Journal of Psychological Abnormalities in Children

Medeiros, J Psychol Abnorm Child 2015, 4:3
DOI: 10.4172/2329-9525.1000141

Research Article Open Access

Behavioral Interventions for Individuals with Intellectual Disabilities Exhibiting automatically-Reinforced Challenging Behavior: Stereotypy and Self-Injury

Kristen Medeiros*

Visiting Assistant Professor, Psychology,Central Connecticut State University, New Britain, CT, USA

Abstract

Challenging behaviors (CBs) among those with intellectual disabilities (ID) such as stereotyped behavior (stereotypy) and self-injurious behavior (SIB) are widespread, dangerous, progressive in nature, and can interfere significantly with an individual's quality of life. When the function of CB is identified, interventions are more successful. This paper reviewed literature on available behavioral interventions for automatically reinforced cases of stereotypy and SIB. Sixteen single-subject studies met the inclusion criteria, and interventions were analyzed according to the topography exhibited. Every intervention successfully decreased the stereotypy or SIB for its participant. This literature review shows that individualized behavioral interventions can be successful at reducing automatically reinforced CBs. Implications for interventions are discussed separately for stereotypy and SIB.

Keywords: Intellectual Disabilities; Challenging Behavior; Behavioral Interventions; Stereotypy; Self-injury

Background

Individuals with intellectual disability (ID) have severe and chronic limitations in intellectual functioning and adaptive behavior that manifest before the age of 18 years American Psychiatric Association, [1]. Two of the central learning problems of individuals with ID are difficulties with language abilities and cognitive or social-emotional self-regulation [2]. These deficits can lead to distinct profiles of abilities and patterns of challenging behavior (CB), including stereotypic behavior (stereotypy) and self-injurious behavior (SIB).

Stereotypy is defined as restricted, repetitive, and stereotyped patterns of behavior, interests, and activities, as manifested by 1) preoccupation with stereotyped and restricted patterns of interest that is abnormal in intensity or focus, 2) inflexible adherence to specific, nonfunctional routines or rituals, 3) stereotyped and repetitive motor mannerisms, or 4) persistent preoccupation with parts of objects [1]. Stereotypy is relatively common among individuals with ID [3], and its exhibition is highly heterogeneous, taking the form of repetitive behaviors or restricted interests, usually depending on the level of disability of the individual. These behaviors look may bizarre and inappropriate to others and can interfere with everyday functions, thus disturbing the individual's quality of life [4].

SIB is self-directed, physical damage that occurs repeatedly, requires intervention, ranges in severity, frequency, and topography, and positively correlates with chronological age, level of ID, and sensory and communication deficits [5]. Some of the more common topographies include head banging with body parts or objects, body hitting with body parts or objects, self-biting, self-scratching, self-pinching, gouging with fingers in body cavities, and self-hair pulling [6-8]. The number of individuals with ID that present SIB is reported as anywhere from 1.7% [9] to 82% [10]. The wide variability in prevalence reports is likely due to differences in sampling and criteria for SIB. Although early onset of SIB appears to be consistent, with parental concern usually beginning at around two years of age [11,12], the particular developmental trajectory of SIB appears to be less consistent. Some research shows a nonlinear pattern, with an increase in youth, stabilization in adolescence, and a decrease in adulthood [13] and some research shows that the trajectory can be moderated by other factors, such as level of functioning, where more severe and profound ID cases increase self-injury in adulthood while moderate and mild intellectual disabilities show a stable amount of self-injury across age groups [14]. Despite the differences in progress, SIB can be extremely dangerous at any point in life due to its diminishing effects on physical, cognitive, and social development, as well as general deterioration to a person's quality of life [15]. The varying patterns of SIB illustrate its progressive nature and therefore provide support for interventions and therapies that target underlying causes rather than treatments that merely mask or control symptoms.

Researchers have developed functional assessments and analyses to examine the underlying causes of these CBs. These tools have come to produce distinct categories of functions (i.e., motivators or reinforcers) with different labels depending on the author and field. Most measures report four separate behavioral reinforcement functions: external positive (i.e. to receive attention or tangibles), external negative (i.e. to evade a social demand), internal positive (i.e. to elicit a physical sensation), and internal negative (i.e. to reduce physical discomfort). Some measures do not distinguish among positive and negative reinforcement, and categorize these functions as either "automatically reinforcing" or "socially reinforcing" [16].

Assessing functions of CBs to produce individualized behavioral interventions that intervene at the antecedent or consequent level can be extremely successful at reducing problem behavior and increasing adaptive behavior [16,17]. It is important to note that several lines of research support gathering information about both behavioral functions and motivating operations to have the best success with interventions, where motivating operations are defined as environmental, biological, social, or cognitive elements that can influence the effectiveness of consequences used in operant conditioning techniques during behavior modification [18-21].

***Corresponding author:** Kristen Medeiros, Visiting Assistant Professor, Psychology, Central Connecticut State University, New Britain, CT, USA. Tel: 12038854873; E-mail: kmedeiros@ccsu.edu

Received March 12, 2014; **Accepted** May 25, 2015; **Published** June 01, 2015

Citation: Medeiros K (2015) Behavioral Interventions for Individuals with Intellectual Disabilities Exhibiting automatically-Reinforced Challenging Behavior: Stereotypy and Self-Injury. J Psychol Abnorm Child 4: 141. doi:10.4172/2329-9525.1000141

Copyright: © 2015 Medeiros K. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Although assessment of functions can be helpful, it is common for observers to assume that stereotypic behaviors are maintained by automatic reinforcement [22]. In addition, the majority of the literature using our current assessment options suggests that automatic reinforcement maintains most stereotypy [16] and researchers frequently refer to the neurobiological source of stereotypy, using evidence from nonhuman studies [23] Stereotypy is even referred to as "stimming" in the literature and field to signify how the behavior is self-stimulatory in nature [24]. Therefore, the label of automatic reinforcement may be overprescribed in some cases of stereotypy (Cunningham, & Schreibman, 2008[24]). Similarly, research on the prevalence rates for specific functions of SIB varies widely, with the range of automatically reinforced SIB reported as anywhere from 2.6% [25] to 98.4% [26] among individuals with ID.

