

**The Use of ReminX as a Behavioral Intervention for Mild to Moderate Dementia:
A Proof of Concept Study**

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Study Summary

This study examined the impact of a digital therapeutic software system on emotional functioning in a group of patients with Dementia. The digital therapeutic software is based on Reminiscence Therapy and allows the uploading of pictures and narration to create slideshow stories depicting important moments in the patient's life. Patients were evaluated in their home and the initial evaluation consisted of patients responding to questionnaires assessing their level of depression, anxiety, and overall level of emotional distress. Patients' caregivers were also asked to rate the patient's level of emotional functioning. After the initial assessment, and on the same day, patients and their caregivers were instructed on how to use the digital therapeutic software and created a slideshow. Patients then viewed the slideshow and immediately after were re-assessed using the same set of questionnaires as prior to the viewing. Results indicated that patients reported significantly less anxiety, depression, and overall emotional distress after having viewed their story. Furthermore, patient's caregivers also reported that the patient appeared less emotionally distressed. The effect sizes for the significant results were typically large and ranged from 0.76 to 0.91 (effect sizes are used to quantify the magnitude of a statistical effect, with 0.50 typically being viewed as a moderate effect and 0.80 being considered a large effect of an intervention). These effect sizes, which were larger than anticipated, suggest that digital therapeutic software can have an immediate and positive impact on emotional functioning in patients with Dementia. In addition, the accessibility and ease of use of the software system suggests that this technology holds great promise for bringing important aspects of Reminiscence Therapy to patients with Dementia who are suffering from various mood symptoms.

This project was sponsored by DThera Sciences, Inc., which produces the ReminX software used in this article.

Background

Estimates have indicated that there are 5.2 million Americans suffering from Alzheimer's disease (AD), there are 1.4 million people in nursing homes and another 700,000 in residential care communities with about 50% of these individuals suffering from some form of dementia, and that the costs to the United States in caring for patients with AD or other dementias will be approximately \$259 billion in 2017 (Alzheimer's Association, 2017). The number of individuals with AD is expected to triple by the year 2050, which will result in approximately 4.2 million people with this disease and the cost of patient care will also likely triple to \$708 billion annually. The cognitive deficits and behavioral symptoms (e.g., depression, anxiety, and apathy) are difficult to treat in AD and other forms of dementia, and currently the first-line of treatment are pharmaceuticals, but these have met with only limited success.

Reminiscence Therapy is behavioral intervention that involves the introduction of familiar pictures, music, or other materials to help individuals reminisce about their past experiences. These therapies have been shown to have a positive impact on mood and cognition in such populations as individuals with AD or other dementias, older adults with depression, and older adults with anxiety (Asiret & Kapucu, 2016; Gonzalez et al., 2015; Hsieh et al., 2010; Hsu & Wang, 2009). A recent meta-analysis of 12 randomly controlled studies in older adults or patients with various forms of dementia demonstrated that RT significantly reduced depression after a brief trial (Huang et al., 2015).

Major limitations of this therapy, however, is that it is typically provided in a formal therapy session, is only provided once a week, and is only provided within a limited time-frame, which greatly limits the consistent use of RT. Furthermore, this therapy often requires an individual to work one-on-one with a patient, which can be very time consuming for the caregiver and is often not practical in most settings.

ReminX is an online-based story-sharing platform that allows users to record audio over photos as a way to share memories with family members who are suffering from a neurological or psychiatric condition. Similar to RT, ReminX is a potential digital therapeutic that allows patients to reminisce about their past, but does not have the structured time requirement or one-on-one administration that is needed with these formal therapies. Furthermore, ReminX is readily accessible and can easily be used on an ongoing basis by patients. The technology is unique in that it allows multiple family members, even if they are separated by time and place, to collaborate on the stories in just a few minutes a day. The platform transforms the short audio notes and individual photos into rich documentary-like stories that are then archived in a private and secured database. These stories can then be viewed very easily with a tablet whenever the patient chooses and the interface is very simple to operate. ReminX has the potential to be a practical and highly implementable adjunct behavioral intervention for a variety of patients, including those with Dementia.

The proposed project provided a proof of concept for the in-home use of ReminX in individuals with mild to moderate Dementia.

