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ORIGINAL PAPER

A Video-Enhanced Activity Schedule Reduces Food Stuffing in Child with Pervasive Developmental Disability: a Single Subject Design Case Study

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Abstract

Objectives This study evaluated the effects of a video-enhanced activity schedule on the dangerous food stuffing (rapid eating) of a child with pervasive developmental disorder-not otherwise specified (PDD-NOS).

Methods An iPad Mini and the software application *My Pictures Talk* were used to deliver the video-enhanced activity schedule intervention. A multiple baseline across meals with an embedded ABAB design was used to evaluate changes in food stuffing behavior.

Results A reduction in food stuffing across breakfast, lunch, and snack was demonstrated with experimental control. Generalization probes with the child's mother suggested the improvement generalized to meals without the therapist but caution in conclusions regarding generalization is limited by the small number of generalization probes. The child's mother provided anecdotal social validity data indicating the intervention approach was acceptable, treatment goals were meaningful, and outcomes were positive.

Conclusions This study replicates previous research demonstrating the potential benefit of video-enhanced activity schedules and extends previous research by reducing inappropriate mealtime behavior in a child with PDD-NOS.

Keywords Food stuffing · Rapid eating · Activity schedules · iPad

Rapid eating is the ingestion of food at a quantity or pace that increases the risk of choking and contributes to social stigmatization via unpleasant table etiquette (Echeverria and Miltenberger 2013). Topographies of rapid eating include taking typical size bites at a dangerously fast pace (i.e., short interresponse time [IRT]) and taking dangerously oversized bites wherein a large quantity of food is packed into the mouth (food stuffing). Rapid eating may be maintained by a variety of behavioral functions (Silbaugh et al. 2018). Previous research has demonstrated that a combination of differential reinforcement of lower rates (DRL), response blocking, and verbal prompts may increase IRT and slow the rate of eating (Lennox et al. 1987; Wright and Vollmer 2002). Similarly, Anglesea et al. (2008), Echeverria and Miltenberger (2013), and Page et al. (2017) treated rapid eating using tactile prompts provided by vibrating pagers, verbal prompts to slow, and rules highlighting desired mealtime behavior and contingencies. Although there has been some success in treating rapid eating by increasing IRT between bites, there is a relative paucity of research exploring behavioral intervention options for food stuffing where the danger involves the quantity of food in the mouth. A reduction in food stuffing that involves taking smaller bites should also reduce the risk of choking and additional intervention research is warranted.

Video-enhanced activity schedules involve video models nested within a visual activity schedule presented on a portable electronic device (e.g., iPads and smart phones). The visual activity schedule component includes a series of pictures presented in a sequence of behaviors that the learner references while engaged in a task or activity (Bryan and Gast 2000). The video component involves the learner observing and then imitating a model engaging in each step of the target task (Miltenberger and Charlop 2015). Specifically, when the two components are combined, the static pictures in the schedule are linked to videos of a model completing the step

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represented in each picture. The learner moves through the sequence of pictures by observing each video model, imitating that model, and then selecting the next picture in the sequence until the task is complete.

Video-enhanced activity schedules have been used to improve a variety of academic and daily-living skills (e.g., Spriggs et al. 2015; Ledbetter-Cho et al. 2017) but, to our knowledge, have not been used to reduce food stuffing (Silbaugh et al. 2018). In several previous intervention studies targeting a reduction in rapid eating, in an effort to reduce demands on staff time during meals, prompting was provided by a device as opposed to being directly delivered by another person (e.g., Anglesea et al. 2008; Echeverria and Miltenberger 2013; Page et al. 2017). The current study aimed to replicate and extend previous research by evaluating a video-enhanced activity schedule to reduce food stuffing in a young boy with a pervasive developmental disability.

Method

Participants

Logan, an 8-year-old boy diagnosed with pervasive developmental disorder-not otherwise specified (PDD-NOS), bilateral moderate-severe sensorineural hearing loss, and severe expressive and receptive language disorder, participated in this study. Although he was not diagnosed with autism spectrum disorder, Logan scored a 46 on the Childhood Autism Rating Scale, Second Edition (CARS-2) indicating severe autism symptoms (Schopler et al. 2010). This study was initiated when Logan's parents completed a clinical intake safety skills survey (available on request) that indicated Logan often stuffed large amounts of food in his mouth before swallowing, and that he did not comply with requests to take smaller bites. Due to fear he might choke, his mother fed him separate from the rest of the family to supervise each bite during meals at home. At the time of the study, Logan did not use utensils and instead used his hands to pick up food. Therefore, his family prepared meals he was able to eat with his hands.

