

REVIEW ARTICLE

Behavioral interventions for reducing aggressive behavior of individuals with a brain injury

Kayo MATSUO

Faculty of Rehabilitation, Osaka Kawasaki Rehabilitation University

Correspondence: Kayo Matsuo, PhD, Faculty of Rehabilitation, Osaka Kawasaki Rehabilitation University, 158 Mizuma Osaka, 597-0104, Japan.

E-mail: matsuok@kawasakigakuen.ac.jp

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INTRODUCTION

Individuals with a brain injury often suffer physical, functional, cognitive, psychological, and/or behavioral handicaps (Alderman, 2013; Sabaz, 2014). After a brain injury, it is normal for affected individuals to experience behavioral problems. Furthermore, their family, friends, and work colleagues may encounter difficulties because of their behaviors (Ylvisaker, 2007). Behavioral problems such as poor social judgment and emotional regulation or self-control may cause individuals with a brain injury to misinterpret another's emotions, facial expressions, and behavioral intentions (Hamilton, 2017; Ryan, 2013a, 2013b), which may lead to disrupted social relationships with others. Other behavioral problems such as aggressive behavior may also upset relationships with others and hamper social participation as well as educational and employment opportunities (Eames, 1985; Wehman, 2017; Williams, 2018; Yody, 2000). Therefore, dealing with issues related to aggressive behaviors is crucial for helping individuals with a brain injury with their problems and facilitating healthy social relationships with others so as to improve their quality of life. In this article, the occurrence of aggressive behaviors after acquiring a brain injury is overviewed. Furthermore, behavioral approaches as intervention procedures to reduce aggressive behavior of those with a brain injury are introduced. Although studies of

Abstract

Individuals who suffer a brain injury often exhibit challenging behaviors that they previously did not display. Challenging behaviors may include various types of aggressive behaviors such as physical aggression toward individuals and/or objects as well as verbal aggression. Behavioral approach is one of psychological intervention procedures that are often employed to eliminate or reduce the frequency of aggressive behaviors. This article overviewed the occurrence of aggressive behaviors of individuals with a brain injury and outlined three types of behavioral interventions, the contingency management procedure, positive behavior intervention support, and a combination of both. All are based on the theory of operant conditioning that posits that behaviors are learned through consequences. Although behavioral interventions are widely employed to ameliorate undesirable behaviors, their effectiveness varies among individuals. Tips for choosing an appropriate procedure are discussed.

brain injury usually specify which type of brain injury they focus on, acquired brain injury (ABI) in general or traumatic brain injury (TBI) in specific, this article encompassed studies on both ABI and TBI unless specified.

AGGRESSIVE BEHAVIORS AFTER A BRAIN INJURY

Kelly et al. (2006) classified types of challenging behaviors into nine categories based on 543 cases that were referred to a facility in Australia: Verbal aggression, physical aggression toward objects, physical acts toward self, physical aggression toward people, inappropriate sexual behaviors, perseveration or repetitive behaviors, wandering or absconding, inappropriate social behaviors, and lack of initiation. Four of the nine categories were associated with aggressive behaviors and accounted for approximately 80% of the consultations. Another research by Kelly et al. (2008) revealed that 85.8% of 190 brain injury patients exhibited verbal aggression followed by 41.1% physical aggression against people, 35.3% aggression against objects, and 5.3% physical acts against self.

The authors also explored specific behaviors in each category that patients exhibited. Of the 163 patients who displayed verbal aggression, shouting

occurred 68%, insulting 79%, moderate threats 69%, and serious threats 28%. Of the 78 patients who were physically aggressive toward others, swinging occurred 77%, striking 58%, mild injury 30%, and severe injury 3%. Of the 67 patients who exhibited aggression toward objects, slamming occurred 69%, throwing 54%, and breaking 30%. Of the 10 patients who displayed physical acts against themselves, 20% scratched, 80% hit, and 20% cut themselves (Kelly, 2008).

While Kelly et al.'s (2006, 2008) findings may offer some impressions that aggression appears to be a common behavioral problem among individuals with a brain injury, other studies have shown some variances in the frequency of aggressive behavior. An analysis of 12 studies between 1985 and 2009 demonstrated that physical and verbal aggression and irritability were evident between 11% and 96% of the studies (Sabaz, 2014). A recent analysis of 10 studies revealed that while the frequency of physical aggression ranged from 1.5% to 33.8%, that of verbal aggression occurred between 14% and 70% (Pouwels, 2019). The reasons for the wide range in the frequency may have been due to the participants' various characteristics such as age, severity of brain injury, and period since onset and/or the measurements of aggressive behavior (Byrne, 2016). Nevertheless, it appears that individuals who suffer a brain injury, to some extent, often exhibit some types of aggressive behaviors.