Individuals whose CB is believed to be (whether from caregiver conclusion or professional assessment) a function of external reinforcement may receive behavioral interventions, engaging play, increased social interaction, and opportunities for independence. This trajectory is inexpensive, safe, and potentially enduringly successful. Individuals whose CB is believed to be a function of internal or automatic reinforcement may receive biomedical treatments, solitary self-stimulating play, restraints, institutionalization, and a loss of independence. This trajectory can be expensive, risky, and potentially short-lived.

With the function of CB determining such variation in treatment and prospects, the tools for determining functions should be fairly accurate. Recall that much research supports the use of functional assessments or analyses to choose more successful interventions strategies [16,17] Determining the function of CB can help practitioners address specific skill deficits (i.e., language) or performance deficits (i.e., communication), modify the learning environment (i.e., removing distractors or adding stimulation), and provide supports (i.e., knowing triggers or challenging tasks that may elicit CBs) [27,28]. However, there are some assessment instruments that have not been evaluated for reliability or validity. In addition, functional assessments are almost always completed by caregivers rather than the individual themselves, due to the low level of functioning or inconsistent communication of individuals with ID. This makes the assessment vulnerable to caregiver bias and item misinterpretation. In addition to assessment complications, the constructs and nature of the distinct functions are not very well understood. Sometimes SIB serves multiple functions for an individual at a given time [29] or changes in function over time [30]. Therefore, in some cases, ineffective treatments may be the result of inaccurate identification of the function of CBs [31].

In conclusion, the tools we use to identify behavioral motivations of stereotypy and SIB are indirect and imprecise, which can lead to an over identification of the behaviors as automatically reinforced and the subsequent prescription of medications or temporary interventions, such as restraints. Although it is not representative of the current state of research, this is unfortunately a fair description of reality for most individuals placed in low-quality institutional, residential, and educational settings. This paper will review effective behavioral intervention options for caregivers, practitioners, and individuals suffering from these complex CBs.

Method

Data collection

First, systematic searches were performed on PsychInfo, the Social Science Citation Index, and Education Full Text using the following search term strings and related variations: stereotypic behavior, self-injurious behavior, automatic, and disability. Next, ancestry and descendant searches were conducted for all relevant literature reviews [32-34]. Finally, a hand search was conducted of the following journals from January through March 2012: Journal of Applied Behavior Analysis and Behavioral Interventions, Journal of Applied Research in Intellectual Disabilities, and Journal of Mental Health Research in Intellectual Disabilities.

Criteria for inclusion

In this literature review, only stereotypy and SIB were investigated, excluding research on aggression. Studies with typically developing individuals exhibiting stereotypic movement disorder or non-suicidal self-injurious behavior were not included since this literature base is distinct from the research on individuals with ID.

Articles were included for consideration if they met the following criteria: (a) research-based, (b) published in peer-reviewed journals, (c) intervention-based, (d) included only atypically developing participants with an intellectual disability, (e) included participants who were determined to have automatically reinforcing SIB or stereotypy (excluding vocal stereotypy), (f) included participants who had a formal diagnosis under the intellectual disability umbrella, (g) used only a behavioral intervention, and (h) were published after 2000.

Results

The results of these literature reviews will be presented separately for stereotyped behavior and self-injurious behavior. Stereotyped behaviors are further classified in to two different topographies: repetitive sensorimotor behaviors and repetitive toy play behavior. Self-injurious behaviors are further classified in to four different topographies: Skin Picking, Self-Hitting, Self-Rubbing, or Mouth Related. Various genders, ages, and types of diagnosis exhibit these challenging behaviors. Rather than organizing these studies by the type of intervention used, gender, age, or type of diagnosis, categorizing by topography should help readers see the applicability of these strategies to their own interventions at work, during research, or with their own families.

Stereotypy

Seven articles met the criteria for being included in this review (Table 1). The total number of participants was 11, with seven males and four females, who ranged in age from 4 to 28 years old (M=11.73, S=8.62). Seven individuals were diagnosed solely with autism, two individuals were diagnosed solely with Mental Retardation (MR), and two individuals were given comorbid diagnoses of autism in conjunction with Down Syndrome and MR, respectively. The level of disability varied, with participants labeled as either mild (n=1), severe (n=7), or profound (n=1). Two participants did not have a clear label of disability level.

To determine the function of their stereotypy, all 11 participants underwent a formal Functional Analysis (FA). In addition, four participants also had functional assessments (e.g. Motivation Assessment Scale), interviews (i.e. Functional Assessment Interview), or observations (i.e. Functional Assessment Observation) completed. The two main types of interventions were noncontingent reinforcement (NCR) with or without a response cost (n=5) and play skills therapy with or without an Abolishing Operation Component (AOC) (n=5). One intervention consisted of symbolic cue cards. Interobserver agreement was determined for all cases to be acceptable (at or above 87%). The studies are presented by topography to better facilitate the