Procedures

Setting Procedures were conducted at a university-based autism clinic. The clinic room contained a cabinet for food storage, a child-sized table, and several chairs. The room was also equipped with an audio and video surveillance system that discretely and clearly recorded all activity in the room. During sessions, a therapist sat at the table with Logan in the same arrangement that his mother sat with him during meals at home. During generalization probes, Logan's mother sat at the table in place of the therapist.

Materials The software application *My Pictures Talk* was used to upload pictures and sequence video model clips on an iPad Mini (Grembe Inc., http://www.grembe.com/mpt). Pictures were taken of the actual materials (e.g., plates, cups, and foods) used in the study and the video sequence consisted of six video clips that were approximately eight seconds each in duration. Video clips depicted the therapist modeling all of the steps in the following sequence: (1) picking up a single bite of food at a time; (2) saying, "eat one at a time" loud enough for Logan to hear despite hearing impairment; (3) placing the bite of food in mouth; (4) putting hands down; and (5) chewing and swallowing the bite of food. The sixth video clip modeled taking a sip of juice from a cup, placing the cup back on the table, and saying, "all done." The foods used in the study were identified by his parents as foods Logan enjoyed and had been successfully used as reinforcers when addressing Logan's other unrelated intervention goals in the past.

Technology Training Prior to implementing intervention, Logan was taught to operate the iPad and interface with the *My Pictures Talk* software using procedures described in previous research (Spriggs et al. 2015). Specifically, Logan was taught to use video-enhanced activity schedules in the context of completing familiar tasks unrelated to eating (e.g., matching objects to sample). A task analysis of device operation was created (e.g., pushing play, navigating to next video) and data were collected on the percentage of steps Logan completed accurately. Mastery of device operation was defined as 100% accurate completion of all steps in the task analysis without prompting in three consecutive opportunities on two consecutive days. After mastery criteria for device operation were met and baseline data stabilized, the iPad was loaded with the food stuffing video-enhanced activity schedule and intervention was implemented in the first meal.

Meal Preparation and Presentation Based on routine in-home meals, meals in the clinic were presented on a plate that was divided into three equal sections that separated foods. Foods were prepared by Logan's mother. Only one plate of six equal sized bites (approximately 2–3 cm) was presented to Logan at a time. The size of the precut bites of food was held consistent across the study. Two to four plates were presented each meal during baseline and intervention. We did not put all the food that was to be served in a meal on a single plate at the same time in order to prevent Logan from quickly grabbing and stuffing an unsafe amount of food before the therapist could block.

Baseline Phases During all baseline phases of the embedded ABAB design, the therapist facilitated meals in the same way Logan's mother did at home. Specifically, (a) a plate with three equally partitioned sections was used to deliver food; (b) Logan was told to "eat one bite at a time, chew and

swallow"; (c) verbal praise was delivered contingent upon the absence of stuffing; and (d) attempts to stuff were blocked. Plates contained six bites of food with two equal bites of the same food per section of the plate. Baseline continued until there was evidence of stability or of an increasing trend in stuffing.

Intervention Phases All intervention phases were the same and were similar to baseline except that the video-enhanced activity schedule procedure was implemented via an iPad. Logan was given the iPad cued to the first picture with video model. The therapist then said, "Time to eat" and presented him with a plate of food and the iPad. Logan then touched the first picture in the schedule activating the video model for that step and progressed through schedule as intended. The therapist delivered a prompt (point to iPad) to redirect Logan to the iPad when necessary. Mastery criteria for each meal were five consecutive sessions with zero instances of stuffing. Intervention began in the next meal after stuffing level was below baseline in a decreasing trend. Intervention continued until stuffing frequency was at zero for five consecutive sessions at which time the return to baseline phase was initiated. The return to baseline continued until an increasing trend or level consistent with the initial baseline was observed and intervention was reinstated.

Measures

Food stuffing (stuffing) was operationally defined as placing—or attempting to place—a bite past the plane of the lips before the previous bite had been swallowed and/or taking more than one of the precut bites at a time. If his cheeks were puffed out, chewing was still occurring, or food was still visible inside Logan's mouth when a new bite was taken, stuffing was recorded. For safety, the therapist physically blocked attempts to stuff when there was a large quantity of food still in the mouth (i.e., three unswallowed bites) by lightly preventing the hand with food from reaching his mouth. Attempts to stuff were scored the same as stuffing. The frequency of stuffing was recorded and graphed each session. Treatment fidelity data were collected on therapist's implementation of intervention procedures in 11% of all treatment sessions ($n = 11$). Specifically, a checklist of procedures was used to evaluate therapist treatment adherence. The number of correctly implemented steps was divided by the total number of checklist steps and multiplied by 100. Mean treatment fidelity was 95% (range 86 to 100%).

Inter-observer Agreement Two data collectors were trained on the dependent measure, and inter-observer agreement (IOA) data were collected. Incidents of disagreement between data collectors were examined in video recordings until resolved. Initial IOA on the frequency of stuffs was calculated by dividing the smaller number by the larger number and multiplying by 100. IOA was collected for 26% of sessions across all phases and mean IOA was 90% (range 50 to 100%).

