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BRIEF REPORT: The Effects of Noncontingent Reinforcement with Alternative Oral Stimulation in the Treatment of Rumination

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Abstract

We evaluated the effects of noncontingent reinforcement on rumination exhibited by a young boy with autism. Specifically, the percentage of time the boy engaged in post-meal rumination was measured under conditions when he did and did not have noncontingent, continuous access to alternative oral stimulation via a chew toy. The results show that post-meal rumination was lower when the participant had noncontingent access to a chew toy than during baseline conditions (i.e., when the toy was absent). The results of a follow-up assessment suggest that the chew toy continued to compete with rumination after 8 months of intervention. These results are briefly discussed in terms of functionally matched stimulation and motivating operations.

Rumination, the chronic regurgitation, rechewing, and reswallowing of previously ingested food, occurs most often in populations of individuals with developmental disabilities (Rast, Johnston, Ellinger, Allen, & Drum, 1985). Previous research has evaluated a number of antecedent-based treatments for rumination such as post-meal satiation diets (e.g., Dudley, Johnson, & Barnes, 2002; Kenzer & Wallace, 2007), liquid rescheduling (e.g., Wilder, Draper, Williams, & Higbee, 1997), and noncontingent reinforcement (NCR) through fixed-time (FT) presentation of small amounts of food or liquid (supplemental feeding) or access to competing stimulation (Lyons, Rue, Luiselli, & DiGennaro, 2007; Rhine & Tarbox, 2009; Wilder, Register, Register, Bajagic, & Neidert, 2009). For example, Lyons et al. (2007) evaluated the effects of noncontingent access to alternative stimuli on the post-meal rumination of two children with developmental disabilities. For one participant, noncontingent access to fruit punch decreased rumination to near-zero levels. For the other participant, noncontingent access to food, liquid, or the chew ring (circular infant teething ring) initially eliminated rumination; however, rumination ultimately returned to baseline levels when the chew ring was available. A potential limitation of treatments involving antecedent delivery of food items is that the increased caloric intake may produce weight gains or interfere with academic programming by decreasing the value of contingently delivered food items. Thus, additional research is needed on antecedent interventions for rumination that do not involve ingestion of food items.

Rhine and Tarbox (2009) evaluated the effects of chewing gum on rumination that was displayed by a young boy with autism. The results showed that access to chewing gum decreased the participant's rumination to near-zero rates and suggest that oral stimulation produced by chewing gum com-

peted with or substituted for stimulation produced by rumination. Although chewing gum does not increase caloric intake, some individuals who engage in rumination may not posses the skills to either chew gum appropriately or dispose of chewed gum in an appropriate manner (e.g., placing a chewed piece in the trash as opposed to on carpet or furniture). In addition, individuals may simply swallow the gum, which may give rise to other health-related or behavioral problems. Therefore, additional research on treatments that allow individuals to contact alternative non-food sources of oral stimulation, without extensive training, is also warranted.

The effectiveness of antecedent-based interventions for decreasing rumination may, in part, be a function of modifying motivating operations for rumination (see Laraway, Snycerski, Michael, & Poling, 2003). For example, access to alternative items may produce stimulation that is similar to that generated by rumination (i.e., substitutable stimulation) and thereby produce an abolishing operation (AO) for that stimulation. The purpose of the present study was to extend the findings of the Lyons et al. (2007) and Rhine and Tarbox (2009) studies by evaluating the effects of providing continuous access to an alternative source of oral stimulation (i.e., a chew toy) on a young boy's post-meal rumination.

Method

Participant

Jesse (pseudonym) was an 8-year-old boy who was diagnosed with autism. Jesse was referred by his parents for the treatment of chronic rumination and intermittent vomiting. Prior to the referral, these behaviours lead to Jesse's discharge from an early-intervention behavioural treatment program. Jesse communicated using a few manual signs (e.g., cookie, movie, all done) and two micro-switches with pre-recorded messages to request access to attention and the bathroom. Prior to the start of this study, a medical evaluation did not reveal any physical causes for rumination (e.g., gastroesophogeal reflux disorder); however, Jesse had a history of mild esophagitis and stomach ulcers. Additionally, Jesse experienced extensive tooth decay that was directly attributed to his rumination. Prior to the beginning of this study, a dentist had capped all of Jesse's teeth to prevent further decay.

