

## REDUCING ESCAPE-MAINTAINED SPITTING BEHAVIOR IN A CHILD WITH AUTISM SPECTRUM DISORDER USING DIFFERENTIAL REINFORCEMENT OF INCOMPATIBLE BEHAVIOR: A SINGLE-CASE STUDY

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### ABSTRACT

Spitting behavior in children with autism spectrum disorder (ASD) presents significant social, educational, and hygiene-related challenges that may interfere with therapeutic and instructional activities. The present study evaluated the effectiveness of Differential Reinforcement of Incompatible Behavior (DRI) combined with extinction and Functional Communication Training (FCT) in reducing escape-maintained spitting behavior in a child with ASD. A single-case AB design was implemented with a seven-year-old boy receiving Applied Behavior Analysis (ABA) services in a clinical setting. Functional assessment procedures, including Antecedent–Behavior–Consequence (ABC) recording and the Questions About Behavioral Function (QABF), identified escape from task demands as the primary maintaining variable of the behavior. Baseline data were collected across five sessions, followed by 14 intervention sessions and five post-intervention sessions. The intervention package included bubble blowing as the incompatible behavior, extinction of escape-maintained responding, task modification, and FCT for requesting breaks appropriately. Baseline data demonstrated stable and elevated rates of spitting behavior, averaging 9.6 occurrences per session. Following intervention implementation, an extinction burst was observed, with spitting increasing to 19 instances during early sessions. Continued

*intervention resulted in a progressive reduction in behavior, reaching zero occurrences during the final intervention session. Post-intervention assessment demonstrated maintenance of treatment gains, with only one instance of spitting recorded across five follow-up sessions. The findings suggest that function-based DRI combined with extinction and FCT may effectively reduce escape-maintained spitting behavior in children with ASD. The study supports the use of reinforcement-based and topography-specific interventions for challenging behaviors in clinical ABA settings.*

**Keywords:** Autism Spectrum Disorder, Differential Reinforcement of Incompatible Behavior, Functional Communication Training, extinction, spitting behavior, Applied Behavior Analysis

## INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication and social interaction, along with restricted and repetitive patterns of behavior, interests, or activities (American Psychiatric Association, 2022). Many children with ASD also display challenging behaviors, including aggression, self-injury, tantrums, property destruction, and disruptive oral-motor behaviors that interfere with learning, social participation, and adaptive functioning.

One challenging behavior frequently observed in clinical and educational settings is spitting. Spitting behavior presents substantial health, hygiene, and social concerns and may disrupt therapeutic and instructional activities. From a behavioral perspective, problem behavior typically serves a specific function, including access to attention, tangible items, escape from demands, or sensory stimulation (Cooper et al., 2020). Therefore, identifying the maintaining variable of behavior through functional assessment is essential before implementing intervention procedures.

Differential reinforcement procedures are among the most widely used evidence-based interventions in Applied Behavior Analysis (ABA) for reducing challenging behavior while simultaneously strengthening adaptive responses (Cooper et al., 2020; Miltenberger, 2016). Differential reinforcement involves reinforcing desirable behaviors while withholding reinforcement for maladaptive responses. Common forms include Differential Reinforcement of Other Behavior (DRO), Differential Reinforcement of Alternative Behavior (DRA), and Differential Reinforcement of Incompatible Behavior (DRI).

DRI specifically reinforces a behavior that cannot occur simultaneously with the target behavior (Cooper et al., 2020). In the context of spitting, behaviors such as maintaining closed lips, swallowing, drinking through a straw, or blowing bubbles may function as incompatible responses because they physically prevent spitting from occurring. DRI procedures may therefore provide a practical and socially acceptable intervention strategy for oral-motor challenging behaviors.

Research indicates that differential reinforcement procedures are most effective when interventions are functionally matched to the maintaining variables of behavior (Hanley et al., 2003). Spitting behavior may be maintained by social attention, escape from task demands, access to tangibles, or automatic sensory reinforcement. When escape functions as the maintaining variable, interventions frequently combine extinction procedures with teaching an appropriate communicative replacement behavior (Carr & Durand, 1985).

