Journal of Translational Science

Research Article

ISSN: 2059-268X

Virtual reality hypnosis improves sleep quality of first-line medical staff responding to COVID-19

Guo Zhongwei[1]*, Duan Xin[2], Wang Lijuan[1], Zheng Jisheng[1] and Lu Longxi[2]

[1]Department of Psychiatry, Tongde Hospital of Zhejiang Province, Zhejiang 310012, China

[2]Department of Geriatrics, Wuzhongpei Memorial Hospital, Shunde District, Foshan 528333, Guangdong Province, China

[3]Zhejiang Province Center for Disease Control and Prevention, Zhejiang, 310051, China

Abstract

Objective: To explore the effects of a virtual reality hypnosis (VRH) intervention on insomnia among first-line medical staff responding to COVID-19.

Methods: A questionnaire was conducted via a WeChat working group containing 150 first-line medical staff. All group members who felt that their sleep quality had declined received VRH intervention once or twice a week. The Athens Insomnia Scale (AIS) was used to evaluate the effects after 2 weeks of intervention.

Results: Thirty-six participants completed the VRH intervention and returned the questionnaire. Of these, 27 had AIS scores ≥ 6 (objective insomnia), and nine had AIS scores ranging from 1 to 5 (subjective insomnia). At baseline, the total AIS score, the "nocturnal sleep problems" score and the "daytime dysfunction" score were 8.50 [P50], 6.00 [P50] and 2.00 [P50] respectively. After VRH intervention, all three scores were significantly reduced (6.00 [P50] vs 8.50 [P50], $P < 0.05$; 5.00 [P50] vs 6.00 [P50], $P < 0.05$; 1.00 [P50] vs 2.00 [P50], $P < 0.01$; respectively).

Conclusion: The results revealed that a VRH intervention improved sleep quality among first-line medical staff responding to COVID-19.

Introduction

The COVID-19 epidemic is a public health emergency of international concern, owing to its rapid spread, severe harm and complexity of pathogenesis. Wuhan was the first city to be severely affected in the COVID-19 epidemic, and tens of thousands of medical staff provided emergency assistance in the city. Among our team of 150 first-line medical staff from Zhejiang Province, more than a quarter reported a decline in sleep quality [1]. Previous studies have reported that poor sleep impairs occupational function [2] and increases the risk of medical accidents [3,4]. Therefore, it is urgent to improve the sleep quality of front-line medical staff fighting the epidemic.

Hypnosis is considered to be useful for managing sleep disorders [5,6]. However, hypnosis has several limitations, including the time required by clinicians to induce hypnosis, and the cognitive effort required by patients [7]. Virtual reality (VR) is a computer-generated simulation of a three-dimensional environment, providing a realistic and immersive environment tailored to an individual's needs. VR therapies have been reported to be beneficial for some mental disorders [8], including anxiety disorder, depressive disorder, and post-traumatic stress disorder. VR hypnosis (VRH), the combination of VR and hypnosis, involves the application of VR technology to guide the patient through the same steps that would typically be used for inducing hypnosis via an interpersonal process. In VRH, VR replaces many of the stimuli that patients sometimes struggle to imagine via verbal cueing from the therapist [7]. Several previous studies [9-11] reported positive effects of VRH on pain, fatigue, and anxiety.

In the face of the COVID-19 epidemic, medical staff and members of the public in China experienced severe psychological stress, including emotional symptoms, sleep disturbance and fatigue, particularly in Wuhan [12]. A preliminary survey of our team revealed that approximately 25% of team members had poor sleep [1], and some members experienced coexisting emotional symptoms [13]. Team members reported that spiritual relaxation and physical relaxation were their most desired psychological needs [1]. Based on the results of our survey and the advantages of VRH, VRH technology was used as an intervention for treating sleep disorders among our frontline health workers.