Reference	n	Age	Sex	Diagnosis		Level of Disability	Assessment of Function	Topography	Materials
Repetitive Sensorimotor Behavior									
Athens et al. (2008)	1	11	M	DS; Autism	-	FA	Vocalizations	Preferred	items
Britton et al. (2002)	2	28	M	MR	Severe	FA; *SCA*	Head rocking	Preferred	items; Massage
		26	F	MR; Autism	Profound	FA; *SCA*	Face rubbing	Preferred	items; Gloves
Conroy et al. (2005)	1	6	M	Autism	Mild	FA; *FAI*; *MAS*; *FAO*	Hand flapping	Cue	cards
Falcomata et al. (2004)	1	18	M	Autism	-	FA	Vocalizations	Preferred	items
Higbee et al. (2005)	1	12	M	MR	Severe	FA	Hand waving	Preferred	items; Edibles
Restricted Toy Behavior									
Lang et al. (2009)	1	8	F	Autism	Severe	FA	Toy spinning	Preferred,	appropriate toys
Lang et al. (2010)	4	4	M	Autism	Severe	FA; *QABF*	Toy swinging	Preferred, appropriate toys	appropriate toys
		7	M	Autism	Severe	FA; *QABF*	Lining up / counting toys	Preferred, appropriate toys	appropriate toys
		4	F	Autism	Severe	FA; *QABF*	Tapping toys together	Preferred, appropriate toys	appropriate toys
		5	F	Autism	Severe	FA; *QABF*	Labeling toys	Preferred, appropriate toys	appropriate toys

M= Male
F= Female
DS= Down Syndrome
MR= Mental Retardation
FA= Functional Analysis
SCA= Sensory Class Assessment
FAI= Functional Assessment Interview
MAS= Motivational Assessment Scale
FAO= Functional Assessment Observation
QABF= Questions About Behavioral Functions Scale

Table 1: Stereotypy.

generalization of these findings to caregivers and case-workers in the field.

Repetitive sensorimotor behavior

Six participants were diagnosed with automatically reinforced stereotypy involving repetitive sensorimotor behaviors: inappropriate vocalizations (n=2), hand flapping or waving (n=2), head rocking (n=1), and face rubbing (n=1).

Athens, Vollmer, Sloman, and St. Peter Pipkin [35] used an ABABCADAC design to study an 11 year old male co-diagnosed with Down Syndrome and autism, who exhibited loud, repetitive noncontextual or unintelligible verbalizations. The intervention consisted of trained graduate students providing noncontingent attention, contingent demands, and response costs in a playroom in his home. The sessions took place for 5 minutes, 2-3 times per day, 3 days per week. Results showed a decrease in stereotypy, and successful fading of the presence of the therapist, with three consecutive sessions free of stereotypy while the therapist was absent.

Falcomata et al. [36] used an ABCACBC design to study an 18 year old male diagnosed with autism, who exhibited inappropriate vocalizations (e.g. singing, imitating drums or guitars). The intervention consisted of 10 minute sessions of either NCR with continuous access to a preferred item (Walkman radio), or NCR plus response costs (5 second loss of access to Walkman radio in response to stereotypy). Results showed a reduction of stereotypy from 99.1% at initial baseline to 1.2% during the NCR plus response costs condition.

Conroy, Asmus, Sellers, and Ladwig [37] used an ABB design to study a 6 year old boy diagnosed with high functioning autism (mild ID), who exhibited hand flapping that was disrupting his learning potential in school. The intervention consisted of using cue cards which indicated with symbols whether stereotypy was appropriate (a red circle) or inappropriate (a red circle with a strikethrough line) at the current time. A researcher, and then subsequently the teaching assistant, placed the cue cards on his desk during Math lessons (20 minutes) in school after briefly explaining their purpose. Results showed a decrease in the rate of hand flapping from .37/minute to .13/minute during the inappropriate cue card sessions. This intervention proved successful across implementers, however; interestingly, the boy engaged in more stereotypy during the "appropriate" cue card sessions than during the initial baseline.

Higbee, Chang, and Endicott [38] used an ABACB design to study a 12 year old male diagnosed with severe MR who exhibited hand waving. The intervention consisted of 5 minute sessions 2-6 times per day, and 2-6 days per week conducted in the living room of his home. NCR was provided in the form of a two conditions: a preferred toy with flapping wings (which presumably provided similar visual stimulation as his stereotypy) or preferred edibles (pretzels). Results showed that stereotypy decreased more during the preferred item condition (M=20%) than the preferred edibles condition (M=25.8%) from the initial baseline (74.5%). This study would have been more compelling had there been a second comparison toy that did not simulate the stereotypy, since edibles and toys are so disparate.

Britton, Carr, Landaburu, and Romick [39] used multiple designs to test two interventions with older individuals. One participant was a 28 year old man with severe MR who exhibited head rocking. The other participant was a 26 year old woman diagnosed with profound MR and autism who exhibited face rubbing. The first intervention was to replace or remove the physical sensation fulfilled by the stereotypy; the man received neck massages and the woman received gloves to wear. The second intervention was NCR with a preferred toy, and the study altered whether play was prompted or unprompted by an experimenter. Treatments lasted for 10 minutes, 3 times per day, and 4 days per week. When researchers prompted engagement with the preferred item, manipulation was high and stereotypy was low. Without the prompting (i.e. placing the object in the individual's hand), the participants did not engage in object manipulation and exhibited high rates of stereotypy. The combination of the interventions together resulted in stereotypy decreasing to 0% for the man, and to 10% for the woman.

Restricted toy play behavior

Five participants exhibited restricted toy play behavior, consisting

of repetitively engaging in spinning toys on a flat surface, swinging toys in front of their eyes, lining up or counting toys, tapping toys together, or verbally labeling toys [40,41] used a simple AB design to study these children, all diagnosed with severe autism, ranging from 4 to 8 years old. The intervention involved 10 minute sessions of play skill therapy that either were or were not preceded by an unlimited AOC period, where the children were free to engage in stereotypy with the target toys (both preferred and age-appropriate) until stereotypy ceased for 10 *s* or they attempted to leave the room. The play intervention involved modeling, prompting, reinforcement, and child-directed naturalistic instruction by a researcher. The percentages of stereotypy, functional play, and problem behavior were recorded.