Functional Communication Training (FCT) is an evidence-based intervention in which individuals are taught socially appropriate communication responses that serve the same function as the challenging behavior (Tiger et al., 2008). For example, if a child engages in spitting to escape difficult tasks, teaching the child to appropriately request a break may reduce the need for maladaptive behavior.

The current literature supports the effectiveness of differential reinforcement procedures across a wide range of challenging behaviors in children with ASD (Wong et al., 2015). However, limited research has specifically examined the use of DRI for reducing spitting behavior. Existing studies often combine spitting with broader categories of disruptive behavior or rely on multiple

intervention components without directly evaluating topography-specific incompatible responses.

The present study aimed to evaluate the effectiveness of a function-based DRI intervention combined with extinction and FCT in reducing spitting behavior in a child with ASD. The study contributes to the growing literature on positive behavioral interventions targeting socially significant challenging behaviors.

### Literature Review

Spitting behavior and other challenging behaviors in children with autism spectrum disorder (ASD) are commonly addressed using reinforcement-based behavioral interventions grounded in Applied Behavior Analysis (ABA). Existing literature strongly supports differential reinforcement procedures as evidence-based interventions for reducing challenging behavior in individuals with ASD and related developmental disabilities (Wong et al., 2015). Differential reinforcement strategies have consistently demonstrated effectiveness across multiple behavioral topographies, including aggression, stereotypy, self-injurious behavior, disruptive classroom behavior, and noncompliance. However, the majority of published studies have focused on broader categories of challenging behavior rather than topography-specific interventions targeting spitting behavior.

Research examining differential reinforcement procedures has emphasized the importance of function-based intervention planning. Hanley et al. (2003) highlighted that interventions informed by functional assessment procedures are more likely to produce clinically meaningful reductions in challenging behavior because treatment procedures directly address maintaining contingencies. Similarly, Barton et al. (2018) reported positive behavioral outcomes across multiple settings when reinforcement-based interventions were functionally matched to behavioral variables.

Within the differential reinforcement taxonomy, Differential Reinforcement of Incompatible Behavior (DRI) has been particularly effective for behaviors with clearly observable motor responses.

Previous studies have demonstrated that reinforcing behaviors physically incompatible with the target response can substantially reduce maladaptive behavior while promoting adaptive alternatives. Athens et al. (2007), for example, reduced rapid eating behavior by reinforcing utensil placement between bites, whereas Lang et al. (2011) reported reductions in stereotypic behavior through reinforcement of competing activities.

Although the literature supports DRI procedures broadly, limited research has specifically evaluated DRI for oral-motor challenging behaviors such as spitting. Existing studies examining spitting behavior often include the response within larger disruptive behavior categories or combine multiple intervention procedures without specifically evaluating incompatible oral-motor responses. Kurtz et al. (2003) reported reductions in disruptive behaviors, including spitting, using reinforcement-based interventions; however, the role of topography-specific incompatible responses remained unclear.

Current evidence also supports combining extinction procedures with reinforcement-based interventions. Extinction procedures involve discontinuing reinforcement previously maintaining the target behavior and are frequently used when challenging behavior is escape-maintained (Cooper et al., 2020). However, research has shown that extinction may initially produce temporary increases in behavior frequency or intensity, commonly referred to as extinction bursts (Lerman et al., 1999). Combining extinction with reinforcement of adaptive responses may reduce long-term problem behavior while increasing socially appropriate alternatives.

Functional Communication Training (FCT) has repeatedly demonstrated effectiveness in reducing escape-maintained challenging behavior by teaching functionally equivalent communication responses (Carr & Durand, 1985; Tiger et al., 2008). Previous research indicates that FCT may improve treatment outcomes when combined with differential reinforcement procedures because individuals learn more efficient and

socially acceptable methods for obtaining reinforcement.

