

*PREFERENCE FOR PROGRESSIVE DELAYS AND
CONCURRENT PHYSICAL THERAPY EXERCISE IN
AN ADULT WITH ACQUIRED BRAIN INJURY*

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The purpose of this study was to increase self-control and engagement in a physical therapy task (head holding) for a man with acquired traumatic brain injury. Once impulsivity was observed (i.e., repeated impulsive choices), an experimental condition was introduced that consisted of choices between a small immediate reinforcer, a large fixed-delay reinforcer, and a large progressive-delay reinforcer. The participant showed a preference for the progressive-delay option, even when the duration of the delay exceeded that of the fixed delay. The results have implications for establishing optimal choice making and teaching life-enhancing skills.

DESCRIPTORS: brain injury, impulsivity, physical therapy, self-control

One key component in a comprehensive rehabilitation program for persons with brain injury is physical therapy. Unfortunately, many persons who need physical therapy refuse to participate in it, and as a result, do not reach optimal levels of independence postinjury. Not participating in physical therapy may be conceptualized as an impulsive choice whereby the person selects the small immediate reinforcer of escape from a demanding task over the larger delayed reinforcer of greater independence. Vollmer, Borrero, Lalli, and Daniels (1999) have crafted a similar model conceptualizing the choice between engaging in problem behavior or actively participating in meaningful tasks. Thus, treatment strategies are

needed to increase cooperative participation in important, but difficult, tasks (e.g., physical therapy).

To date, much of the self-control research incorporating a fading-to-delay procedure has compared obtained performances after training to a preexisting baseline of impulsive choices (Dixon & Cummings, 2001; Dixon & Holcomb, 2000). That is, during baseline and following the self-control training procedure, the participants were given a choice between a small immediate reinforcer and a larger delayed reinforcer that was available after the participant completed a task for a fixed duration of time. However, during the self-control training procedure, the smaller reinforcer was available as in baseline, but the larger reinforcer was made available after a progressively increasing delay (starting at 0 s and gradually increasing to the delay associated with the larger reinforcer during baseline). In effect, these studies might be conceptualized as pretest–posttest designs. No study has assessed the relative changes in preference that may occur from the experience with a progressively delayed alternative on a concurrently available baseline choice between a smaller immediate reinforcer and a large fixed-delay reinforcer.

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Therefore, the purpose of the present study was to increase cooperation with physical therapy in an adult man while providing him with three choices: (a) a small immediate reinforcer, (b) a large reinforcer delivered after a fixed delay, or (c) the same large reinforcer delivered after a progressive delay.

METHOD

Participant, Target Behavior, and Setting

Ray was a 31-year-old man with an acquired brain injury that had occurred about 2 years prior to the current study. Ray had lost a significant amount of muscle control in his neck and very rarely raised his head to the point that his face was no longer touching one of his shoulders or chest. Therefore, the target behavior was the duration (in seconds) of head holding, which was defined as holding his head up to the point that the bottom of his chin was above his shoulders where they met his neck. Sessions were conducted in the natural environment of either the kitchen area or lounge area at his residence. In both cases, the room contained a table, a laptop computer equipped with a DVD player, and relevant discriminative stimuli.

Interobserver Agreement

During 25% of the sessions, a second observer was present. Interobserver agreement was calculated by dividing the number of agreements on the choice made or the duration of head holding (measured within a 3-s difference between observers) by the number of agreements plus disagreements and multiplying by 100%. The percentage of agreement for choice among reinforcer options was 100%. The percentage of agreement for response-engagement duration was 95%.

Preference Assessment

We assessed preferences for potential reinforcers using a multiple-stimulus-without-

replacement preference assessment (DeLeon & Iwata, 1996). A DVD movie with footage of underwater ocean scenes depicting various fish and other ocean wildlife served as the reinforcer.

Experimental Design

First, a natural baseline was conducted to determine Ray's level of head holding in the absence in any programmed consequences. Second, a choice baseline was introduced to assess Ray's preference between smaller immediate reinforcers and larger delayed reinforcers for head holding at longer durations than those observed during baseline. Third, a self-control training condition was implemented that included the choices available in the choice baseline (i.e., small immediate vs. larger delayed) as well as a third choice option in which a larger reinforcer was delivered after a progressively increasing delay.

Procedure

Natural baseline. Trials began as the experimenter instructed Ray to engage in his target behavior by saying, "Lift your head up for as long as you can." No further instructions, prompts, feedback, or reinforcement was provided during these sessions. Each session concluded after Ray ceased engaging in the activity for more than 1 s. This condition continued until a relatively stable duration of head holding was observed.

