Research Article

The Efficacy of A Single-Session Virtual Reality Exposure In The Therapeutic Intervention of Specific Phobias*

Özgül Fobilerin Tedavisinde Tek Seans Sanal Gerçeklikle Maruz Bırakmanın Etkinliği

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Abstract

The present study endeavors to evaluate the therapeutic efficacy of a singular session of virtual reality (VR) exposure therapy for treating specific phobias. A total of 33 individuals with clinically diagnosed specific phobias were allocated into either a treatment group (N=16) or a waiting list control group (N=17). Measurement instruments included the Demographic Information Form, the DSM-5 Severity Measure for Specific Phobia Scale, and the Self-Reported Anxiety Measure. In terms of statistical analyses, a mixed-design analysis of variance (ANOVA) was utilized to examine both within-group and between-group differences over time, effectively allowing for a more comprehensive understanding of the treatment's impact. Results demonstrated a statistically significant reduction in the severity of phobia symptoms in the treatment group compared to the control group ($p < .05$). The therapeutic gains were maintained during a three-month follow-up assessment, with associated levels of anxiety and panic also showing a significant reduction in the treatment group ($p < .01$). This study corroborates the clinical efficacy of a single VR exposure session for the amelioration of specific phobias. The gains were not only immediate but also durable over a follow-up period, substantiating the longer-term effectiveness of this treatment modality. Despite certain limitations, such as the absence of active control treatments and a somewhat homogeneous sample demographic, the findings make a significant contribution to the extant literature. The study serves as an important foundation for future research that aims to broaden the applicability and understanding of VR-based therapeutic interventions for specific phobias.

Keywords:

Virtual Reality, Exposure, Specific Phobia

Öz

Mevcut çalışma, özgül fobilerin tedavisinde yalnızca bir sanal gerçeklikle (SG) maruz bırakma seansının ne derece etkili olduğunu ortaya koymayı hedeflemektedir. Klinik olarak özgül fobi teşhisi konmuş toplam 33 katılımcı, ya bir tedavi grubuna (N=16) ya da bir bekleme listesi kontrol grubuna (N=17) dahil edilmiştir. Kullanılan ölçüm araçları arasında Demografik Bilgi Formu, DSM-5 Özgül Fobi Şiddeti Ölçeği ve Öz Bildirime Dayalı Anksiyete Ölçümü yer almaktadır. İstatistiksel analizlerde, tedavinin etkilerini daha derinlemesine anlamak için karma bir varyans analizi (ANOVA) modeli benimsenmiştir. Analiz sonuçları, tedavi grubunun kontrol grubuna kıyasla fobi semptomlarında istatistiksel olarak anlamlı bir düşüş yaşadığını göstermektedir ($p < .05$). Üç aylık takip değerlendirmesinde de, bu terapötik kazanımlar korunmuş ve tedavi grubunda anksiyete ve panik düzeyleri de anlamlı derecede azalmıştır ($p < .01$). Bu çalışma, özgül fobilerin hafifletilmesi için tek bir SG maruziyeti seansının uzun vadeli etkisini de desteklemektedir. Aktif bir kontrol grubunun olmaması ve örneklem demografisinin nispeten homojen olması gibi sınırlamalara rağmen, bu bulgular alandaki mevcut literatüre önemli bir katkı sağlamaktadır. Bu çalışma, özgül fobiler için SG tabanlı terapötik yaklaşımların anlaşılması ve uygulanabilirliği konusunda daha fazla araştırma yapılması için sağlam bir temel oluşturmaktadır.

Anahtar Kelimeler:

Sanal Gerçeklik, Maruz Bırakma, Özgül Fobi

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INTRODUCTION

A considerable segment of the population is comprised of individuals who possess specific phobias. Based on the findings of Kessler et al. (2005), particular phobia is commonly recognized as the most widespread anxiety disorder in modern culture, with a lifetime prevalence rate of roughly 12.5%. According to the meta-analysis conducted by Eaton et al. (2018), the estimated lifetime prevalence of specific phobias is 7.2%, with a global average that varies between 4% and 10%. It is worth noting that the most commonly observed specific phobias are to acrophobia (fear of heights) and zoophobia (fear of animals).

