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**Research treatments for self injurious behavior
with unclear or automatically reinforced causes
and their correlation to
Least Restrictive Behavioral Interventions**

By:

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Introduction:

Self injurious behavior (SIB) is one of the most perplexing and frightening behaviors exhibited by some students. SIB is defined as behavior wherein the individual is engaging in repetitive or stereotypical behaviors that may and in some cases does result in physical harm to the individual (Jacob-Timm, 1996). The behaviors are displayed in a variety of topographies. They can range from fingernail picking to head banging, and can be so destructive that the student can cause severe injury to themselves or even death. Individuals who display this type of behavior also display a variety of medical and clinical diagnosis which may include Lesch-Nyhan Syndrome, Down Syndrome, Autism, Cornelia de Lange Syndrome and Cerebral Palsy.

In an analysis of the prevalence and incidence of SIB, Willard L. Johnson and Robert M. Day (1992) concluded that rates of SIB tend to be higher in males than in females. Also, there tends to be an "inverse relationship" between the measure of intelligence level of the individual and the prevalence of the self injury. Individuals with relatively low measured intelligence levels may not effectively communicate or understand the reasons or functions of their SIB, leaving the identification of function to others. This is evident when the number of individuals who are admitted into residential treatments due to SIB is tabulated. It is suggested that one-fifth of all admissions into residential treatment facilities are due to SIB and the lack of effective treatment available (Jacob-Timm, 1996).

The primary difficulty with SIB lies in determining what the appropriate treatment is for the student. In many cases teachers are at a loss as to what to do when the child engages in SIB. In 1997, the United States Government re-authorized the Individuals with Disabilities Act. This

re-authorization stipulated that, prior to a change of placement or removal of the student to another facility due to behavior problems, such as SIB, a Functional Behavior Assessment (FuBA) must occur, followed by a Behavioral Intervention Plan (BIP). The IEP team, comprised of the parents, administrator, teachers and other persons who have knowledge about the student, is to determine what interventions should be used. This decision is based upon the data that has been generated by the Functional Behavior Assessment (Utah State Office of Education, 2000). While the Functional Behavior Assessment and the Behavior Intervention Plan provide methods to determine what is maintaining the behavior, it is not always easy to determine what treatments will be effective or even which treatment to use.

Unlike most behaviors, which are maintained by escape, avoidance or attempts to gain access to something, some individual cases do not readily identify what is reinforcing or maintaining the SIB. Researchers have categorized this as Automatic Reinforcement (AR) or Undifferentiated Function (Iwata et al. 1994). Automatic Reinforcement can be used to describe the behavior following a functional behavior assessment as follows:

- a- alone is the highest condition and is significantly higher than play,*
- b- the rates of behavior tend to be higher (across most sessions) in conditions with less external stimulation (alone, social attention, and tangible) and lower in the conditions with higher external stimulation (demand and play) or*
- c- all conditions are high and relatively stable with overall trends (the mean of all conditions is greater than or equal to approximately 1.5 per minute), and there are less than five zero points. (Hagiopian et al, 1997)*

To simplify this definition other researchers have sought to define automatic reinforcement. Iwata states that automatic reinforcement is maintained by contingencies that are reinforced independently of the social environment (Iwata et al. 1994). He further stipulates that

according to a study done by Maurice and Trudel (1982), 24% of the population investigated in Canadian institutions were engaging in SIB with “no identifiable circumstances.” Iwata also states that out of a group of 152 subjects 25 percent of the population engaged in SIB that was seen to be maintained by automatic reinforcement or whose data was undifferentiated (Iwata et al. 1994)

Skinner (1953) stated that in some cases two or more independent variables may combine to create one problem. So in some cases, individuals who are attempting to define a function for the behavior may involve defining two different functions. From the same group studied by Iwata et al. (1994), 5% of the subjects’ SIB was maintained by multiple variables.

Without an easily definable function, such as attention or escape, treatment is difficult to identify. In fact, finding the “operant mechanisms that do not rely on social mediation may be extremely difficult and may be beyond the current scientific capacities of the field” (Vollmer, 1994). If finding the functions of the behavior are so difficult then how are teachers, to pinpoint those “mechanisms” that are producing SIB and in many cases disrupting their classrooms.

To add to this problem, public education is limited in what sort of treatments are available to be used. The Least Restrictive Behavioral Interventions (LRBI) published by the Utah State Board of Education contains four levels of behavioral interventions that are categorized by their intrusiveness. Permission must be gained from parents for the use of more restrictive treatments, and in some cases, a behavior expert is required to be a member of the IEP team. To lend additional support and monitoring, each district must create an LRBI team to monitor the Level III and IV interventions used (Utah State Office of Education, 2001).