Choice baseline. The mean occurrence of the target behavior during the natural baseline was calculated. The resulting value, 16 s, was then multiplied by 10, which produced the goal duration of engagement time/waiting time of 160 s to be tolerated by Ray. The multiplication by 10 was chosen arbitrarily and was similar to prior studies (Dixon & Cummings, 2001; Dixon & Holcomb, 2000). The magnitude of the larger delayed reinforcer was three times the quantity of the smaller reinforcer. The value of the reinforcer associated with the imme-

mediate choice was 10 s of DVD time versus 30 s associated with the large delayed reinforcer.

Discrimination training involved two free- or one forced-choice trial for each choice available during the condition. During forced-choice trials, one of two different-colored index cards (8 cm by 12 cm) was placed in front of Ray, and he was instructed to touch the card. If the card was associated with the small immediate reinforcer, the reinforcer was delivered immediately. If the card was associated with the large delayed reinforcer, the card was removed, and Ray was instructed to engage in head-holding behavior. If Ray was able to engage in the activity for the duration of 160 s, the reinforcer was delivered following the interval. Each trial was followed by an intertrial interval (ITI) that was an amount of time between consumption of the reinforcer and the beginning of the next trial. When the large delayed reinforcer was delivered, the ITI was 5 s. When the small immediate reinforcer was chosen, the ITI was calculated by adding 5 s to 160 s (for the larger reinforcer), and this total of 165 s served as the ITI. If Ray was unable to engage in the activity for the duration of the interval, the trial was discontinued, and the balance remaining of 160 s plus 5 s served as the ITI prior to the start of the next trial.

After the two forced-choice trials, Ray was exposed to an average of 10 free-choice trials. During these trials, both cards were presented in random positions (i.e., right or left) across trials. No prompts were provided to initiate a selection. Once Ray made physical contact with one of the cards, the corresponding reinforcer (small immediate or large delayed) was delivered as described above. This phase remained in effect until a stable rate of responding occurred that reflected a preference for the small immediate reinforcer coupled with at least three con-

secutive sessions during which the small immediate reinforcer was selected.

Self-control training. This phase included conditions that were identical to those described in the choice baseline, with the addition of a third choice condition. The third option consisted of a large reinforcer with a delay (initially set at 0 s) that gradually increased across trials. The magnitude of the large reinforcer was equal to that of the large reinforcer associated with fixed-delay (160 s) reinforcer (i.e., 30 s of DVD viewing).

Three forced-choice trials preceded each series of free trials as described above. As before, one of the cards was associated with the small reinforcer that was delivered immediately. With the addition of the third choice (large reinforcer delivered following increasing increments) there were two different cards representing the two different delay conditions associated with the delivery of the large reinforcer. One stimulus was associated with the large reinforcer delivered after the duration of 160 s, and the other stimulus was associated with the large reinforcer delivered after the progressively increasing delays. If Ray chose the progressive-delay reinforcer over three consecutive trials, the delay was increased by 10 s. This condition remained in effect until the delay exceeded 160 s.

RESULTS AND DISCUSSION

Figure 1 (top) shows the number of seconds Ray displayed head holding across baseline and training conditions; the bottom panel shows his percentage of choices for each response option. During the natural baseline, Ray engaged in head holding for 6 s to 24 s ($M = 16$ s). During the choice baseline, Ray consistently chose the small immediate reinforcer on 13 of the last 15 trials in that condition and on 17 of the total 28 trials. With the implementation of self-control training, Ray exhibited a pref-

