Mechanisms of Action for Latent Inhibition of Dental Fear in Humans

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Introduction

Latent inhibition (LI) is a learning process where repeated exposure to a neutral cue without any aversive stimulus leads to a reduced fear response when the cue is later paired with an aversive stimulus. This mechanism can be applied to pediatric dental patients to mitigate dental fear, which is prevalent in this population.

Hall and Rodriguez's model of latent inhibition suggests that novel stimuli initially attract attention due to their potential relevance to negative events. For instance, a child's first painful dental visit can create a negative association with dental visits. However, if the child is repeatedly exposed to neutral dental visits (e.g., painless check-ups) before experiencing any painful procedures, the association between dental visits and negative outcomes is weakened. This process reduces the child's attention to the dental visit as a potential threat, thereby blunting the fear response.

Hypothesis

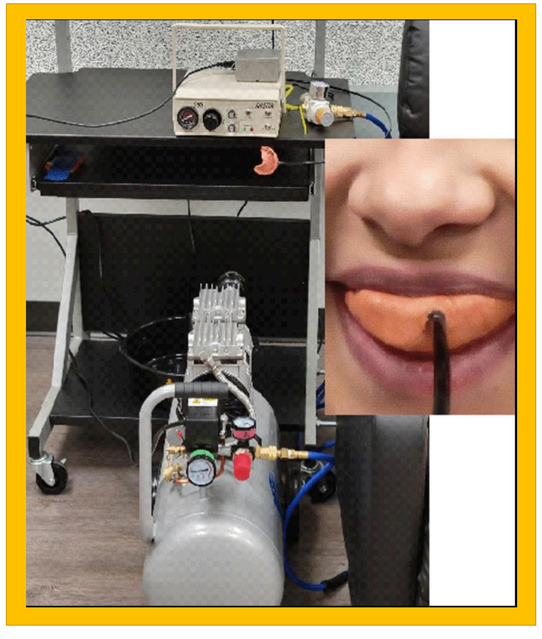
1. A larger dose of pre-exposure (24 pre-exposures with one alien), compared to a smaller dose (12 pre-exposures with one alien), will strengthen the LI of conditioned fear. [7]
2. Compounding the pre-exposure (introducing a second novel alien) will strengthen the LI of conditioned fear. [7]
3. Spaced pre-exposure sessions (all exposures in one session vs returning one week later for the other half of the sessions), compared to no spacing, will strengthen LI of conditioned fear. [8]
4. Multiple context pre-exposure (half of pre-exposure in a light tan room, the other half in a dark green room) as compared to pre-exposure in a single context, will enhance LI of conditioned fear. [8]

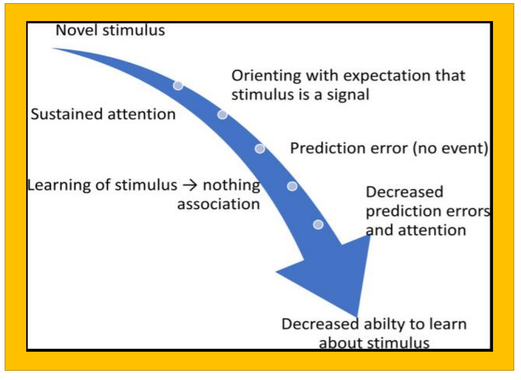
Material & Methods

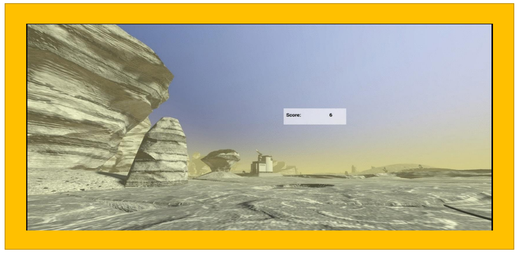
Methods are extracted from Seligman et al [6]. The experimental task takes place in an immersive virtual reality simulation of an alien planet. Participants play a game collecting fuel canisters to power their spaceship and return to Earth. They are told that some interactions may feel slightly uncomfortable, helping to simulate dental visit experiences and provide context for wearing the dental mouthpiece during the task.

A constructed mouthpiece will be used during the experimental task for all study sessions. A 60 psi puff of air will be delivered to an anterior maxillary central incisor through the mouthpiece with a 3/16” tube that will receive pressurized air. Participants will be told that the mouthpiece will allow them to experience the diverse sensations that humans can have on the alien planet. The air puff serves as the unconditioned stimulus, or surprise stimulus.[6]

Seligman et al. also measured fear learning three different ways: subjectively, behaviorally, and psychologically. Subjective fear learning was measured by participants rating their relaxation or anxiety after the onset of different alien stimuli but before the dental startle. These ratings will be made in a virtual reality environment using handheld controllers. Behavioral fear learning was measured by: (1) the number of times participants approach the alien to obtain a "fuel cell", and (2) the shortest distance between participants and these aliens during each trial. Physiological fear learning was measured by recording skin conductance responses using a Biopac MP160 system with a wireless BioNomadix module. Increased skin conductance indicated increased fear. [6]







Purpose

No previous studies have created a protocol to manipulate LI through frequency of exposure, time in between exposures, and context of exposures. Our study aims to test and understand how to strengthen latent inhibition by increasing pre-exposure dose and introducing novel pre-exposure contexts to enhance latent inhibition. Study protocols designed by psychologists, Geers and Seligman, investigated pre-exposure mechanisms of latent inhibition in terms of dental fear. [6, 7, 8.]

Seligman et al outlined a framework for pre-exposure and fear learning investigation. [6] Geers et al1 investigated the effects of pre-exposure spacing and setting [7]. Geers et al2 investigated the effects of pre-exposure dose and novelty [8].

Discussion

Implementing latent inhibition in pediatric dentistry involves scheduling early and regular dental check-ups before any invasive procedures are needed. These early visits serve as neutral exposures, helping children become familiar with the dental environment without associating it with pain. This approach can desensitize children to future fear-provoking experiences. Establishing care at a dental home can provide opportunities for anticipatory guidance and early detection of dental pathology, therefore reducing the need for invasive treatments.

Results and Conclusion

Data is currently in collection. No results can be made at this time. No conclusions can be made at this time.

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My contribution

- The material choice of the mouthpiece has been designed to be easy to reproduce by a non-dentist. Detailed powerpoint presentations were designed to aid in research assistant training in creating mouthpieces for each participant. Training sessions and competency exams were designed by dentists to ensure the research assistant is qualified to fabricate the mouthpiece consistently. Research assistants must: watch training videos, attend a practice session in person or online, practice the fabrication, and finally pass a competency exam with the study dentist. The mouthpiece will be fabricated in visit 1 using 3 M™ STD Vinyl Polysiloxane Express Putty.