



Review

Reminiscence Therapy in the Treatment of Depression in the Elderly: Current Perspectives

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Abstract: Reminiscence therapy has been known to provide relief against depression and behavioral and psychological symptoms of dementia. This therapy has been used for decades as a nonpharmacological treatment or tool that has produced both positive and negative results. This paper explores the current trends in reminiscence therapy in the treatment of depression in the elderly. Some of these trends involve the use of technology such as mobile apps and robotics while others follow more traditional and proven methods. A comparison of the variations in the interpretations of reminiscence therapy treatment mechanisms and their impacts will also be discussed. The ultimate goal of this paper is to highlight the current trends in the use of reminiscence therapy in treatment of depression in the elderly.

Keywords: aging; dementia; therapy; elderly; technology



Citation: Khan, A.; Bleth, A.; Bakpayev, M.; Imtiaz, N.

Reminiscence Therapy in the Treatment of Depression in the Elderly: Current Perspectives. *J. Ageing Longev.* **2022**, *2*, 34–48.

<https://doi.org/10.3390/jal2010004>

Academic Editor: Matthew C. Lohman

Received: 22 January 2022

Accepted: 18 February 2022

Published: 24 February 2022

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1. Introduction

There has been a steady growth in the population of people aged 65 and older in the United States. As per the US Census Bureau, this group has grown in size by 34.2% or 13,787,044 since 2010. In 2018 alone, there was a growth of 3.2% [1].

Additionally, depression affects 19 million people each year across the United States. Depression is particularly high among people aged 65 and older [2]. In a study conducted in 1996, prevalence of depression in the residents of nursing homes was approximately 20% [3]. A literature review on reminiscence therapy and its impact on depression, conducted in 2003, identifies reminiscence therapy as one method with which to address depression [4,5].

Reminiscence therapy is a mechanism to help someone remember events from their life. It is often used as a therapy tool for reducing depression, calming behavioral and psychological symptoms of dementia, or affecting mood of the elderly. Although its most common use is for the elderly and people affected with dementia or depression, it has also been used with people of all ages, including children. The reminiscing process can take place in a group or individually or by using technological devices such as mobile devices or robots. It is marked by remembering notable events from the past. Some papers reviewed have reported positive effects of reminiscence while some others have reported neutral or even negative impacts. The negative effects have been observed due to the reminiscence bringing on longing or yearning for the past.

2. History and Definition of Reminiscence Therapy

Reminiscence therapy, described as “a non-pharmacological intervention involving the prompting of past memories, often with artifacts such as old photographs or music”, has been applied to help relieve depression, behavioral and psychological symptoms of dementia, address the social and emotional needs of people with dementia, offer “therapeutic benefits such as the facilitation of social interactions or the increase of self-esteem” [6].

Reminiscence therapy (RT) has been in use for decades. Although no research papers clearly identify the origin of reminiscence therapy, mentions of it have been seen as far back as the early 60s. A majority of the papers gave a positive tribute to this therapy mechanism. Butler was one of the first to discuss reminiscence therapy [7]. He described it as a “universal occurrence in older people of an inner experience or mental process of reviewing one’s life.” Erikson’s theory of life cycle argues the final stage of life (closer to death) requires mankind to “master the developmental conflict of the final stage of life which provides the primary motivation for reminiscence in old age” [8].

Over a period of time, various changes have been made in reminiscence therapy interventions. Recent trends have led to the employment of integrating technology into reminiscence therapy. Technology integration in reminiscence therapy has been used in a range of applications depending upon the type of technology that was being used. On the high end, robot-like systems have been used to conduct reminiscence therapy such as Hugvie, a humanoid shaped pillow, which presents a physical entity that the elderly can interact with and talk to [9]. Additionally, more high functioning robots have been recently used such as MARIO, a much larger humanoid robot, capable of video, speech, as well as interacting with those around it with its multiple sensors [10]. Another higher end robot with less capability is Zenbo Junior, a smaller robot that sits on a table and is capable of video and speech [11]. Robotic solutions are still a work in progress as of now and are continuing to be developed in hopes that they may help provide a more personalized experience. On the other hand, low end technologies are as simple as using digital photos and videos for sharing among individuals with dementia for therapy [12]. Additional technologies include VR (virtual reality), mobile applications, video streaming, and an internet-based recommender for caretakers. VR applications are mostly used for digital image viewing, both static and panoramic pictures, as a way of immersing the elderly in a memory [13]. Other uses include haptic feedback along with VR (replicating the sense of touch) as a way of furthering the immersion of the reminiscence therapy [14]. The use of android devices and applications also are being implemented as ways to facilitate reminiscence therapy. Such solutions include a media viewer of videos and photos providing a way of facilitating reminiscence to multiple elders simultaneously [15]. Current trends continue to push towards more and more technology integrations, foretelling the future of further inquiries of technological assistance in reminiscence therapy.

