Biting behavior induced by acute stress in the rat during experimental tooth movement

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Biting behavior and emotional stress are directly related in rats [1]. In humans, likewise, emotional stress is known to induce parafunctional oral behaviors such as bruxism, tooth clenching, and nail biting. This phenomenon is well documented, but its mechanism is poorly understood. Would there be a purpose for the development of these stereotypies? One explanation is that such behaviors would be sought in order to counteract environmental stimuli. Indeed, biting is known to help alleviate the stress response in rats [2-4]. However, it is not clear what role the sensory experience from tooth contact plays in emotional experience in general and stress in particular. For example, the response to pain, a sensation with strong emotional component, includes not only stimulus avoidance, but also behaviors that actively inhibit pain, such as rubbing or licking the affected area. It is conceivable that stressed animals would seek the pleasurable or familiar sensation of tooth contact as a means to reduce stress. To address this question, we measured the biting behavior in rats during mechanical tooth movement and compared to that of naïve controls. Previous studies have shown that periodontal sensation is reduced during mechanical tooth movement [5].

Under barbiturate anesthesia, Wistar albino rats weighing 150 g had orthodontic springs placed on their maxillary incisors. The springs were made of Co-Cr wire with 0.4 mm in diameter and delivered a force of about 40 g in the lateral direction. In the same procedure, electromyography (EMG) electrodes were implanted into the masseter muscle on one side. Control rats went through a sham procedure, and also received EMG electrodes. EMG electrodes consisted of two stainless steel wires insulated except for 3 mm at the tip. One end of the wires was passed through the muscle 3 mm away from each other; the other end was passed from under the skin toward the top of the head and soldered to a connector, which was fixed to the skull with dental cement. After 24 h, the rats' response to acute restraint stress was recorded. The rats were placed inside a restraining cylinder with an opening at the snout for 30 minutes, and after that, biting behavior was measured by the masseter muscle EMG and by video monitoring of the freely-moving animals for 5 minutes. During recordings the animal was connected to the EMG apparatus by a flexible cable attached to its head. The cable was kept elevated to avoid entanglement without restraining animal movement. The EMG signal was passed through a differential amplifier and stored in a computer. Biting activity was estimated on video by observing the rapid bulging movement of the eyes and the movements of the cheeks and whiskers. The duration of these movements was measured with a stopwatch. EMG activity was analyzed by counting the number of bursts in the recorded waveform.

As a result, after restraint stress biting behavior was similar between tooth movement and control rats, both in duration and number of strokes. Biting behavior is a reliable parameter of stress response in rats. The data indicate that the sensory inputs from the teeth are not essential to the expression of stress-induced biting behavior. It is suggested that biting behavior is a stereotypical component of the stress response, but not necessarily a behavior sought with the purpose of relieving stress through a comforting sensory experience.

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