

Virtual Reality for Smoking Cessation: A Case Report

Irene PERICOT-VALVERDE^a, Olaya GARCÍA-RODRÍGUEZ^{b1}, Marta FERRER-GARCÍA^a, Roberto SECADES-VILLA^b, José GUTIÉRREZ-MALDONADO^a

^aUniversity of Barcelona, Spain

^bUniversity of Oviedo, Spain

Abstract. This study presents a case report describing the use of Virtual Stop Smoking (VSS) program. The VSS includes a multicomponent behavioural approach and a Virtual Reality graded exposure technique. The subject was a 22-year-old female who smoked 20 cigarettes per day. Six weekly 90-minute sessions were conducted once a week over a 6-week period. Measures of efficacy included the number of cigarettes smoked, breath carbon monoxide levels, and self-reported subjective craving. The results obtained supported the efficacy of VSS for smoking cessation.

Keywords. Virtual Reality, cue exposure treatment, smoking.

Introduction

Smoking behaviour is strongly associated with specific stimuli and contexts^{1,2}. Exposure to smoking-related cues can elicit tobacco craving and trigger cigarette use³⁻⁵. Relapse prevention training (RPT) and cue exposure treatment (CET) may be two effective techniques for smoking cessation treatments⁶. RPT focuses on enhancing patients' skills in order to prevent relapse after quitting smoking. CET exposes the smoker to drug-related cues aimed to reduce cue and context reactivity by extinction processes. As a treatment for addictive behaviours, CET has various modes of exposure, one of the most innovative being the use of Virtual Reality (VR)⁷.

The aim of the present study was to test the Virtual Stop Smoking (VSS) program; a multicomponent behavioural treatment for smoking cessation⁸ that integrates a module of VR graded exposure⁹ in a 22-year old female smoker.

1. Method

1.1 Participant

The subject, recruited through advertisements in Barcelona, Spain, was a 22-year-old female who had smoked an average of 20 cigarettes per day over the previous seven years. She reported health-related reasons as her motivation for quitting. She had

¹ Olaya García-Rodríguez. Department of Psychology. University of Oviedo. Plaza Feijoo s/n. 33003. Oviedo, Spain. E-mail: garciaolaya@uniovi.es.

attempted to stop smoking twice in the past, but she had been unable to maintain abstinence for more than a couple of days.

1.2 Instruments and measures

During the intake session (Table 1) the patient completed a questionnaire on her patterns and history of smoking, the Structured Clinical Interview (SCID) for the diagnosis of nicotine dependence, the Fagerström Test for Nicotine Dependence (FTND), and the Nicotine Dependence Syndrome Scale (NDSS). Breath carbon monoxide (CO) levels were assessed in the intake session and at each treatment session. Eight previously tested virtual environments⁴ were used in the study. Self-reported subjective craving was evaluated on a visual analogue scale (VAS) from 0 to 100, build-in the virtual environments. Environments were presented with a virtual reality eyewear Vuzix iWear VR920 with 3 degree of freedom head tracker.

Measures	
Age at onset of smoking	17
Cigarettes per day	20
Nicotine per cigarette (mg)	.8
CO	10
SCID	5
FTND	4

Table 1. Intake assessment results.

1.3 Treatment

The Virtual Stop Smoking (VSS) treatment involved one weekly session (90 minutes long) for six consecutive weeks. The VSS included: contract, self-monitoring, graphic representation of cigarettes, nicotine and cigarette fading, information about smoking, stimulus control procedures, strategies for relapse prevention, problem solving procedures, strategies to cope with withdrawal syndrome, physiological CO feedback, and virtual reality exposure (from the second to the sixth session).

The virtual environments were selected according to a hierarchy drafted during the first session and based on self-reported craving levels for each of the eight situations. Tables 1 and Table 2 show the results of the intake assessment and the specific hierarchy for the subject. On the basis of this hierarchy (Table 2), the five environments that trigger the highest levels of craving were selected for the graded exposure.

VR environments	Craving
Being in a pub	10*
Watching TV at night	9*
Lunch at restaurant	8*
Lunch at home	7*
Coffee in a café	6*
Waiting in the street	5
Having breakfast	4
Museum	0

Table 2. Hierarchy for virtual exposure.

2. Results

The patient successfully quit smoking during treatment. She stopped smoking at session 4 and then maintained abstinence throughout the rest of the intervention. Up to treatment session 4, she gradually decreased the number of cigarettes smoked. The gradual decrease was also reflected in CO levels (Figure 1).