3. Trends in Reminiscence Therapy in the Treatment of Depression

Reminiscence therapy is “a reflective, narrative process that encourages senior adults to mentally access and tell their personal stories” [8,16]. It is used mostly as a support and counsel to seniors. Seniors recall themselves at a younger age which invokes happy memories (and sometimes sad) that allow them to socialize about or reflect upon. The interventions are usually for a period of time, ranging from short workshops with one session to longer periodical sessions over the course of weeks or months. Reminiscence therapy comes in two forms: individually and in groups, but recently technologically driven interventions are being explored as supplemental or even primary forms of intervention.

4. Methods

The objective of this scientific a systematic discussion paper is to explore the current trends in reminiscence therapy in the treatment of depression in the elderly. Most of this paper is based on the PRISMA format. All of the PRISMA guidelines could not be followed due to the nature of the literature and the topic overlap. For example, some of the trends in reminiscence therapy involve the use of technology such as mobile apps and robotics, while others follow more traditional and proven methods. This would mean that the literature could be divided into two eras, where one era involves heavy use of technology while the second era does not involve technology. However, the era concept could not be applied in this case since the technology involvement had no correlation to the time. This situation could only be addressed by creating two tables and hence not all the PRISMA

guidelines could be followed strictly. The authors performed a Google scholar search with keywords “reminiscence therapy + depression” with a limited time period, from the year 2000 to current. A set of inclusion and exclusion criteria for the scientific papers were set before the search. The inclusion criteria included topics such as reminiscence therapy, depression, and elderly, while the exclusion criteria included papers that were published prior to the year 2000. Several hundred articles were retrieved, out of which approximately 100 papers met the inclusionary criteria and were reviewed. The first part of this paper will discuss the history of reminiscence therapy, leading into the various interpretations of reminiscence therapy and the trends in the employment of this therapy over the years.

5. Interpretations of Reminiscence Therapy

There have been various interpretations of reminiscence therapy mechanisms utilized in the addressing of depression in the past. Some of these interpretations are group reminiscence therapy [4,17–25], autobiographical [26], psychologist-driven therapy [27], structured [28], standard [29], brief dynamic therapy [30], cognitive-behavior therapy [30,31], interpersonal psychotherapy [32], creative [33], companion robot [10], robot guided [11], digital [15], group art [34], individual [35,36], music [37], integrative [38–40], internet based video therapy [41], Lifebook [42], life review [43], mediation model [44], mobile solution [45], negative therapy (rumination) [46,47], photo [48], video [12], psychosocial [49], robotic assistive [9], tablet-based [50], transmissive [51], ubiquitous devices [52], virtual avatar [53], virtual reality [14], web interface based [54], and more. Some of the variations mentioned above have only been used once in a specific study, while group therapy has been the most widely used type of reminiscence therapy.

Given the variety in translation and application of reminiscence therapy, there are many different treatments to choose from. For instance, one approach could be constructive reappraisal of the past in a group using integrative reminiscence [25]. There is also transmissive reminiscence therapy (TRT) where seniors pass their skills to the younger generation, as shown in a study with college students and institutionalized senior adults [16]. Spiritual or internal reflections such as meditation have also been used as a way of calming one’s mind and reflecting on one’s life with a more focused method. Individual reminiscence therapies used religious songs, which lifts moods and spirit of individuals [36]. Music therapy has been shown to provide great supplemental effectiveness when tied to other forms of therapy as well. Further exploration into therapy involved bringing in healthcare professionals to give opinions and help design an effective intervention [54]. Psychologist-driven reminiscence therapy is a pre-planned activity of relaxation and exercises for group reminiscence [27]. More complicated therapies such as interpersonal psychotherapy [32] are being used as a more focused version of intervention. Cognitive-behavior and psychosocial therapies [30,31,48] are also being used to change moods in a more positive way. These studies use additional psychological tools to further improve the effectiveness. There is also creative reminiscence therapy which uses the medium of drawings, poems, and other creative media [25,33]. Some therapies also include Lifebook and life review that goes over the individual’s life as a whole [41,42]. Along with life review, autobiographical reminiscence helps with the recall of their own personal memories [26]. Some studies are exploring the effects of negative reminiscence, or rumination, as a way of understanding what effects reminiscence can have [46].