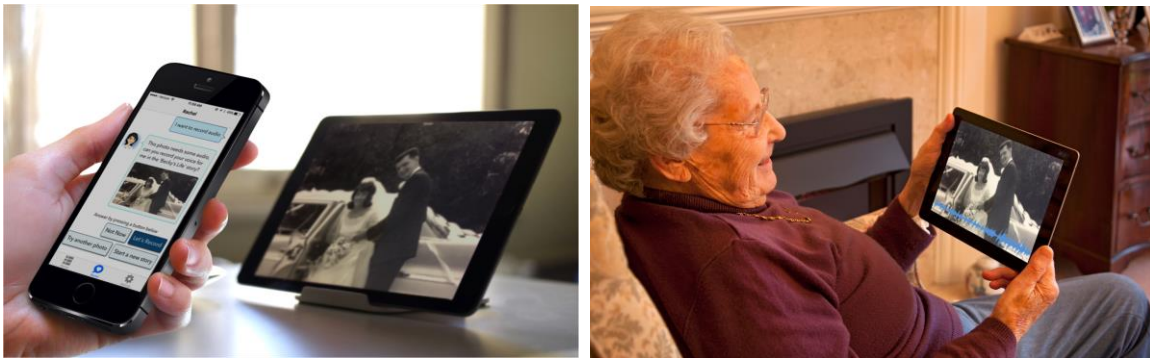
Methods

Participants:

The study included 14 patients with mild to moderate dementia and their caregivers. Patients were recruited from an outpatient neuropsychological clinic at UC San Diego. The inclusion criteria for patients were the following:

1. Sixty-years or older.
2. Dementia (Major Neurocognitive Disorder) as diagnosed by the DSM-V by Dr. Filoteo.
3. Mild to Moderate cognitive deficits based on an MDRS total score of no less than 110.
4. Adequate hearing and vision to see the tablet.
5. Caregiver who was available and willing to participate.
6. Adequate comprehension and speaking of English (given test materials are currently in English only).

Figure 1. Example of the ReminX platform and viewing by non-study patient.



Procedures:

Patients and caregivers were seen in their home, at which time the study coordinator explained the details of the study, obtained informed consent, and administered the brief emotional/mood assessments to the patient. Caregivers filled out a caregiver-based questionnaire asking about emotional distress in the patient. Afterward, the patient and their caregiver were instructed on how to use the digital therapeutic software and created a slideshow (see Figure 1). Patients then viewed the slideshow and immediately after were re-assessed using the same set of questionnaires as prior to the viewing. The following measures were used to evaluate patient's mood prior to viewing the slideshow and after:

- Emotional Thermometer (ET; Mitchell et al., 2010)
- State subtest of the State/Trait Anxiety Inventory (STAI; Spielberger et al., 1983)
- Hospital Anxiety and Depression Scale (HADS; Zigmond AS, Snaith P, 1983)
- Neuro-QOL Depression Scale-Modified (NQOL; Cella, D et al., 2008)
- Caregiver Questionnaire (CQ; Split and Filoteo, personnel communication)

Greater scores on each of these measures indicate greater levels of emotional distress. Please see the Appendix for a description of each of the measures.

Results

Figures 2-6 display the mean scores for the ET, STAI, HADS, NQOL, and CQ prior to and after the patients viewed their story. The mean pre- and post-viewing scores were compared for each measure using paired sample t-tests. Results indicated that patients' scores were significantly lower post-viewing as compared to pre-viewing on the ET, STAI, HADS, and CQ (p 's<.05), but not the NQOL. The results indicate that patients and caregivers reported significantly less anxiety, depression, and overall emotional distress in the patient after the patient viewed their story.

Figure 2. Mean scores on patient the Emotion Thermometer (ET), pre- and post-viewing. The ET pre-viewing score was 1.96 and the post-viewing score was 0.39. Error bars are represented as Standard Error of the Mean (SEM).

