simply due to repeated exposure to items; if improvements were due to taking the tests again then individuals would have shown significant improvements on the CAT following the bejeweled period as well. Strong agreement ratings were found for scoring of CUs; samples were scored blindly by three speech pathologists. All patients stated that they used the app for the recommended dosage however, compliance could not be confirmed. Five of the patients were tested 6 months post-treatment; gains were maintained.

Altogether, these findings provide compelling evidence for the use of self-delivered, tablet-based therapy for the treatment of aphasia. Specifically, patients with more severe expressive aphasia, may show improvements in their expressive language abilities through the use of self-administered therapy; and importantly, these gains may be maintained.

#### Case Study Designs

Case studies follow a single subject through a particular period or treatment. They can be valuable for studying small cohorts, or as an initial trial for a later study with more subjects. Due to the small sample size, these studies have weak evidence levels and their findings cannot be generalized to larger populations.

**Lavoie, Routhier, Légaré & Macoir (2016)** led a case study assessing the efficacy of self-administered therapy using a smart tablet for the treatment of verb naming difficulties. The patient, a 63-year old woman with chronic aphasia, completed graphemic cueing therapy, four times a week for three weeks using cued and uncued verb lists on an iPad. Improvements in written verb-naming skills were found for both cued and uncued stimuli, and these gains were maintained 3 weeks following therapy. Generalization to verb production tasks was also noted for the cued verbs.

The authors provided detailed information on the study participant, so although generalization of results may be limited, having detailed information on the client may be beneficial for narrowing who treatments may be appropriate for later. The methods used to create word lists were discussed in detail and

compared to confirm absence of significant differences. Measurements were taken at baseline, at weekly intervals and following the treatment period which allowed the authors to compare the participant's performance across time. A control was used to compare the participant's performance for treated verbs with and without cues to untreated verbs; including this comparison was important to show that changes couldn't be attributed to other general factors like time or general treatment effects. Compliance data was not reported; information pertaining to this would be useful to readers. The authors acknowledged that further research would be required to confirm the validity and reproducibility of results. Appropriate statistical analyses were used to evaluate the effectiveness of the treatment.

Overall, these findings provide suggestive evidence for the use of self-delivered, tablet-based therapy for the treatment of aphasia.

**Routhier, Bier & Macoir (2016)** conducted two single case-studies to assess the effectiveness of using a tablet at home for self-administered treatment of verb anomia in chronic aphasia. Two participants completed 20 sessions of self-administered therapy over 5 weeks, after being trained on tablet use. Both participants showed significant improvements in verb naming for trained stimuli, however no generalization was recorded. Patient satisfaction with treatment was high.

Inclusion and exclusion criteria were explained in detail and the demographic information of both participants was listed. Appropriate stimuli were selected for the study and the authors ensured stimuli were comprehensible prior to including them in treatment. Inter-rater agreement was used to increase the validity of measurements at baseline and post-treatment. Procedures and treatment were described thoroughly which allows for reproducibility. Although both patients made improvements over the course of the study, only trained verbs made gains, so this treatment could not be generalized for other verbs. Additionally, one of the participants did not maintain the gains he made following the treatment period, so the usefulness of therapy may be limited. A final limitation of this study was that the participants were limited to the 20 sessions of therapy in the 5-week period. The authors noted interest in investigating outcomes with longer therapy periods. Appropriate statistical analyses were used to conduct their research.

Altogether, these findings provide suggestive evidence for the use of self-delivered, tablet-based therapy for the treatment of aphasia.

### ***Discussion***

This paper aimed to determine whether self-delivered therapy on an iPad or tablet was an effective treatment method for individuals with chronic aphasia. A critical review of the existing literature revealed that this appears to be an effective treatment method. As such, a transition towards this form of care may be warranted for some patients. However, clinicians should be cautious when determining appropriate therapy plans for their clients as these studies did not lack limitations. The studies reviewed used specific apps and programs, and other programs may not yield similar outcomes. Additionally, the inclusion criteria for many of these studies was very specific, which restricts the population that these findings are applicable to. Finally, therapy outcomes were dependent on many individual factors; this reinforces the importance of individualized therapy plans for aphasia treatment. Future studies should investigate these factors further, to determine who self-delivered therapy is most appropriate for.

It is also important to note that while these treatment methods were considered self-administered, there was still a lot of intervention required from the speech-language pathologist for the treatment to be effective. These directions were in the form of remote access to tablets, phone calls, weekly meetings etc. None of these studies have suggested that sending an individual off with an iPad or tablet to complete therapy on their own, would produce comparable outcomes. Another essential component of these studies was compliance rates and interest in treatment. Future studies should investigate the factors that contribute to increased compliance, to build enjoyable programs that patients will want to continue using.

### ***Clinical Implications***

Tablet computer-based, self-delivered therapy, may be an effective treatment for patients with chronic aphasia in the future. Investigating which apps are effective, and understanding how individual factors influence therapy outcomes, will be important for determining whether this is an appropriate option for clients. It is possible that clinicians can switch roles to become orchestrators of treatment for some clients, and the clients can then administer the treatment themselves.

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