Methods

Participants

All participants met the following criteria: coming from 105 hospitals in Zhejiang Province, working on the clinical frontline at Tianyou Hospital (affiliated with the Wuhan University of Science and Technology), and self-isolating after finishing work in the same apartment hotel located 500 meters from Tianyou Hospital. The study was approved by the ethics committee of Tongde Hospital in Zhejiang Province. All participants provided informed consent.

Investigation method

Based on Questionnaire Star technology platform, a questionnaire was designed and distributed to 150 medical staff using the WeChat app. Participants anonymously submitted completed questionnaires

Correspondence to: Guo Zhongwei, Department of Psychiatry, Tongde Hospital of Zhejiang Province, Zhejiang 310012, China, E-mail: guozw1977@aliyun.com

Key words: *COVID-19, medical staff, sleep quality, virtual reality*

Received: July 20, 2020; **Accepted:** August 10, 2020; **Published:** August 14, 2020

online. Participation was completely voluntary and participants received no payment for taking part in the study. The first scale was issued on February 22, 2020, and the second was March 12, 2020. The Athens Insomnia Scale (AIS) [14] was used to assess the severity of sleep disorders. The AIS is an inventory comprising eight items. The first five items assess nocturnal sleep problems (e.g., difficulty in sleep initiation, awakening during the night, early morning awakening), and the remaining three items assess daytime dysfunction caused by insomnia (e.g., overall functioning, sleepiness during the day). Responses were reported on a four-point scale ranging from 0 (no problem at all) to 3 (very serious problem). A total score of ≥ 6 on the eight AIS items indicates objective insomnia. The Patient Health Questionnaire-9 (PHQ-9) [15] depression self-assessment scale was used to assess depression symptoms. The PHQ-9 is a nine-item self-assessment scale rated on a four-point Likert scale; higher scores indicate more severe depression. A total score < 5 indicates no depression and a score ≥ 5 indicates depression.

VRH intervention program

The VRH device (provided by Hangzhou Xinjing Technology Co., Ltd, Zhejiang Province, China.) comprising two parts: an iPad serving as the control terminal, and two VR headsets with head-mounted displays (HMDs). The VR program had three scenarios: a moonlit scene in a lotus pond with corresponding gentle voice speaking ("…Now I want you to pay attention to one of the lotus flowers in front of you. You must pay attention to it… Good… You're tired, every muscle in your body… Longing for sleep…"); hazy scenes of the sea and a moonlit night with corresponding gentle voice speaking ("…Close your eyes so gently that you will listen to what I say with ease and concentration, every word… This gentle flow, gradually transmitted to your lower back, and the breath… So comfortable to sleep, deep, comfortable sleep, in sleep, your body and mind can also feel you absorb the energy of the universe…"); scenes of sea and sky merged into one with a corresponding gentle voice speaking ("Now, please open your eyes and see the sea, beach and sky in front of you… Seeing this wonderful scene, feeling far away from the secular world, your heart gradually becomes peaceful and quiet… Now, you're relaxed from head to toe, and you feel very comfortable, very light pine…").

In the hotel in which the team members were residing, a separate set of rooms was set up as the VRH intervention room, which was quiet, ventilated and met infection control standards. The scene was chosen according to participants' preferences, and the intervention was conducted twice a week in accordance with the participants' schedules. Two participants could undergo the intervention at the same time. The participant lay on a comfortable sofa, covered themselves with clean sheets, put on the HMD, viewed an attractive three-dimensional scene, listened to a voice speaking slow psychological induction language, and gradually relaxed.

Statistical methods

Data were exported from the Questionnaire Star platform and saved in Excel. SPSS 19.0 was used to establish a database for analysis. The measurement data were in accordance with a skewed distribution and were expressed as median (quartile [P50 (P25, P75)]. The Wilcoxon test was used to examine differences of AIS and PHQ-9 before and after VRH intervention. $P < 0.05$ was considered to indicate statistical significance.