As per the American Psychological Association (2013), a specific phobia is distinguished by a profound sense of apprehension or worry directed towards a particular object or situation. Although dread is sometimes described as irrational or excessive, it constantly emerges as a result of the actual or anticipated presence of the feared object or event, the act of avoiding the feared object or situation, or enduring the experience with significant suffering (APA, 2017). Phobias, as distinguished from typical fears, exhibit a degree of intensity that can lead to significant disruption or suffering in an individual's daily activities (Craske, 2003).

Cognitive behavioral therapy (CBT) is commonly utilized as the primary method for resolving phobias within clinical settings. Cognitive therapies have the objective of assisting individuals in the identification and resolution of inaccurate beliefs or cognitive processes (Grös & Antony, 2006). The application of exposure to stimuli that induce fear is a frequently utilized behavioral strategy in the therapeutic treatment of phobias. According to the meta-analysis conducted by Wolitzky-Taylor et al. (2008), it has been concluded that exposure-based treatments, which fall under the category of behavioral interventions, exhibit the greatest effectiveness and long-term sustainability.

According to the American Psychological Association (2013), exposure therapy has demonstrated efficacy in the treatment of a range of anxiety disorders, such as phobias, panic disorder, social anxiety disorder, obsessive-compulsive disorder, post-traumatic stress disorder, and generalized anxiety disorder. Due to the extensive study conducted by Choy et al. (2007), the primary therapeutic approaches utilized for specific phobias are exposure therapy, systematic desensitization, progressive muscle relaxation, behavioral therapy, and cognitive therapy. After evaluating different methods, it was determined that exposure is the most effective approach. One particular type of exposure is referred to as in vivo exposure, which involves direct interaction with the phobic stimulus.

Exposure therapy is a psychological therapeutic approach developed to assist individuals in confronting their fears or anxieties. Fear-inducing stimuli comprise a diverse array of origins, encompassing both living and non-living things, as well as depictions of dreaded situations and allusions to intrusive thoughts or past recollections (Richard & Lauterbach, 2007). The therapist possesses the capacity to methodically expose the patient to the stimulus or circumstance that elicits fear within a regulated setting. This process can be implemented incrementally, commencing with less demanding assignments and advancing towards more complex ones. Alternately, the clinician may choose to employ the "overflow" technique, in which the patient is immediately exposed to the most difficult task. An alternative strategy involves integrating the exposure technique with relaxation exercises, as seen in the method known as "systematic desensitization" (APA, 2017).

Virtual reality (VR) refers to a sophisticated kind of human-computer interaction that emulates a realistic environment, allowing individuals to navigate and interact with a virtual world from various vantage points. This engagement involves a range of actions, including reaching, capturing, and sculpting, as described by Zheng et al. (1998). Virtual Reality (VR) is a nascent graphical technology that facilitates the immersion of users into a simulated environment, allowing them to perceive a tangible sensation of physical presence. Additionally, VR empowers individuals to actively participate and interact inside this artificial realm (Botella et al., 2004). In contemporary times, therapists have increasingly turned to virtual reality (VR) technology as a viable option, despite its initial high cost and hardware requirements, primarily due to its decreasing affordability (Wiederhold & Wiederhold, 2005).

The term "virtual reality exposure (VRE)" in this study refers to a methodological definition. It involves a systematic and controlled approach where individuals are gradually exposed to fear-inducing, anxiety-provoking, or avoidance-triggering scenarios or events within a virtual environment. Throughout this process, trained therapists closely monitor and guide the individuals. According to the findings of Freitas et al. (2021), therapists are afforded the opportunity to modulate the intensity of the stimulation in therapy sessions through the utilization of virtual reality exposure (VRE). Furthermore, virtual reality exposure (VRE) allows therapists to systematically replicate identical scenarios and adjust parameters in a way that is not practically achievable through in vivo exposure.

Since the initial publication of a virtual reality exposure (VRE) study in 1995, there has been a substantial increase in research investigating the effectiveness of VRE as a therapeutic intervention for various psychological disorders. These disorders include anxiety disorders, post-traumatic stress disorder, eating disorders, and sexual disorders (Botella et al., 2004; Botella et al., 2006). The utilization of the Virtual Reality Exposure (VRE) technique has witnessed a significant increase in its application for the management of specific phobias and various anxiety disorders. This growth can be attributed to developments in technology and enhanced availability, which have occurred within the last ten years. In healthcare settings, the utilization of Virtual Reality Environments (VRE) is facilitated by researchers and clinicians through the adoption of pre-existing software solutions or the development of customized applications. The available research suggests that Virtual Reality Exposure (VRE) has been shown to be effective in treating specific phobias and various anxiety disorders, as evidenced by studies conducted by Park et al. (2019), Işıklı et al. (2019), Garcia-Palacios et al. (2002), Michaliszyn (2010) and Shiban et al. (2013).