Previous attempts to treat Jesse's rumination included a combination of supplemental feeding (i.e., noncontingent access to food) and mild punishment (i.e., the application of Listerine® on a toothbrush to Jesse's tongue for 5 s contingent on the occurrence of rumination). This treatment package initially decreased Jesse's rumination to near-zero levels for several months; however, his rumination ultimately increased following meals (though not to initial baseline levels). Informal observations suggested that Jesse's rumination occurred independent of social consequences. In addition, formal analyses that were conducted for other problem behaviour (e.g., motor stereotypy) that was displayed by Jesse indicated that his rumination persisted in the absence of social consequences (data available from the second author). Prior to the start of the study, caregivers occasionally gave Jesse access to a chew toy and reported that Jesse engaged in little if any rumination. Given staff reports and our informal observations, we operated under the assumption that access to the chew toy would decrease Jesse's rumination. Thus, the present study was conducted to verify the effectiveness of an intervention consisting of access to alternative oral stimulation.

Target Behaviour, Data Collection, and Interobserver Agreement

Rumination was defined as contact between one of Jesse's hands or a piece of furniture with his abdomen while simultaneously leaning forward (precursory responses), the presence of food or liquid in Jesse's mouth in the absence of the ingestion of food, or sounds of air originating from Jesse's mouth, which almost always preceded regurgitation of food. Although chewing of previously ingested food is often a part of rumination, we did not include chewing, per se, within the formal response definition because Jesse typically manipulated the food with his tongue as opposed to actively chewing it. Mouthing the chew toy was defined as placement of the chew toy (or the necklace to which it was attached) past the plane of his lips. Sessions were videotaped and subsequently scored using a laptop computer. Data were collected on the duration of the target behaviours and converted to a percentage of time measure. Sessions were conducted 1 to 2 times per week before and after Jesse ate either breakfast or lunch.

The amount of food that Jesse consumed during each meal was calculated by weighing the

amount of food before (pre-meal) and after (post-meal) a meal, and subtracting the post-meal weight from the pre-meal weight. Jesse consumed a mean of 356 g (range, 307 g to 440 g) during sessions with noncontingent access to a chew toy and a mean of 340 g (range, 250 g to 412 g) during baseline sessions. A second observer scored 26% of sessions across phases. Interobserver agreement (IOA) scores were calculated using the block-by-block method for continuous measurement wherein the observation period was divided into consecutive 10-s blocks (see Mudford, Martin, Hui, & Taylor, 2009). For each bin, the smaller value was divided by the larger value. The value from each block was then totaled, divided by the total number of blocks, and then multiplied by 100%. The IOA score for the percentage of time with post-meal rumination was 81% (range, 73% to 96%).

Experimental Design and Procedures

The effects of alternative oral stimulation on rumination were evaluated using an A-B-A-B-A reversal design with a follow-up B phase. Each session consisted of a 20-min post-meal observation. The first 15 min of the post-meal observation was conducted immediately after a meal and the last 5 min of the post-meal observation was conducted 30 min after a meal. The data from these observations were collapsed into a single post-meal measure of Jesse's engagement in rumination. The end of a meal was typically determined in one of two ways. First, Jesse signed "all done." Second, Jesse refused a known preferred food item on two or more consecutive trials. Following both scenarios, Jesse was permitted to leave the dining table and then data collection for his target behaviours commenced within 2 or 3 min.

During the *baseline* phase, Jesse was placed in the family room of his home after each scheduled meal and was free to manipulate items that were typically available in that environment (e.g., toys, books, videos). The trainer did not initiate interactions with Jesse; however, Jesse could request attention from the trainer using a micro-switch.