Preliminary strategies are those interventions that should be ongoing, i.e. that do not require parental consent or involvement of a behavior expert. These strategies include home

notes, environmental engineering and positive praise statements. The first level of intervention does not require parental permission or a behavioral expert since it is comprised of positive behavioral supports such as chaining, differential reinforcement and redirection. For example, differential reinforcement consists of reinforcing specifically, determined desired behavior. The second level contains those interventions that have been labeled as mildly intrusive contingent procedures. Four of those interventions require parental permission for their use. Examples of interventions from this level include time out, in school suspension and response cost. For example, response cost involves the withdrawal of a token, reward or other preferred item upon the demonstration of a problem behavior. The third level of intervention has been labeled as moderately intrusive contingent procedures. All interventions at this level require parental consent and a behavior expert on the IEP team. These interventions include seclusionary time out, inhibiting devices, and forceful physical guidance. An example of an inhibiting device would be the placement of gloves on the hands of a student who seriously scratches their face. The last level of intervention contains interventions labeled as highly intrusive contingent procedures. As in level three, level four interventions require parental consent and a behavior expert on the IEP team. These interventions include manual restraint, taste aversion, and enforced relaxation. For example, enforced relaxation involves the use of holds to protect the student while teaching relaxation. For all four intervention levels, positive behavioral methods are to be in use (Utah State Office of Education, 2001).

The state of Utah is not the first to stipulate that students have the right to ethical treatment. Van Houten and his associates (1988) issued a statement of client/ student rights that contains six rights. They are as follows:

- 1. An Individual Has a Right to a Therapeutic Environment*
- 2. An Individual Has a Right to Services Whose Overriding Goal is Personal Welfare*
- 3. An Individual Has a Right to Treatment by a Competent Behavior Analyst*
- 4. An Individual Has a Right to Programs That Teach Functional Skills*
- 5. An Individual Has a Right to Behavioral Assessment and Ongoing Evaluation*
- 6. An Individual Has a Right to the Most Effective Treatment Procedure Available*

This last right holds particular meaning when the behavioral function has been defined as being automatically reinforced. What if the most effective treatment is not available for use or is questionable in nature? In a survey of the American Psychological Association, 3% of the respondents stated that 3% of those surveyed stated that they had experienced an ethical dilemma regarding questionable or harmful interventions (Pope & Vetter, 1992). LRBI was created by the state of Utah to assist teachers with locating interventions that can be used, but what are teachers to do when they have performed their Functional Behavior Assessment and tried all the interventions available? Teachers are not only supposed to control the behavior of these students but are to in some fashion teach the student who engages in SIB some sort of functional skills to create a meaningful life.

The purpose of this paper is to locate those studies in the research literature that discuss or test methods of treating SIB maintained by automatic reinforcement. The interventions are then compared to the LRBI and placed in the appropriate intervention level. By summarizing the interventions used and comparing them to the Utah intervention levels, it is hoped that a tool can be formed to assist teachers in locating effective interventions seen in research conditions. These interventions could then be applied to the public education environment.

Methods: _____

A search of EbscoWeb, ERIC and the website for the Journal of Applied Behavior Analysis was conducted to locate articles on Automatic Reinforcement and SIB. Articles on electric shock or transcutaneous electric nerve shock (TENS) were not selected. Teachers are not allowed to utilize these methods, and they typically require medical supervision, so evaluating their effectiveness would not add to this study.

The data from these studies was visually analyzed and the article itself was summarized. The topography, intervention and intervention level according to LRBI were then compiled for each article. In some cases, the intervention level is an approximation, since not every intervention is listed in the LRBI. For instance, response blocking is not in the LRBI as an intervention, but it could be seen as an inhibitory device so that would place it in Level 3.

Results:

Seventeen articles were identified. Each article used a functional analysis that was described by Iwata, Pace, Kalsher, Cowdery & Cataldo (1990). This method included various combinations of demand, alone, attention, escape and a control condition that was usually play. Other functional analysis variables were directly related to the reported behavior displayed by the subject.

Subjects used in the articles were treated in a variety of environments. Ten subjects were admitted to in-patient facilities. Two were treated in schools and 1 each in clinics or day programs. In 3 studies the treatment environment was not reported.

Of the SIB topographies investigated hand mouthing was the most common with 5 occurrences. Head banging and body banging appeared 3 times. Hand biting, body hitting, face

and body picking, body slapping and pica were seen twice, while face hitting, scratching, rapid tongue movements and arm rubbing were treated once. The topography in Sqrake, Holland & Thomas (1997) was non specified and Iwata et al.(1994) covered a variety of topographies.

Preference assessment seemed to be the most common intervention. It was used a total of 10 times in the 17 articles. The authors who used this assessment stated that it was used to help determine what would reinforce the subjects' behavior. It was also used to further analyze the reinforcing properties of the SIB.