Factors associated with aggressive behaviors by those with a brain injury have been investigated in a number of studies. Cognitive impairment and intelligence factors including visuo-spatial ability, verbal memory, and intelligence quotient as well as social economic status and the male gender are correlated with aggression (Farrer, 2013; Winstanley, 2004; Wood, 2006). Correlations between aggression and age at the time of brain injury (Baguley, 2006) as well as alcohol and/or drug abuse have also been found (Tateno, 2003). Escape or avoidance from activities sufferers are not willing to participate in is another factor that triggers aggressive behaviors (Berkowitz, 1989; Giles, 2013). Furthermore, in some instances, those with a TBI may engage in aggressive behaviors for no apparent reason (Wood, 2006). Of the numerous factors associated with aggressive behaviors, depression is one of the most predictive factors (Baguley, 2006). Tateno et al. (2003) found that the number of patients who were diagnosed with severe depression was significantly larger in aggressive individuals with a brain injury than non-aggressive

individuals with a brain injury; however, in relation to those diagnosed with mild depression, there was no significant difference between aggressive and non-aggressive individuals with a brain injury. Similarly, Wood and Lossi (2006) revealed that among 287 patients with a severe brain injury, aggressive individuals exhibited more depressive symptoms and/or feelings of anxiety than non-aggressive individuals.

Almost half of the challenging behaviors, which were referred to a facility in Australia, were characterized by aggression (Kelly, 2006). However, one cannot necessarily deduce that in all circumstances the degree and frequency of aggressive behaviors are high. In fact, depending on the various studies, the frequency of aggressive behavior has differed (Sabaz, 2014; Pouwels, 2019). Aggressive behaviors are exhibited when factors such as cognitive and socio economic issues (Wood, 2006) and the desire to avoid participating in activities (Giles, 2013) are present. Aggressive behaviors cause difficulties for the patients as well as those in close proximity to them. In the following section, various types of psychological interventions that emphasize behavioral approaches for dealing with aggression are outlined.

BEHAVIORAL INTERVENTIONS FOR AGGRESSIVE BEHAVIORS

There are several types of psychological intervention procedures for aggressive behaviors that can be classified mainly into two types, behavioral interventions and cognitive interventions (Alderman, 2003; Byrne, 2016). Behavioral interventions, which are also known as applied behavior analysis, are based on the theory of operant conditioning. The operant conditioning focuses on the interactions of the environment (antecedent), behavior, and consequence, in which behavior in a specific environment can be maintained as its consequence (Alderman, 2013; Schlund, 1999; Turner, 1990; Watson, 2001; Yody, 2000). This is also known as the three-term contingency (see Figure 1). If a certain behavior in a specific environment results in a favorable outcome for the actor, the behavior can be learned as it results in reinforcement. Consequently, the individual will engage in the same behavior in similar situations frequently. On the contrary, if a certain behavior in a specific environment results in an unfavorable outcome, punishment will result and thus, the frequency of the behavior will decrease. Behavioral interventions are beneficial for individuals with a brain injury, especially those who exhibit aggressive behaviors. The behavioral approach may



Figure 1. Three-term contingency: Behavior occurs by an antecedent and is learned by its consequence

be regarded as a learning method without any consciousness about a relationship between a behavior and its consequence. It does not require cognitive ability because thinking does not mediate in learning the relationship (Alderman, 2003). Individuals with a brain injury are able to learn adaptive behaviors in specific situations without cognitive constraints through the experience of being rewarded or punished following certain behaviors (Wood, 2011).

Three types of behavioral intervention procedures are utilized for the treatment of aggressive behavior: The contingency management procedure (CMP) in which the relation between a behavior and its consequence are emphasized; positive behavior intervention support (PBIS)¹ during which the antecedent stimulus is emphasized; and a combination of the CMP and PBIS (Byrne, 2016). Referring to Wood and Alderman (2011), they are described below.

CMP

The CMP is a traditional intervention method that focuses on a specific behavior and its consequence (Alderman, 2003, 2013). The CPM aims to increase the frequency of desirable behaviors and reduce undesirable behaviors by manipulating the consequence, which occurs after a certain behavior.