The *Noncontingent chew toy (NCT)* phase was identical to the baseline phase except that Jesse had continuous access to an ARK'S Grabber® chew toy after each meal. The chew toy was attached to a Chewlery® necklace that was placed around Jesse's neck. If Jesse removed the chew toy from his neck and did not replace it within 1 min, a trainer placed it back around his neck (no additional interaction was provided). The chew toy was only available after meals.

The *8-month follow-up* phase with the NCT intervention was conducted 8 months after the last NCT session. Each session in this phase was separated by four or five days. This phase was conducted to determine if the chew toy continued to compete with rumination after it was used for an extensive period of time.

Results and Discussion

Figure 1 shows the mean percentage of time Jesse engaged in rumination and mouthing during post-meal observation sessions. During the first baseline phase, Jesse's rumination was exhibited for a mean of 13.9% of the sessions and it decreased across sessions. In the first NCT phase, Jesse's rumination decreased to near-zero levels (M = 1.2%) and he mouthed the chew toy for a high percentage of each session (M = 63.4%). In the second baseline phase, Jesse's rumination increased to prior baseline levels (M = 10.9%). During the second NCT phase, Jesse's rumination gradually decreased to low levels (M = 5.1%) and his mouthing of the chew toy increased to levels that were comparable to those observed in the first NCT phase (M = 64.4%). Due to the decreasing trend in Jesse's rumination during the first baseline phase, a third baseline phase was implemented in an attempt to provide a stronger demonstration of the effects of NCT on Jesse's behaviour. During the third baseline phase, again, Jesse's engagement in rumination immediately increased to prior baseline levels (M = 13.5%). The results of this analysis suggest that Jesse's post-meal rumination decreased when he had access to the chew toy. During the 8-month follow-up phase, Jesse's rumination was very low (M = 0.7%) and his engagement with the chew toy (M = 80.2%) was high. Thus, these results suggest that the chew-toy continued to compete with rumination even after it was used over an extensive period of time.

The results of the present study contribute to the literature in at least two ways. First, this is one of only a few studies to show that continuous access to a nonfood item following meals can decrease post-meal rumination. A potential advantage of using the chew toy for Jesse was

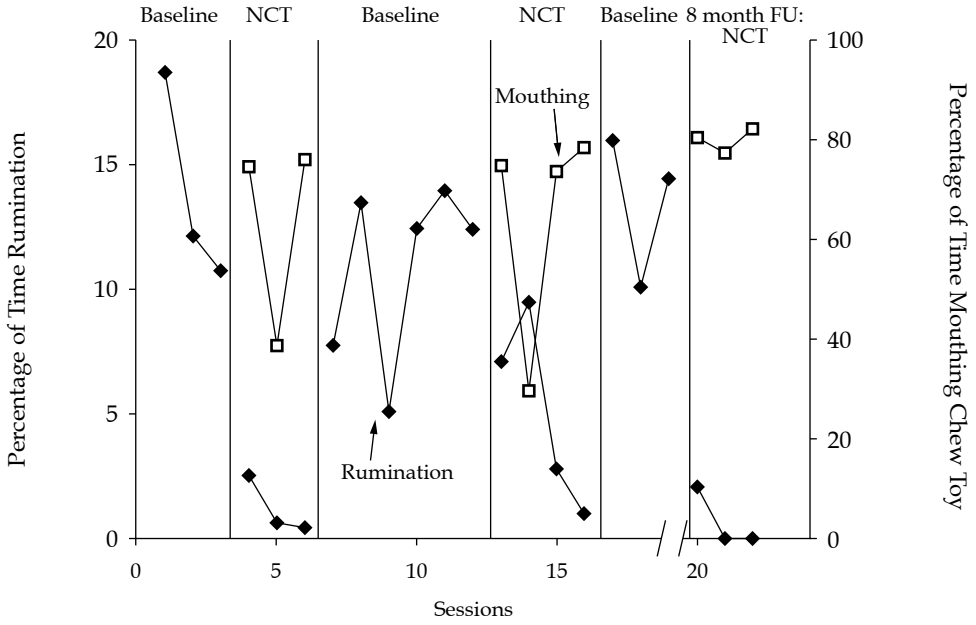

Figure 1. Percentage of time Jesse engaged in rumination (primary y-axis) and mouthing of the chew toy (secondary y-axis) across sessions during the baseline, noncontingent chew toy (NCT) and 8-month follow-up (FU) NCT phases