Differential Reinforcement was used five times and noncontingent reinforcement was used four times. Those interventions that were used three times were extinction, response block, and inhibitory devices. Object manipulation was used twice and the remaining interventions were only used once. Combination treatments were used 6 times in the literature. Table 1 lists all interventions used and the corresponding LRBI levels.

The number of interventions at each level were summed to examine the frequencies per level. Preference Assessment and Functional Behavior Analysis were not included as LRBI levels, but were included on the table since they are valuable tools in the diagnosing and treatment of SIB. As shown in Table 2, Level one (Positive Interventions) was used in the literature thirteen times, while level two (Mildly Intrusive Contingent Procedures) appeared five times. Level three (Moderately Intrusive Contingent Procedures) was used on five different occasions, while Level 4 (Highly Intrusive Contingent Procedures) was applied in three instances.

It must be noted that the interventions listed in Table 1 are only the number of studies that applied those interventions. This study did not deal with the number of times the intervention

was applied per subject or study. For instance, Iwata et al. (1994) looked at 12 interventions and reported results for 10 of those interventions. These interventions were used on the 39 subjects that exhibited SIB that was maintained by automatic reinforcement or their behavior was undifferentiated in its function.

It also must be noted that there were eight reported cases where the intervention was not successful for that individual. The interventions that were unsuccessful were, noncontingent reinforcement, single intervention strategies, escape extinction, sensory integration (two subjects), environmental enrichment, differential reinforcement of other behavior, and contingent sensory reinforcement/ response blocking combined. These interventions failed for 8 individual subjects out of 81 subjects. When interventions were changed or combined, reductions in SIB were reported as seen in Carr, Dozier, Patel, Adams & Martin (2002) or Lindberg, Iwata & Kahng (1999),

Table 1

Interventions	LRBI Level	Interventions
Environmental Change	Preliminary Strategy	1
Environmental Enrichment	Preliminary Strategy	1
Response Cost	Level 2	1
Contingent Sensory Reinforcement	Level 1	1
Response Interruption	Level 2	1
Extinction	Level 2	3
Inhibitory Devices	Level 3	3
Response Block	Level 4	3
Noncontingent Reinforcement	Level 1	4

Preference Assessment	-----	10
Wrist Weights	Level 4	1
Matched Sensory Stimuli	-----	1
Functional Behavior Analysis	-----	17
Object Manipulation	Level 1	2
Arm Restraints	Level 4	1
Sensory Integration	-----	1
Differential Reinforcement	Level 1	5
Task Modification	Preliminary Strategies	1
Verbal Reprimand	Level 2	1
Time-Out	Level 2	1
Contingent Demands	Level 1	1
Water Mist	Level 4	1
Restraint Fading	Level 4	1
Combination Treatments	-----	6

Table 2

LRBI Intervention Levels	Appearance in Literature
Preference Assessment	10
Preliminary Strategies	3
Level 1	13
Level 2	5
Level 3	5
Level 4	3
Functional Behavior Analysis	17

Discussion:

Preference assessments, functional behavior analysis, differential reinforcement, noncontingent reinforcement and combination treatments were the most frequently investigated interventions. The results of these studies are promising in that they demonstrated a reduction in the rates of SIB. The common feature that they shared was their use of the preference assessment and the functional behavior analysis.

Functional behavior analysis was used to determine the function of the behavior. Following a diagnosis of automatic reinforcement the preference assessment was used to determine what items functioned as reinforcers. This was also used to determine the reinforcing properties of the desired items or behavior. For instance, Piazza et al. (1998) investigated the desirability of hard versus soft items. A preference assessment can assist in narrowing down the variables in the desirable items so that individuals receive similar stimulation as previously received when engaging in SIB, but must now engage in desirable behavior to obtain it.

The preference assessments used were dependent upon the needs of the researcher. For instance, in Piazza, Hanley & Fisher (1996) a preference assessment was used to determine the reinforcing properties of a cigarette butt. They compared herb cigarette butts to tobacco cigarette butts to determine what was the reinforcing property of cigarette pica. In another study, Goh et al.(1995) designed a preference assessment to determine whether hand mouthing was automatically reinforced due to hand stimulation or by mouth stimulation. In each case the preference assessment was designed around the needs of the research.

The functional behavior assessments used were based upon the method described by Iwata, Pace, Kalsher, Cowdery & Cataldo (1990). This method included various combinations of demand, alone, attention, escape and a control condition that was usually play. As a teacher, the four condition method is not the one I use and is not the method that many of my colleagues are trained to use. It is more productive and less intrusive for me to take data on the behavior. Once I have at least 20 data points to use, I will analyze the data and determine what is reinforcing the behavior or what interventions might be useful for this particular student. While taking data, if the behavior tends to be more disruptive, I will experiment with possible interventions, but note that in the documentation. In this way, I can monitor and implement behavior but continue to educate the other students in my classroom without major interruption. It is not known if a significant difference exists between the four condition method described by Iwata et al. (1990) and the method that I use. Investigation to compare the diagnostic accuracy of the two methods could prove interesting.