Despite strong empirical support for differential reinforcement, extinction, and FCT procedures individually, research specifically examining function-based DRI interventions for spitting behavior in children with ASD remains limited. Furthermore, relatively few studies have evaluated incompatible oral-motor responses that directly compete with spitting behavior while simultaneously addressing sensory and escape-related components. The present study addresses this gap by evaluating the effectiveness of a function-based DRI intervention using bubble-blowing behavior combined with extinction and FCT in reducing escape-maintained spitting behavior in a child with ASD.

## Method

### Research Design

The study employed a single-case AB experimental design to evaluate the effectiveness of the intervention package. Phase A consisted of baseline assessment without intervention, while Phase B consisted of implementation of the intervention procedures. Frequency recording was used to measure the occurrence of spitting behavior across sessions.

### Participant

The participant was a seven-year-old boy diagnosed with autism spectrum disorder receiving Applied Behavior Analysis therapy at a clinical center in Chakwal. He attended therapy five days per week for approximately 45 minutes daily. The child demonstrated good imitation skills but limited receptive language abilities. He used single-word speech consistently and occasionally produced spontaneous two-word phrases. The participant was also receiving speech therapy and occupational therapy at the same center.

### Ethical Considerations

Parental consent was obtained before implementation of assessment and intervention procedures. Confidentiality of the participant was maintained throughout the study by excluding identifying personal information from all data

records and written documentation. The intervention procedures were implemented as part of the participant's ongoing clinical ABA treatment program.

### Setting

The intervention was conducted in a controlled clinical therapy room during one-to-one ABA sessions focused primarily on tact training and instructional activities. The therapy room measured approximately 8 × 8 feet and contained a therapy table, chairs, learning materials, adequate lighting, ventilation, and instructional resources.

### Functional Assessment

Direct and indirect functional assessment procedures were conducted before intervention.

### Antecedent–Behavior–Consequence (ABC) Recording

ABC recording was used to identify environmental events associated with the occurrence of spitting behavior. Continuous observation was conducted during therapy sessions to document antecedents, target behavior, and consequences.

### Questions About Behavioral Function (QABF)

The QABF was administered as an indirect assessment measure to identify potential maintaining variables of the behavior. The assessment includes five functional domains: attention, escape, tangible, physical, and nonsocial functions. Both ABC recording and QABF findings indicated that spitting behavior was primarily maintained by escape from task demands.

### Materials

The following materials were used during assessment and intervention:

- ABC recording forms
- QABF assessment forms
- Functional Assessment Interview (FAI)
- Frequency recording sheets
- Pens and paper

- Bubble-blowing materials for DRI implementation

### **Operational Definition of Spitting**

Spitting behavior was operationally defined as the intentional expulsion of saliva, mucus, or oral fluids from the mouth directed outward from the oral cavity without food particles. The behavior included tongue thrusting and forceful oral projection producing visible droplets or spray directed toward objects, surfaces, therapists, or self. Each separate expulsion of oral fluid was counted as one occurrence.

### **Procedure**

The study was conducted from November 24, 2025, to December 19, 2025.

### **Baseline Phase**

Baseline data were collected across five sessions during routine ABA therapy. During baseline, instances of spitting behavior were recorded without implementation of intervention procedures.

The participant primarily engaged in spitting during instructional demands and difficult tasks. Spitting was not commonly observed during play or highly preferred activities.

### **Intervention Phase**

The intervention phase consisted of 14 ABA sessions. The intervention package included:

1. Differential Reinforcement of Incompatible Behavior (DRI)
2. Extinction of escape-maintained behavior
3. Functional Communication Training (FCT)
4. Task modification
5. Prompting procedures

### **Differential Reinforcement of Incompatible Behavior**

Bubble blowing was selected as the incompatible behavior because it physically prevented simultaneous spitting behavior. During precursor behaviors associated with spitting, such as lip rolling, the participant was prompted to blow

bubbles for approximately 5–10 seconds before returning to the instructional task.