Clark et al. (2019) conducted an extensive meta-analysis to examine the body of research on fear of flying, arachnophobia, acrophobia, and claustrophobia. The findings suggest that the use of Virtual Reality Exposure (VRE) has a significant effect on reducing phobic symptoms. According to the researchers, virtual reality (VR) based exposure is considered to be more accessible, feasible (for instance, in replicating air travel), and less susceptible to participant drop-out when compared to in-person exposure. Wechsler et al. (2019) did a study which entailed a meta-analysis that examined the comparison between virtual reality (VR) exposure and in vivo exposure. The present study examined patients who had received diagnoses of Specific Phobia, Social Phobia, or Agoraphobia, utilizing both virtual reality (VR) and in-person exposure methods. The proposition made by the authors suggests that Virtual Reality Exposure (VRE) has equal effectiveness to in vivo exposure in

the therapeutic intervention of Specific Phobia and Agoraphobia. Furthermore, it has been suggested that the integration of virtual reality (VR) and in vivo exposure could potentially yield enhanced therapeutic advantages. Freitas et al. (2021) did a comprehensive literature analysis to investigate the impacts of virtual reality (VR) and in vivo exposure. Numerous studies have provided empirical evidence supporting the effectiveness of virtual reality (VR) as a modality for exposure therapy in the management of various phobias. Nevertheless, the superiority of in vivo exposure over other alternatives for specific phobias has not yet been proved.

Based on the aforementioned facts, the primary aim of this study was to determine the effectiveness of Virtual Reality Exposure (VRE) as a therapeutic intervention for certain phobias. The purpose of the study was to determine if a single session of Virtual Reality Exposure (VRE) had a positive impact on participants' anxiety levels and to examine the durability of this effect during a 3-month follow-up period after the intervention.

METHOD

The work received ethical approval from the Social and Human Sciences Publication Ethics Committee of Antalya Bilim University, as indicated by Decision No. 2021/21, dated October 18, 2021.

Research Design

The research utilized the sequential random assignment technique, along with a pre-test / post-test control group design, to examine the effects of virtual reality exposure on the severity of phobia symptoms. The phobia symptom intensity served as the dependent variable, whereas the level of exposure to virtual reality was considered as the independent variable. The process of assigning individuals to either the treatment group or the waiting list control group was carried out using random allocation. The present study comprised a sample of 33 persons who either sought treatment for a specific phobia at the clinic or showed their readiness to participate in the research. In order to establish eligibility, a clinical interview was administered to verify that these patients satisfied the diagnostic criteria for particular phobia as delineated in the DSM-5. Both groups underwent the administration of the DSM-5 Severity Measure for Specific Phobia Scale as a pre-test and post-test. In addition, the anxiety levels reported by the participants were evaluated while they underwent virtual reality exposure as part of the treatment intervention. The participants in the experimental group had a single session of virtual reality exposure, whereas the participants in the control group were placed on a waiting list. Following a 3-month period of follow-up, measurements were once again collected from the therapy group.

Sample

The participants in this study consisted of persons between the ages of 18 and 65 who actively sought therapy at the clinic for a specific phobia. They readily consented to participate in the research and were assessed to meet the diagnostic criteria for specific phobia as outlined in the DSM-5, using clinical interviews. The study encompassed a cohort of 33 individuals, with 16 participants being allocated randomly to the treatment group and 17 participants being assigned to the control group in a consecutive fashion.

The study did not include individuals who had comorbid psychiatric problems or organic health concerns, in both the control and experimental groups. Within the cohort of participants, there exists a collective of 23 female individuals and 10 male individuals. Thirteen participants reported feeling acrophobia, another thirteen participants showed zoophobia, and a further seven participants claimed to have hemophobia. The sociodemographic information for all participants is presented in Table-1.