While functional behavior analysis and preference assessments are useful for determining function, it was also noted that satiation could occur once an intervention was in place. For example, Ringdahl, Vollmer, Marcus & Roane (1997) were concerned that the "brief sampling behavior may lead to premature predictions about the sustained efficacy of environmental enrichment (eg. satiation effects or preference changes may not be evident)." He suggests that ten minute data sessions could be completed each day to monitor the behavior. Tracking the behavior on an ongoing and frequent basis would allow the teacher to monitor and track the reinforcing properties of the SIB and to keep up with needed changes to the child's behavior program.

Functional behavior analysis and preference assessments that are needful and required through IDEA, are proven tools that will identify the functions and preferences that maintain the problem behavior. Knowing why the behavior is happening and matching the intervention to the results of the analysis will allow for a better intervention. The use of functional behavior analysis in all of the selected studies as well as the use of the preference assessment in 10 of the studies, emphasizes the use of these tools in the diagnosis and determination of the maintaining variables surrounding the behavior. Without this information, researchers would be blindly throwing intervention darts at the behavior. Since researchers are using functional behavior assessments and preference assessments to further pinpoint the maintaining variables involved in automatic reinforcement then teachers should also be able to apply the same tools to diagnose and treat their students. The use of functional behavior assessments and preference assessments are not limited to age, location, or specific topographies of SIB. In other words, if researchers are doing it then teachers can.

The incidences where treatment was initially ineffective, but was followed with an effective combination treatment are of interest. In those two cases, the individual interventions were not effective. But when placed in a combination treatment condition, such as noncontingent reinforcement and response blocking, the levels of SIB were reduced. Experimentation with combinations of interventions as well as continued evaluation of the functional behavior assessment and preference assessment could improve the treatments and narrow down the range of possible positive interventions that are effective with that individual. The failure of the initial treatments could be attributed to personal preferences and maintaining variables. Continued data taking and observation of the implemented treatments, can pinpoint

further needs or reveal unknown variables that can interfere with ongoing treatment.

It is also interesting to note that many interventions investigated are positive interventions that fall in the Level 1 category in LRBI. This suggests that the more intrusive interventions may not be necessary in some cases. But as stated above, the maintaining variables must be explored and matched to the interventions

Self-injurious behavior is dangerous and frustrating behavior to have to manage when faced with a student who is displaying behavior that is automatically reinforcing. The purpose of this study was to provide a tool to aid teachers in their search for interventions that would be potentially useful for students who are automatically reinforced. The overall results of this study indicated that while there is still a limited amount of research being done on automatic reinforcement in regards to SIB, there are interventions that can and do change the behavior most of which are positive interventions. Functional behavior assessments in combination with preference assessments are effective in determining the function of SIB when it has originally been classified as automatically reinforcing.

Hopefully this investigation and the following article summary will be of assistance to teachers in selection of interventions that will be beneficial to their students. Following this is a summary of the articles selected and a brief summary.

Article Summaries

Carr, J. E., Dozier, C. L., Patel, M. R., Adams, A. N., Martin, N. (2002). Treatment of automatically reinforce object mouthing with noncontingent and response blocking: experimental analysis and social validation. *Research in Developmental Disabilities*. 23, 37-44.

Behaviors	Intervention	LRBI Level
Hand Mouthing	Response Blocking and	Level 3
	Noncontingent	Level 1
	Reinforcement	
	Preference Assessment	-----

A functional behavior analysis was done on a subject that engaged in SIB in the form of hand mouthing. The results of the analysis indicated that the behavior was automatically reinforcing. Following the functional behavior analysis a stimulus preference assessment was done to determine what the subject preferred most.

A combination of response blocking and noncontingent reinforcement were used. The response blocking alone reduced SIB but the when the subject was returned to baseline conditions the behavior resumed its original levels. When noncontingent reinforcement was used, it failed to reduce SIB. SIB was reduced when noncontingent reinforcement and response blocking was used together.

Goh, H., Iwata, B. A., Shore, B. A. DeLeon, I. G., Lerman, D.C., Ulrich, S.M., & Smith, R. G. (1995). An analysis of the reinforcing properties of hand mouthing. *JABA*, 28, 269-283.