Results

General demographic characteristics of participants

The first evaluation was conducted on February 22, 2020, and the VRH intervention treatment was started. The second evaluation was conducted on March 12. Thirty-six participants completed the scale evaluation before and after VRH. There were eight males and 28 females, aged mainly between 31 and 40 years. Almost all participants had undergraduate education or below. At baseline, the AIS score was 8.50 [P50] and the PHQ-9 score was 5.00 [P50] (Tables 1 and 2).

Differences in AIS and PHQ-9 scores before and after VRH intervention

After VRH intervention, the AIS total score and sub item scores decreased significantly (6.00 [P50] vs 8.50 [P50], $P < 0.05$; 5.00 [P50] vs 6.00 [P50], $P < 0.05$; 1.00 [P50] vs 2.00 [P50], $P < 0.01$; respectively). The PHQ-9 score also decreased significantly compared with that before intervention (2.50 [P50] vs 5.00 [P50], $P < 0.01$)

Table 1. General demographic characteristics of participants

Item	Total (n=150)	Poor sleep (n=36)
Gender		
Male	57	8(14.0%)
Female	93	28(30.1%)
Age		
20-30	30	9(30.0%)
31-40	90	23(25.6%)
>40	30	4(13.3%)
Marriage		
Unmarried	38	7(18.4%)
Married	112	29(25.9%)
Education		
Undergraduate or below	130	35(26.9%)
Master's degree or above	20	1(5.0%)
Occupation		
Doctor	40	6(15.0%)
Nurse	97	29(29.9%)
Managerial and technical staff	13	1(7.7%)
Title		
Primary	40	13(32.5%)
Intermediate	80	21(26.3%)
Senior	30	2(6.6%)

Table 2. Differences in AIS and PHQ-9 scores before and after VRH intervention

Item	Before VRH (n=36)	After VRH (n=36)	z	*P*
AIS				
Total	8.50(5.25~11.00)	6.00(4.00~8.00)	-2.441	0.015
nocturnal sleep problems	6.00(5.00~9.00)	5.00(3.25~6.75)	-2.075	0.038
daytime dysfunction	2.00(1.00~3.00)	1.00(0.00~2.00)	-2.748	0.006
PHQ-9	5.00(2.25~7.00)	2.50(0.25~6.00)	-2.544	0.011

Discussion

To the best of our knowledge, this is the first report of VRH technology being used in a psychological stress intervention among first-line medical staff responding to COVID-19. Our results revealed that VRH technology quickly improved sleep quality among medical staff. Several possible reasons for these findings are discussed below.

First, although what participants see and hear in VR scenarios is distinct from the real environment, it still constitutes a relatively realistic perception. Therefore, participants were able to enter directly into the virtual scene without having to imagine themselves in it and felt free and accepted implied reality. Hypnosis can be used to directly communicate with the subconscious mind, and to subconsciously input new instructions. VR imagery may enable greater engagement compared with traditional hypnosis methods [16] and participants in one study expressed a high degree of satisfaction with the relaxation they experienced in the VR intervention [17].

Second, VRH can reduce negative emotional symptoms. Previous studies reported that VR exposure treatment effectively reduced participants' fear of storms [18], and that VR decreased anxiety levels among deployed military medics [19]. Additionally, using electroencephalography, Tarrant *et al.* [20] reported that VR intervention reduced broadband Beta activity in the anterior cingulate cortex, consistent with a physiological reduction of anxiety, further supporting the therapeutic potential of VR for anxiety management and stress reduction programs. Previous studies also demonstrated that hypnosis intervention can reduce depressive symptoms during pregnancy [21] and postpartum [22]. Depression and anxiety are associated with various sleep-related issues [23]. The improvement of mood may be an important factor in improving sleep quality, and depression improved after VRH in the current study.

Third, both overwork and wearing tight protective clothing can lead to chronic fatigue and exhaustion, which are reported to be related to sleep disturbance [24]. Gao *et al.* [25] employed VR to investigate physiological responses, psychological responses, and individual preferences for different urban environments. The results revealed that participants experienced the greatest physiological stress restoration when asked to close their eyes for relaxation, and presentation of participants' preferred scene VR provided both objective and subjective relaxation. Anderson *et al.* [26] reported that VR can provide relaxation for people living in isolated confined environments, particularly when matched to personal preferences. Therefore, it may be necessary for participants to choose their own preferred scenarios to relax and improve their sleep.