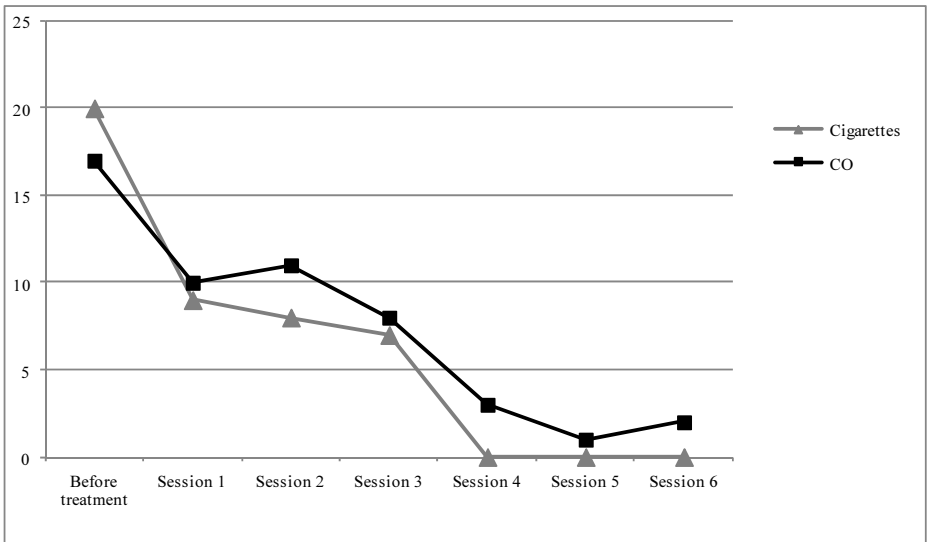


Figure 1. CO levels and number of cigarettes before and during the treatment.

Table 3 shows the evolution of craving scores during each session of exposure. Baseline craving levels were recorded before each session. Extinction was achieved when the patient's craving ratings dropped to baseline levels or lower or baseline levels + 15% when exposure exceeded 20 minutes.

VR environments	Session	Baseline score	Max score during exposure	Extinction score	Duration of exposure (min)
Waiting in the street	2	32	50	35	22
Coffee in a café	3	30	56	1	14
Lunch at home	4	24	31	21	10
Lunch at restaurant	5	31	54	22	14
Watching TV at night	6	1	11	1	12

Table 3. Graded virtual exposure and craving levels

3. Conclusions

This study reflects how a cue exposure treatment approach can be individualized based on the patient's needs.

The patient achieved and maintained abstinence during the treatment. The number of cigarettes smoked, CO levels and self-reported craving decreased as the sessions progressed.

The post-treatment results suggest that virtual reality environments may improve CET for tobacco dependence. Nevertheless, clinical trials with a more robust design and longer follow-ups are necessary to determine the efficacy of this treatment program.

Limitations of use case studies are well known¹⁰. In research, case studies involve only a single person or just a few, and so it may not be possible to generalize the results to other populations. Sometimes, replication is impossible and the reliability of measures is too low.

This study is an effective example of the use of virtual reality in smoking cessation programs. The results should be interpreted with caution; nevertheless, this is the first study to show the usefulness of integrating VR in a multicomponent behavioural treatment for smoking cessation, and for this reason more controlled and larger clinical trials using VSS should now be carried out.

Acknowledgements

This work was supported by a Ministry of Science and Innovation (MICIIN) grant from the Spanish Government, Ref. PSI2008-05938/PSIC.

References

- [1] B.L. Carter, S.T. Tiffany, Meta-analysis of cue-reactivity in addiction research, *Addiction* **94** (1999), 327-340.
- [2] O. García-Rodríguez, M. Ferrer-García, I. Pericot-Valverde, J. Gutiérrez-Maldonado, R. Secades-Villa, J.L. Carballo, Identifying specific cues and contexts related to smoking craving for the development of effective virtual environments, *CyberPsychology, Behaviour and social networking* **14** (2011), 91-97.
- [3] D.C. Drummond, S.T. Tiffany, S. Glautier, B. Remington, *Addictive behaviour. Cue exposure theory and practice*, Chichester: John Wiley & Sons, 1995.
- [4] O. García-Rodríguez, I. Pericot-Valverde, J. Gutiérrez-Maldonado, M. Ferrer-García, R. Secades-Villa, Validation of smoking-related virtual environments for cue exposure therapy, *Addictive Behaviors*, (in press).
- [5] S.B. Baumann and M.A. Sayette, Smoking cues in a virtual world provoke craving in cigarette smokers, *Psychology of Addictive Behaviors* **20** (2006), 484-489.
- [6] D.C. Drummond, and S.T. Tiffany, S. Glautier, B. Remington, *Addictive behaviour. Cue exposure theory and practice*, John Wiley & Sons, Chichester, 1995.
- [7] O. García-Rodríguez, I. Pericot-Valverde, J. Gutierrez Maldonado, M. Ferrer García, La Realidad Virtual como estrategia para la mejora de los tratamientos del tabaquismo [Virtual Reality as a strategy to improve smoking treatment], *Health and Addictions* **9** (2009), 39-55
- [8] E. Becoña Iglesias, *Programa para dejar de fumar [Smoking cessation program]*, Nova Galicia Edicions, Vigo, 2007.
- [9] O. García-Rodríguez, I. Pericot-Valverde, J. Gutiérrez-Maldonado, G. García-Fernández, M. Ferrer-García, R. Secades-Villa, Virtual Stop Smoking. Exposición a través de la realidad virtual en un programa para dejar de fumar, *Adicciones* **23** (2011), 198.
- [10] N. Hayes, *Doing Psychological Research: gathering and analysing data*, Open University Press, Buckingham, 2000.