Data Analysis

Research Design A multiple baseline across meals with an embedded ABAB design was used to evaluate the influence of intervention on food stuffing. Generalization probes with the child's mother were conducted during baseline and intervention.

Generalization Generalization probes with Logan's mother were implemented in the first baseline session of lunch and snack and again during the final intervention phase for the same meals. Logan's mother was unavailable during breakfast precluding generalization probes during that leg of the multiple baseline.

Results

Figure 1 depicts stuffing per session across meals. During initial lunch baseline, mean stuffs was 3.25 (range 0–8) with a variable but increasing trend. In snack, mean stuffs was 3.58 (range 0–14) with a relatively stable trend after 14 stuffs occurred in session 12. For breakfast, mean stuffs was 1.97 (range 0–7) with evidence of an increasing trend. In the first intervention session during lunch, stuffs dropped below the baseline mean and continued to decrease until five consecutive sessions with zero stuffs was recorded beginning in session 44 (29th intervention session). The mean during initial lunch intervention was 1.10 stuffs with no more than five stuffs recorded per session. Mean stuffs during the first intervention for snack decreased to 1.07 with no more than four stuffs. Six consecutive sessions with zero stuffs occurred beginning in session 43. An initial session was run beyond the five session mastery criteria because there was a break between sessions 46 and 48 due to the schedule of the university-affiliated clinic. Finally, stuffs during breakfast decreased to a mean of 0.5 with no more than two stuffs in the initial intervention phase and five consecutive sessions with zero stuffs was reached beginning in session 46. Intervention was then withdrawn for the return to baseline phase until stuffs increased to a level comparable with the initial baseline. Finally, intervention reinstatement was staggered across meals and the final phase continued until session 75 when Logan was no longer available for treatment for logistical reasons unrelated to the study. Mean stuffing decreased across all meals to an average of 1.05 for lunch, 1.12 for snack, and 0.67 for breakfast in the final intervention phase. Data from generalization probes were consistently aligned with the trend and level of sessions within the same phase.