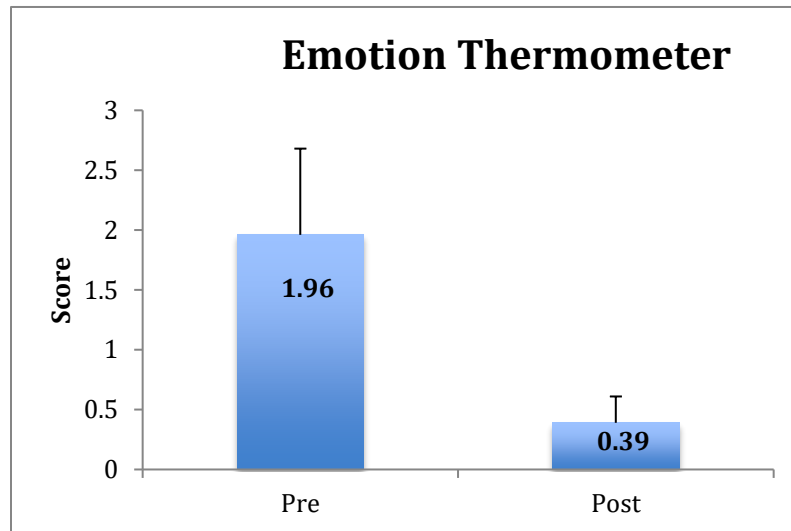


Figure 3. Mean scores on patient the State Anxiety Inventory (STAI), pre- and post-viewing. The STAI pre-viewing score was 35.36 and the post-viewing score was 29.64. Error bars are represented as Standard Error of the Mean (SEM).

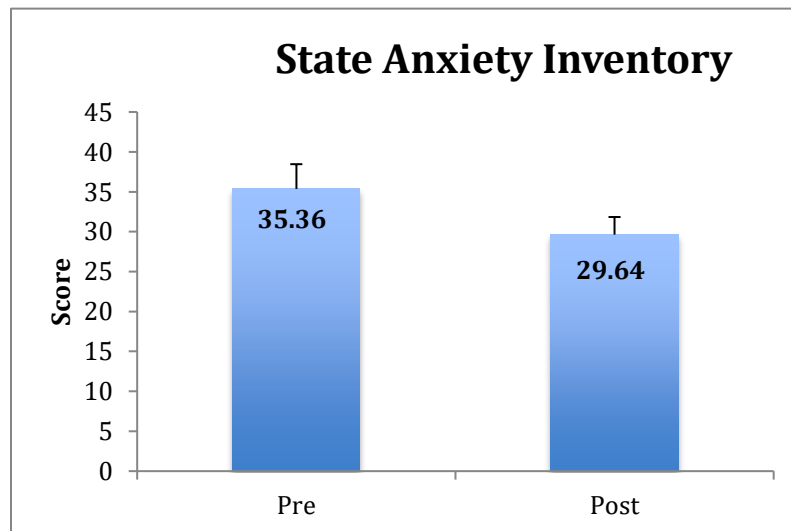


Figure 4. Mean scores on patient the Hospital Anxiety and Depression Scale (HADS), pre- and post-viewing. The HADS pre-viewing score was 9.14 and the post-viewing score was 5.28. Error bars are represented as Standard Error of the Mean (SEM).

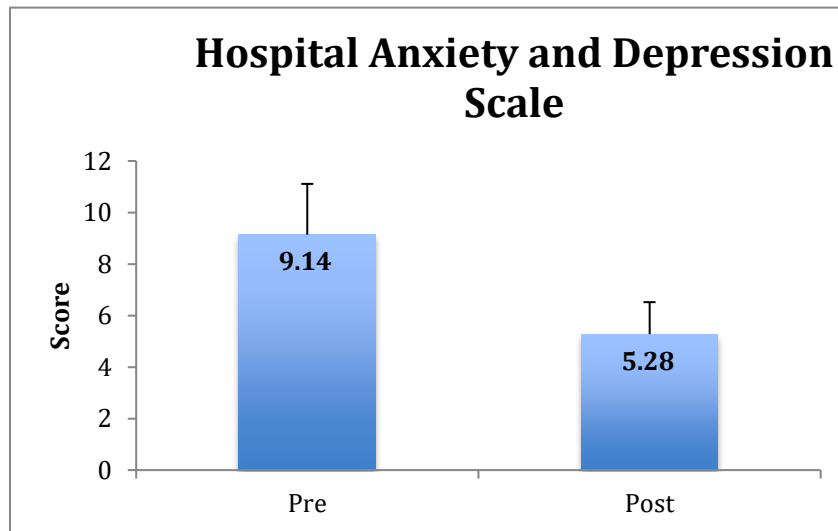


Figure 5. Mean scores on patient the Neuro-Quality of Life (NQOL), pre- and post-viewing. The NQOL pre-viewing score was 42.21 and the post-viewing score was 39.14. Error bars are represented as Standard Error of the Mean (SEM).