Results were somewhat variable and reflective of individual differences. Stereotypy decreased from baseline levels in both conditions, but higher levels of functional play were seen in the AOC conditions, and problem behaviors were more common in the no-AOC conditions. Over time, more functional play was seen across all participants, and in the AOC condition, individuals seemed to grasp the idea of functional play faster and more consistently. The reasons for the effectiveness of the AOC were not discussed. Since all these participants were young and engaged in a similar type of stereotypy, it is unclear if AOC would benefit older individuals or sensorimotor stereotypy similarly, what the necessary amount of AOC would be to see reductions, if too much AOC time would be unproductive, or if the amount of AOC session needed would be stable for individuals.

Self-injurious behavior

Nine articles met the criteria for being included in this review (Table 2). The articles were published in Developmental Medicine and Child Neurology, Child and Family Behavior Therapy, Journal of Applied Behavior Analysis, Clinical Case Studies, Disability and Rehabilitation, and Research in Autism Spectrum Disorder. The total number of participants was 15, with seven males and eight females, ranging in age from 9 to 50 years old (M=25.47, S=14.33). There was a range of diagnostic categories, with five individuals diagnosed with autism or Autistic Disorder, nine individuals diagnosed with Mental Retardation, two individuals diagnosed with Asperger syndrome, one individual diagnosed with Prader Willi syndrome, one individual diagnosed with Attention Deficit Hyperactivity Disorder, and eight cases of comorbidty.

To determine the function of their SIB, twelve participants underwent an FA, and four participants had functional assessments completed, such as the Functional Analysis Screening Tool (FAST), the Motivation Assessment Scale (MAS), and the Questions About Behavioral Function (QABF) scale. The predominant type of intervention was the use of distraction with objects (n=9), but other methods, such as removing sensation (n=2), positive punishment (n=2), and negative punishment (n=2) were also utilized. The level of disability varied, with participants labeled as either moderate (n=3), severe (n=2), or profound (n=6). Four participants were not given a clear label of disability level. The cases are presented here by topography of automatically reinforced SIB to better facilitate the generalization of these findings to caregivers and case-workers in the field.

Skin picking

Five participants were diagnosed with automatically reinforced SIB of skin picking with various body targets. Two of the interventions used distraction with objects, two of the interventions used positive reinforcement for not engaging in skin picking, and one intervention aimed to remove the sensation of skin picking. Even though the studies used very different outcome measures, all of the interventions showed a successful reduction in SIB.

Reference	*n*	Age	Gender	Diagnosis	Level of Disability	Assessment of SIB Function	SIB Topography	Materials
Kern et al. (2003)	1	12	M	Autism; MR	S	FA	Self slapping	1g eutectic marcaine lidocaine
Ladd et al. (2009)	1	9	F	Autistic Disorder	U	*MAS*	Skin picking	PI
Lane et al. (2006)	1	9	M	ADHD; LD; speech-language impairment	M	Interview; *ABC*	Skin picking	Preferred manipulatives
Lang et al. (2009)	1	17	F	Asperger syndrome; borderline intellectual disability	M	Interview; *QABF*	Skin picking	Variously sized bandages
Lindberg et al. (2003)	3	37	F	MR	P	FA	Hand mouthing	PI
		43	F	MR	P	FA	Head hitting	PI
		30	M	MR	P	FA	Arm rubbing	PI
Roane et al. (2001)	2	23	F	Rett syndrome; MR	P	FA	Hand wringing	PI
		14	F	Rett syndrome; MR	P	FA	Hand mouthing	
Rosales et al. (2010)	4	50	M	MR; seizure disorder; Autism	U	FA	Head hitting	PI
		39	F	MR; PDD-NOS	P	FA	Saliva play	PI
		9	M	Autism	U	FA	Thumb sucking	PI
		45	F	Autism; MR	S	FA	Face rubbing	PI
Stokes & Luiselli (2009)	1	26	M	Prader Willi syndrome	M	FA; *FAST*; *MAS*	Rectal picking	PI
Tiger et al. (2009)	1	19	M	Asperger syndrome	U	FA	Skin picking	"reward" tickets

M= Male;
F= Female
MR = Mental Retardation
ADHD= Attention Deficit Hyperactivity Disorder
PDD-NOS= Pervasive Developmental Disorder- Not Otherwise Specified
U= Unknown; M= Mild; S= Severe; P=Profound
QABF= Questions About Behavioral Function
ABC= Antecedent Behavior Consequence
FAST= Functional Analysis Screening Tool
MAS= Motivation Assessment Scale
PI= Preferred Items

Table 2: Self-Injurious Behavior.

Distraction with stimulating objects (non contingent reinforcement): Lane, Thompson, Reske, Gable, and Barton-Arwood [42] used an ABCBAB design to study a 9 year old male diagnosed with attention deficit hyperactivity disorder, learning disability, and speech-language impairment. The function of his skin picking (target: all body) was determined through an interview with his teacher and the intervention was administered in his classroom during school hours. The intervention consisted of asking the boy to choose of one of three manipulatives (malleable plastic balls with different textures) to occupy his hands during instruction. A teaching assistant recorded the duration of object manipulation and the duration of skin picking. Results showed a general decrease in SIB while having the manipulatives in his hands, and baseline levels or higher when he had no manipulatives.

Ladd, Luiselli, and Baker [43] used an ABAB design to study a 9 year old female diagnosed with Autistic Disorder. The function of her skin picking (target: fingers) was determined through the *MAS* completed by both her mother and her in-home therapist, and the intervention was administered in the home. The intervention consisted of allowing the girl to hold and manipulate objects (silly putty, play doh, or a koosh ball) that the mother rated as preferred. The first author and in-home therapist observed the girl during various activities and recorded the percentage of SIB occurrence within 10-second intervals throughout 3 minute observations. Results showed a 45% decrease during 2 separate trials.