### **Extinction Procedure**

Because assessment results indicated escape-maintained behavior, escape reinforcement following spitting was discontinued. Therapists continued instructional demands while neutrally blocking spitting attempts using protective materials.

### **Functional Communication Training**

The participant was taught to appropriately request a break verbally by saying “break” instead of engaging in spitting behavior.

### **Task Modification**

Instructional tasks were modified into smaller and easier components to reduce task difficulty. For example, larger tasks were divided into shorter response requirements.

### **Prompting**

Most-to-least prompting procedures and physical guidance were implemented to facilitate compliance with instructional tasks and replacement behaviors.

## **Results**

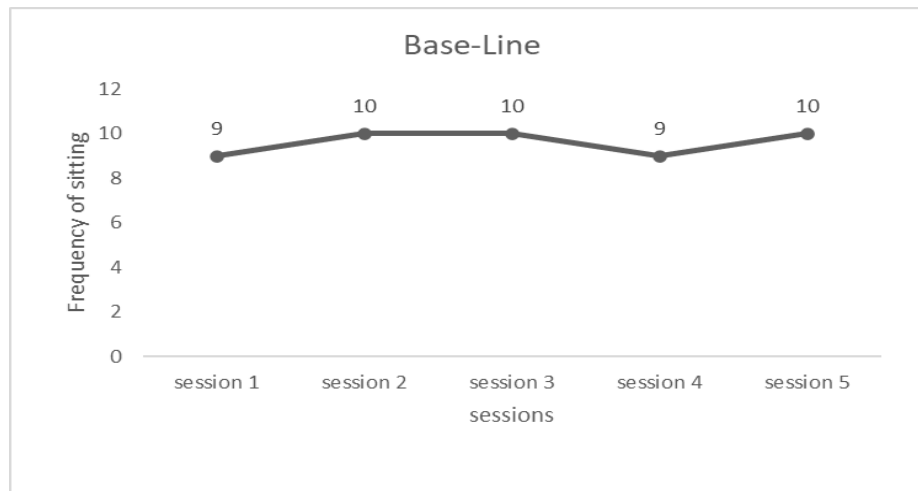
### **Baseline Phase**

Baseline data were collected across five consecutive ABA sessions before implementation of the intervention package. During this phase, the participant consistently demonstrated high rates of spitting behavior during instructional and demand-related tasks. A total of 48 instances of spitting were recorded across the five baseline sessions, with frequencies ranging between 9 and 10 occurrences per session.

Specifically, the first baseline session recorded 9 instances of spitting behavior. During Sessions 2 and 3, the frequency increased slightly to 10 occurrences and remained stable. Session 4 demonstrated a minor reduction to 9 instances, while Session 5 again recorded 10 instances. The baseline data therefore demonstrated a stable and consistently elevated pattern of spitting behavior with minimal variability across sessions.

The mean baseline frequency was approximately 9.6 occurrences per session. The stability of the baseline phase suggested that the behavior was unlikely to decrease in the absence of intervention and established an appropriate comparison condition for evaluating treatment effects. In addition to frequency stability, observational data collected through ABC recording indicated

that spitting behavior most frequently occurred immediately following presentation of instructional demands, task transitions, or increased task difficulty. The participant rarely demonstrated spitting behavior during preferred activities or reinforcement periods, further supporting escape-maintained responding.



*Figure 1. Frequency of spitting behavior across baseline sessions.*

### Intervention Phase

The intervention phase consisted of 14 ABA sessions implementing Differential Reinforcement of Incompatible Behavior (DRI), extinction, Functional Communication Training (FCT), task modification, and prompting procedures.