Additionally, there are adaptations of traditional reminiscence therapy techniques with technology-based methods. Although technology is being used in assistive technologies, it is designed based on technology and not taking user needs and usability in account [55]. Internet-based video and regular video-based reminiscence therapies are starting to be used [12,40]. Video-based solutions can either include video calls for virtual group reminiscence or past videos for virtual individual reminiscence. Mobile solutions to reminiscence therapy are also starting to be deployed [44], as well as tablet-based applications and other ubiquitous devices which are integrated into different methods of reminiscence therapy [49,51]. These applications of reminiscence therapy use prior techniques such as

individual reminiscence to facilitate the interventions and reduce the workload for caregivers. Web-based applications are also used as a supplemental tool for caregivers in keeping track of and preparing for reminiscence therapies [53]. Other technology-based therapies include Virtual Reality reminiscence therapy, which uses a virtual reality headset to provide a more immersive reminiscence for individuals by showing panoramic scenes or pairing virtual reality with haptic feedback (physical stimuli that recreate feeling of touch) to facilitate the experience [14,47]. Robot interaction, integration, and design add a more humanoid integration of technology [9–11]. These robotic interactions are still being explored and designed, but the current studies produced provide a starting point for robot-based reminiscence therapies. Other humanoid technologies are also being developed and used to provide a more social experience such as virtual avatars [52]. These avatars are able to interact with individuals through a screen and act as facilitators for the therapy. Additional techniques are continuing to be developed and explored and will most likely start blending different methods of reminiscence to create stronger and more effective interventions.

6. Participants in the Interventions

The number of participants in each of these studies varied greatly between 3 and 637 participants. Some of the papers were just proposals for a study while others conducted studies with participants that were healthy, patients, veterans with combat experience, urban elderly, African-American elderly, females only, non-institutionalized, elderly affected with dementia, elderly in nursing homes, and Alzheimer's patients. The majority of the studies had anywhere between 10 participants to 150 participants. There were a few exceptions to this, such as the study involving ubiquitous devices which only used 5 participants [51], as well as several others [9,12,53]. Additionally, there was one study on a more numerous scale, which was a reminiscence therapy rumination study that involved 637 participants across Cameroon, the Czech Republic, and Germany. One factor to note is that traditional reminiscence therapy (group therapy, integrative, and individual) had a sufficient number of participants to show statistical significance, while newer adaptations that integrate technology had lower numbers of participants [14]. This suggests that as time has passed, reminiscence therapy studies involving technology are gaining traction. Unlike traditional reminiscence therapy where the participants interact with another, or interact with a trained expert, technology-based solutions must be built ethically and soundly due to potential effects that technology can have in therapy. This means that due to their more recent appearances in studies, and the integration of a non-human device, the methods for these devices need to continue to be explored and developed before they can be used on a larger scale.

7. Length and Frequency of Interventions

Some of the interventions in the reviewed papers were conducted in the United States, while many of these studies were conducted across international borders in countries such as UK, Turkey, Taiwan, South Korea, Singapore, Portugal, Netherlands, Japan, Italy, Iran, Israel, Indonesia, India, Germany, Switzerland, France, Dutch, Dominican Republic, China, Czech Republic, and Australia. Certain countries, such as Taiwan, have a higher rate of reminiscence therapy studies than others. Although the subject of reminiscence therapy is studied world-wide, a majority of the studies researched in this paper come from Europe and Asia. The length of the periods for interventions also varies greatly with some lasting one session of 30–60 min [47] and others lasting up to 6 months [56]. Some studies also include follow-up sessions to see the lasting effects of the intervention. Reminiscence therapy is known for being an effective short-term solution for depression symptoms, and as such studies that lasted longer tended to leave a more permanent effect compared to the shorter studies. That being said, follow-up sessions show that interventions should remain continuous if the effects are to remain constant.

