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Visual Functional Communication Training in a Multilingual Home Context: Enhancing Communicative Agency in Autism with Vestibular Hypersensitivity

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ABSTRACT

This single-case ABAB study examined visual-based Functional Communication Training (FCT) as a multimodal approach to supporting communicative agency in a multilingual child with autism and vestibular hypersensitivity. Baseline data showed high rates of self-injurious behavior (M = 85.71%) and self-stimulatory behavior (M = 87.86%) across seven vestibular antecedents. During intervention phases, visual communication cards ("stop"/ "break") were taught as accessible linguistic alternatives, reducing SIB to 49.29% and SSB to 53.57%. Independent communicative exchanges increased from 48% to 67%. Findings position visual communication as an equity-oriented tool enhancing participation, identity expression, and inclusive language access for neurodiverse learners in multilingual contexts.

Keywords: *Vestibular hypersensitivity, autism spectrum disorder, functional communication training, self-injury behavior, self-stimulation behavior.*

INTRODUCTION

Self-injury behavior (SIB) is a serious and often destructive form of problem behavior that is commonly found in autism spectrum disorder (ASD) patients. SIB could involve head banging, biting, scratching, or hitting self and may cause tissue damage, loss of access to instruction and elevated caregiver stress. It has been estimated that some proportion of people with ASD develop some type of SIB in their development, especially those who have co-occurring intellectual impairment. Since it continues and can cause bodily injury, the identification of effective and functional interventions to SIB is of utmost importance.

Problem behaviors like the SIB could only be explained in a functional context. Problem behavior is maintained by the variables in the environment that are identified using functional behavior assessment (FBA), such as social (e.g., escape, attention, access to tangibles) or automatic (sensory consequences) reinforcement. The identification of behavioral functioning enables the practitioners to be able to formulate interventions that can directly focus on the maintenance of variables and not exclusively based on the concept of suppression by consequences. The intervention should be consistent with behavioral function and, as a result, the effects of treatment are stronger and more prolonged.

The functional communication training (FCT) which was first defined by Carr and Durand (1985) is an evidence based intervention that aims at the replacement of a problem behavior with a functionally equivalent communicative response. The person is conditioned in FCT to make a different response as far as communication is concerned, which elicits the same reinforcement as that which he or she previously received because of problem behavior. The intervention is usually comprised of three key elements namely (a) behavioral function identification using FBA (b) explicit instruction of a functional communication response (FCR), and (c) extinction of the undesirable behavior in a manner that makes it no longer to generate reinforcement. To enhance the appropriate behavior, one applies differential reinforcement of communicative response and to diminish reliance on maladaptive behavior, one applies the differential extinction.

In multilingual societies such as Pakistan, children with autism often navigate layered communicative expectations across home and educational environments. When expressive verbal language is limited, the absence of accessible linguistic modalities may intensify frustration and behavioral responses. Visual communication systems can function as alternative semiotic resources that enable meaning-making across languages and reduce communicative marginalization.

There exists a large amount of literature that promotes the efficacy of FCT in socially sustained problem behaviors, especially escape- and attention-maintained SIB. Nevertheless, there are less researches that explore the involvement of FCT where problem behaviors emerge in reaction to antecedent conditions like sensory or vestibular stimuli. Certain ASD patients exhibit SIB and self-stimulatory behavior (SSB) in response to posture, movement, walking surfaces or environment spatial needs changes. Where these behaviors have an escape or regulatory role in these situations, FCT can offer a socially acceptable alternative response. There is limited empirical evidence regarding the targeting of FCT to vestibular related antecedents, especially in a naturalistic home environment.

In multilingual societies such as Pakistan, children with autism frequently navigate layered communicative expectations across home, school, and therapy environments. When expressive verbal language is limited, restricted access to linguistically responsive modalities may intensify frustration and behavioral manifestations. Visual communication systems can function as alternative semiotic resources, enabling meaning-making beyond spoken language and supporting communicative participation within multilingual ecologies. In Global South contexts such as Pakistan, access to inclusive communication resources remains uneven. Visual-based communicative pedagogies may serve as low-cost, culturally adaptable tools to advance inclusive education in multilingual societies. In Global South contexts such as Pakistan, access to inclusive communication resources remains uneven across socioeconomic and linguistic communities. Children with disabilities who navigate multilingual ecologies may experience compounded marginalization due to limited availability of culturally and linguistically responsive supports. Visual-based communicative pedagogies represent low-cost, adaptable tools that can advance inclusive education and communicative justice in resource-constrained settings. By situating this intervention within a multilingual Pakistani household, the present study contributes to broader discussions of global educational equity and the democratization of communicative access.