To realize an increment of desirable behaviors, therapists reinforce patients when the desirable behavior occurs. Reinforcers may include verbal praise and/or external items that the patients would like to possess. Tokens that patients collect and use in an exchange for cash or prizes are an example of such a reinforcer. Other examples may comprise listening to music, playing games for five minutes, and a walk. The reinforcers may be on a list prepared by a rehabilitation facility from which the patients can choose (Hegel, 2000).

The CMP is characterized by three types of reinforcement: Differential reinforcement of incompatible behavior (DRI), differential reinforcement of other behavior (DRO), and differential reinforcement of low rates of responding (DRL). The type of reinforcement that is employed is dependent on the kinds of behav-

iors and frequency of occurrence. Therapists should select a type of reinforcement carefully so as to help patients receive the most suitable reinforcement for learning appropriate behaviors (Alderman, 1997). DRI reinforces appropriate behaviors that do not occur in conjunction with inappropriate behaviors simultaneously. For example, smiling and glaring are incompatible behaviors. Therefore, patients are reinforced when they smile at individuals but suppress glaring at them. Although DRI appears to be a simple method in that patients are reinforced when they show favorable behaviors but not unfavorable behaviors at a certain time, it is possible that they do not have enough opportunities to receive reinforcement at the outset of an intervention (Wood, 2011). In such instances, DRI may not be suitable. DRO reinforces appropriate behaviors when they are exhibited during a certain period even if inappropriate behaviors are also displayed during that period. Accordingly, patients will be reinforced even if they glare at another individual, but smile within a certain period thereof. DRO is founded on the idea that increasing favorable behavior by reinforcing it and reducing unfavorable behavior by ignoring could happen concurrently (Wood, 2011). The third type of reinforcement, DRL, emphasizes the reduction of inappropriate behavior. In DRL, reinforcement is given when the frequency of a certain inappropriate behavior within a period is the same at the outset of the intervention or lower (Turner, 1990). This method may be effective when the reduction of an inappropriate behavior that occurs in high frequency is the first goal for achieving the formation of a favorable behavior (Wood, 2011).

Therapists may also punish patients by scolding (positive punishment) or removing external reinforcement (negative punishment) from them in order to reduce the frequency of aggressive behaviors. Negative punishment may comprise removing favorite stimulus (response cost) or time for their favorite activity (time-out) (Eames, 1985). When employing the method of response cost, patients are given a certain number of tokens at the beginning of an intervention but removed when they exhibit inappropriate

¹ PBIS is also called positive behavior support (PBS).

behaviors. The punishment occurs immediately after the inappropriate behavior. A verbal explanation as to why the tokens were removed is also provided by therapists (Stewart, 2010). This method involves the patient's motor response in which they are expected to hand over their tokens to the therapists by themselves. It also involves the recognition of why this occurs and what behaviors result in them losing the tokens through explanations from the therapist. Accordingly, the method of response cost includes not only mechanical motor responses but also cognitive activities. Thus, it is considered an *active* intervention (Alderman, 1994, 2013).

Aggressive behaviors may be learned and retained as means to avoid or escape an intervention activity as well as getting attention from others (Alderman, 2013). In these cases, avoiding the intervention or being scolded may become a positive reinforcement that is contingent on the aggressive behavior. When scolding or attention could serve as a positive reinforcement for patients, it is imperative that therapists ignore them and leave them socially isolated as negative punishment. It is important that every member in an intervention group should respond to the patient in the same way (Alderman, 2013).

In the CMP, patients' behaviors may be controlled and managed without their autonomy; thus, various ethical matters could be criticized (Eames, 1985). However, the CMP may be more appropriate for individuals whose cognitive ability is impaired or who exhibit severe aggressive behaviors (Wood, 2011) because it is thought that the intervention does not require thinking for learning new behaviors (Alderman, 2003). Alternatively, PBIS may be more appropriate for other individuals with a brain injury.

PBIS

While the CMP focuses on certain behaviors and manipulates the consequences of those behaviors, PBIS focuses on antecedent external stimuli including environments and/or events that trigger the behaviors. PBIS also focuses on internal stimuli such as loneliness, sense of loss, and physical pains that cause the behaviors (Byrne, 2016). PBIS aims to increase the frequency of favorable behaviors in a social context, community, and home by preventing, modifying, and managing the unfavorable behaviors. The most important priority in PBIS is to change the lives of patients and those of their significant others to be satisfied. An emphasis on changing a certain behavior comes secondly (Ylvisaker, 2007).

