

Virtual Reality Therapy for Social Phobia: A Scoping Review

Elham SALEHI^{a,1} Mahdi MEHRABI^a Farhad FATEHI^{b,c} Asiyeh SALEHI^d

^a Islamic Azad University, Shiraz, Iran

^b Centre for Online Health, The University of Queensland, QLD, Australia

^c Tehran University of Medical Sciences, Iran

^d School of Health and Human Sciences, Southern Cross University, QLD, Australia

Abstract. Virtual reality (VR) has become an interesting alternative for the treatment of social phobia. This scoping review explored the impact of VR technologies in the treatment of social phobia (25 papers were included). Treatment approaches to social phobia included virtual reality exposure therapy, cognitive behaviour therapy, exposure group therapy, in vivo exposure therapy, and waiting list. VR was identified as the most successful approach, not only in improving social phobia, but also resulting in real life changes such as improvement in occupational success. VR Head Mounted Displays were used in most of studies (76%), followed by VR-based Specific Systems (24%). Although VR techniques indicated positive impact on patients to reduce their anxiety, it is paramount to consider variables such as the way therapists control the environment as well as individuals' characteristics for achieving the best outcome.

Keywords. Social phobia, Social fear, Social anxiety, Virtual reality

1. Introduction

Anxiety disorders are characterized by apprehension, tension, nervousness, or worry. Social phobia, as the most common anxiety disorder, is the unreasonable fear of social situations and the interaction with other people that can bring on feelings of self-consciousness, judgment, evaluation, and inferiority, and can result in social isolation [1]. Diagnosis and treatment of anxiety disorders are difficult as there are no objective biomarkers, however, phobia therapy is the first-line treatment for anxiety disorders, modifying the result of fear of in-memory structures [2, 3]. The treatment approaches include Cognitive Behavioural Therapy (CBT) and Exposure Therapy (ET). CBT includes exposure to fear-triggering stimuli (e. g. speaking in front of a group), social skills training and relaxation training to change cognition and behaviours [4]. In Exposure Group Therapy (EGT), patients are exposed to the feared object or context without any danger to overcome their fears. If the patient is exposed to the real situation, it is called In Vivo Exposure Therapy (iVET) [5].

Virtual Reality (VR) is a human-computer interaction that allows a person to step into an unseen environment to face their fears which participants could react in the virtual world with their observation through images on a computer screen [6, 7, 8, 9]. VR is an effective method for the treatment of a variety of phobias such as social phobia, post-

¹ Corresponding Author: Email: eliss.salehi@gmail.com

traumatic stress disorder, claustrophobia, arachnophobia and fear of heights [10, 11,12]. This review aimed to investigate the efficacy of VR in improving social phobia.

2. Methodology and design

This scoping review systematically searched four databases (PubMed, PsycINFO, IEEE Explore, and Science Direct) from 2000 to 2018. Keywords were: ("virtual reality" OR "virtual environment" OR "cyberspace") AND ("social phobia" OR "social isolation" OR "social fear" OR "anxiety"). Peer-reviewed papers written in English that used VR for improving any case of social phobia, social fear, and social speaking fear were included. A total number of 726 records were initially considered for the review, and a final set of 25 papers were deemed eligible and included in this scoping review. Constant comparative analysis was used to explore and categorize the themes across the studies. Synthesis of the information was performed based on different approaches of VR for treating social phobia, and comparing VR with conventional treatments.

3. Results

3.1 Study characteristics

Participants' age range was 18-70. Sample size varied from 2-97, with a relatively equal distribution of both genders. Treatment included Virtual Reality Exposure Therapy (VRET) with the highest percentage (65%), cognitive behaviour therapy (CBT), exposure group therapy (EGT), in-vivo exposure therapy (iVET) and waiting list (WL). This review identified three main themes.

3.2 Virtual reality in the treatment of social phobia - trends and applications

By comparing different therapeutic approaches, VR approaches and CBT showed the most remarkable improvements in the treatment of social phobia [1, 5-6, 13-18]. There were no significant differences between VR and CBT and they indicated relatively equal outcomes [1, 6]. However, VR was highly recommended and there has been an increasing number of studies during the last 19 years. VR is affordable and provides equal or even more satisfactory results in comparison to other non-VR approaches such as CBT. VR has a paramount impact on not only the treatment of social phobia but also different aspects of personal life and wellbeing. Some examples are: more improvement in well-being and quality of life; fewer sessions for accomplishing the therapy; confidence [14], positive self-statement [5], improvement in emotion and communication, real life changes such as occupational success [7, 17], decreased fear, anxiety, avoidance of the social situation, improvement in physiological measures on public speaking anxiety, patient's attention focus, and changing behaviour [10, 14, 15].

The number of treatment sessions in VR interventions varied from 1-12 sessions and the duration ranged from 5-90 minutes. There were also variations in the follow-up period, from a few weeks to one year. Among VR approaches, iVET group was more realistic than VR conversation, and participants commented that the VR conversation would be more realistic if they did not meet the actor and if they were not in the same

room as the other participants [1, 6, 16, 19]. In addition, fear rating was higher during VR conversation than in iVET conversation [1, 6, 16, 19].