Table-1. *Sociodemographic Data of All Participants*

		Total		**Treatment Group**		**Control Group**	
		n	%	n	%	n	%
Gender	Women	23	69,7	9	56,3	14	82,4
	Men	10	30,3	7	43,2	3	17,6
Age	20-24	9	27,3	4	25,1	5	5
	25-29	20	60,7	10	62,3	10	10
	30+	4	12	2	12,6	2	2
Education	Graduate	23	69,7	13	81,3	10	58,8
	Bachelor	4	12	1	6,3	3	17,6
	High School	6	18,3	2	12,5	4	23,5
Work	Working	12	36,4	2	12,5	10	58,8
	Not working	21	63,6	14	87,5	7	41,2
Marital Status	Single	27	81,8	2	12,5	4	23,5
	Married	6	18,2	14	87,5	13	76,5
Type of Phobia	Heights	13	39,4	9	56,3	4	23,5
	Animal	13	39,4	5	31,3	8	47,1
	Blood-Injection	7	21,2	2	12,5	5	29,4
Total		33		16		17	

Measurement Tools

Demographic Information Form:

The researchers have devised a questionnaire aimed at collecting data regarding the demographic attributes of the participants, encompassing factors such as age, gender, educational attainment, employment situation, marital status, presence of phobias, history of physical or psychiatric ailments, and patterns of substance utilization.

DSM-5 Severity Measure for Specific Phobia Scale:

The measurement scale employed in the research done by Oztekin et al. (2017) is a self-report questionnaire comprising of ten items. The instrument utilizes a five-point Likert-type scale to assess the frequency of anxiety, fear, and avoidance behaviors demonstrated by individuals in reaction to different situations or stimuli. After the identification of the particular phobia, the participant proceeds to evaluate their dread level by assigning scores

to 10 items on the scale. The mean score, which ranges from 0 to 4, is obtained by adding the individual scores and dividing the amount by 10. The score functions as a measure of the intensity of individuals' phobia symptoms. The internal consistency of the scale was assessed using Cronbach's alpha technique, yielding a value of 0.79. Furthermore, the correlation coefficients between the item scores and the overall scores varied between 0.33 and 0.78, and these correlations were found to be statistically significant at a p-value of less than 0.001 (Oztekin et al., 2017).

Self-Reported Anxiety Level Measurement:

The initial establishment of the notion of subjectively judging stress levels, known as the 'Subjective Units of Distress Scale' (SUDS), can be attributed to Joseph Wolpe in 1969. The scale devised by Wolpe (1969) enables individuals to assess the level of discomfort they encounter, with a numerical range spanning from 0 to 10. This is a measurement methodology that is predicated on the vocal or written declaration of the subject. In the current investigation, the participants evaluated their levels of anxiety during their interaction with the virtual reality exposure program utilizing a numerical scale that spanned from 0 to 10. The assessments indicated above were carried out both before and after the intervention was implemented to evaluate the observed changes in participants' self-reported anxiety levels. The research conducted an evaluation of the discrepancies in scores before and after the introduction of the virtual reality application, in order to ascertain if there was a statistically significant increase or decrease.

Procedure

The procedure of data collection began following the approval of the Social and Human Sciences Publication Ethics Committee of Antalya Bilim University on October 18, 2021. Following the clinical interview, the individuals who voluntarily consented to participate in the study were asked to complete the informed consent form, the demographic information form, and the DSM-5 Severity Measure for Specific Phobia Scale. Following the implementation of the sequential random assignment method, individuals were allocated to certain groups. Subsequently, the groups completed appropriate procedures. The participants in the treatment group underwent a solitary session of virtual reality exposure, while the participants in the control group were assigned to a waiting list. The mean duration of the treatment group's sessions was 45 minutes. The DSM-5 Severity Measure for Specific Phobia Scale was administered to the participants in the therapy group both at the end of each session and at an average interval of three months. On the other hand, the control group demonstrated a reversion to the DSM-5 Severity Measure for Specific Phobia Scale following an average period of three months. After the completion of the final procedures, individuals who were placed on the waiting list were provided with virtual reality exposure therapy as per their explicit request. Nevertheless, it is crucial to acknowledge that the treatment data acquired from these subjects was not included in the analysis undertaken for this specific investigation. Supplemental 1 offers a full account of the methodology utilized in the study of the respective groups.

RESULTS

In the present study, both within-group and between-group repeated measures were conducted to evaluate the SMSPS scores of the treatment group at pre-test, post-test, and follow-up stages. Repeated measures Analysis of Variance (ANOVA) and subsequent post hoc analyses were employed for this purpose. Additionally, an independent samples t-test and paired samples t-tests were applied to compare the change in SMSPS scores between the treatment and control groups, to assess the SUDS scores of the participants in the treatment group before and after the VR sessions, as well as to analyze the SUDS scores during the in-session exposure. The threshold for statistical significance (p) was set at .05 in all analyses. Data processing and statistical computations were executed using IBM SPSS Statistics software, specifically version 28.0.0.0.