Ylvisaker et al. (2007) noted various factors to

ensure that PBIS is effective: The construction of meaningful environments; setting objectives for achievement; the provision of meaningful and comprehensible daily tasks; the assurance of sufficient alternatives and control; the assurance of learning through appropriate support that functioned well previously; the assurance of positive and supportive communication by communication partners; and providing positive communication alternatives for negative behavior. This procedure enables therapists to achieve non-aversive, errorless rehabilitation for patients (Ducharme, 2003; Rothwell, 1999).

Patients with a brain injury first need to set a goal with their support team at the beginning of PBIS intervention. Specific procedures of the intervention can be determined after patients' aggressive behaviors as well as the stimuli that lead to such behaviors are defined. For example, when aggressive behaviors occur in a workplace due to others' refusal or the re-scheduling of a work shift, an essential intervention may involve developing a contract between patients and a workplace. The contract may include not arriving at the workplace more than 15 minutes before work starts, becoming involved with other employees only for work-related issues, and leaving the place for 10 minutes when one feels angry. They can return to work if the feeling of anger passes within 10 minutes, but they are expected to go home if they remain angry (Goodall, 1996). For individuals with a poor memory, a poster indicating the contents of the contract or instructions on a wall at the workplace that they can see may serve as a visual prompt for them (Zencius, 1989b).

When aggression is triggered by the motivation to escape or avoid an intervention, while the CMP can be employed to control a consequence after aggressive behavior such as ignoring the patient, PBIS controls the cause before it happens. For example, when patients perceive that they are controlled by others as they engage in an intervention activity, it may be possible to reduce negative images and feelings toward the intervention by sending them an invitation and map to the venue every time the intervention is conducted (Zencius, 1989b). Although PBIS emphasizes antecedent stimuli of behaviors, it does not underestimate the consequences after the behaviors. PBIS employs multiple elements by focusing on a consequence contingent on a specific behavior. Although the latter is similar to the CMP, while the CMP utilizes artificial reinforcements such as tokens, PBIS employs reinforcements that could rationally occur in reality; for example, good grades are a reinforcement

for studying conscientiously (Ylvisaker, 2007).

Although the CMP has been longer history of research and applied more in practice than PBIS, it appears that PBIS has been employed more in the rehabilitation of patients with a brain injury since 2000. Ylvisaker et al. (2007) revealed that whereas nine ($n = 38$) intervention studies that used the CMP were conducted between 1980 and 1989, 14 ($n = 27$) between 1990 and 1999, and three ($n = 5$) between 2000 and 2005, no intervention studies employed PBIS between 1980 and 1989, six ($n = 13$) between 1990 and 1999, and 11 ($n = 39$) between 2000 and 2005. Enhanced popularity of PBIS may be due to the emphasis on the antecedent stimulus, which appears to be suitable for the disability characteristics of patients with a brain injury including suppression and difficulty in learning from consequences (Ylvisaker, 2005). However, it is difficult to make a complete distinction between the CMP and PBIS because positive contingencies such as contentment and praise from others occur naturally when achieving adaptive behaviors through PBIS procedures (Ylvisaker, 2007). Some scholars have noted that it may be desirable to apply both the CMP and PBIS in conjunction with one another to meet individual needs, which are complicated and differ among patients (Alderman, 2013).

A combination of the CMP and PBIS

As noted previously, while the CMP controls aggressive behaviors by managing consequences that occur after the behaviors, PBIS controls aggressive behaviors by managing stimuli or the environment that may trigger the behaviors. In some cases, the behavioral approach combines the two procedures and applies these when conducting an intervention with patients. Two studies ($n = 3$) used the combined procedure between 1980 and 1989, 14 ($n = 37$) between 1990 and 1999, and six ($n = 10$) between 2000 and 2005 (Ylvisaker, 2007).

An example of the combined procedure involves setting a goal with a patient with a brain injury by first (i.e., PBIS) and making an agreement to offer reinforcement, which the patient would like if the goal is achieved, then the reinforcement is given as the goal is actually achieved (i.e., CMP) (Zencius, 1989a,b). Another example of reducing aggressive behavior for patients with a brain injury who have a mild cognitive impairment, such as patients who regularly participate in a daycare program, is to ask their peers in the program not to make any comments about them during the program, and give the patients feedback directly at the end of the program in relation to how

many times they exhibited aggressive behaviors during the program (Schlund, 1999). Alderman et al. (2013) asserted that combining the CMP and PBIS supports effective learning and builds an environment to facilitate patients with a brain injury to achieve goals by raising their awareness and motivation and setting appropriate levels of expectation.