8. Tools Used to Study Depression

Some of the tools used in the studies explored to understand the impact of reminiscence therapy have used the Geriatric Depression Scale [36], the Life Satisfaction Index A, self-esteem scale and Geriatric Depression Scale Short Form [57], Geriatric Depression Scale, Life Satisfaction Index, and psychology well-being scale [29]. Table 1 represents the annotated scientific research papers.

Table 1. Reminiscence therapy studies with results.

Author, Year	Type of Intervention	Length of Intervention	Number/Type of Participants	Region
Duru, 2016 [24]	Group Reminiscence	12 weeks, 30–35 min sessions	62 patients	Turkey
Bohlken et al., 2017 [41]	Lifebook reminiscence therapy	3–4 months, 50 min	54 participants	Germany
Bohlmeijer et al., 2005 [33]	Creative Reminiscence	8 courses	79 elderly participants	Netherlands
Brinker & Jay, 2013 [46]	Reminiscence therapy with rumination	1 session, with 1 follow up 20 days later	150 elderly participants	Australia
Chao et al., 2006 [58]	Group reminiscence therapy	9 sessions	24 participants, 20 by the end (4 withdrew)	Taiwan
Chin et al., 2007 [59]	Review of reminiscence Therapy	N/A	N/A	N/A
Chiang et al., 2010 [29]	Standard reminiscence therapy.	8 sessions over 2 months	92 elderly	Taiwan
Cho, 2018 [60]	Review of reminiscence therapy	N/A	N/A	S. Korea
Choi, 2013 [25]	Group art/reminisce therapy	5 weeks, twice per week	63	S. Korea
Elias et al., 2015 [17]	Group reminiscence therapy, review	N/A	N/A	N/A
Frazer et al., 2005 [61]	Systematic review of various treatments for depression in older people	N/A	N/A	N/A
Fujiwara et al., 2012 [54]	Workshop for healthcare professionals	7 sessions	N/A	Japan
Gil, 2020 [56]	Reminiscence therapy in nursing homes.	6 months, 14 session	60 elderly Participants	Portugal
Gonçalves et al., 2009 [42]	Life review for older women	8 weeks	22 elderly female participants	Portugal
Hofer et al., 2017 [45]	Negative reminiscence (rumination)	N/A	637 participants across Cameroon, the Czech Republic, and Germany	Czech Republic
Housden, 2009 [18]	Group reminiscence therapy review	N/A	N/A	N/A
Hsieh, 2003 [4]	Review of reminiscence	N/A	N/A	Taiwan
Hsieh, 2010 [5]	Reminiscence group therapy	12 sessions 40–50 min sessions	61 participants	Taiwan
Jayasekara et al., 2015 [31]	Behaviour therapy review	N/A	N/A	Australia

Table 1. *Cont.*

Author, Year	Type of Intervention	Length of Intervention	Number/Type of Participants	Region
Korte et al., 2012 [43]	Mediational model of reminiscence	1 session	202 participants	Dutch
Lök, 2019 [23]	Group reminiscence therapy	8 weeks 60 min	60 participants	Turkey
Lopes et al., 2016 [26]	Autobiographical memory reminiscence therapy	5 weeks	41 participants	Portugal
Mackin et al., 2005 [30]	Brief dynamic therapy, cognitive-behavior therapy, interpersonal psychotherapy, tied with reminiscence therapy analysis	N/A	N/A	United States
Meléndez et al., 2015 [37]	Integrative reminiscence group therapy	4 sessions	34	Dominican Republic
Musavi et al., 2017 [39]	Integrative reminiscence therapy	10 sessions	46 participants	Iran
O'Philbin, 2018 [62]	Reminisce therapy for dementia review	N/A	N/A	United Kingdom
Oriaifo, 2021 [63]	Reminiscence therapy for mild dementia	8 weeks, 60-min	30 participants	United States
Peng et al., 2009 [64]	Review of reminiscence therapy techniques	N/A	N/A	China
Pinquart et al., 2012 [48]	Psychosocial outcomes of reminiscence therapy, analysis	N/A	N/A	Germany/ Switzerland
Poorneselvan et al., 2014 [34]	Individual reminiscence therapy	7 sessions, 45 min	20	India
Raji et al., 2021 [22]	Group reminiscence therapy	4 weeks, 2 h	60	India
Rubin et al., 2019 [65]	Benchmark for reminiscence therapy	N/A	N/A	N/A
Shellman et al., 2009 [38]	Integrative reminiscence therapy	8 week intervention, 30 day follow up afterwards	56 older African Americans	United States
Song et al., 2014 [19]	Group reminiscence therapy meta-analysis	N/A	N/A	China
Stinson et al., 2006 [28]	Structured reminiscence	6 weeks	24 elderly women	United States
Subramaniam et al., 2012 [35]	Individual reminiscence therapy review	N/A	5 trials of 225 patients used for review	N/A