To assess the primary hypothesis of the study, SMSPS scores administered to both the treatment and control groups were evaluated through a repeated measures Analysis of Variance (ANOVA), as delineated in Table-2. The analysis revealed statistically significant differences between the groups ($F = 13.349$, $p < .001$). A subsequent post hoc analysis for the groups and measurements ascertained that the treatment group experienced a statistically significant reduction in their SMSPS scores, with a strong effect size being observed ($t = 6.138$, Cohen's $d = 1.284$, $p < .001$). However, it was noted that the initially statistically nonsignificant differences in SMSPS scores between the two groups at the pre-test stage did not evolve into significant differences at the post-test stage. Detailed post hoc analyses are presented in Table-3, while descriptive plots of the groups are depicted in Figure-1, and Raincloud plots are available in Figure-2.

Table-2. *Repeated Measures ANOVA of SMSPS Scores Between Treatment and Control Groups*

Measurement	Group	n	$\bar{x}$	SD
Pre Test	Treatment	16	2.881	0,675
	Control	17	2.459	0,848
Post Test	Treatment	16	1.813	0,930
	Control	17	2.276	0,852

Source of Variation	Sum of Squares	df	Mean Square	F
Repeated Measures	6.451	1	6.451	26.594
Repeated Measures x Groups	3.238	1	3.238	13.349
Residuals	7.520	31	0.243	

Table-3. *Post Hoc Analysis of SMSPS Scores for Treatment and Control Groups*

		Mean Difference	SE	t	Cohen's d	Ptukey
Treatment, Pre-test	Control, Pre-test	.422	.290	1.457	.508	.471
	Treatment, Post-test	1.069	.174	6.138	1.284	<.001
	Control, Post-test	.605	.290	2.087	.727	.174
Control, Pre-test	Treatment, Post-test	.646	.290	2.230	.777	.131
	Control, Post-test	.182	.169	1.079	.219	.704
Treatment, Post-test	Control, Post-test	-.464	.290	-1.601	-.558	.389

Figure-1. *Descriptive Plots Illustrating SMSPS Score Changes Across Treatment and Control Groups Over Time*

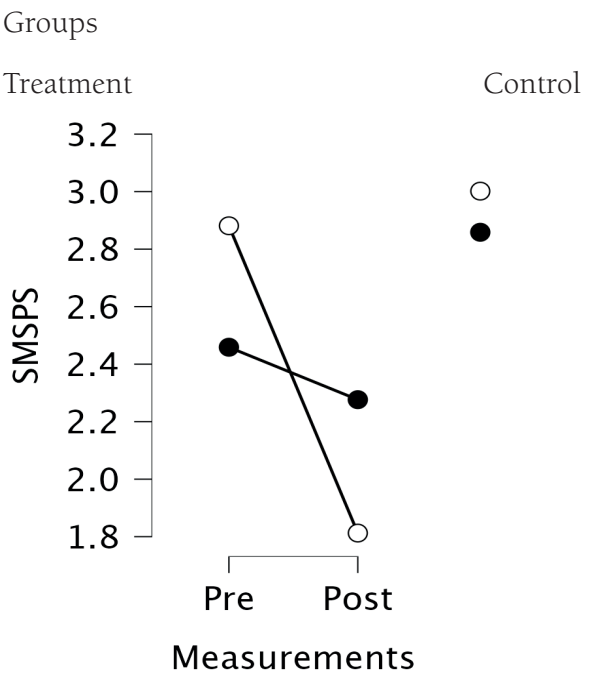
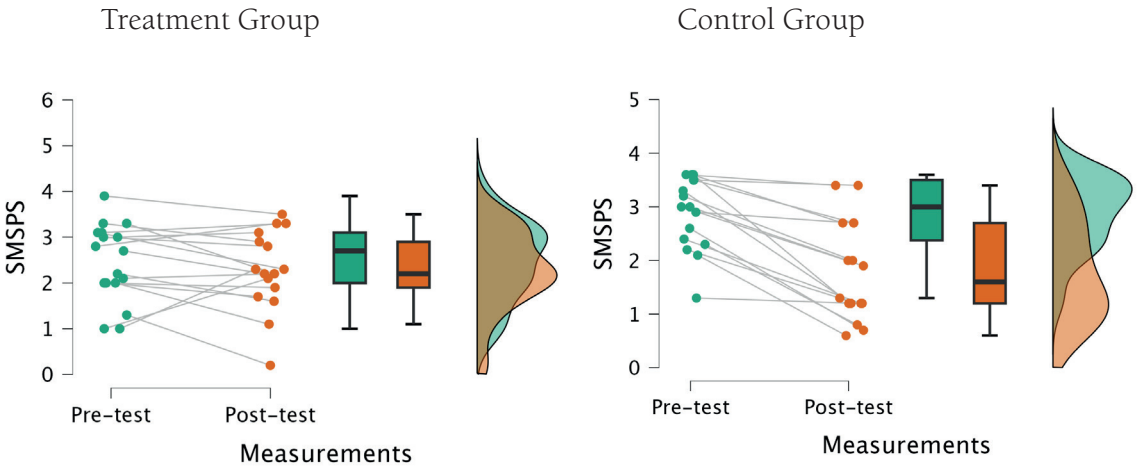