Positive reinforcement (differential reinforcement): Stokes and Luiselli [44] used an AB design to study a 26 year old male diagnosed with Prader Willi syndrome. The function of his skin picking (target: rectum) was determined through the *FAST, MAS*, and an FA. The intervention was administered at his vocational training day program by its staff members and consisted of staff praising him throughout bathroom times for good behavior and recording whether or not SIB had occurred after each bathroom visit. If no SIB occurred, he was allowed to choose from a reward menu (social experiences, colorful wristbands, small trinkets, certain activities), and after three consecutive good bathroom visits he was allowed to go on a special community outing with a preferred staff person. Results showed a decrease in SIB and 25 consecutive weeks of no SIB occurrences.

Tiger, Fisher, and Bouxsein [45] used an ABABC design to study a 19 year old male diagnosed with Asperger syndrome. An FA determined that his skin picking (target: forehead, mouth, nose, hands) occurred for automatically reinforcing reasons. The intervention took place in a small therapy room at his treatment center and consisted of him monitoring his own skin picking. After each 5-min SIB-free period, he earned a reward ticket, which he could then cash in for various items. After seven-hour sessions for two weeks, the percentage of his skin picking was reduced to zero.

Removing sensation: Lang et al [46] used an ABAC design to study a 17 year old female diagnosed with Asperger syndrome and borderline intellectual disability who engaged in skin picking on multiple areas of her body. Through a *QABF* completed by her mother and an informal interview with the girl, researchers determined that her skin picking was automatically reinforcing. The intervention prevented both the tactile and visual stimulation by covering the target areas with large bandages. The mother ensured that the bandages were kept in place daily, and a researcher counted the number of open sores on her body once a month. Over a year, the intervention produced an initial decrease in SIB, and there was no SIB for 5 months during fading procedures (decreasing the size of bandages).

Self-hitting

Three participants were diagnosed with automatically reinforced SIB of self-hitting, targeting the head and face. Two of the interventions used distraction with objects, and one of the interventions aimed to remove the sensation of the self-hitting.

Distraction with stimulating objects (non contingent reinforcement): The following two cases of head hitting used ABAB designs, noncontingent reinforcement with preferred items based on formal preference assessments, and frequency of SIB per minute as an outcome measure. Using these methods, Lindberg, Iwata, Roscoe, Worsdell, and Hanley [47] showed a decrease in head hitting with a 43 year old female diagnosed with mental retardation. Her preferred item was a ribbon, and the intervention consisted of 2-4 sessions daily, 5 days a week. The use of the ribbon to reduce head hitting was successful at her day program and in her home. Rosales, Worsdell, and Trahan [48] found similar results with a 50 year old male diagnosed with mental retardation, seizure disorder, and autism. His preference assessment determined several preferred items, including a coin sorter, Bingo, beads, Perfection, and Lite Brite, but his SIB was lowest when he was allowed a single item as opposed to multiple items. There were 23, 30-minute sessions, 2-4 times a day, and occurring 3-4 days a week at his residential facility.

Removing sensation: Kern, Bailin, and Mauk [49] used an ABABBA design to study a 12 year old male diagnosed with autism and mental retardation. His self-hitting was targeted mostly at his cheeks and an FA determined it was automatically reinforcing. The intervention consisted of removing the physical sensation by applying 1g of eutectic marcaine lidocaine analgesic in a 5cm x 5cm patch to his cheeks for one hour prior to observation. During observation, a rater counted the number of SIB occurrences per minute while the boy was playing with his mother. On two different days, 10 minute observations were taken without the analgesic and then with the analgesic, and on a third day the analgesic condition occurred before the non-analgesic condition. Results showed that self-hitting reduced by 43%, 45%, and 26% on the three different days.

Self-rubbing

Three participants were diagnosed with automatically reinforced SIB consisting of arm, hand, or face self-rubbing. Two of the interventions used distraction with objects, and one of the interventions used positive punishment.

Distraction with stimulating objects (non contingent reinforcement): Lindberg et al. [47] used an ABAB design to study a 30 year old male diagnosed with mental retardation who targeted his arms. The intervention was conducted in his home and consisted of providing the man with a vibrating ball and recording the number of SIBs per minute. There was a decrease in arm rubbing with an increase in object manipulation; however, the effects did not last, even after trying new manipulatives.

Rosales et al. [48] used an ABAB design to study a 45 year old female diagnosed with autism and mental retardation who targeted her face. The intervention consisted of providing the woman with items that were formally found to be preferred (glue, paint, wigglepen, peg games, or stickers) and recording the percentage of SIB over 31, 30-min sessions 2-4 times a day, 3-4 days a week. The greatest decrease in face rubbing occurred when multiple preferred manipulatives were available simultaneously.

Positive punishment (differential reinforcement): Roane, Piazza, Sgro, Volkert, and Anderson [50] used an ABACD design to study a 23 year old female diagnosed with Rett syndrome and mental retardation who targeted her hands. The intervention consisted of saying "hands

down" and manually bringing her hands down to her waist for 20 seconds after an episode of hand rubbing. At least eight sessions took place daily in a hospital therapy room, and the percentage of duration that SIB occurred was recorded. Hand rubbing was reduced by 50.5%.

Mouth related

Four participants were diagnosed with automatically reinforced SIB that was mouth-related. Three of the four cases were females; two of which were labeled as having profound disabilities. All four studies used an FA to determine the motivation of the SIB and an ABAB design. Three of the interventions consisted of distraction with preferred items that was formally determined, while one of the interventions consisted of positive punishment.

Distraction with stimulating objects (non contingent reinforcement): Lindberg et al. [47] studied a 37 year old female diagnosed with mental retardation who engaged in self-injurious hand mouthing. The intervention took place in a workshop and in the home 2-4 times each day, 5 days a week, with each session lasting 15 minutes. Observers recorded the percentage of SIB occurrence during the sessions and the amount of preferred object manipulation (beads and string). The results showed a decrease in hand mouthing in both the workshop and in the home.