9. Technology-Based RT

As noted earlier, technology can play an important role in reminiscence therapy [66]. As with non-technological approaches, technology-based RT is aimed at recollecting the past using the technology. On a basic level, technology can be used as a simple tool for bringing the memories back or using them as means to connect to memory-based activities. For instance, various digital technologies can be used to support reminiscence practices, such as writing diaries using computers [67]. On a more sophisticated level, technology can be used to create immersive experiences for the patients, such as virtual or

augmented reality, as well as interaction with robots and artificial intelligence. The purpose of this section is an overview of technology-based RT specifically, noting some specific examples of the technology applications and current tech-based RT practices. Mulvenna, Zheng, and Wright [68] refer to RT technologies as reminiscence systems. The authors first overview what makes technology-based approaches different from traditional ones. Although traditional approaches are actively used by practitioners, advances in digital technologies, especially as seen with the robots, are offering novel directions for the development of reminiscence therapy. Then, examples of the novel technologies used in the field of reminiscence therapy are provided, with some of the exemplary studies that show various types of technologies in a table format.

One of the differences in the technological approach is that the experiences can be digitized. For instance, digital files can be uploaded to a technological platform. As used in non-technological approaches, such materials could be personal photos and videos. There could be a possibility to upload materials that are used for the purposes of retrieval, e.g., music or sounds from a certain time period. However, now technology can be used for better resource management, storing and ease of retrieval of the data, connectivity, and a potentially more enhanced personalized experience. Current practices in the use of technology are based on the capacities that such technologies have. Evaluating technologies in the context of senior care, Haron, Sabri, and Jamil [69] differentiate four types of technologies—storytelling technology, mobile technology, collaboration technology, and multimedia technology. Communication technologies such as emails, chatrooms, or electronic bulletins are examples of collaboration and/or storytelling technologies. Technologies currently are used to document management systems, maintain workflow, and learning. Technology-based experiences can widely utilize capacities to process digital photo and video content. We already noted the use of images to recollect some events from the past, but the same approach has been used to create more dynamic and immersive experiences. Moreover, such technologies allow RT practitioners to focus on multi-sensory treatment that combines the use of sight, touch, smell, and sound [14,70].

Past research identified successful use of digital reminiscence technologies across multiple platforms—smartphones, tablets, laptops, desktops, robots, and other devices that create conversational and immersive reality for the users [44,71,72]. Some studies investigated various apps, video games, virtual reality, augmented reality, as well as the development of AI-based platforms. Artificial intelligence can help to automate the processes and make them more widely accessible for the users. For instance, Caros and colleagues [73] identified that based on deep learning the therapy can efficiently be used by users. Elisabot is a conversational AI-based bot that is used showing the pictures and asking questions about the image. The user provides the answer, and a bot provides a response to that. The conversational agents here can simulate a conversation with a reminiscence therapist—such an approach is efficient in simulating the memory and developing communication with the users. RT technology can automate the process of reminders where it can be used based on artificial learning. As with basic technologies, photos and videos can be used to generate the interaction.

Computer-aided programs can help engage in verbal reminiscence. For instance, Lancioni [74] identified that even a simple computer-aided program can be used for reminiscence therapy. Such therapy is used widely in individual and group settings. Successful use of mobile and tablet apps is another major direction for reminiscence technologies. For instance, Memory Matters is an iPad reminiscence game that was identified to improve social interaction and mood [75]. The interactive capacity of digital technologies allows for novel possibilities to interact with the users. Due to the fact that technologies can bring in the stimuli such as images or sounds, it can create a possibility to verbally engage with the past experiences. Due to the fact that computers are connected in the network, one of the advantages of the use of reminiscence systems could be the accessibility of the programs. For instance, Kuwahara and colleagues [12] note the use of networked reminiscence therapy where videophones could be used to communicate with therapists.

Digital technologies can also be immersive. For instance, users can experience a more enhanced virtual reality [47,70,76], which is also identified to have positive effects on social interaction and life satisfaction of seniors. Tsao, Chu, and Lan (2019) integrated virtual reality (VR) and augmented reality (AR) into a visualized RT system. The authors note “three Is” of virtual reality: immersion, interaction, and imagination. Using VR glasses, users can immerse themselves into the past.