### Initial Treatment Response and Extinction Burst

Immediately following introduction of the intervention package, an extinction burst was observed. During Session 1 of intervention, the frequency of spitting increased sharply from baseline levels to 17 instances. In Session 2, the frequency further increased to 18 instances, and the highest level of responding occurred during Sessions 3 and 4, each with 19 recorded instances. The temporary increase in spitting behavior during early intervention sessions is clinically consistent with behavioral extinction processes described in Applied Behavior Analysis literature. Removal of escape reinforcement likely produced an initial escalation in responding as the

participant attempted to regain access to previously reinforced outcomes.

Despite the temporary increase in behavior, therapists maintained consistent implementation of extinction procedures, DRI, and FCT protocols across sessions.

### Progressive Reduction in Spitting Behavior

Following the extinction burst phase, a progressive reduction in spitting behavior was observed across subsequent sessions.

During Session 5, the frequency decreased to 15 instances, representing the first substantial reduction following treatment implementation. Session 6 demonstrated further improvement with 12 recorded occurrences. By Session 7, the frequency had reduced to 10 instances, returning to approximate baseline levels.

Continued decreases were observed across later intervention sessions. Session 8 recorded 7 instances of spitting, and Session 9 maintained the same level with 7 occurrences. In Session 10, the frequency decreased to 6 instances.

A more rapid reduction occurred during the final intervention sessions. Session 11 recorded 3 instances of spitting behavior, followed by 2 occurrences during Session 12 and 1 occurrence during Session 13. By Session 14, no spitting behavior was observed.

The intervention data demonstrated a clear downward trend following the initial extinction burst. The progressive decline across sessions suggested that the intervention package effectively reduced the reinforcing value of spitting behavior while simultaneously strengthening appropriate replacement behaviors.

### Functional Communication and Behavioral Adaptation

Clinical observations during intervention indicated gradual improvement in the

participant's use of replacement behaviors. Over time, the participant increasingly tolerated instructional demands and demonstrated greater compliance with modified tasks.

The participant also began using the taught verbal response ("break") more consistently when experiencing task-related frustration. Bubble-blowing behavior appeared to function as an effective incompatible oral-motor activity, reducing opportunities for spitting while simultaneously providing sensory engagement.

Task modification procedures likely contributed to behavioral improvement by decreasing task difficulty and reducing escape motivation. Breaking larger tasks into smaller components appeared to improve instructional tolerance and reduce behavioral escalation.

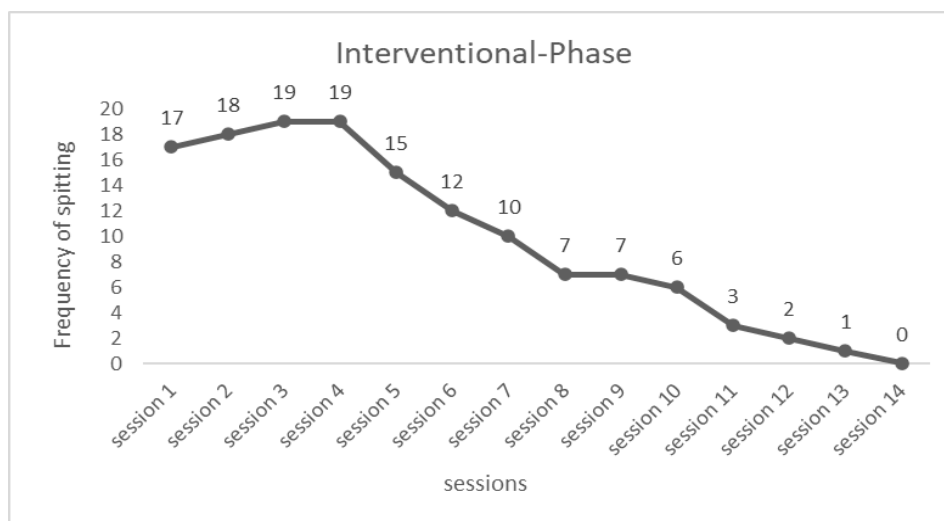


Figure 2. Frequency of spitting behavior across intervention sessions.