that his rumination decreased without increasing his caloric intake or interfering with other programming, which relied heavily on the use of edible reinforcers. In addition, some supplemental feeding procedures involve the delivery of liquid every 15–30 s for up to 30 min following a meal; this process can be both time and labor intensive for caregivers and may interfere with on-going academic skills training. By contrast, the trainer in the present study simply placed the chew toy around Jesse's neck after meals and replaced it when needed (this did not occur very often). Second, the current study directly measured Jesse's engagement with the alternative stimulus and showed that rumination typically decreased when mouthing of the chew toy increased. This finding suggests that Jesse's rumination was, at least in part, maintained by the oral stimulation produced by rechewing previously ingested food.

Some potential limitations to the current study warrant discussion. First, a formal functional analysis was not conducted to rule out the possibility that rumination was influenced by social consequences and we did not present data on Jesse's rumination from other times of the day. Nevertheless, the combination of no-interaction conditions, which were conducted for other problem behaviour, and descriptive assessment across multiple days, indicated that Jesse's rumination occurred independent of social consequence shortly after meals. Likewise, we initially collected data on Jesse's rumination for 20 min before each meal; however, he rarely exhibited the behaviour during this period. A second potential limitation stems from the decreasing trend in Jesse's rumination in the first baseline phase. Initially, decisions regarding phase changes were based on analyzing Jesse's rumination in 5-min blocks; this was later changed. Despite the decreasing trend in rumination during the first baseline phase, the data from the subsequent baseline and treatment phases provide a believable demonstration of the effects of NCT on Jesse's rumination. Finally, the net effect of the NCT intervention was a decrease in one problem behaviour, but an increase in another potentially problematic behaviour (i.e., object mouthing). Although the chew toy did not interfere with training tasks that were conducted with Jesse, it is possible that his chewing on the toy may interfere with future training tasks that involve appropriate

vocal behaviour. Similarly, chewing on a toy may be perceived negatively by his peers and, therefore, decrease his opportunities for appropriate social interactions. Nevertheless, Jesse's parents preferred that he chewed the toy in place of rumination. Likewise, although it was not formally evaluated, it is likely that chewing on the toy would be viewed as a more socially acceptable behaviour in social settings (e.g., school) for Jesse than engaging in rumination.

Future research should evaluate the extent to which the passage of time following a meal influences post-meal rumination. Although the data for Jesse's rumination are presented as the percentage of time he engaged in rumination during post-meal observations, we also analyzed his rumination across 5-min blocks. The results of this analysis showed that Jesse's post-meal rumination was typically highest 5 to 10 min following a meal and lower during the 30-min post-meal observation. Among other possibilities, this finding suggests that previous access to rumination potentially functioned as an AO for engaging in subsequent rumination, the passage of time made rumination more difficult (i.e., ingested food was further along in the digestive process), or a combination of both. Isolating the effects of the passage of time on post-meal rumination may aide in the development and implementation of treatments. Specifically, if rumination typically occurs at the highest level during the first 10 min following a meal and then slowly decreases during the ensuing 30 min, it may only be necessary to implement an intervention during a brief window of time following a meal. Future research should also evaluate the separate effects of NCR before a meal and NCR after a meal on post-meal rumination. It is possible that providing access to the chew toy before a meal could produce an AO for oral stimulation and, thereby, decrease rumination after a meal.

Key Messages from This Article

People with disabilities: Decreasing socially inappropriate behaviour (rumination) may sometimes involve increasing behaviour (chewing on objects) that may also be, at times, socially inappropriate.

Professionals: This brief study illustrates the importance of ongoing data collection and multi-component interventions.

Policy Makers: Behavioral interventions can produce socially meaningful changes in behaviour for children and adults with autism. The effects of the interventions require on-going assessment.

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