Rosales et al. [48] used noncontingent reinforcement with two cases of mouth-related SIB. One of their participants, a 39 year old female diagnosed with mental retardation and Pervasive Developmental Disorder-Not Otherwise Specified, engaged in self-injurious saliva play. Her intervention took place in a residential facility across 19, 30-min sessions 2-4 times a day, 3-4 times a week. The percentage of her saliva play decreased the most when she was given only one of her preferred items (puzzles, coin sorter, Bingo, Connect 4, or Perfection). A second participant, a 9 year old male diagnosed with autism, engaged in self-injurious thumb sucking. His intervention took place in his school across only 12, 30-min sessions 2-4 times a day, 3-4 times a week. The percentage of his saliva play decreased the most when he was allowed multiple preferred items (beads, coin sorter, Lite Brite, blocks, or puzzle) simultaneously.

Positive punishment (differential reinforcement): Roane et al. [50] studied a case of a 14 year old female diagnosed with Rett syndrome and mental retardation who engaged in self-injurious hand mouthing. At every attempt of hand mouthing, her hands were manually brought down to her side for 5 seconds, and the implementer would say, "Hands down." Sessions took place in a hospital therapy room eight to ten times a day. The researchers observed a reduction in hand mouthing during the intervention.

Summary

The results of this literature review shed light on the diverse range of behavioral interventions. All of these studies were successful at reducing automatically reinforced stereotypy and SIB in individuals who were young and old, male and female, from mildly disabled to profoundly disabled, and ranging in diagnostic characteristics. This should motivate practitioners, families, teachers, and caregivers in a variety of situations to appeal for a behavioral intervention before a more restrictive or risky treatment.

These results trigger questions in regards to our functional assessment measures. The label of automatically reinforcing CB could be due to either positive automatic reinforcement (i.e. self-stimulation) or negative automatic reinforcement (i.e. reduction in discomfort) and a variety of potential stimulation sources (e.g. visual, auditory, or tactile). All of the participants in these studies were determined to have automatically reinforced stereotypy or SIB, but a more nuanced description of the motivations were not investigated. Perhaps these studies illustrate that the distinction between positive and negative drives is unnecessary to produce successful decreases in challenging behaviors. Moreover, since only a few of the behavioral interventions included an element of addressing the specific sensory stimulation, assessments of stimulation sources may be unnecessary.

None of the studies which used both FA and a functional assessment discussed inconsistent conclusions between or within these tools, which contradicts findings by Wilke et al. (2012[22]) that multiple behavioral functions are frequently seen in individuals with ID. In addition, conducting both FA and functional assessments may not be necessary to create effective interventions. Since all studies were successful at reducing SIB, this brings into question the necessity of formal FA, which can be a very lengthy procedure. Although FA is considered the gold standard of evaluating the function of CB, and most of these studies did adhere to this convention, it appears that functional assessments and informal interviews might be just as useful. The assessments are faster, cheaper, and require less training for administration; therefore, this literature review would support the use of these methods in exchange for the more conventional FA method. Although beyond the scope of these analyses, there is a possibility that the accuracy of these methods depends on the level of disability of the individual. For example, it could be the case that FA is more accurate in determining the function of CB for an individual for profound intellectual disability than a functional assessment would be. Future research should explore this possibility to limit the time and resources spent in assessments prior to intervention for those with automatically reinforced CBs.

The interventions that used distraction with objects often employed a formal "preference assessment" to determine favored items. Although this was the predominate method, the alternatives such as caregiver report were also successful. Therefore, the time and money needed for administering a formal preference assessment may not be necessary to produce an effective behavioral intervention. Interviewing caregivers might be an equally accurate method of determining the types of items or manipulatives an individual will find engaging.

The fact that our functional assessments categorized restricted toy play behavior as automatically reinforcing is a concern since the NCR and play therapy interventions involved levels of social engagement and were successful at decreasing stereotypy. Perhaps what our assessment instruments deem to be automatic reinforcement is itself driven by boredom or lack of developmentally-appropriate social stimulation; therefore, these functions may not be so distinct from social motivators or behaviors may have multi-layered functions.

Although the play therapy intervention was only used with play-related stereotypy, it may be beneficial for repetitive sensorimotor behaviors as well. Many of those studies used preferred items as reinforcement and to encourage engagement in an activity that competed with the individual's stereotypy; however, one study showed that without prompting, lower functioning individuals may not benefit from the use of preferred items (i.e. Britton et al., 2002). Play therapy may give the individuals the skills they need to engage with items spontaneously and independently while reducing sensorimotor stereotypy or SIB. Essentially, combinations of these interventions may be beneficial for some individuals.

The play therapy intervention results illustrate promise for the future study of CBs among individuals with ID. Inappropriate,

restrictive toy play had a clear link to the child's poor play skills, so the researchers could target a reciprocal developmental skill instead of the stereotypy itself. This is an area that is too often unexplored in intervention research. Rather than simply suppressing an inappropriate or CB, interventions should be simultaneously building strengths in other areas that will help the individual to engage in appropriate, adaptive behaviors.

Finally, regardless of the details of each intervention, every study successfully decreased CB for the participant. Hence, one overarching conclusion may be the importance of accommodating individual differences with individualized interventions. The type of intervention chosen clearly does not depend on the sex, age, or diagnosis of the participant. The intervention should be realistic and convenient for the individual, school, family, and direct caregivers to maximize consistent administration and potential generalization across contexts.