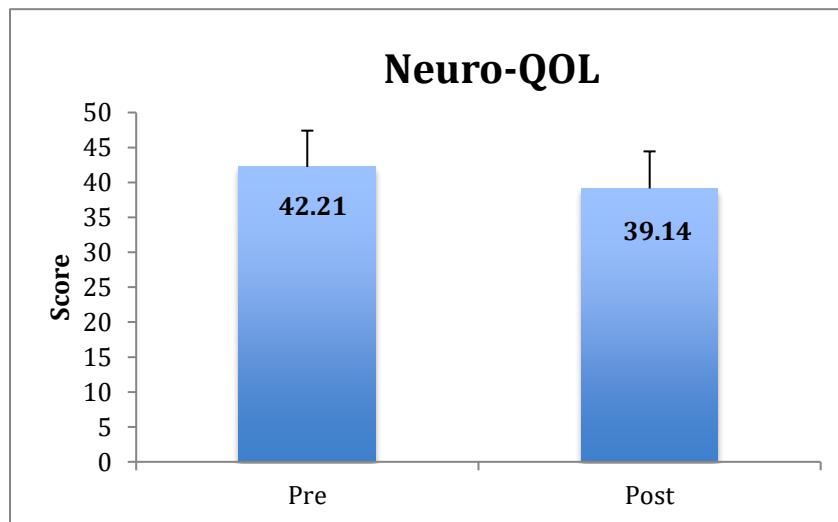
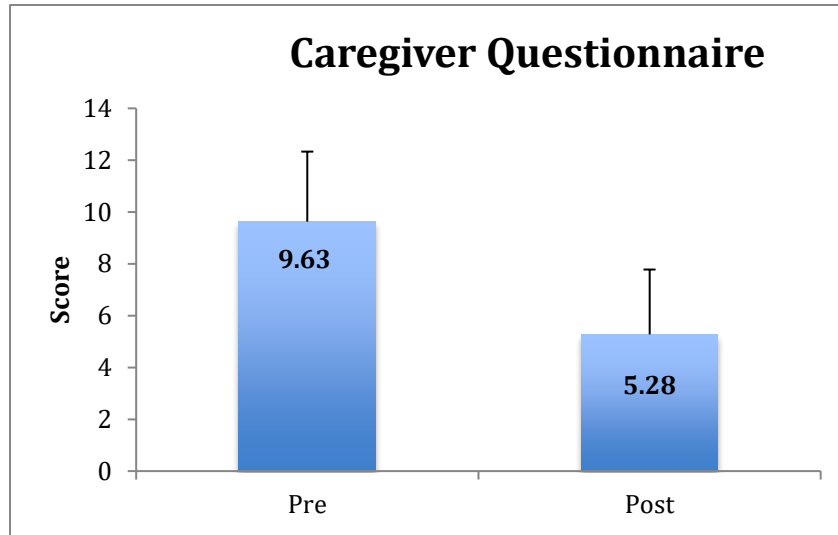
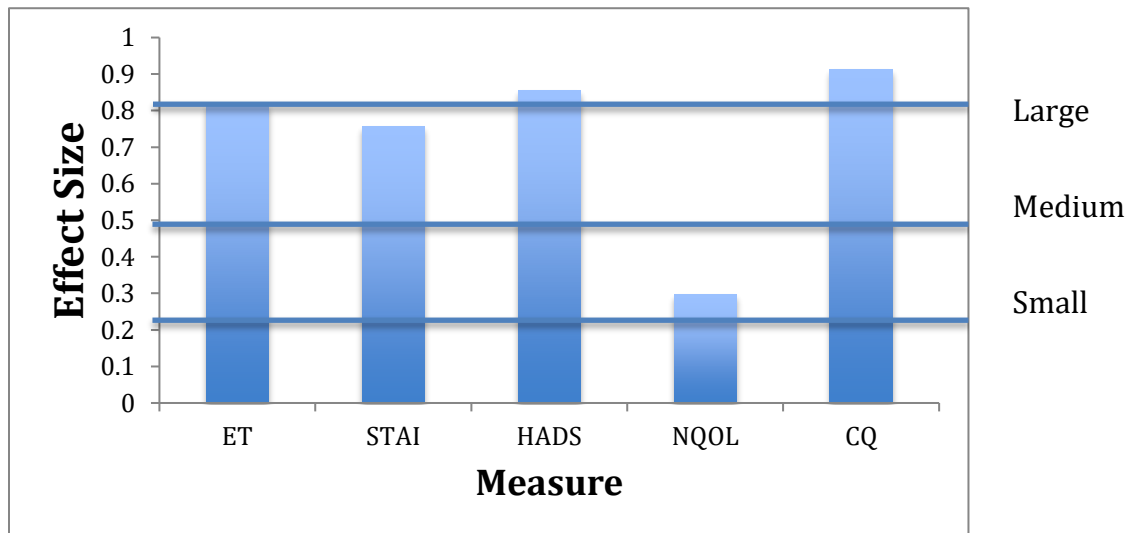


Figure 6. Mean scores on patient the Caregiver Questionnaire (CQ), pre- and post-viewing. The CQ pre-viewing score was 9.63 and the post-viewing score was 5.28. Error bars are represented as Standard Error of the Mean (SEM).