Importantly, appropriate VRH technology should be selected for providing psychological stress intervention for front-line medical staff during the COVID-19 epidemic. This technology could play an important role in emergency response teams. First, the VRH intervention substantially reduces the required contact time between psychological professionals and team members, thus reducing the risk of spreading disease. Second, this technique can benefit a variety of stress symptoms at the same time, such as relieving fatigue by relaxing and improving negative emotions besides sleep quality, and these symptoms are impossible for an unassisted psychologist to treat at the same time. Third, participants may prefer to relax as a "healthy" person through VRH rather than undergoing psychotherapy as a psychologically "unhealthy" person; thus, VRH may provide a bridge of respect between participants with stress symptoms and medical staff.

The current study involved several limitations that should be considered. First, there was no comparison with other interventions. In our 150-member team, there was only one psychological professional. Thus, it is unrealistic to implement other methods at the same time. Moreover, we were unable to compare our sample with other teams because there is no unified command or design [27]. Second, several members of the team had direct communication with psychological professional through the mobile WeChat app, potentially having a positive effect on their cognitive stress responses.

Conclusion

Overall, in sudden epidemic situations, medical staff are always at the forefront, which inevitably leads to stress reactions. Thus, finding quick and effective intervention methods is critical. VRH can improve the sleep quality of medical staff, reduce negative emotions and relieve fatigue. Technology-assisted therapies provide a means of psychological intervention for treating stress under special circumstances.

Acknowledgments

We thank Benjamin Knight, MSc., from Liwen Bianji, Edanz Editing China (www.liwenbianji.cn/ac), for editing the English text of a draft of this manuscript.

Conflicts of interest

None

Author statement contributors

Guo Zhongwei conceptualized and designed the study, drafted the initial manuscriptand revised, and approved the final manuscript as submitted. Wang Lijuan designed the data collection instruments. Zheng Jisheng and Lu longxi collected data. Duan Xin participated in the discussion.

References

1. Xiaozheng L, Lijuan W, Jisheng Z (2020) Investigation of Sleep Quality of 150 First-Line Medical Staff Responding to COVID-19. *Int J Psychiatr Res* 3: 1-6.
2. Xie Z, Chen F, Li WA, Geng X, Li C, et al. (2017) A review of sleep disorders and melatonin. *Neurological Research* 39: 559-565.
3. Arimura M, Imai M, Okawa M, Fujimura T, Yamada N, et al. (2010) Sleep, mental health status, and medical errors among hospital nurses in Japan. *Industrial Health* 48: 811-817.
4. Scott LD, Arslanian-Engoren C, Engoren MC (2014) Association of sleep and fatigue with decision regret among critical care nurses. American journal of critical care: an official publication. *American Association of Critical-Care Nurses* 23: 13-23. [Crossref]

5. Becker PM (2015) Hypnosis in the Management of Sleep Disorders. *Sleep Medicine Clinics* 10: 85-92. [Crossref]

6. Anbar RD, Slothower MP (2006) Hypnosis for treatment of insomnia in school-age children: a retrospective chart review. *BMC Pediatrics* 6: 23. [Crossref]

7. Askay SW, Patterson DR, Sharar SR (2009) Virtual reality hypnosis. Contemporary hypnosis: *The Journal of the British Society of Experimental and Clinical Hypnosis* 26: 40-47.

8. Kim S, Kim E (2020) The Use of Virtual Reality in Psychiatry: A Review. Soa--ch'ongsonyon chongsin uihak. *Journal of Child & Adolescent Psychiatry* 31: 26-32.