LITERATURE REVIEW

According to He et al. (2007), the trainer (s) determines which behaviors he/she wants to increase or decrease and which other behaviors (incompatible or communicative) to teach them in order to apply appropriate and suitable technique of FCT. Then the trainer (s) identifies time interval and establishes criterion. What is more, inappropriate behaviors are neglected and the performance of the child is observed. Schmahl et al. (2004) recommended that self-injury and self stimulated behaviors could be totally different

behaviors, altered behaviors, or even socially favorable behaviors that are triggered by new antecedent following the adoption of concerned procedure of FCT.

Certainly, social reinforcement (positive and negative) is of paramount importance in the operant theory, (Bandura and McDonald, 1963; Harris et al., 1964), but with a narrower emphasis, Carr and Durand (1985); Howlin et al. (2007) suggested the communication hypothesis of taxing behaviors. The major undertaking premise of this hypothesis is that lacks of verbal communication results in taxation behaviors (Hogan and Henley, 1970), so nonverbal antisocial acts, feelings or thoughts occur in place of socially acceptable behaviors (Landa et al., 2007).

This hypothesis can be supported by the inverse association between communicative skill and behavior problems (Mundy et al., 1986; Kravits et al., 2002), which suggests that in the case of people with autism spectrum disorder ASD, taxing behaviors are performed and exist as communicative behavior, to get and obtain attention; avoid needs and demands; or get a desired object (Buffington et al., 1998; Adams et al., 2004). Those having strong to severe autistic traits and borderline I.Q levels are less likely to learn behaviorally equivalent ones and consequently keep taxing ones in behavioral repertoire. According to the communication hypothesis, Carr and Durand (1985) developed FCT, which implies that taxing behaviors act as a communication and that problematic individuals are conditioned to engage in socially appropriate and sustainable communicative functional operations namely through the application of picture exchange communication system.

The case of a nine-year-old girl with ASD that was presented by Ladd et al. (2009) showed a very severe self-skin picking, primarily of her fingers which caused tissue damage by decreasing its value. The researchers checked the possibility of an alternative behavior to mitigate SIB through an antecedent-based intervention (ABI) that could be applied by a child alone with environmental manipulations especially with the aim of altering the condition in the environment that the learner is stimulated. They found that SIB occurred most often during unstructured time and determined the function of this behavior was automatic reinforcement of sensory stimulation (Pies & Popli, 1995; Simeon & Favazza, 2001; Ladd et al., 2009).

According to a study by Rosenthal-Malek and Mitchell (1997) it is assumed that self-injury and self-stimulatory would be put on extinction procedure of FCT in which no longer the reinforcing use would be associated with the troublesome behavior such as delinquency and major barriers in the educational and social strategems of development. The demonstration of the superior behavior can be enticed and provoked in case it will oppose and interfere with the revelation of the bad behavior. Despite simply punishing undesirable behavior, we strive to change it into positive behavior by rewarding nominated and deputed behaviors that would keep the unacceptable exertions and movements never to take place. Extinction is a very effective process whereby all reinforcements are eliminated that is related to the desired behavior (Williams, 1959; Rincover, 1978; Katner and Weiss 1999). As Iwata (1987) observes, complex issues are usually encountered with the process where extinction occurs whereby aggressive behavior is no longer reinforced, self-injury behavior, self-harm behavior or self-stimulated behavior.

Williams (1959) describes extinction as a non-theoretical concept in defining the strategy to end reinforcement of a previously reinforced behavior, which eventually leads to reduction of that specific targeted behavior. Bandura and Menlove (1968) highly indicated that, extinction is the withdrawal process of a motivating and encouraging reinforce that reinforces a behavior which in a number of cases is more admirable than the punishment processes since most punishment processes are considered unethical and, in most of the states, they are unlawful. Based on the evidence-based researches, the intervention of extinction has been effective in preschooler learners and those with high school ASD, (Everett et al., 2007; Winterbauer et al., 2013).

However, it is a good way of reducing undesired behaviors, although extinction procedures should be implemented with the highest level of caution by the professionals, as they are usually coupled with extinction ruptures and blowouts (Rincover, 1978; Horner et al., 2002). According to Hoch et al, (1994), the non-permanent increase in the rate of occurrence, intensity of targeted behavior and duration of the specific behavior targeted as the procedure being carried out in the extinction is known as extinction paroxysms and effusions. Extinction violence involves the occurrence of unconscious emotional reaction to an extinction pattern which is often represented by hostility and the development of fictitious and hardback behaviors not normally present before the extinction procedure (Thompson et al., 2003; Reed et al., 2004).