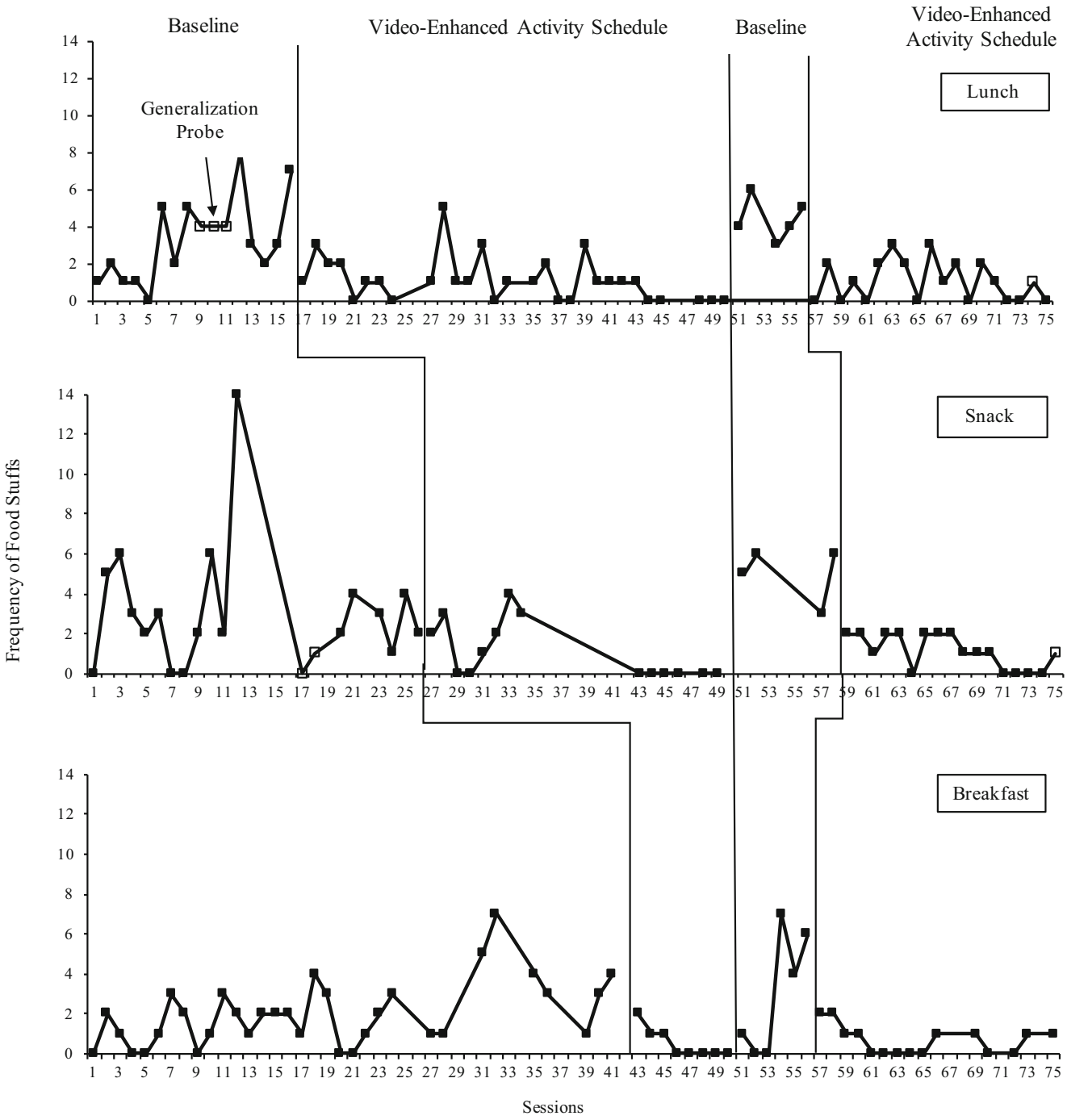

Fig. 1 Frequency of food stuffs per session

Discussion

A reduction of food stuffing was observed when the video-enhanced activity schedule intervention was in place. This reduction was replicated across meals in the multiple baseline design and within meals in the embedded ABAB design. This finding replicates previous research demonstrating beneficial outcomes of video-enhanced activity schedules and extends previous research by reducing food stuffing in a child with PDD-NOS. Further, the reduction in stuffing appeared to generalize to meals with Logan's mother in the absence of the therapist. However, caution is warranted in the interpretation of generalization data due to a limited number of generalization probes and because generalization was only assessed across lunch and snack.

After the final session, Logan's mother was given the software and the video-enhanced activity schedule file that was created for Logan. She was taught how to load and use the application on her personal iPad to empower implementation

of the intervention outside of the clinic. In a follow-up check, Logan's mother indicated the intervention approach was acceptable, treatment goals were meaningful, and outcomes were positive. Further, she stated that she intended to continue using the intervention at home and to include Logan at the table during family meal times. Although this provides some anecdotal evidence of social validity and maintenance, this must be considered with caution because we did not directly observe meals at home or collect in vivo maintenance data.

As noted in previous research involving rapid eating (Anglesea et al. 2008; Echeverria and Miltenberger 2013), the use of portable and inconspicuous technology can be beneficial in reducing dangerous food stuffing. It appears to be somewhat common to find children, regardless of disability, engaging with a tablet or smartphone during meals. Therefore, the use of an iPad with video-enhanced activity schedules may offer an effective intervention option that is less intensive and less stigmatizing than other options for some children and their families.

Limitations and Future Research

In cases where intensive intervention is necessary, future research could examine the potential of this approach as a supplemental component. For example, video-enhanced activity schedules could be used to facilitate generalization to restaurants and school cafeterias for children receiving intensive intervention in home or clinical settings. Additionally, the relative efficiency of this intervention is not known and future research could compare this approach to other options for reducing food stuffing.

Future research should also address limitations in the current study. First, the operant function of Logan's food stuffing was not addressed here and treatment outcomes may differ across different socially mediated contingencies (e.g., escape from meal time or attention from caregivers). Future research involving a functional assessment of food stuffing prior to treatment could address this possibility. Second, given positive outcomes demonstrated in this study, replication and extension to additional children across different settings (e.g., home, school, and restaurant) appears warranted. Given that the current study did not did directly assess social validity and maintenance or generalization across settings, future research should. Because food stuffing quickly returned to initial baseline levels during the reversal phases, it seems likely that future research will need to include approaches to fading intervention to support maintenance. Finally, the video-enhanced activity schedules could be expanded to teach children to cut their own food into safe size bites and other desirable mealtime behaviors.

The positive results of this study suggest this approach may offer families with a novel intervention option and highlights the need for additional research in this area. Finally, these results further extend the growing corpus of evidence demonstrating the clinical and educational benefit of video-enhanced activity schedules.

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Author Contributions MK: designed and executed the study, analyzed the data, and wrote the paper. RL: supervised the research process, contributed to the design of the study, assisted with data analysis, and collaborated in writing and editing the final manuscript. AL: assisted with executing the study and data analysis. KLC: collaborated in writing and editing the manuscript. All authors made meaningful contributions to the content presented in the discussion.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethics Statement All procedures performed in studies involving human participants were in accordance with the guidelines of the research ethics committee of Texas State University-San Marcos.

Informed Consent Informed consent was obtained from all participants in the study.

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