### Post-Intervention Assessment

Five post-intervention assessment sessions were conducted following completion of treatment to evaluate maintenance of treatment effects.

Across the five post-intervention sessions, only one instance of spitting behavior was recorded. Session 1 recorded zero occurrences, Session 2 recorded one occurrence, and Sessions 3, 4, and 5 each recorded zero occurrences.

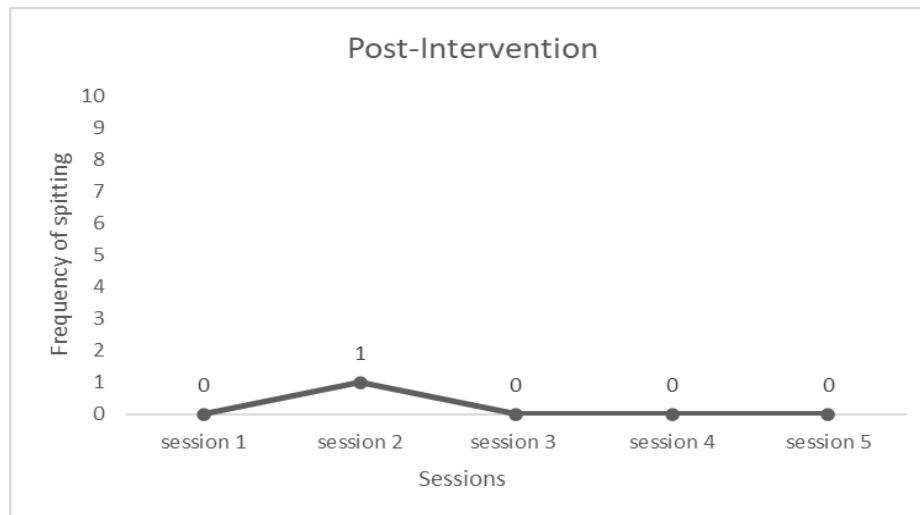
The post-intervention mean frequency decreased from approximately 9.6 occurrences per session during baseline to 0.2 occurrences per session during follow-up assessment. This represented an

approximate 97.9% reduction in average spitting behavior across phases.

The maintenance data indicated that treatment gains were sustained after completion of the intervention phase and suggested that the participant successfully acquired more adaptive methods for responding to instructional demands and escape-related situations.

Overall, the results demonstrated that the intervention package was associated with substantial and clinically meaningful reductions in escape-maintained spitting behavior in the participant with ASD. Visual analysis

demonstrated changes in level, trend, and variability across phases, with minimal overlap between baseline and intervention data.



*Figure 3. Frequency of spitting behavior during post-intervention assessment.*

### Discussion

The findings of the present study support the effectiveness of Differential Reinforcement of Incompatible Behavior (DRI) combined with extinction and Functional Communication Training (FCT) for reducing escape-maintained spitting behavior in a child with autism spectrum disorder (ASD). The intervention package was associated with substantial reductions in spitting behavior across treatment sessions and maintenance of treatment gains during post-intervention assessment.

Visual analysis of the data demonstrated a stable baseline with consistently elevated levels of spitting behavior and minimal variability prior to treatment implementation. Following introduction of the intervention package, an immediate increase in behavior frequency occurred, indicating an extinction burst consistent with behavioral extinction literature (Lerman et al., 1999). After this temporary escalation, the data demonstrated a clear downward trend across intervention sessions with progressively reduced responding and minimal overlap between baseline and later intervention phases. The participant ultimately demonstrated zero occurrences of spitting during the final intervention session and near-zero responding during follow-up assessment.

Functional assessment procedures identified escape from instructional demands as the primary maintaining variable of the behavior. The intervention package therefore addressed both the topography and the function of the target behavior. Bubble blowing was selected as the incompatible response because it physically prevented spitting while simultaneously providing oral-motor engagement. The intervention may therefore have functioned through multiple behavioral mechanisms, including response competition, sensory replacement, and reinforcement of adaptive responding.