The FCT procedure of punishment is where a consequence immediately follows a behavior to reduce future levels and occurrence of the behavior by the use of three forms of punishment presentation of aversive stimuli, response cost, and freedom restriction (LaVigna and Donnellan, 1986; Carver and White, 1994). Just like in the case of reinforcement of positive and negative, a thing or event that stimulates a certain functional response within the organ of a person may be introduced in case of positive punishment or eliminated in case of negative punishment. Even in practice punishment may have undesirable side effects (Matson and Kazdin, 1981). Other other unwanted effects may include bitter indignation and frustration over the punishment, attempts and undertakings to avoid the punishment, display of affliction and negative emotions conjoined with it and attribution by the punished person between the punishment and the punisher (Axelrod, 1987; Matson and Taras, 1989).

Carver and White (1994) recommended that punishment may be adopted as a method by introducing or imposing a penalty as revenge of the wrong behavior or ability. Annett and Stanton (2000) argue that an unpleasant stimulus may be associated with undesired behavior to extinguish specific behavior in the form of self-injury and self-stimulatory as the FCT procedure is implemented using either the process of extinction or punishment. The principle behind force with fear as a strategy of functional communication training is the exposure of fear-provoking situations or objects to individuals in a quick and intense manner to reduce the frequency of desired behavior (Schraagen et al., 2000). Similarly, systematic desensitization is also a process of teaching to be relaxed as one pays attention to the elimination of self-injury and self-stimulatory. Shaping is a conditioning paradigm of FCT, which is applied mostly in the reduction of self-injury habits and self-stimulated habits. Chaining, modeling and task analysis are also beneficial strategies that are presented in the paradigm of FCT that operate through watching actions to accomplish their desired objectives (Richard, 2003).

According to Johnson et al. (2007), FCT, is nothing more than the simple and pure application of behavioral principles, to everyday situational circumstances, which with time, results in either the more or less of targeted behaviors. Multidimensional life surviving skills, which include acquisition of language skills, self-help skills, leisure skills, and play skills have been acquired by children with the help of FCT. Similarly, techniques involving behavioral principles may be used to reduce the instances of paradoxical behaviors and ticklish behaviors including aggressive behaviors, self-injury behavior and self-stimulation behavior (Filipek et al., 2000). Indeed, by prescribing individuals with intellectual disabilities/autism spectrum disorders with suitable and socially acceptable critically equivalent communicative behaviors (Martin et al., 2005; Ringdahl et al., 2009; Mancil and Boman, 2010), definitely attenuates the severity and frequency of taxing behaviors particularly when it comes to the well-structured system of exchanging pictures and communicative cards (Bondy and Frost, 1994; Kelley et al., 2002; Davis et al Well, the potency and efficacy of FCT in terms of lessening the number of times taxing behaviors like self-injury behaviors and self-stimulated behaviors have been further supported by a number of studies.

Theories in the language and communication acquisition have been and will always be used to define the processes that are involved in the language and communication acquisition in normally growing children,

however the development and learning of socially appropriate forms of communication rather than self-injury and self-stimulatory in the individuals with ASD have never been considered within the Pakistani society. Most of the current study involved the application of FCT to diminish the self-injury and self-stimulating behaviors of highly destructive and damaging nature in individuals having ASD and to generate more functional means of communication by serving the same purpose of a necessity or a need.

Not only, however, is the present study an addition to the already existing body of knowledge but is also concerned with the research of the effects of FCT on hypersensitive sensations that induce self-injury behaviors and self-stimulated behaviors in autistic children. It is no doubt that a lot of research has been conducted in this area, but when it came to conducting a literature review it was established that there were a few studies concerning the efficacy of the FCT to reduce sense related self-injury behaviors and self-stimulated behaviors to the socially acceptable level. Previously, relevance of FCT was not viewed as a desirable tool in raising the autistic children up to the surface with harmonious sensations, however, these days, more enlightenment has greatly recognized the presence of simulative means in achieving the more and more satisfactory and self-sufficient living.

The research on FCT is mostly devoted to attention- or escape-sustained behavior, and the number of studies devoted to sensory-or vestibular-triggered self-injury and self-stimulatory behavior is limited. It is also missing studies that are in naturalistic home settings, especially in Pakistan and studies have not looked at long term maintenance or generalization across environment. This paper will fill such gaps by exploring FCT in relation to the behaviors of vestibular hypersensitivity in ASD children.

Visual communication systems such as picture exchange cards function not merely as behavioral tools but as multimodal linguistic resources. From a multimodal perspective, meaning is constructed through visual, spatial, and gestural modes alongside speech. For multilingual learners with autism, visual symbols may bridge gaps between linguistic expectations and expressive capacity, supporting participation and identity affirmation.

From a multimodal perspective, communication extends beyond speech to include visual, spatial, and gestural modes of meaning-making. Visual symbols function as legitimate linguistic systems that enable participation when verbal channels are inaccessible. For neurodiverse learners, access to alternative semiotic systems supports not only behavioral regulation but also identity affirmation. Communicative participation is central to the construction of agency and self-representation in educational contexts. Within multilingual environments, visual communication may serve as an equity-oriented pedagogical strategy, reducing linguistic marginalization and expanding inclusive access to classroom interaction.

THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK

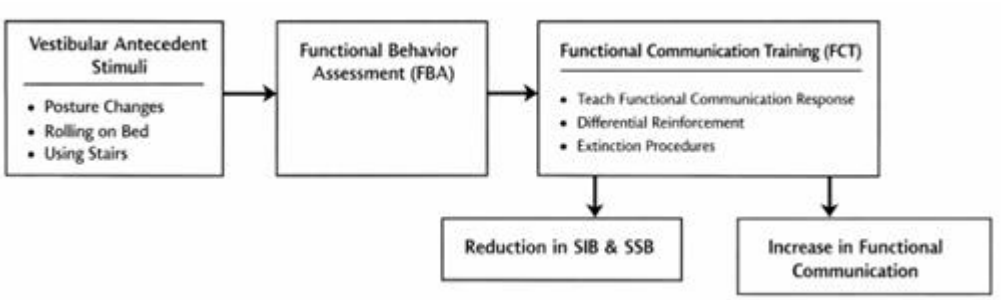
The present paper is based on the ABA and operant learning theory (Skinner, 1938) that state that the antecedents and consequences shape and maintain behavior. SIB and SSB tend to be maladaptive reactions to the environmental or sensory stimuli in people with ASD. These actions are supported by either socially mediated reinforcement e.g. attention, escape or access to desired objects or automatic reinforcement e.g. sensory stimulation. Communication hypothesis (Carr and Durand, 1985) is a hypothesis which argues that difficult behavior often plays communicative role to individuals with little verbal skills who can thus get attention, avoid demands or satisfy sensory need that they would otherwise say inconveniencing.

FCT puts this theoretical view into practical use by training an FCR which substitutes maladaptive behavior without loss of access to the same reinforcement. FCT incorporates three important elements namely establishing the role of behavior using FBA, teaching an appropriate communicative response explicitly and using extinction procedures such that the problem behavior no longer elicits reinforcement. The

effectiveness of FCT in SIB and SSB reduction has been evidenced by empirical literature (Bondy and Frost, 1994; Mancil and Boman, 2010), but little has been done on sensory or vestibular antecedents, especially in a naturalistic home environment.

The conceptual framework of the proposed study represents the connection between antecedent stimuli, problem behaviors, intervention, and outcomes. SIB and SSB in children with ASD may be provoked by the vestibular antecedent stimuli, which may include posture changes, rolling on the bed, or climbing the stairs. With FBA, the functional roles of such behaviors are determined, which inform the development of FCT interventions. The intervention includes the teaching of a functional response to communication, which is reinforced with the help of the differential reinforcement and facilitated by the extinction of the problem behavior. It is presumed that with the successful implementation of FCT, the decrease in SIB and SSB and the rise in adaptive functional communication can be observed, which is why it is essential to consider adapting the intervention strategies to the behavioral functions identified.

Figure 1: Conceptual Framework Illustrating the Effect of FCT on Reducing SIB and SSB and Increasing Functional Communication



Note. This flow chart depicts the conceptual framework of the study, showing how Functional Communication Training (FCT) targets self-injurious behavior (SIB) and self-stimulatory behavior (SSB) by identifying behavioral functions, teaching functionally equivalent communication responses, and applying differential reinforcement, ultimately leading to increased socially appropriate functional communication.

Objectives of the study

Following objectives were designed to address the research problem:

1. To examine the effect of FCT on reducing SIB associated with vestibular hypersensitivity in a child with ASD.

2. To evaluate the effect of FCT on reducing SSB triggered by vestibular antecedent stimuli.

3. To determine whether the ABAB withdrawal design demonstrates experimental control through replication of treatment effects and increases in functional communication exchanges.

Research Questions

1. What is the effect of FCT on the occurrence of SIB across identified vestibular antecedent conditions?

2. What is the effect of FCT on the occurrence of SSB across identified vestibular antecedent conditions?

3. Does the ABAB design demonstrate a functional relation between FCT implementation and reductions in maladaptive behavior accompanied by increases in functional communication?

METHODS

Participant and Recruitment

The **participant B** lived in a multilingual household where Urdu was primarily spoken at home and English was used in educational materials. Verbal expressive abilities were limited, which increased reliance on nonverbal and visual communicative forms. Participant B was a 12-year-old girl who had been diagnosed with clinical diagnosis of autism spectrum disorder (ASD) by a licensed developmental pediatrician in a tertiary care hospital before. The diagnosis was based on the DSM-5 criteria and supplemented by the developmental history, parent interview and direct clinical observation. Her cognitive functioning was also tested within the year before the study with the Wechsler Intelligence Scale of Children- IV (WISC-IV) and produced a Full-Scale IQ score of 70, stating the borderline intellectual functioning.