Effect sizes were also computed using Morris and DeShon’s (2002; equation 8) method for effect size estimation in repeated measures. The calculated effect sizes are depicted in Figure 7. Effect sizes are used to quantify the magnitude of a statistical effect, with 0.20 typically being viewed as a “small” effect size, 0.50 being viewed as a “moderate” effect and 0.80 being considered as a “large” effect size (Cohen, 1988). As can be seen in Figure 3, the impact of the patient viewing their story resulted generally in “large” effect sizes on the ET, STAI, HADS, and CQ, but not the NQOL, which is consistent with the t-test results reported above. Thus, the use of ReminX had a significant and meaningful impact on acute emotional functioning in the patients sampled.

Figure 7. Effect Sizes for the various measures.



Discussion and Study Limitations

The results of this study are very encouraging in that they demonstrate that there is an acute and significant impact of the use of a digital therapeutic, ReminX, on the emotional functioning in patients with Dementia. These results are highly encouraging and indicate the need for future research to determine the neuropsychiatric mechanisms that lead to these emotional improvements (e.g., improved physiological functioning, decreased heart-rate, etc.).

Importantly, this study provides the proof-of-concept that elements of an evidence-based therapy (RT) can be brought to patients in a much more frequent and consistent manner, with the added benefit of being highly cost-effective. As noted above, one major limitation of traditional RT is that it is often performed in a one-on-one or group setting, which greatly limits the frequency and consistency in which this therapy can be provided to patients. Furthermore, this technology enables family members to participate in the implementation of important elements of RT that traditional RT does not enable, which increases the likelihood of a decrease in caregiver burden or possible guilt associated with not being directly involved in the care of their loved-ones (i.e., family members can upload story content from anywhere in the world as long as they have internet access, which potentially allows them to feel more involved in their loved-one's care). The impact of this technology on family member's psychological functioning will be an important area of future research.

As with any study, there are limitations with our study, including the lack of a control group, our inability to determine the specific elements of the technology that lead to improved mood symptoms, and a lack of the assessment of the long-term improvement in mood. Despite these limitations, the results of this study strongly warrant further investigation as to how to best implement this important and novel technology, which has great potential for improving mood in patients with Dementia. Given recent set-backs in pharmacological trials, behavioral interventions such as those offered by ReminX technology opens up a novel approach in the ever growing area of Dementia treatment.

Appendix: Study Descriptions

State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983); The STAI is a common measure used to assess trait anxiety. It contains 20 items, such as “I am tense; I am worried” and “I feel calm; I feel secure.” All items are rated on a 4-point scale from “Almost Never” to “Almost Always.”

Neuro-QOL Depression Scale-Modified (Cella, D et al., 2012): This particular scale is used to assess certain characteristics that are often experienced with depression, (e.g. feelings of hopelessness, sadness, decrease in positive affect, etc.). It contains 24 questions, originally asking how they have been feeling over the past 7 days (e.g. I felt depressed, I felt hopeless). We modified this form to read in the present moment for the purposes of this study (e.g. I feel depressed, I feel hopeless). Questions are answered on a 5-point scale from “Never” to “Always.”

Hospital Anxiety and Depression Scale (HADS; Zigmond AS, Snaith P, 1983); This scale has been widely used for assessing anxiety and depressive disorders. It contains 14 questions, phrased in the present moment, (e.g. “I feel tense or wound up,” “I still enjoy the things I used to”) and the responses are indicated on various 4-point scales (e.g. “Not at all” to “Most of the time” or “Hardly at all” to “Definitely as much”).

Emotion Thermometers (ET; Mitchell et al., 2010); This is a 5-item assessment designed to measure multiple emotional domains, such as distress, anxiety, depression, and anger, that are often associated with depression. The respondents rate how they feel, if at all, for each of these domains on a scale from 1-10. Scores are then summed and higher scores suggest worse depressive symptoms.

Informant Questionnaire

This is a 5-10 minute caregiver-reported questionnaire that was designed to obtain the patients emotional symptoms (anger, distress, anxiety, depression, apathy/indifference) from the caregiver’s perspective at three different occurrences, (1) how they feel on a daily basis, (2) how they feel before watching their personal stories, and (3) how they feel after watching their personal stories. This form was created and structured for the purposes of this study.

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