Various procedures are practiced within behavioral interventions for the treatment of aggressive behaviors exhibited by individuals with a brain injury. Although all the procedures noted previously are based on the three-term contingency, they emphasize different aspects. Furthermore, there are no fixed techniques that therapists should employ, but rather they can choose from numerous alternatives depending on their patients. It is imperative that each procedure should satisfy patients' needs and consider individual differences.

EFFECTIVENESS OF BEHAVIORAL INTERVENTIONS

A number of studies have been conducted to examine the effects of psychological interventions on aggressive and/or challenging behaviors of individuals with a brain injury. Furthermore, several systematic reviews have explored the effectiveness of these studies. Of these, Ylvisaker et al. (2007) evaluated 65 studies, Cattalani et al. (2010) 63 studies, and Byrne and Coetzer (2016) 11 studies. The criteria for choosing studies varied among the three reviews: Ylvisaker et al. selected studies that examined the effect of behavioral approaches on behavioral disorders in general, Cattalani et al. chose studies that investigated the effect of psychological interventions on behavioral and psychosocial problems, and Byrne and Coetzer selected studies that explored the effects of behavioral and cognitive-behavioral approaches on aggressive behavior.

The results of the three reviews suggested that most studies have, to some extent, demonstrated the effects of behavioral interventions: the CMP, PBIS, or a combination thereof on the target behavior. Furthermore, Byrne and Coetzer (2016) noted that interventions would be more effective if they focused on external factors such as physical and verbal aggressive behaviors rather than on internal factors, for instance, anger and hostility. However, most studies have not revealed the retention of the effect. Follow-up results were indicated in 27 of the 65 studies in Ylvisaker et al. (2007) and 7 of the 65 studies in Cattalani et al.'s (2010) reviews. The results of the follow-up demon-

strated that retention of the intervention was found in 23 of 34 studies. On the contrary, Byrne and Coetzer (2016) reported that no study retained the effect of the intervention on reducing aggressive behavior; however, there were only two studies included in the review.

Most of the studies reviewed employed a single-case experimental design. In single-case experimental designs, data are collected by measuring the frequency of aggressive behaviors multiple times as a baseline of a particular patient. Thereafter, the patient's environment is controlled and interventions are conducted. Therefore, although these studies may reveal a significant effect of the intervention procedure, it may be difficult to deduce that the procedure can be applied to any patient with the same results. A randomized controlled trial (RCT), which is considered the best method and involves the patients being randomly assigned to one of several conditions to investigate an effect of the intervention, was utilized by only four studies (Medd, 2000; Wade, 2006 in the review by Ylvisaker, 2007; Carnevale, 2002; Salazar, 2000 in the review by Cattalani, 2010). RCT studies have demonstrated that the interventions were not effective enough to reduce aggressive behaviors.

The unfavorable outcomes may be largely due to individual differences. There are a significant number of individual differences among patients with a brain injury including socio-demographic characteristics, etiology, region of brain injury, degree of aggressive behaviors, cognitive ability, mental disorders, and medication (Cattalani, 2010). Furthermore, there are differences in the factors involved in aggressive behaviors and types of behaviors. As noted previously, when an effect of an intervention procedure is demonstrated in a study, it does not necessarily ensure all patients who exhibit similar behaviors to those of the research participant will experience equal effects. Consequently, therapists may struggle when they are endeavoring to find the most effective procedure for their patients (Alderman, 2003). In addition, because various methods are adopted in different studies, it is difficult to compare multiple studies directly. However, as noted by Johnson and Belleny (1996), aggression could be exacerbated without appropriate interventions. Thus, therapeutic procedures prevent the patients' aggression from becoming worse. Consequently, therapists need to assess patients with a brain injury carefully so as to clarify patients' personal factors as well as factors that influence aggressive behaviors and decide on

an intervention procedure that is suitable for them to help reduce their inappropriate behaviors.

CONCLUSION

In this article, an overview of behavioral therapy as a psychological intervention for reducing aggressive behavior of individuals with a brain injury was presented. Although behavioral interventions have been developed based on numerous rigorous scientific evidence (Schlund, 1999), what and how specific procedures should be applied depends on patients' characteristics, backgrounds, and needs (Alderman, 2003). A thorough assessment is imperative and critical for selecting and designing an intervention for each patient. Once the intervention commences, consistent approaches and implementations are required to realize a successful intervention. In addition, although it is important that patients learn that their aggressive behaviors are not socially accepted, it is also essential that patients do not feel socially isolated (Wood, 2011). Although the effectiveness of intervention procedures is dependent on individual patients, it remains crucial to conduct and review research so as to make a contribution to society.

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