The observed extinction burst during the initial intervention sessions was clinically important because it demonstrated the participant's continued attempts to access previously reinforced escape outcomes. Consistent implementation of extinction procedures likely weakened the reinforcement contingency maintaining spitting behavior over time. The gradual reduction in behavior frequency following the extinction burst suggests that the participant learned that spitting no longer resulted in task avoidance.

Functional Communication Training (FCT) likely contributed substantially to treatment effectiveness by teaching a socially appropriate alternative response that served the same escape

function as the target behavior. As the participant increasingly learned to request breaks verbally, reliance on maladaptive behavior appeared to decrease. Previous research has consistently shown that replacement communication responses improve treatment outcomes for escape-maintained challenging behavior (Carr & Durand, 1985; Tiger et al., 2008), and the present findings support those conclusions.

Task modification procedures may also have reduced the aversiveness of instructional demands and increased tolerance for academic activities. Breaking larger tasks into smaller components likely reduced response effort and improved compliance during therapy sessions. Similarly, prompting procedures may have facilitated acquisition of replacement behaviors during the early stages of intervention.

The present findings are consistent with previous research supporting reinforcement-based interventions for challenging behavior in children with ASD (Barton et al., 2018; Wong et al., 2015). However, the current study contributes specifically to the limited literature examining topography-specific DRI procedures for spitting behavior. Many previous studies have addressed challenging behavior broadly, whereas the present intervention targeted a physically incompatible oral-motor response directly competing with spitting behavior.

The clinical implications of the study are noteworthy for ABA practitioners and related professionals working with children who display escape-maintained oral-motor challenging behaviors. The findings suggest that selecting incompatible responses closely matched to the physical and sensory characteristics of the target behavior may improve intervention effectiveness. Bubble blowing represented a practical, inexpensive, and easily implemented intervention strategy within routine clinical therapy sessions.

Although the findings are promising, stronger experimental designs, larger participant samples, and long-term follow-up measures are needed to further evaluate treatment effectiveness and generalization across settings. Future research should also examine caregiver-implemented

interventions and compare different incompatible oral-motor responses for spitting behavior.

### **Limitations**

Several limitations should be considered when interpreting the findings. First, the study employed a simple AB single-case design without reversal or multiple-baseline procedures. Therefore, stronger experimental control and demonstration of functional relation were limited. Second, the study involved only one participant in a controlled clinical setting. Generalization of findings to other children, settings, or caregivers should therefore be approached cautiously.

Third, post-intervention follow-up was limited to five sessions. Long-term maintenance and generalization across environments were not evaluated.

Fourth, the intervention was implemented by trained ABA therapists. The effectiveness of the procedures when implemented by parents, teachers, or less experienced caregivers remains unknown.

Finally, prompting and physical guidance procedures were used during intervention. Future studies should evaluate independent maintenance of replacement behaviors with systematic fading of prompts.

An additional limitation of the present study was the absence of interobserver agreement (IOA) and treatment integrity measures. Because the study relied primarily on therapist-recorded behavioral data, objective evaluation of measurement reliability and procedural consistency could not be formally established. Future research should incorporate IOA and procedural fidelity measures to strengthen methodological rigor and improve confidence in treatment outcomes.

### **Conclusion**

The present study demonstrated that Differential Reinforcement of Incompatible Behavior combined with extinction and Functional Communication Training effectively reduced escape-maintained spitting behavior in a child with autism spectrum disorder.

The intervention package produced substantial reductions in behavior following an initial

extinction burst and maintained near-zero levels during post-intervention assessment. The findings support the use of function-based, reinforcement-focused behavioral interventions for socially significant challenging behaviors in children with ASD.

Future research should evaluate the effectiveness of DRI procedures across multiple participants, settings, and caregivers using stronger experimental designs and long-term follow-up measures.

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