Behaviors	Intervention	LRBI Level
Hand Mouthing	Preference Assessment and Noncontingent Reinforcement	----- Level 1

A functional behavior analysis was done on 10 subjects to determine if the function of their hand mouthing was a function of a lack of social reinforcement, and to provide an initial analysis of hand mouthing when it was seen to be a result of automatic reinforcement. Three experiments were done. The first consisted of the functional behavior assessment in which 12 subjects participated. Of those, 10 appeared to be engaging in hand mouthing due to automatic reinforcement. The second experiment further analyzed the hand mouthing to determine if the hand mouthing was due to hand stimulation or mouth stimulation. Four subjects participated in this experiment. Data were collected in three areas, hand-mouth, toy-mouth, and hand-toy contact. Data indicated that the hand-toy condition tended to be higher than toy-mouth and hand-mouth behavior, although the toy-mouth condition was seen at a comparable rate for one of the subjects. The third experiment involved five subjects whose behavior was maintained by automatic reinforcement. This last experiment was conducted in two phases. The first phase allowed free access to and large number of toys and then those toys that were preferred were used to measure hand-toy or mouth-toy use. For all five subjects the hand-toy contact was preferred over mouth-toy or hand-mouth. Goh et al. hypothesize that the function of the hand mouthing

was that of hand stimulation.

This study demonstrates the use of a preference assessment following the functional behavior assessment to further pinpoint the function of the behavior. In this case the function was automatic reinforcement only because the behavior was automatically reinforced when the subjects were able to gain hand stimulation.

Hanley, G. P, Piazza, C. C., Keeney, K. M., Blakeley-Smith, A.B., & Worsdell, A. S. (1998).

Effects of wrist weights on self-injurious and adaptive behaviors. *JABA*, 31, 307-310.

Behaviors	Intervention	LRBI Level
Hand to head hitting	Wrist Weights	Level 4

The relationship between wrist weights, self injurious behavior and adaptive / novel behaviors are explored in this study. The behavior in question was hand-to-head hitting in a single subject. A functional behavior assessment was done and the behavior was said to be maintained by automatic reinforcement, although specific data was not supplied. The subject was then evaluated in a multiple-baseline across non-injurious behaviors format. The non-injurious behaviors used were the use of a switch play / communication (novel behavior), pacifier to mouth (pre-existing), and self-feeding (pre-existing). All conditions were tested with and without the wrist weights. The wrist weights, which were worn through all conditions, were only loaded with 2 pounds of weight during weight conditions. Initially the novel behaviors did not see much increase, but SIB was reduced to near 0 levels with one or two exceptions. The pre-existing behaviors were strengthened by with the use of the wrist weights. SIB was reduced to

near 0 levels for the pre-existing behaviors.

Iwata, B. A., Pace, G.M., Dorsey, M. F., Zarcone, J. R., Vollmer, T. R., Smith, R. G., Rodgers, T. A., Lerman, D. C., Shore, B. A., Mazaleski, J. L., Goh, H. L., Cowdery, G.E., Kalsher, M. J., McCosh, K.C., & Willis, K. D., (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. *JABA*, 27, 215-240.

Behaviors	Intervention	LRBI Level
Varied	Functional Behavior Assessment and Matching Intervention	-----

Iwata et. al. use their research of 152 subjects who engage in self-injurious behavior to further define and refine the understanding of patients who engage in self-injurious behavior. A functional behavior analysis technique was described in which all subjects are exposed to social-positive conditions, social negative conditions, alone and finally play as a control. The results of this study were collated in several formats to analyze and compare the data in different ways. Of the 152 subjects evaluated 39 were seen to engage in self-injurious behavior due to automatic reinforcement, undifferentiated high responding, or pain attenuation. The percentage of the study who engaged in SIB was tabulated at 25.7% of the population. Treatment data were also analyzed for the number of specific treatment applications that were used versus the number of successful outcomes. Twelve treatments were explored with the automatic reinforcement population. Of those, noncontingent reinforcement proved to be the best working treatment with

9 positive outcomes. While task modification, attention (extinction), verbal reprimand and time-out did not result in the same degree of success, they still exhibited between 2 and 4 positive outcomes. The last 5 treatments that resulted in positive outcomes were seen to have only 1 positive outcome. They were: escape (extinction), sensory (extinction), differential reinforcement, contingent demands, water mist, and restraint fading.

The study summarized its findings by stating that functional assessment is highly effective, and that knowing the function of the behavior will and should determine the course the treatment should take. In other words, be sure of the function and then plan an intervention that matches the data.

Kuhn, D. E., DeLeon, I. G., Fisher, W. W., Wilke, A. E. (1999). Clarifying an Ambiguous Functional Analysis with Matched and Mismatched Extinction Procedures. *JABA*, 32, 99-102.

Behaviors	Intervention	LRBI Level
Head Banging	Extinction	Level 2
Face Hitting	Inhibitory Devices	Level 3

A functional behavior analysis was done on a subject in order to determine the function of the behavior and to select matched and mismatched extinction procedures on SIB maintained by automatic reinforcement. Three treatment conditions were used to test the theory: sensory extinction (helmet on head), escape extinction, and a combination of both. The sensory extinction

alone proved to be effective since the SIB was reduced to zero. The sensory and escape extinction condition did also reduce the behavior to near zero levels, while escape extinction was not seen to be effective.

