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CARL: A LabVIEW 3 computer program for conducting exposure therapy for the treatment of dental injection fear

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Abstract

This paper describes CARL (Computer Assisted Relaxation Learning), a computerized, exposure-based therapy program for the treatment of dental injection fear. The CARL program operates primarily in two different modes; *in vitro*, which presents a video-taped exposure hierarchy, and *in vivo*, which presents scripts for a dentist or hygienist to use while working with a subject. Two additional modes are used to train subjects to use the program and to administer behavioral assessment tests. The program contains five different modules, which function to register a subject, train subjects to use physical and cognitive relaxation techniques, deliver an exposure hierarchy, question subjects about the helpfulness of each of the therapy components, and test for memory effects of anxiolytic medication. Nine subjects have completed the CARL therapy program and 1-yr follow-up as participants in a placebo-controlled clinical trial examining the effects of alprazolam on exposure therapy for dental injection phobia. All nine subjects were able to receive two dental injections, and all reduced their general fear of dental injections. Initial results therefore indicate that the CARL program successfully reduces dental injection fear.
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The therapy most commonly used in the treatment of simple phobia is controlled exposure (Carlson et al., 1988). Typically, the procedure has been to expose the patient to increasingly anxiety-provoking situations, but at a gradual pace so that the anxiety that is experienced does

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not become overwhelming. Such basic exposure therapy has also been successfully combined with relaxation training, self-efficacy training, and modification of negative cognitions (Williams et al., 1985; Wolpe, 1982; Meichenbaum, 1977).

Early successes with tape-recorded voice and video-tape exposure therapy (Berggren and Carlsson, 1984; Marks, 1975) have encouraged the recent introduction of computer-guided exposure therapy. In the earliest versions of computerized therapy, computers were used as substitute therapists. Computers helped the patient create an exposure hierarchy, instructed him/her to imagine the hierarchy situations, provided relaxation instruction, assigned homework tasks and collected information on how much anxiety was experienced as each task was accomplished (Carr et al., 1988; Chandler et al., 1988; Wilson et al., 1991). Recent advances in technology, however, have expanded the usefulness of computers in exposure-based therapy. Rothbaum and colleagues (Rothbaum et al., 1995) have successfully treated acrophobia using 'virtual reality' to create gradual exposure to increasing heights. Subjects in this study were first exposed to a virtual footbridge 7 m above the water, and gradually worked through a variety of virtual situations culminating in a virtual glass elevator, which rose 49 floors to a height of 147 m above a virtual street. The investigators report significant reductions in anxiety, avoidance, and attitudes towards heights compared with a wait-list control 8 weeks following virtual reality therapy. Rothbaum's group is now expanding this technology to the treatment of fear of flying (Rothbaum et al., 1996). While such sophisticated computerized exposure may not be required to reduce patient fear, one group has reported that degraded images of spiders presented on a computer screen were not sufficient to reduce spider fear in two young children (Nelissen et al., 1995). Virtual reality exposure therapy for spider phobia has been reported to be more successful (Carlin et al., 1997).

This paper describes a computerized, exposure-based therapy program for the treatment of dental injection fear. The effectiveness of exposure-based therapy for the treatment of dental fear has been well-documented (Gale and Ayer, 1969; Shaw and Thoresen, 1974; Klepac, 1975; Gatchel, 1980; Berggren and Linde, 1984). Semi-automated, video-tape based therapy has also been shown to be helpful in treating dental phobia (Berggren and Carlsson, 1984). This particular program was designed as part of a clinical trial to assess the efficacy of combining a short-acting anxiolytic agent, alprazolam, with exposure therapy for dental injection fear. The advantages of using a computer in this situation include; standardizing patient treatment, precisely controlling exposure duration and content, facilitating data collection (self-reported anxiety levels, heart rate data, etc.), and minimizing the need for therapist contact with the patients.

1. Hardware configuration

The system is designed around a multimedia-configured Power Macintosh 8100/110. This 110-MHz machine has been upgraded to 40 MB RAM and 4 GB disk capacity. The operator has a MultiSync 17" color monitor, extended keyboard and mouse. The operator's monitor is normally out of view of the *S*. The *S* views a second, MultiSync 15" color monitor. This monitor is configured as the second Macintosh screen and is mounted on a movable platform over a dental chair, which is used by the *S*. The 15" monitor is provided with full frame rate/full

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