Figure-2. *Raincloud Plots Representing the Distribution of SMSPS Scores for Treatment and Control Groups at Pre-Test and Post-Test Stages*



In the treatment group, paired samples t-test analyses were conducted to assess the SUDS scores of individuals before and after exposure to images related to their feared situation or event; these results are presented in Table-4. The analysis revealed a significant difference in the reported SUDS scores of participants before and after exposure to virtual reality; t(9.299), p < .001, Cohen's d = 2.325. Specifically, the average SUDS score prior to the virtual reality exposure session was 7.50, which subsequently decreased to an average score of 4 following the session.

Table-4. *Comparison of SUD's Obtained From The Treatment Group Before and After The VR Exposure Session*

Measurement	n	$\bar{x}$	SD	t	df	p	Cohen's D
Before VRE	16	7,50	1,789	9,299	15	<.001	2,325
After VRE	16	4	2,477				

Table-5 delineates the analysis of SUDS scores within the treatment group during the virtual reality (VR) session. Measurements were obtained at the initial moment of exposure to the fear-inducing stimulus and immediately prior to terminating the exposure. The results indicated a statistically significant difference in the reported SUD S levels between the onset and conclusion of the exposure session within the treatment group; t(15) = 8.860, p < .001, Cohen's d = 2.215. Specifically, the mean SUDS levels observed at the initiation of the exposure session were 6.5, which decreased to an average score of 2.69 by the end of the exposure.

Table-5. *T-Test Comparison of SUD Scores Obtained During the Virtual Reality Exposure Session*

Measurement	n	$\bar{x}$	SD	t	df	p	Cohen's D
At the beginning of exposure	16	6,5	1,826	8,860	15	<.001	2,215
At the end of exposure	16	2,69	1,580				

Moreover, the evaluation of the SMSPS scores at three distinct time points—pre-intervention (pre-test), immediate post-intervention (post-test), and at a designated follow-up—was executed via a repeated measures Analysis of Variance (ANOVA), owing to the existence of three interrelated variables (Table-6). The data disclosed a statistically meaningful variation in SMSPS scores across the pre-test, post-test, and follow-up assessments, substantiated by an F-statistic of 2.26 and a p-value less than .01. The effect size for this variation, as quantified by eta-squared (η^2), was substantial at .476. A comparative analysis of the mean scores revealed a marked reduction from the pre-test ($\bar{x}$ = 2.914) to the post-test ($\bar{x}$ = 1.88) and the follow-up ($\bar{x}$ = 1.914) evaluations. The results demonstrated a statistically significant divergence between pre-test and post-test scores (p < .001); however, no statistically meaningful difference was detected between post-test and follow-up scores (p > .05).