Conclusions

Future research should seek to confirm the consistent results between functional assessments and analyses to help reduce excessive testing on children before interventions begin. In addition, evaluating the effects of demographic variables, such as gender, age, and diagnosis, on response to intervention or on the type of CB displayed could help practitioners decide on an individualized intervention plan. In addition, this research provides the following implications for practitioners: 1) attempt to use behavioral therapies before prescribing medications even when assessments may show a biological or internal motivation for behavior; 2) we may be able to streamline the assessment process by conducting functional assessments rather than functional analyses; 3) combining these interventions described in these studies may prove effective for individuals exhibiting complex CBs; and 4) try to use reciprocal interventions when possible, to balance the efforts to suppress inappropriate behaviors and strengthening appropriate behaviors. This literature review shows that when behavioral interventions are developed in response to an individual's needs, they can be successful at reducing automatically reinforced CBs. In conclusion, this review supports the decision to utilize less invasive interventions rather than more risky, biomedical, or restrictive interventions for those CBs that appear to be internally driven or automatically reinforced self-stimulation.

References

1. American Psychiatric Association (2000) Diagnostic and statistical manual of mental disorders, DSM IV. Washington, DC.
2. Borkowski JG, Carothers SS, Howard K, Schatz J, Farris JR (2007) Intellectual assessment and intellectual disability. In J. W. Jacobson, J. A. Mulick, & J. Rojahn (Eds.), Handbook of intellectual and developmental disabilities (pp. 261-277). New York: Springer Science & Business Media. doi: 10.1007/0-387-32931-5_14
3. Rapp JT, Lanovaz MJ ,Stereotypy J K (2011) Teaching and behavior support for children and adults with autism spectrum disorder: A practitioner's guide (127-135). New York, NY: Oxford University Press.
4. Gal E (2011) Nosology and theories of repetitive and restricted behaviours and interests. In J. Matson & P. Sturmey (Eds.), International handbook of autism and pervasive developmental disorders. Autism and child psychopathology series (115-125). New York, NY: Springer Science & Business Media.
5. Rojahn J, Schroeder S, Hoch T (2008) Self-injurious behavior in intellectual disabilities. Oxford, UK: Elsevier.
6. Bodfish JW, Powell SB, Golden RN, Lewis MH (1995) Blink rate as an index of dopamine function in adults with mental retardation and repetitive behavior disorders. American Journal on Mental Retardation 99:334-335.
7. Emerson E, Kiernan C, Alborz A, Reeves D, Mason H, et al (2001) The prevalence of challenging behaviors: A total population study. Research in Developmental Disabilities 22: 77-93.
8. Rojahn J, Matson JL, Lott D, Esbensen AJ, Smalls Y (2001) The behavior problems inventory: An instrument for the assessment of self-injury, stereotyped behavior, and aggression/destruction in individuals with developmental disabilities. Journal of Autism and Developmental Disorders 31:577-588.
9. Rojahn J (1986) Self-injurious and stereotypic behavior of non-institutionalized mentally retarded people: Prevalence and classification. American Journal on Mental Deficiency 91:268-276.
10. Poppes P, Van der Putten AJJ, Vlaskamp C (2010) Frequency and severity of challenging behaviour in people with profound intellectual and multiple disabilities. Research in Developmental Disabilities 31:1269-1275.
11. Borthwick-Duffy S (1994) Prevalence of destructive behaviors: A study of aggression, self-injury, and property destruction. In T. Thompson, & D. B. Gray (Eds.), Destructive behavior in developmental disabilities: Diagnosis and treatment (pp. 3-23). Thousand Oaks, CA: Sage Publishing.
12. Rojahn J (1994) Epidemiology and topographis taxonomy of self-injurious behavior. In T. Thompson, & D. Gray (Eds.) Destructive behavior and developmental disabilities. Thousand Oaks, CA: Sage Publications.
13. Borthwick S, Meyers CE, Eyman RK (1981) Comparative adaptive and maladaptive behavior of mentally retarded clients of five residential settings in three western states. In RH Bruininks, CE Meyers, BB Sigford, and KC Lakin (Eds), Deinstitutionalization and community adjustment of mentally retarded people. Washington, DC: American Association of Mental Deficiency.
14. Jacobson JW (1982) Problem behavior and psychiatric impairment within a developmentally disabled population I: Behavior frequency. Applied Research in Mental Retardation 3: 121–139.
15. Rojahn J, Esbensen A (2002) Epidemiology of self-injurious behavior in mental retardation: A review. In S. Schroeder, M. Oster-granite, & T. Thompson (Eds.) Self- injurious behavior. Washington, DC: American Psychological Association.
16. Rapp, JT, & Vollmer, TR (2005a) Stereotypy I: A review of behavioral assessment and treatment. Research in Developmental Disabilities 26(6), 527-547.
17. Reid DH, Parsons MB, Lattimore LP (2010) Designing and evaluating assessment- based interventions to reduce stereotypy among adults with autism in a community job. Behavior Analysis in Practice 3:27-36.
18. Langthorne P, McGill P (2009) A tutorial on the concept of the motivating operation and its importance to application. Behavior Analysis in Practice 2: 22-31.
19. Langthorne P, McGill P, O'Reilly M (2007) Incorporating 'motivation' into the functional analysis of challenging behavior: On the interactive and integrative potential of the motivating operation. Behavior Modification 31: 466-487
20. Laraway S, Snycerski S, Michael J, Poling A (2003) Motivating operations and terms to describe them: some further refinements. Journal of Applied Behavior Analysis 36: 407-417.
21. Laraway S, Snycerski S, Olson R, Becker B, Poling A (2014) The motivating operations concept: Current status and critical response. The Psychological Record 64:601-623.
22. Wilke AE., Tarbox J, Dixon DR,Kenzer AL, Bishop MR, et al. (2012) Indirect functional assessment of stereotypy in children with autism spectrum disorders. Research in Autism Spectrum Disorders 6: 824-828.
23. Rapp JT, Vollmer TR (2005b) Stereotypy II: A review of neurobiological interpretations and suggestions for an integration with behavioral methods. Research in Developmental Disabilities 26:548-564.
24. Cunningham AB, Schreibman L (2008) Stereotypy in autism: The importance of function. Research in Autism Spectrum Disorders 2:469-479.
25. Iwata BA, Pace GM, Dorsey MF, Zarcone JR, Vollmer TR, et al. (1994) The functions of self-injurious behavior: An experimental-epidemiological analysis. Journal of Applied Behavior Analysis 27: 215–240.
26. Roscoe EM (2002) Assessment and treatment of hand mouthing: A large-scale analysis. Dissertation Abstracts International: Section B: The Sciences and Engineering, pp. 4769.
27. Goh, H, Iwata, BA, Shore, BA, DeLeon, IG, Lerman, DC, et al. (1995) An analysis of the reinforcing properties of hand mouthing. Journal of Applied Behavior Analysis 28, 269–283.
28. Iwata BA, Dorsey MF, Slifer KJ, Bauman KE, Richman GS (1994) Toward a functional analysis of self-injury. Journal of Applied Behavior Analysis 27: 197–209.