Lindberg, J. S., Iwata, B.A. & Kahng, S. (1999). On the relation between object manipulation and stereotypic self-injurious behavior. *JABA*, 32, 51-62.

Behaviors	Intervention	LRBI Level
Body Hitting, Body Banging,	Object Manipulation,	Level 1
Head and Face Picking	Arm Restraints	Level 4
	Preference Assessment	-----

The purpose of this article was to compare an increase in object manipulation upon the performance of SIB. Following a functional behavior analysis in which behavior was seen to be maintained by automatic reinforcement, the subjects underwent a preference assessment. The top four leisure items were selected for use in the leisure training. The leisure training was also paired with positive reinforcement, positive reinforcement with response blocking, and positive reinforcement and protective equipment. It must be noted that the experimenters used a 3 step prompting sequence every thirty seconds if the subject was not manipulating the items. For both subjects, object manipulation was very low during baseline while SIB was at a higher rate. For one of the subjects, none of the interventions are particularly effective, until the last phase where leisure training, positive reinforcement and response blocking were used. This may mean that the response block was teaching the student what behavior was wanted and what was not wanted.

The other subject displayed a reduction in SIB in all phases of the study, but the most drastic reduction in SIB was seen when arm restraints were used.

Mason, S. A., & Iwata, B.A. (1990). Artifactual effects of sensory integrative therapy on self-injurious behavior. *JABA*, 23, 361-370.

Behaviors	Intervention	LRBI Level
Hand Biting, Hand Mouthing,	Sensory Integration,	-----
Head Banging, Body	Differential Reinforcement	Level 1
Slapping	and Response Interruption	Level 2

Sensory integration was tested as a means to reduce levels of self-injurious behavior. Following a functional behavior analysis, it was determined that one of the three subjects engaged in self-injurious behavior that was maintained by automatic reinforcement. Sensory integration therapy was provided for the subject in the second phase, followed by behavioral intervention in the third phase. For this subject, sensory integration was not effective. SIB increased beyond those seen in baseline. When behavioral treatment strategies were used SIB was reduced to levels below baseline. The treatment selected in this case was access to toys, differential reinforcement of other behavior, and response interruption. It should be noted that for all subjects the sensory integration phase only contained between 5 and 15 points, depending on the subject. It is unknown what would happen if the sensory integration phase had been implemented for a longer period of time. It must also be noted that not all subjects were returned to baseline conditions between phase changes.

O'Reilly, M. F. (1996). Assessment and Treatment of Episodic Self-Injury: A Case Study.

Research in Developmental Disabilities, 17, 349-361

Behaviors	Intervention	LRBI Level
Head Hitting	Environmental Change	Preliminary Strategies

A subject who was engaging in bouts of SIB was assessed for the maintaining variables of his SIB through a functional behavior analysis. His behavior was seen to be occurring following his return from respite care. The behavior was undifferentiated for all conditions. After respite care was changed, the behavior disappeared.

Patel, M. R., Carr, J. E., Kim, C., Robles, A., Eastridge, D. (2000). Functional analysis of aberrant behavior maintained by automatic reinforcement: assessments of specific sensory reinforcers. *Research in Developmental Disabilities*, 21, 393-407.

Behaviors	Intervention	LRBI Level
Rapid Tongue Movements and Head Hitting	Preference Assessment and Matched Sensory Stimuli Differential Reinforcement	----- Level 1

Functional behavior analysis was used to determine if SIB was maintained by automatic

reinforcement. This was followed by an antecedent assessment to further explore the functions of the behavior. For these subjects, it was noted that head or auditory stimulation seemed to be the primary reinforcing element. Stimulus preference assessments were then performed to determine the most and least preferred items. These items, both most and least preferred, were used in the treatment evaluation. These items were used to differentially reinforce the nonoccurrence of SIB. For both subjects, the items selected for use were effective in reinforcing the nonoccurrence of SIB. Although each subject did experience a spike in the occurrence of SIB during the treatment phase. Essentially the data were consistent in reducing the behavior. It should be noted that the least preferred items did maintain the more stable effect in reducing SIB. The authors note this and suggest that this could be due to the limited number of items available for selection during the stimulus preference assessment. The importance of knowing what is preferred as a source of reinforcement was stressed.

Piazza, C. C., Hanley, G. P., Fisher, W. W. (1996). Functional Analysis and Treatment of Cigarette Pica. *JABA*. 29, 437-450.