Her parents referred to the participant to home-based behavioral consultation because of chronic self-injury behavior (SIB) and self-stimulatory behavior (SSB) that complicated everyday activities and mobility. The recruitment was done at the request of the parents on the behavioral support services. No monetary reimbursement was given. Informed consent was obtained orally by the parent before taking part and the procedures of the study were reviewed and accepted by the institutional ethics committee.

Setting

The meetings were going on in the bedroom of the participant in her home. There was a bed, table, chairs, cushions, picture communication cards, and data recording materials in the room. Only other people were present in sessions when necessary, due to safety reasons. The home setting enabled the study to be done within a familiar environment and reduced the effects of the new contextual variables.

Response Definitions

Prior to the collection of the baseline data, operational definitions of target behaviors were created to ensure replicability and consistency. Self-injury behavior was conceptualized as any occasion when the head of the participant came into contact with a hard surface forcefully, when the participant bit herself and her body, when she struck her head or body with her hand or an object with force, or when she scratched her skin and the redness took at least five seconds.

Self-stimulatory behavior was characterized by rocking of the body at a level of three or more seconds followed up by two or more seconds, flapping of hands, or staring at an object or surface with no engagement during five or more seconds. The occurrence of a behavior was rated only during a recording interval when the behavior met the entire operational definition.

Measurement and Interobserver Agreement

The data on behavior was recorded in partial-interval using partial-interval recording technique in 30 minutes sessions separated by 180 successive 10-second intervals. The observers noted the presence or

absence of SIB and SSB in every interval. The percentage of intervals of SIB or SSB per session was used as the main dependent variable.

One of the trained observers independently scored 30 percent of the sessions that were distributed throughout all the phases of the experiment. It was determined that interobserver agreement was calculated by the number of point-by-point agreement by taking the number of agreements and dividing it by the sum of agreements plus disagreements and multiple by 100. Interobserver agreement was more than 90 percent in all phases, and there were no phases that were less than 85 percent, which also indicates reliability in the measurements.

Functional Behavior Assessment

To determine which variables to maintain SIB and SSB and to select an appropriately functional response to communication, a structured functional behavior assessment (FBA) was carried out before the intervention to identify the maintaining variables of the latter two. The evaluation consisted of indirect and direct aspects.

Indirect measurement involved parent interview, structured in nature and aimed at the typical antecedent conditions, typical consequences and contextual variables of problem behavior. Direct assessment entailed the use of ABC (antecedent-behavior-consequence) data gathering in naturally occurring episodes. Each of the identified antecedent conditions was observed at least ten times, such as modified walking surfaces or footwear, stepping up and down stairs, adapting position, open area, peering down, and rolling on the bed.

When the ABC data were analyzed, it was found that SIB most commonly came after environmental transitions, postures, or mobility requests and was frequently succeeded by caregiver attention or a temporary elimination of the demand. The data patterns indicated that the social mediation of reinforcement in the form of escape and attention was the one that maintained SIB. Conversely, SSB was most repeatedly observed under vestibular stimulation and did not constantly have social effects, indicating that it was maintained by automatic sensory reinforcement. These practical meanings had direct implications in the design of interventions. Communicative response that was chosen as the object of teaching thus consisted in the request to stop or have a break so that the participant could get an escape/attention in the socially recognized and approved way and not by SIB.

Intervention: Functional Communication Training

Functional communication training (FCT) was adopted as a multicomponent intervention and involved instruction in a functional communication response, the differentiation of reinforcement of the communicative response and the elimination of problem behavior. Every session commenced by introduction of a known antecedent stimulus that evoked problem behavior such as change of posture or stair use.

Antecedent was introduced, and the participant was instructed to trade a laminated card with a few words printed on it that said Stop. There was the application of a graduated prompting hierarchy, whereby full physical guidance was applied when necessary, then there was partial physical guidance, gestural guidance and subsequently there was independent responding. Fast fading was done based on the ability of the participant to exhibit 80 percent independent responding in two sessions. The laminated “Stop” card functioned as a visual linguistic sign that enabled the participant to negotiate environmental demands without reliance on spoken language. Rather than serving solely as a behavioral replacement, the card provided an accessible communicative modality that supported agency within a multilingual context.

In case the participant shared the card on his own or in a timely manner, the reinforcer identified was provided instantly. The antecedent stimulus was presented in escape-maintained situations to 30 seconds of no stimulus. Short social attention was provided in attention maintained situations. After the strengthening period, the antecedent was reentered and the process repeated.

SIB and SSB were put under extinction processes. Escape and attention could no longer be generated by problem behaviors. The researcher was very neutral in his effect and blocked his behavior only when needed to protect his safety. No unpleasant procedures were applied. The sessions were around 42 minutes.