Table-6. *ANOVA Analysis of Repetitive Measurements of SMSPS Pre-Test, Post-Test, and Follow-Up Test Scores in the Treatment Group*

Measurement	n	$\bar{x}$	SD
Pre Test	14	2,914	0,706
Post Test	14	1,879	0,956
Follow-Up Test	14	1,914	0,737

Source of Variation	Sum of Squares	df	Mean Square	F	p	η2	Significant Difference*
Between subjects	14,763	13	1,136				
Measurement	9,679	2	4,839	11,809	<.001	0,476	1-2. (p=.000) 1-3. (p=.000) 2-3. (p=1.00)
Error	10,655	26	0,410				
Total	35,097	41					

*1: Pre Test, 2: Post Test, 3: Follow-Up Test

Utilizing a quantitative approach, the investigators conducted a comparative analysis of the change in SMSPS scores from the pre-test to the post-test stages within both the treatment and control cohorts, as delineated in Table-7. The empirical analysis revealed statistically significant differences between the changes in SMSPS scores among members of the treatment and control groups. A t-test was conducted with 31 degrees of freedom (t(31)), yielding a p-value below the conventional alpha level of .001. Consequently, the observed difference was deemed statistically significant. The effect size, denoted by Cohen's d, was calculated to be 1.273, signifying a large effect size according to Cohen's conventional categorizations. In terms of mean change in scores, the treatment group displayed a notably elevated mean ($\bar{x}$ = 1.069) in contrast to a more modest mean change ($\bar{x}$ = 0.1824) observed in the control group.

Table-7. *Comparative Analysis of Changes in SMSPS Scores from Pre-Test to Post-Test for Treatment and Control Groups*

				Levene's Test for Equality of Variances					
Group	n	$\bar{x}$	SD	F	p	t	df	p	Cohen's D
Treatment	16	1,0688	0,70495	0,013	.909	3,654	31	<.001	1,273
Control	17	0,1824	0,68851						

In a detailed empirical investigation, the study analyzed the changes between the treatment group's pre-test and follow-up SMSPS scores compared to the changes in pre-test and post-test scores within the control group, as articulated in Table-8. The statistical analysis revealed discernible discrepancies in the modifications from pre-test to post-test scores across the treatment and control cohorts. The resulting t-statistic (t(29) = 2.850) reached statistical significance with a p-value less than the conventional alpha level of .01. Additionally, the magnitude of the effect size, quantified by Cohen's d, was ascertained to be 1.029. In regard to the mean scores, the treatment group manifested a notably elevated average ($\bar{x}$ = 1.000) in contrast to the more subdued average ($\bar{x}$ = 0.1824) observed in the control group.

Table-8. *Comparative Analysis of Changes in SMSPS Scores from Pre-Test to Post-Test and Follow-Up Among Treatment and Control Groups*

				Levene's Test for Equality of Variances					
Group	n	$\bar{x}$	SD	F	p	t	df	p	Cohen's D
Treatment	14	1,000	0,90893	3,578	.069	2,850	29	.008	1,029
Control	17	0,1824	0,68851						

DISCUSSION

The primary focus of the current research was to empirically evaluate the therapeutic impact of a single-session virtual reality exposure treatment for individuals with specific phobias. Statistical analyses reveal that this one-time intervention significantly mitigated the severity of phobia-related symptoms among the participants in the treatment group, as compared to a control group. Importantly, the reductions in symptom severity were not only immediate but also appeared to be sustained, as evidenced by follow-up assessments conducted over an average interval of three months. However, it should be noted that while there was a significant reduction in SMSPS scores within the treatment group, this change did not yield a significant difference when compared to the control group in post-test assessments. One potential explanation for this discrepancy could be the nature of the single-session intervention. It is conceivable that the observed treatment effects might require multiple sessions to manifest as statistically significant differences in a between-group context. This poses an important question for future research, which could explore the utility of extending the number of virtual reality exposure sessions.

The present study aligns with extant literature confirming the efficacy of virtual reality exposure in treating specific phobias. Similar to the findings of Işıklı et al. (2019), our data indicated a statistically significant decline in fear reactions following a single-session virtual exposure. In line with Clark et al. (2019), we also observed a robust reduction in phobic symptoms. These immediate reductions were not only statistically significant but also sustained over a follow-up period, resonating with the long-term benefits documented by Rothbaum et al. (2002; 2006). Moreover, our study adds nuance to the results of Vogt (2021), who emphasized the importance of multi-timepoint assessments. In our study, the treatment gains were preserved at follow-up, underlining the potential for lasting therapeutic impact.

However, one point of divergence is noteworthy; while our treatment group showed significant reductions in SMSPS scores, this was not reflected in post-test comparisons with the control group. This raises the question of the sufficiency of a single-session intervention, a query that aligns with Emmelkamp et al.'s (2002) finding of sustained benefits over a six-month period after multiple sessions. Our results also parallel those of Michaliszyn et al.