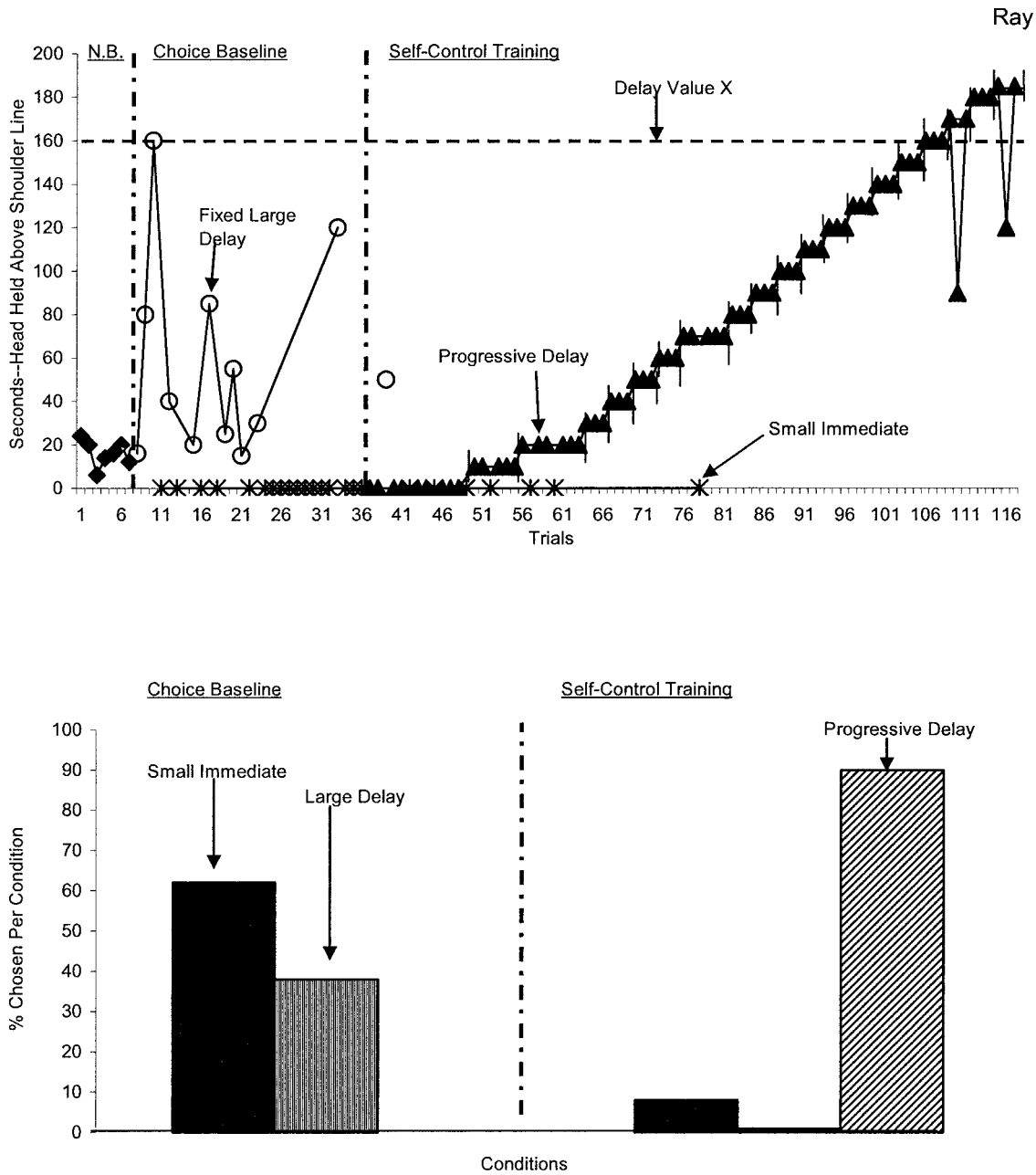


Figure 1. The top section displays duration of target behavior and corresponding response allocations. The bottom section displays summary percentages of choices for each phase.

erence for the progressive-delay reinforcer even as the delay to reinforcement surpassed the value of the fixed-delay reinforcer by 25 s (185 s vs. 160 s). Ray's head holding also improved throughout self-control training and occurred for the duration of the delay

during all trials but two (170 s, 185 s). The overall mean for head holding during self-control training was 83 s compared to 16 s during natural baseline.

These results support those of Dixon and Cummings (2001) and Dixon and Holcomb

(2000), who also showed that exposure to gradually increasing delays to large reinforcers may result in increases in self-control. One possible explanation for our results could be the history of exposure regarding the specific discriminative stimulus associated with that consequence. Because Ray was repeatedly exposed to the large reinforcer in the absence of delay, it is possible that the specific discriminative stimulus paired with this option began to take on conditioned reinforcement properties of that outcome. Stromer, McComas, and Rehfeldt (2000) suggested a similar hypothesis regarding the use of signals presented during the delay. The current data suggest that the discriminative stimuli, and perhaps the associated concurrent activity, may also take on conditioned reinforcement properties (see also Dixon, Horner, & Guercio, 2003).

In conclusion, the present results show that schedules of reinforcement that use concurrent fixed delays (small), fixed delays (large), and progressive delays can not only promote choices that can be conceptualized as self-control but can also increase engagement in target activities identified as neces-

sary for advancement of physical well-being for an individual with acquired traumatic brain injuries.

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