Procedural Fidelity

A 10-step procedural integrity checklist was filled to make sure the implementation was consistent, which was done during 25 percent of the sessions. The checklist evaluated proper presentation of antecedents, delivery of prompt and immediate reinforcement after communicative response and use of a uniform application of extinction procedures. Mean procedural fidelity was more than 95 which means that there was high compliance with intervention procedures.

Experimental Design

The functional relationship between FCT and decreases in SIB and SSB was assessed with the use of an ABAB withdrawal design. In the first baseline (A1) the antecedents stimuli were introduced and problem behavior was noted, however no prompts or programmed consequences were given. The procedure of FCT was implemented as follows in the initial stages of intervention (B1). During the withdrawal phase (A2), they removed all the FCT components and restored the baseline contingencies to determine whether or not behavior would go back to the baseline levels. In the second intervention phase (B2), the process of FCT was re-introduced to determine replication of the treatment effects.

The phase changes had to happen at least five sessions and at the point where the data showed stability, which could be three successively data points in at least a 15% range without a definite trend in therapeutic change.

Data Analysis

Visual inspection was used to analyze data in accordance with the standards of the single-case experimental design. There was visual analysis based on variations in level, trend, variability, immediacy of effects, overlap and consistency of patterns across similar phases. Descriptive analysis on the nonoverlap of baseline and intervention phases was used in order to interpret the effect of treatment. No inferential statistical analyses were done, which is in line with methodological norms of single case experimental studies.

RESULTS

Table 1: Baseline Percentage of Intervals with SIB and SSB Across Vestibular Antecedent Stimuli

Antecedent Stimulus	SIB (%)	SSB (%)
Rolling on bed	85	90
Change in walk surface/footwear	80	90
Crowds/open spaces	90	85
Straight posture	85	90
Looking downward	90	90

Using stairs	85	80
Straight walking	85	90

Note. Values represent mean percentage of intervals with behavior during baseline sessions (A1 phase).

Table 2: Percentage of Intervals with SIB Across ABAB Phases

Antecedent Stimulus	A1 (Baseline)	B1 (FCT)	A2 (Withdrawal)	B2 (Reintroduction)
Rolling on bed	85	62	80	40
Walk surface/footwear	80	68	78	45
Crowds/open spaces	90	72	88	55
Straight posture	85	65	82	50
Looking downward	90	74	87	60
Using stairs	85	60	83	45
Straight walking	85	70	84	50

Note. Values represent phase means (percentage of intervals).

Table 3: Percentage of Intervals with SSB Across ABAB Phases

Antecedent Stimulus	A1 (Baseline)	B1 (FCT)	A2 (Withdrawal)	B2 (Reintroduction)
Rolling on bed	90	70	85	45
Walk surface/footwear	90	72	86	50
Crowds/open spaces	85	75	83	65
Straight posture	90	68	88	55
Looking downward	90	78	87	65
Using stairs	80	65	78	45
Straight walking	90	70	88	50

Note. Values represent phase means (percentage of intervals).

Table 4: Mean Percentage of Intervals with SIB and SSB by Phase (Collapsed Across Stimuli)

Phase	Mean SIB (%)	Mean SSB (%)
A1	85.71	87.86
B1	67.29	71.14
A2	83.14	85.00
B2	49.29	53.57

Note. Means calculated across seven vestibular antecedent stimuli. No inferential statistics were conducted.

Table 5: Functional Communication Response (FCR) Acquisition Across Intervention Phases

Phase	Sessions Conducted	Independent Exchanges (%)
B1	420	48
B2	420	67

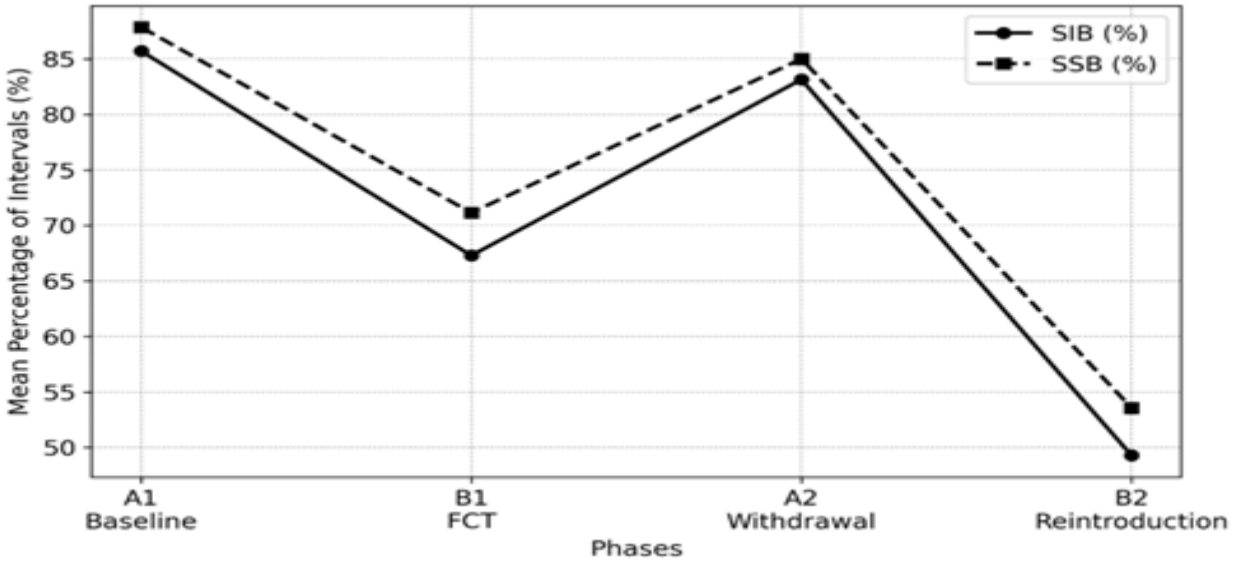
Note. Independent exchange defined as card exchange without physical prompt.