(2010), who noted lasting improvements in arachnophobia symptoms following virtual reality exposure, maintained over a three-month period. The absence of significant post-test differences between our treatment and control groups suggests that more sessions might be needed for the virtual reality exposure therapy to translate into observable differences when compared with non-intervention.

In sum, both the extant literature and the present study underscore the efficacy of virtual reality exposure as a therapeutic modality for treating specific phobias. The immediate and long-term therapeutic gains reported here substantiate this form of treatment. Notably, our study contributes to this body of work by demonstrating the statistically significant amelioration of phobia symptoms following a single-session virtual reality exposure therapy, a finding that aligns with Krijn et al. (2004) who highlighted the advantages of virtual reality over no treatment in individuals with acrophobia.

Our results also offer parallels to the work of Vogt (2021), who found virtual reality exposure to be as effective as in vivo exposure in reducing acrophobia symptoms. However, it is crucial to note that our post-test comparisons between the treatment and control groups did not reveal significant differences, thus suggesting that additional sessions may enhance treatment efficacy—a consideration in line with the results from Garcia-Palacios et al. (2002). In that study, as many as 83% of participants showed clinically significant improvements after receiving virtual reality exposure, compared to those on a waiting list.

Furthermore, our study echoes Michaliszyn et al.'s (2010) findings that both virtual and in vivo exposure outperform a waiting-list condition, with sustained benefits observed over a three-month period. These insights concur with Rothbaum et al.'s (2002; 2006) observations, which emphasized the lasting effects of both virtual and standard exposure therapy in treating aviophobia, with benefits enduring for 6 to 12 months. Finally, our findings also resonate with the work of Uçkun (2019), who found that both hypnotherapy and virtual reality exposure were effective in reducing fear associated with flying, when compared to a control group.

While our data support the use of virtual reality exposure as an efficacious short-term and potentially sustainable treatment option for specific phobias, they also flag the need for multiple treatment sessions to maximize benefits, a factor that calls for further exploration.

This study is not without limitations that warrant careful consideration. Firstly, the absence of an active control group in the experimental design restricts the ability to completely rule out placebo effects. The impact of a single session of virtual reality exposure on the treatment group raises questions about the generalizability of the findings, particularly when our post-test scores between the treatment and control groups showed no significant differences. This could imply the necessity for a multi-session treatment approach to achieve enduring benefits. Secondly, the study population was heterogeneous with respect to the types of phobias presented, which may limit the direct application of our findings to specific phobic conditions. Thirdly, the demographic profile of our sample was skewed towards younger, educated individuals who were predominantly unemployed. While this may enhance the perceived efficacy of the virtual reality treatment due to their comfort with technology, it simultaneously limits the generalizability of our findings to broader demographic groups. Furthermore, the phenomenon of higher resilience among the unemployed partic-

ipants in the treatment group poses another layer of complexity, highlighting the need for additional research to isolate the influence of employment status on treatment outcomes. Lastly, the study was conducted during a period significantly affected by a global pandemic, which could have introduced extraneous variables affecting participant engagement and response. To enhance the validity and applicability of future research, more diversified samples and more rigorous control conditions are recommended.

CONCLUSION

The primary objective of the present research was to empirically evaluate the therapeutic efficacy of a single-session virtual reality exposure treatment for specific phobias. The study employed a two-group experimental design, comprising a treatment group that received the intervention and a control group that did not. The central focus was on ascertaining changes in the degree of fear and severity of phobia symptoms among participants. Rigorous statistical analyses were employed for both within-group and between-group comparisons.

Our findings substantiate that a single session of virtual reality exposure can lead to a significant reduction in the severity of phobia symptoms, in contrast to the control group, which showed no such change. Additionally, this improvement was not only immediate but also maintained over a period of approximately three months in subsequent assessments.

However, the post-test comparisons between the treatment and control groups did not reveal significant differences, highlighting a potential need for multi-session interventions for long-term efficacy. Limitations pertaining to the study's design, heterogeneous sample, and the context of the global pandemic also prompt cautious interpretation of the results.

In summary, the current study lends support to the utility of virtual reality exposure as a promising therapeutic strategy in the treatment of specific phobias, albeit with caveats that warrant further investigation. The sustained benefits observed over a three-month period post-intervention offer particularly encouraging prospects for the integration of virtual reality technologies into clinical practice. Given the limitations and complexities observed, further studies with more diversified samples and rigorous control conditions are essential to corroborate these findings and to expand our understanding of the most effective therapeutic approaches for specific phobias.

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