Behaviors	Intervention	LRBI Level
Pica	Noncontingent Reinforcement and Preference Assessment	Level 1 -----

Cigarette pica was investigated in a subject in this study. A functional behavior analysis was done to determine the function of the behavior. Cigarette butts with nicotine and cigarette

butts with herbs were presented. The herbal cigarette consumption decreased while nicotine cigarettes remained at high levels. The data indicates that the behavior was automatically reinforced, since the cigarette pica occurred primarily in the alone condition. Next the subject underwent a stimulus preference assessment of the various components that comprise a cigarette butt. The tobacco was seen to be the preferred item.

The next phase explored the effects of noncontingent reinforcement and the response interruption upon cigarette pica. The combination of noncontingent reinforcement and response interruption was effective enough to reduce SIB to near zero levels. This was analyzed both for butt pick-ups as well as butt pica. The results remained the same for both topographies.

The last phase involved providing a purple and yellow card to the subject with specific instructions for each. When the purple card was provided, the subject was instructed to play with the toys or eat the available food. When pica was going to happen the instruction “no butts” was provided. The purple card condition resulted in a decrease of SIB to zero levels and was further generalized to other settings. It must be noted that addiction to nicotine was not addressed in this study.

Piazza, C. C., Fisher, W. W., Hanley, G. P., LeBlanc, L. A., Worsdell, A.S., Lindauer, S. E., Keeney, K. M. (1998). Treatment of Pica Through Multiple Analyses of its Reinforcing Functions. *JABA*, 31, 165-189.

Behaviors	Intervention	LRBI Level
Pica	Preference Assessment and Response Blocking	----- Level 3

Three subjects participated in a functional behavior analysis to determine the maintaining variable of their SIB. The findings of this analysis led the authors to believe that for all three of the subjects, SIB was maintained through automatic reinforcement. A preference assessment was then done on those three subjects. The items selected in the preference assessment were then used in the treatment phase. A matched (things to place in the mouth, or that matched the perceived function of pica) and unmatched (things that could not be placed in the mouth, but provided sensory stimulation) object was selected for each subject.

In the treatment phase the matched and unmatched stimuli were compared, and then matched stimuli were combined with response blocking. The matched stimuli reduced SIB more effectively than the other conditions. Response blocking was used only on one subject. Response blocking combined with matched stimuli dramatically reduced the behavior when compared to the baseline conditions.

This study continued to analyze other components related to pica, specifically the desirability of hard versus soft items. This phase indicates that softer items are preferred.

Ringdahl, J. E., Vollmer, T. R., Marcus, B. A., & Roane, H. S. (1997). An analogue evaluation of environmental enrichment: The role of stimulus preference. *JABA*, 30, 203-216.

Behaviors	Intervention	LRBI Level
Face Scratching and Slapping, Head Banging,	Preference Assessment and Environmental Enrichment	----- Preliminary Strategies
Hand Biting and Body Hitting	Differential Reinforcement	Level 1

Environmental enrichment was explored in this article as a method of treating SIB maintained by automatic reinforcement. A functional behavior analysis was done on four subjects and then predictions were made based upon this information as to whether or not environmental enrichment would reduce self injurious behavior. The function of their self injurious behavior was seen to be maintained by automatic reinforcement. Following this, a preference assessment was used to test the predictions formulated following the functional behavior analysis. Treatment consisted of an alternating treatments design. Environmental enrichment and differential reinforcement of other behaviors was measured alone, while in other phases the command “hands down”, was added to the environmental enrichment condition. Each subject was returned to baseline conditions at least once during the study.

Environmental enrichment worked well in two out of the four cases. With one subject the level of interaction with the environment was high, but the level of SIB did not decrease until the hands down component was added to the treatment package. For the second subject, the enriched environment also did not decrease his SIB, although his interaction with the environment was high. For this subject, differential reinforcement was seen to be more effective. Environmental enrichment was seen to be an effective treatment as well as differential reinforcement. Both were effective treatments for the other two subjects. So much so, that SIB was reduced to levels that were significantly below those seen in the baseline levels.

Several limitations to this study are mentioned. They include the need to separate topographies and treat them differently as well as watching for signs of satiation or preference changes in your reinforcement selections

Roscoe, E. M., Iwata, B. A., & Goh, H. (1998). A comparison of noncontingent reinforcement and sensory extinction as treatments for self-injurious behavior. *JABA*, 31, 635-646.

Behaviors	Intervention	LRBI Level
Arm Rubbing, Body Banging, Hand Mouthing, and Body Picking	Noncontingent Reinforcement, Protective Equipment Preference Assessment	Level 1 Level 3 -----

A functional behavior analysis was used on three subjects to determine if their behavior was automatically reinforced. This was followed by a stimulus selection phase or preference assessment where the subjects were exposed to leisure items and protective equipment. Those items that resulted in low levels of SIB were selected for use in the next phase. Leisure items were used for noncontingent reinforcement, while protective equipment was used for sensory extinction during treatment conditions. For both treatments, noncontingent reinforcement and extinction, the level of self injury was reduced for all three subjects. While there were occasional data spikes, the overall trend is consistent. However, noncontingent reinforcement was seen to reduce self injury to lower levels than that of extinction.