Table 6: Interobserver Agreement Across Phases

Phase	Mean IOA (%)	Range (%)
A1	92	87–97
B1	95	90–98
A2	91	85–96
B2	95	91–99

Note. IOA calculated using point-by-point agreement for 30% of sessions.

Figure 2: Mean Percentage of Intervals with SIB and SSB across ABAB Phases



Note. Mean percentage of intervals with self-injurious behavior (SIB) and self-stimulatory behavior (SSB) across ABAB phases, showing reductions during FCT intervention and resurgence during withdrawal.

DISCUSSION

The present study examined the effects of Functional Communication Training (FCT) on self-injurious behavior (SIB) and self-stimulatory behavior (SSB) under vestibular antecedent conditions in a child with autism spectrum disorder (ASD). Consistent with the functional behavior assessment (FBA), SIB appeared to be maintained by socially mediated reinforcement (escape/attention), whereas SSB was primarily associated with automatic sensory consequences. The systematic reduction of both behaviors during intervention phases, coupled with their partial resurgence during withdrawal and subsequent decline upon reintroduction, demonstrates a functional relation between FCT and behavior change, consistent with standards for single-case experimental control (Cooper, Heron, & Heward, 2020).

These findings align with a substantial body of literature identifying FCT as an evidence-based intervention for socially mediated challenging behavior (Carr & Durand, 1985; Tiger, Hanley, & Bruzek, 2008). Early work by Carr and Durand (1985) established that teaching functionally equivalent communicative responses reduces problem behavior by providing appropriate access to reinforcement. Similarly, Bondy and Frost's Picture Exchange Communication System (PECS) research demonstrated that augmentative communication can effectively replace challenging behavior when it serves the same function. Rosenthal-

Malek and Mitchell (1997) further reported reductions in problem behavior when alternative communicative responses were systematically reinforced. The present study can be seen as an expansion of this literature because it implements FCT in the context of sensory-triggered (vestibular) conditions and reports similar results with the consistent effects under various antecedent conditions in a naturalistic home setting.

The conceptual integrity of the intervention was enhanced with the rigorous use of FBA procedures. Contingency maintenance was determined based on indirect interviews as well as direct ABC observations and the chosen communicative behavior (stop or take a break) yielded functional outcomes identical to the results achieved with the help of SIB. This correspondence between the role of behavior and replacement reaction is the focus of FCT efficacy and probably the extent and continuity of behavioral change. This type of intervention based on functions is the best practice in applied behavior analysis and improves the accuracy of treatment, as well as its social validity.

The development of increased independent communication observed between different stages of intervention is also in agreement with the previous studies conducted on FCT that show gradual learning of skills as prompts are removed and a history of reinforcements is built (Tiger et al., 2008). The stronger and more consistent effects of the second intervention phase (B2) implies stronger stimulus control and fluency of responses, which is a usual finding in replicated designs of single cases. Replication phases tend to show quicker or more endering consequences after primary learning in addition to supporting experimental control.

In addition to the behavioral results, the results indicate that the visual communication systems can be used as equity-based pedagogical instruments in the multilingual settings. Where the demands of spoken language surpass the ability to express oneself, the visual symbols are used to offer another linguistic avenue in which exclusion is minimized and inclusion facilitated in communication. According to a multicultural education approach, the communicative access is at the heart of identity formation and engagement. The fact that the participant had more independent interactions implies the enhancement of behavioral improvements, as well as the opportunities to express oneself. As such, this means that visual communication can help in affirming identity to neurodiverse learners in multilingual settings.