Finally, as noted earlier, one of the current trends in RT technologies is the use of robots and artificial intelligence. A set of studies looked into the possibility of using robots to interact with users regarding their past experiences [9–12]. Kuwahara [12] overviews that, besides the RT elements, robots can be helpful in communication and exercising. Such robots can provide emotional support, interact with users, and replay the materials that are uploaded, similar to other commonly used technologies, such as phones or laptops. The advantage of using robots is that they have a certain degree of autonomy and are humanized/anthropomorphized. Thus, robots are different from smartphones or laptops as they have some more capabilities to communicate with users. In line with artificial intelligence, robots are one of the major current trends in the use of RT. Since conversational abilities are improved—robots are seen as more social tools compared to laptops or phones—users can interact with robots and AI in various ways. Table 2 represents the annotated scientific research papers that utilized technology.

Table 2. Technology and Reminiscence Therapy.

Author, Year	Type of Technology	Length of Intervention	Number of Participants	Region	Results
Ancient et al., 2013 [51]	Ubiquitous devices/tablet	Exploratory	5 participants over 65	United Kingdom	Ubiquitous devices show potential for future research.
Asprino et al., 2017 [10]	Companion robot design	N/A	N/A	Italy	Created a robot algorithm designed to communicate and interact with the elderly. May be useful in future work.
Chang, 2013 [77]	Food stamps game on android tablet	week	10 elderly participants	China	Exercised their memory and made them interested in the game.
Chapoulie et al., 2014 [47]	Virtual reality photo reminiscence	1 session	13 elderly adults	France	Overall positive results of VR image-based reminiscence.
Cosley, 2009 [67]	System prototype—Chatbot	45 min	8	United States	Has potential to support future research, as well facilitate reminiscence activities.
Gamborino et al., 2021 [11]	Robot-guided photo reminiscence	1 h session	10 elderly participants	Taiwan	Had difficulties with design, was unable to provide an effective solution.
Gowans et al., 2004 [71]	Multimedia Conversation Aid design	N/A	N/A	Scotland	Shows promising use for future research.
Haron, 2014 [69]	Technology exploration	Exploratory	N/A	Malaysia	Psychological aspects were less involved in studies found and was often separate from knowledge recall. Merging of the two theories may provide interesting results.
Imtiaz, 2018 [44]	Mobile solution—reminiscence and music therapy	exploratory	N/A	United States	Reminiscence and music therapy can be combined to increase the effectiveness of BPSD therapy.
Klein, 2016 [55]	Interactive memories from technology aided reminiscence design	inquiries	50 dementia patients	Germany	Results show that smart devices and homes can be designed to help elderly and those with dementia.

Table 2. *Cont.*

Author, Year	Type of Technology	Length of Intervention	Number of Participants	Region	Results
Klein et al., 2018 [14]	VR reminiscence and haptic stimuli	1 week	50 participants in nursing homes	N/A	Results showed difficulty with VR for the elderly. More personal interaction is deemed a better solution.
Kuwahara, 2006 [12]	Photo/video reminiscence	18 sessions—part 1	9 participants diagnosed with dementia in part 1,	Japan	More severe stages of dementia had difficulty with video, but more milder cases were able to communicate better. Can be an effective solution.
		2 months—part 2	7 in part 2		
Lancioni et al., 2014 [74]	Computer-aided Virtual avatar	4 sessions, 5 min each	8 patients	Multiple regions	Was beneficial for 7 of the 8 participants.
Lazar, 2014 [6]	Review of technology use	N/A	N/A	N/A	Studies show that the technology used requires expert knowledge and setup, which may be challenging for family caregivers, but show promising results overall.
Moon et al., 2020 [15]	Digital reminiscence therapy	8 sessions over 4 weeks	49 participants	South Korea	Results overall were positive, participants showed a better mood. Depression overall decreased but BPSD did not.
Morales-de-Jesús et al., 2021 [52]	Virtual Avatar	N/A	11 participants related to patient care	Mexico	Results showed the system to be promising for future reminiscence therapy use.
Mulvenna et al., 2009 [68]	Overview of technology in reminiscence work	N/A	N/A	United Kingdom	The use of multimedia systems and touch screen technologies can greatly further reminiscence research.
Nikitina et al., 2018 [72]	Smart conversational agent that can assist older adults in the reminiscence process	N/A	N/A	Italy	Reviewed conversational agents and proposed a design for one. Did not test the conversational agent on human participants.
Otsuka, 2009 [78]	Automatic generating system of reports about life review activities	N/A	N/A	Japan	Developed a system to generate reports but did not test it.
Sarne-Fleischman, 2011 [53]	Website-interface to help facilitate reminiscence therapy	2 sessions—45 min	3 Alzheimer patients	Israel	High satisfaction from both caregivers and patients by helping the process of reminiscence therapy.
Sun et al., 2021 [70]	Virtual reality framework	N/A	N/A	Canada	Shows promise for future use in research for improving overall wellbeing and social connectedness.
Tsao et al., 2019 [76]	Used VR and AR to construct a visualized reminiscence therapy system,	N/A	N/A	Taiwan	Increased social interaction.
Tominari et al., 2021 [13]	Virtual reality with panoramas	8 weeks	52 participants	Japan	Results showed positive signs overall. Panorama use improved overall wellbeing.
Yamazaki et al., 2018 [9]	Robotic—reminiscence therapy, assistive technology	15 min session, over long-term study	5 participants diagnosed with dementia.	Japan	Results were all over the place. Difficult for some participants to interact with the technology.