3.3. Virtual reality tools for social phobia treatment

The VR equipment can be categorized into two groups: Virtual Reality Head Mounted Displays (HMD), and Virtual Reality based Specific Systems (VRBSS). The majority of the research experiments (76%) used HMD, while, the other 24% of the studies used VRBSS, mainly different 3D display/sound equipment and motion trackers.

For HMD usage, there is a Distributed Interactive Virtual Environment, which consists of a computer, HMD, display screens for each eye, stereo ear-phones, Silicon Graphics, main memory, avatar face and model and a head-tracking system. In a virtual environment (VE), the conversation is managed through a virtual avatar interaction with participants, the virtual social situations such as shopping; attending a job interview include semi-scripted dialogues consists of modification templates based around the video game. The participants interact via HMD and wear headphones and a microphone headset to interact. Therefore, avatars mouth movements during the dialogue seem natural [19, 22, 23]. The tracker allows patients to see the virtual world with head movement in the real world, and software package that provides the scenes of speech among the audience [5, 16]. The patient's head movements change the environment, and the therapist can control the audience's reactions and communicate with them via a microphone. During the talk, their heart rate is monitored and the content of the presentation is recorded [10, 12, 14, 15, 20, 21]. Due to the limitation of VR hardware and software, and the associated expenses, off-the-shelf applications for different issues, such as public speaking practice during different scenarios have been developed and are available on mobile app stores [24, 25, 26].

VRBSS consists of the Delft Remote VR system with the capacity to display 3D video, 3D images and 3D glasses and ear headphones for sound immersion. The program displays images and then commands given by the therapist through a wireless USB keyboard for activation of the interaction and changing the scene [17, 23]. The laboratory for VRBSS comprises of two rooms that are separated by a mirror while the therapist can see the patient but the patient cannot see the therapist, they have a face-to-face contact during exposure and communicate via intercom [27].

3.4 Measurement tools in social phobia

Two types of measurements were used during the course of treatment: 1) self-report measure - individual's own report of their symptoms, behaviours, beliefs, or attitudes. This was conducted via pre-treatment and post-treatment assessments. 2) physiological measure - measuring bodily variation such as: heart rate, dry mouth, and blood pressure. An overall of 30 psychological instruments were used as outcome scales across studies [11]: APQ (answer psychology questions), ATQ30 (automatic thought questionnaire), ATPS (attitudes towards public speaking questionnaire), BDI (Beck depression inventory), BCSS (brief core schema scales), BAT (behavioural assessment task), CGI (clinical global improvement scale), DAS (dysfunctional attitude scale), DASS (depression anxiety stress scale), DSM-IV (diagnostic and statistical manual of mental disorder), EUROHISQOL (Eurohis quality of life scale), ERQ (emotion regulation questionnaire), FNE-B (fear of negative evaluation-brief Form), GPTS (green paranoid thought scales), HAD (hospital anxiety and depression), HADS (hospital anxiety and

depression scale), IPQ (I group presence questionnaire), LSAS (Liebowitz social anxiety scale), LSAS-SR (Liebowitz social anxiety scale-self report), PRCA (personal report of communication apprehension), PDBQ (personality disorder belief questionnaire), PRCS (personal report of confidence of speaker), PDBQ (personality disorder belief questionnaire), SUS (slater-Usoh-steed questionnaire), SCID (structured clinical interview for the DSM-IV), SSPS (positive and negative self-statement during public speaking), SCIA (social contexts inducing anxiety), SIAS (social interaction anxiety scale), SAS (social adjustment scale), SF -36 (the medical outcome 36-item short-form health survey), SSQ (simulator sickness questionnaire), SPAI (social phobia and anxiety inventory), STAI (state-trait anxiety inventory), and SUD (subjective unit of discomfort) [1-30]. Key methodological features and findings of the reviewed studies are available online ([DOI: 10.13140/RG.2.2.12587.39209/1](https://doi.org/10.13140/RG.2.2.12587.39209/1)).

4. Discussion and recommendations

VR treatment has a great impact on the communication and seems to be more effective and efficient than conventional therapies for social phobia. However, there have not been any specific comparison between different VR tools, and few mobile-base tools were considered. In addition, from a technological aspect, although HMD and VRBSS are the key effective VR tools, there has not been any specific comparison between them to examine the outcome and performance clearly.

Although the diverse variety of VR tools indicated some type of positive impact in reducing the anxiety, it is still paramount to consider confounding variables, such as the individuals' characteristics and the way therapists control the environment. Some of the participants felt anxious during VRET, due to the presence and the monitoring of the therapist during the session. In addition, therapists should try to maximize a patient's presence because attentional focus leads to better treatment. A powerful sense of presence and immersion is needed to make the experience real, and to enhance the effectiveness of the interventions [6, 21]. Further studies (with larger sample size) are required to clarify the differences between different VR tools in regards to their effectiveness and efficiency. There have been also limited studies around mobile-based VR and their potentials [24, 29, 30]. Future studies may also explore different behavioural patterns in regards to gender for using VR and the treatment outcomes.

There were issues related to the interventions that need to be considered to facilitate future studies. These include: difficulties in producing and editing movies as they are time-consuming [30]; different behavioural patterns due to gender; lack of control for audience interactions with each other for the virtual reality-based specific system; lack of sense of presence/immersion to overcome cognitive barriers [29]; and patients' anxiety due to therapist presence/monitoring [22], small sample size, and limiting the generalizability of the results of the studies [14].

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