Notably, the research will be relevant in the growing debates of sensory-related antecedents in ASD. Even though SSB was partially sustained by the automatic reinforcement, its weakening in FCT phases is an indication that the general response strength can be weakened by altering social contingency and offering organized communicative options even in the presence of automatic elements. This observation correlates with the current behavioral views that focus on the interplay between the antecedent sensory environments and the effects of a socially mediated environmental factors in behavior shaping.

The findings can be taken to imply that visual communication systems can be used as equity-focused pedagogical tools in a multilingual environment. In cases where expectations of spoken language surpass the expressive ability, the lack of available modalities can support the exclusion. There are other avenues of participation by visual semiotic systems. In a multicultural education context, agency and identity are based on communicative access. This fact is shown by the number of independent exchanges made by the participant, which does not only show that the behavior was improved, but that the individual had more chances to express himself/herself and gain social acceptance. Learners with disabilities in the context of multilingualism can have a layered marginalization because of neurodevelopmental and linguistic dissimilarity. The practice of visual communication can help diminish such overlapping obstacles and encourage all-inclusive involvement.

And lastly, the interobserver agreement and high fidelity of the procedure were high, which adds credibility to the findings. The ABAB withdrawal design gave repeated demonstrations of effect, which compensated internal validity by replication and not by comparison. The findings together support FCT as an empirically supported, function-based intervention that can be scaled for sensory-related situations and working in an ecologically-validated home context, as well as having broader implications as to communicative equity and inclusion.

Finally, strong interobserver agreement and high procedural fidelity enhance confidence in the findings. The ABAB withdrawal design provided repeated demonstrations of effect, strengthening internal validity through replication rather than statistical comparison. Collectively, the results reinforce FCT as a function-based, empirically supported intervention adaptable to sensory-triggered contexts and applicable within ecologically valid home settings, while also highlighting its broader implications for communicative equity and inclusion.

CONCLUSION

The findings strengthen the empirical support for Functional Communication Training (FCT) as an effective intervention for reducing maladaptive behaviors associated with vestibular hypersensitivity in children with ASD. Teaching a functionally equivalent communicative response successfully replaced self-injurious (SIB) and self-stimulatory behaviors (SSB) with socially appropriate alternatives. The ABAB design demonstrated clear experimental control, as behavioral reductions systematically corresponded with intervention phases.

This study extends existing literature by documenting FCT effectiveness within naturalistic home settings and sensory-triggered antecedent conditions. As a function-based intervention, FCT directly addressed the maintaining variables of challenging behavior. Moreover, the integration of systematic functional assessment, domain-specific measurement, procedural fidelity, and phase replication illustrates the rigorous application of single-case methodology in applied contexts.

This study contributes to visual-based approaches in education by demonstrating how multimodal communication systems can enhance linguistic participation in marginalized learners. Integrating visual pedagogies within multilingual settings may advance inclusive and culturally responsive educational practices. Overall, the findings underscore the importance of aligning replacement communication with identified behavioral functions and support FCT as a socially valid, evidence-based strategy for managing vestibular-related maladaptive behaviors in autism.

RECOMMENDATIONS

1. Teachers, clinicians, and caregivers ought to use FCT in treating maladaptive behaviors induced by the vestibular hypersensitivity in children with ASD.

2. The interventions must focus on instruction and supporting functional communication and observing extinction bursts or emotional outbursts.

3. It is suggested that parents, teachers, and other caregivers should be trained on the implementation of FCT to allow procedural fidelity and foster generalization across settings.

4. Ethical protection should be practiced such as use of least-restrictive procedures, constant surveillance of safety and effective use of extinction or mild punishment measures.

5. Individualized evaluation of behavioral function should be considered by the practitioners to assist them in the selection of communicative responses based on the individual antecedents of SIB and SSB.

LIMITATIONS

The study involved a single participant, limiting external validity and applicability to broader populations.

1. The ABAB single-case design restricts population-level generalization despite demonstrating experimental control.

2. Generalization across novel settings and contexts was not systematically assessed.

3. No follow-up on maintenance of treatment effects was done outside the intervention period so conclusions could not be drawn on sustainability in the long term.

4. The age of the participant and his or her borderline intellectual functioning (FSIQ = 70) could limit the applicability to other individuals with other developmental or intellectual histories.

5. The frequency of the target behaviors could have been overestimated by partial-interval recording.

6. Vestibular hypersensitivity was identified through behavioral observation and caregiver report rather than standardized sensory processing assessments.

FUTURE RESEARCH

1. Conduct the study using bigger and heterogeneous samples to reinforce external validity.

2. Use multi-elements or randomized multi-baseline designs to enhance methodological rigor.

3. Carry out longitudinal studies to test the sustainability and continuation of FCT results in the long term.

4. Add standardized sensory tests to directly test the vestibular and other sensory sensitivities.

5. Investigate the issue of integrating FCT and sensory based interventions to find out whether integrated interventions can hasten the process of functional skill acquisition and enhance quality of life outcomes in persons with ASD.

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