9. Enea V, Dafinoiu I, Opriş D, David D (2014) Effects of hypnotic analgesia and virtual reality on the reduction of experimental pain among high and low hypnotizables. *The International Journal of Clinical and Experimental Hypnosis* 62: 360-377. [Crossref]

10. Patterson DR, Jensen MP, Wiechman SA, Sharar SR (2010) Virtual reality hypnosis for pain associated with recovery from physical trauma. *The International Journal of Clinical and Experimental Hypnosis* 58: 288-300.

11. Rousseaux F, Faymonville ME, Nyssen AS, Dardenne N, Ledoux D, et al. (2020) Can hypnosis and virtual reality reduce anxiety, pain and fatigue among patients who undergo cardiac surgery: a randomised controlled trial. *Trials* 21: 330.

12. Kang L, Li Y, Hu S, Chen M, Yang C, et al. (2020) The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. The lancet. *Psychiatry* 7: e14. [Crossref]

13. Lijuan W, Longxi L, Jisheng Z, Xiaozheng L, Ruichen Z, et al. (2020) Analytcal Report of Psychological Status of 130 Frontline Medical Staff Dealing With COVID-19. *Int J Depress Anxiety* 3: 021.

14. Soldatos CR, Dikeos DG, Paparrigopoulos TJ (2000) Athens Insomnia Scale: validation of an instrument based on ICD-10 criteria. *Journal of Psychosomatic Research* 48: 555-560.

15. Wang W (2014) Reliability and validity of the Chinese version of the Patient Health Questionnaire (PHQ-9) in the general population. *General Hospital Psychiatry* 36: 539-544.

16. Thompson T, Steffert T, Steed A, Gruzelier J (2011) A randomized controlled trial of the effects of hypnosis with 3-D virtual reality animation on tiredness, mood, and salivary cortisol. *The International Journal of Clinical and Experimental Hypnosis* 59: 122-142. [Crossref]

17. Nooner AK (2016) Using Relaxation and Guided Imagery to Address Pain, Fatigue, and Sleep Disturbances: A Pilot Study. *Clinical Journal of Oncology Nursing* 20: 547-552.

18. Lima J (2018) Treatment of Storm Fears Using Virtual Reality and Progressive Muscle Relaxation. *Behavioural and Cognitive Psychotherapy* 46: 251-256.

19. Stetz MC (2011) The effectiveness of technology-enhanced relaxation techniques for military medical warriors. *Military Medicine* 176: 1065-1070.

20. Tarrant J (2018) Virtual Reality for Anxiety Reduction Demonstrated by Quantitative EEG: A Pilot Study. *Frontiers in Psychology* 9: 1280. [Crossref]

21. Beevi Z (2016) Impact of Hypnosis Intervention in Alleviating Psychological and Physical Symptoms During Pregnancy. *The American Journal of Clinical Hypnosis* 58: 368-382.

22. Beevi Z (2019) The Effectiveness of Hypnosis Intervention in Alleviating Postpartum Psychological Symptoms. *The American Journal of Clinical Hypnosis* 61: 409-425.

23. Yu J (2016) Sleep correlates of depression and anxiety in an elderly Asian population. Psychogeriatrics: *The Official Journal of The Japanese Psychogeriatric Society* 16: 191-195. [Crossref]

24. Grossi G (2015) Stress-related exhaustion disorder--clinical manifestation of burnout? A review of assessment methods, sleep impairments, cognitive disturbances, and neuro-biological and physiological changes in clinical burnout. *Scandinavian Journal of Psychology* 56: 626-636.

25. Gao T (2019) Exploring Psychophysiological Restoration and Individual Preference in the Different Environments Based on Virtual Reality. *International Journal of Environmental Research and Public Health* 16: 3102.

26. Anderson AP (2017) Relaxation with Immersive Natural Scenes Presented Using Virtual Reality. *Aerospace Medicine and Human Performance* 88: 520-526.

27. Yao H (2020) Rethinking online mental health services in China during the COVID-19 epidemic. *Asian Journal of Psychiatry* 50: 102015. [Crossref]