Shirley, M. J., Iwata, B. A., & Kahng, S. (1999). False-positive maintenance of self-injurious behavior by access to tangible reinforcers. *JABA*, 32, 201-204.

Behaviors	Intervention	LRBI Level
Hand Mouthing	Functional Behavior	-----
	Assessment	

The purpose of this study was to explore the possibility of an automatically reinforced behavior that is also being maintained by a highly preferred item that is not provided contingently. The authors are interested in seeing how this “incidental reinforcement” will influence the results or create “false positives” in the functional behavior analysis. A functional behavior analysis is done first followed by naturalistic observation. SIB was seen under all conditions of the functional analysis. Tangibles and no consequences were seen to be the highest conditions. It was felt that the behavior was automatically reinforced since the rates of SIB were elevated and there wasn’t a great deal of variability in occurrence of SIB during the other conditions.

This study demonstrates the need to explore the functions of the behavior fully. The behavior of this student, in many instances, did indicate that the behavior was automatically reinforcing. The addition of a tangible item into the environment further reinforced the behavior.

Shore, B. A., Iwata, B.A., DeLeon, I. G., Kahng, S., & Smith, R. G. (1997). An analysis of reinforcer substitutability using object manipulation and self-injury as competing responses. *JABA*, 30, 21-40.

Behaviors	Intervention	LRBI Level
Hand Mouthing	Object Manipulation,	Level 1
	Differential Reinforcement of	Level 1
	Other Behavior,	
	Response Cost and	Level 2
	Preference Assessment	-----

The substitutability of reinforcers was examined with subjects who engaged in self-injurious behavior that was maintained by automatic reinforcement. This was followed by a stimulus preference assessment to determine individual leisure material preferences. During the course of this study, three experiments were done to examine the relationship of the variables in question.

Experiment one tested the relationship between object manipulation and hand mouthing. Leisure materials were seen to significantly reduce the levels of self injurious behavior significantly for each of the three subjects. Upon return to baseline conditions, SIB returned to the original levels.

Experiment two explored differential reinforcement strategies (DRO) (reinforcement of non-occurrence of SIB) with the preferred objects as reinforcers. The length of the DRO interval was also looked at as well as the interval that the subject was allowed to enjoy their preferred

item following non-occurrence of SIB. Across all three subjects, DRO was not seen to reduce self injurious behavior, regardless of the DRO interval or the length of time allowed with the preferred item.

Experiment three looked at the effects of increasing the response cost of the preferred reinforcer. Each object was attached to a string and was anchored to a specific location. The length of the string was varied depending upon the trail. The subjects were also seated in an up right position at varying degrees. For two of the subjects, this intervention was successful, in that the self injurious behavior decreased. The third subject demonstrated a high level of variability.

Although experiment three was more successful than experiment two, it must be noted that the preferred items were visible in experiment three. It is unknown if the preferred items were visible in experiment two. Visibility of the preferred item may have influenced the results of this study.

Sprague, J., Holland, K., Thomas, K. (1997). The Effect of Noncontingent Sensory Reinforcement, Contingent Sensory Reinforcement, and Response Interruption on Stereotypical and Self-Injurious Behavior. *Research in Developmental Disabilities*, 18, 61-77.

Behaviors	Intervention	LRBI Level
Non specified	Contingent Sensory Reinforcement,	Level 1
	Preference Assessment and	-----
	Response Blocking	Level 3

A functional behavior analysis was done on two subjects who engaged in SIB. The data indicate that the behavior was undifferentiated or automatically reinforced. A component analysis was then done to determine the effects of different sensory consequences upon SIB. For one subject, the behavior seemed to be motivated by the need for tactile objects. For the other subject, the behavior was motivated by tactile and auditory stimulation. The first subject responded well to contingent sensory reinforcement and response blocking, while the second subject only saw increases in SIB.

Zhou, L., Goff, G.A., & Iwata, B.A. (2000). Effects of increased response effort of self-injury and object manipulation as competing responses. *JABA*, 33, 29-40.

Behaviors	Intervention	LRBI Level
Hand Mouthing	Inhibitory Devices and Preference Assessment	Level 3 -----

This study explores the idea of inhibitory devices (flexible arm sleeves) upon the occurrence of self injurious behavior. A functional behavior analysis was done on the four participants of this study. The results of the analysis indicated that SIB was maintained by automatic reinforcement. Preferred items were then selected through a preference assessment. The item selected were then used in the third stage of this study.

The subject had flexible sleeves placed on them during the phases of the study where the preferred item was available. It was seen that self injury was reduced to near zero levels for all four subjects. The sleeves made it more difficult to engage in self injury but did not interfere

with the reaching for objects to manipulate.

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