10. Results of the Applications of Reminiscence Therapy

Based on the research papers explored, results show that the plethora of interventions used are successful in improving overall quality of life and reducing depressive symptoms. Individual reminiscence helped reduce depression symptoms and provide a more positive mental state. Group reminiscence therapy also showed positive effects for personal quality of life, self-esteem, and reducing overall depressive symptoms. However, group reminiscence may only provide short term effects. This trend is also shown across each different type of intervention, in that they only provide short term effects, and therefore must be continuously used in order to remain effective. Integrative reminiscence therapy also shows positive results; however, it must be constructed carefully otherwise it can have few to no significant effects [37].

One thing to note from this review of scientific literature is that some studies showed some inconclusive or even negative results due to constraints of participants, or the design of the study all together. This can happen unexpectedly, such as participants deciding to drop out [58], or can happen due to the design of the study not being engaging or intuitive. (Such as [9], which had participants falling asleep in front of the robot). Additionally, certain studies (such as those with $n < 10$) promote positive results, but ultimately still fall into the inconclusive category due to these studies not providing a large enough sample size to show significance. Alternatively, technology-based interventions are showing promising results, especially with the use of virtual reality. However, some of these studies also fall into the category of inconclusive due to low sample sizes. There is a trend with reminiscence therapies that shows newer techniques and interventions do not often obtain large sample sizes. This could be from any number of the restraints that are placed on the studies, from designing the study or slow adoption of these types of interventions. This should not discount technology-based solutions, as seeing that they are newer in terms of design, some allowance must be given for the studies to transition from exploratory to more in-depth analysis. The length of the application of the interventions were all within a standard range (30–60 min, with multiple sessions) and as such provide consistency across each study. In terms of effectiveness, each variation of intervention (individual, group, and technology based) shows effective results, however benchmarks such as [65] should be applied to these studies to provide further in-depth analysis to distinguish between high quality intervention studies, and lower quality intervention studies.

Current trends in the RT indicate effectiveness in using technologies. Studies indicate that various types of digital technologies can be effective. Results show that tablets, mobiles, laptops, and website technologies can improve the well-being of the patients. There are positive changes in depression, mood, and communication. Since digital technologies can create personalized immersive experiences, technology-based RT has proven to be effective similar to the traditional methodologies. However, because technologies allow connectivity and communication, such technologies could be used as conversational spaces, especially when users can interact with robots and artificial intelligence.