29. Matson JL, Boisjoli JA (2007) Multiple versus single maintaining factors of challenging behaviours as assessed by the QABF for adults with intellectual disabilities. Journal of Intellectual and Developmental Disability 32:39-44.

30. Lerman DC, Iwata BA, Smith RG, Zarcone, JR, Vollmer T (1994) Transfer of behavioral function as a contributing factor in treatment relapse. Journal of Applied Behavior Analysis 27:357-370.

31. Mann A, Mueller M (2009) False positive functional analysis results as a contributor of treatment failure during functional communication training. Education and Treatment of Children 32:121-149.

32. Cannella, HI O'Reilly MF, Lancioni DE (2005) Treatment of hand mouthing in individuals with severe to profound developmental disabilities: A review of the literature. Research in Developmental Disabilities 27, 529-544. doi: 10.1016/j.ridd.2005.06.004

33. DiGennaro Reed FD, Hirst JM, Hyman SR (2012) Assessment and treatment of stereotypic behavior in children with autism and other developmental disabilities: A thirty year review. Research in Autism Spectrum Disorders 6: 422–430

34. Lang R, Didden R, Machalicek W, Rispoli M, Sigafoos J, et al. (2010) Behavioral treatment of chronic skin-picking in individuals with developmental disabilities: A systematic review. Research in Developmental Disabilities 31: 304-315.

35. Athens ES, Vollmer TR, Sloman KN, St. Peter Pipkin C (2008) An analysis of vocal stereotypy and therapist fading. Journal of Applied Behavior Analysis 41:291–297.

36. Falcomata TS, Roane HS, Hovanetz AN, Kettering TL, Keeney KM (2004) An evaluation of response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. Journal of Applied Behavior Analysis 37: 83–87.

37. Conroy MA, Asmus JM, Sellers JA, Ladwig CN (2005) The use of an antecedent-based intervention to decrease stereotypic behavior in a general education classroom: A case study. Focus on Autism and Other Developmental Disabilities 20: 223–230.

38. Higbee TS, Chang S, Endicott K (2005) Noncontingent access to preferred sensory stimuli as a treatment for automatically reinforced stereotypy. Behavioral Interventions 20:177–184.

39. Britton LN, Carr JE, Landaburu HJ, Romick KS (2002) The efficacy of noncontingent reinforcement as treatment for automatically reinforced stereotypy. Behavioral Interventions 17, 93-103. doi: 10.1002/bin.110

40. Lang R, O'Reilly M, Sigafoos J, Lancioni GE, Machalicek W, et al. (2009) Enhancing the effectiveness of a play intervention by abolishing the reinforcing value of stereotypy: A pilot study. Journal of Applied Behavior Analysis 42: 889–894.

41. Lang R, O'Reilly M, Sigafoos J, Machalicek W, Rispoli M, et al. (2010) The effects of an abolishing operation intervention component on play skills, challenging behavior, and stereotypy. Behavior Modification 34: 267–289.

42. Lane K, Thompson A, Reske C, Gable L, Barton-Arwood S (2006) Reducing skin picking via competing activities. Journal of Applied Behavior Analysis 39:459-462.

43. Ladd M, Luiselli J, Baker L (2009) Continuous access to competing stimulation as intervention for self-injurious skin picking in a child with autism. Child and Family Behavior Therapy 31: 54-60.

44. Stokes J, Luiselli J (2009) Applied behavior analysis assessment and intervention for health: Threatening self-injury (rectal picking) in an adult with Prader-Willi syndrome. Clinical Case Studies 8:38-47.

45. Tiger J, Fisher W, Bouxsein K (2009) Therapist- and self- monitored DRO contingencies as a treatment for the self-injurious skin picking of a young man with Aspergers syndrome. Journal of Applied Behavior Analysis 42:315-319.

46. Lang R, Didden R, Sigafoos J, Rispoli M, Regester A, et al. (2009) Treatment of chronic skin-picking in an adolescent with Asperger and borderline intellectual disability. Clinical Case Studies 8:317-325.

47. Lindberg J, Iwata B, Roscoe E, Worsdell A, Hanley G (2003) Treatment efficacy of noncontingent reinforcement during brief and extended application. Journal of Applied Behavior Analysis, 36:1-19.

48. Rosales R, Worsdell A, Trahan M (2010) Comparison of methods for varying item presentation during noncontingent reinforcement. Research in Autism Spectrum Disorders 4:367-376.

49. Kern L, Bailin D, Mauk J (2003) Effects of a topical anesthetic on non-socially maintained self-injurious behavior. Developmental Medicine and Child Neurology 45:769-771.

50. Roane HS, Piazza CC, Sgro GM, Volkert VM, Anderson CM (2001) Analysis of aberrant behavior associated with Rett syndrome. Disability and Rehabilitation 23:139-148.