11. Discussion

The scientific literature reviewed suggests that there could be both positive and negative impacts of administering reminiscence therapy. Most of the studies have reported a significant positive impact, while a few have reported some negative impact. This negative impact has been reported when the therapy was applied on participants who had some negative thinking involving rumination. Over-indulgence in the therapy can lead to emotions that are beyond gentle reminiscing and turn into a longing or excogitation. Hence, the duration of the therapy should be taken into consideration so as to not invoke negative emotions of sadness and longing [45,46]. Reminiscence therapy has also shown a positive impact on autobiographical memory. There is little exploration in this area and it needs to be studied more, especially the long term effects of autobiographical reminiscence therapy [26]. A review of behavior therapy conducted by Jayasekara et al. concluded that reminiscence therapy can be used as an alternative antidepressant [31]. Other studies have

shown a combination of reminiscence therapy along with music can be very effective in warding off depression [44]. Another study combined reminiscence therapy with cognitive behavior therapy and psychotherapy to show some potential for aiding in depression treatment, but previous studies have proposed additional therapies that might be more helpful [30]. Robot-based reminiscence therapy has also been applied as an algorithm that communicates and interacts with elderly to help reduce depression [10]. Reminiscence therapy applied as a creative therapy that involved painting, drawing, or using some creative skill to reminisce also showed a positive impact in reducing the symptoms of depression [33]. A digital version of reminiscence therapy showed significant improvement in mood, but overall there was no impact on the behavioral and psychological symptoms of dementia [15]. Several of the papers reviewed were applications of group therapy. This is one of the most popular forms of reminiscence therapy and has been shown to help reduce the symptoms of depression [17–21,23–25]. Individual reminiscence therapy has also shown a positive impact on people suffering from depression [34]. A variation of the individual reminiscence therapy that involved music has been shown to improve the mental state [36]. An integrative version of reminiscence therapy when applied to an African American elderly population has shown to help with minor symptoms of depression [38]. Some studies with integrative reminiscence have shown to improve the mood overall [39], while others have not shown any conclusive result [37]. An internet-based version of reminiscence therapy has reported significant improvement in cognitive wellness and apathy [40]. Life review, a type of reminiscence therapy has shown to be effective [42]. The Lifebook version of reminiscence therapy has shown to reduce overall symptoms of depression [41]. Reminiscence therapy administered in the form of a mobile app has shown to be effective in addressing depression [44]. The photo and video interpretations of the reminiscence therapy have also shown positive results only among people with mild cognitive impairment [12]. The psychosocial version of the therapy has shown to improve life satisfaction and psychological well-being [27]. The transmissive and traditional reminiscence therapy variations have also shown a positive impact on depression [50]. The structured application of the reminiscence therapy did not show significant impact [28]. The robot assisted or assistive technology-based reminiscence therapy is still a new mechanism and has not shown conclusive results mostly due to the lack of proper application [11]. Long-term applications of reminiscence therapy have not been studied enough and current studies only show short-lived effects and no long-term impact [27]. Nevertheless, technology-based RT can potentially provide various advantages for the care providers as well as the users of the technology. Due to of the inherent advantages that technology brings—especially in the direction of artificial intelligence, when technology can be used to learn more about patterns of behavior and adjustments—RT can be more seamlessly incorporated into daily life of patients. Since emerging technologies are smart, they allow novel mechanisms in the implementation of RT, something that was less possible without the implementation of tech-based approaches. Many of the research papers that used technology to administer RT were only technological designs and development but not tested in an experimental setup with participants.

12. Conclusions

This paper explored the various applications of reminiscence therapy in the past two decades and most scientific studies reviewed have shown a significant positive impact on depression, while some have reported a negative impact. Overall, some studies have recommended reminiscence as a routine treatment for depression, and some have gone as far as to suggest it is an alternative to antidepressants. The scientific literature review on reminiscence therapy suggests that, although there have been variations in the application of reminiscence therapy, it is ultimately a positive tool to have in the toolbox for treatments for depression. Although some researchers suggest the use of technology is not taking into consideration the user needs and are being designed based on the technology, there has been a trend in incorporating technology in the administration of reminiscence therapy

in the form of mobile applications, cuddly robots, virtual reality applications, mobile and tablet-based applications, and robot simulations. This trend will continue to grow. More specifically, artificial intelligence (AI) is one method that can create more possibilities for patient interaction. Conversational AI can be incorporated into RT not only during short RT sessions, but throughout the patient's day as well. Finally, the scientific review revealed positive short-term impacts on depression mood and well-being, but there are no reports or studies on the long-term impact of reminiscence therapy on mood, depression, and wellbeing. The exploration of the scientific literature revealed a strong trend of implementing technology in the administration of reminiscence therapy.

Author Contributions: Conceptualization A.K., methodology A.K., writing original draft A.K., A.B., M.B. and N.I, Validation A.K. and N.I, writing—review and editing, N.I., Funding acquisition A.K., project administration A.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Monarch Healthcare Management LLC.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare there is no conflict of interest.

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