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SHORT COMMUNICATION

Full Body Restraint and Rapid Stimulus Exposure as a Treatment for Dogs With Defensive Aggressive Behavior: Three Case Studies

Nancy G. Williams and Peter L. Borchelt
Animal Behavior Consultant, U.S.A.

We evaluated the effect of full body restraint and rapid stimulus exposure (response prevention-flooding) on three Great Dane dogs, *Canis familiaris,* exhibiting high levels of aggression toward strangers or other dogs. We immobilized each dog in a restraint box by pouring grain in the box up to the level of the dog's neck. Each dog was rapidly subjected to increasing intensity of the appropriate eliciting stimulus (adult, child, or dog) and responses were rated using a standardized numerical rating system. The dogs' aggressive behavior diminished rapidly during restraint, and resulted in calm behavior during the highest stimulus intensity. Owners reported decreases in aggressive behavior for several months to years following the restraint sessions. Rapid stimulus exposure, when accompanied by complete response prevention, seems to result in large and long-lasting decrements in aggressive responses.

Aggression toward humans is probably the most frequent of the serious behavior problems reported in pet dogs (Beaver, 1983; Hart & Hart, 1985). There are approximately 68 million pet dogs in the United States (American Pet Products Manufacturers Association, 2001), and estimates indicate that dogs bite over 4.7 million people annually (Sachs, Kresnow, & Houston, 1996). Dog aggressive behavior directed toward humans includes several types such as dominance related (generally to family members), protective (generally to strangers in the context of perceived threat to owners or property), defensive (in the context of fear or perceived threat to self), predatory, and others (Askew, 1996; Beaver, 1983; Borchelt & Voith, 1982). Beaver (1983), Borchelt (1983), Campbell (1975), and Landsberg (1991) present the relative frequency of these types of behavior problems. Aggression by dogs toward conspecifics is an important, but less frequently reported problem. Studies show considerable variation in the frequency of aggression between household dogs and toward nonhousehold dogs (Askew, 1996; Beaver, 1983; Borchelt, 1983; Sherman et al., 1996).

Outcome studies for treatment of aggressive behavior in dogs are rare. Takeuchi et al. (2001) reported from 84 cases involving dog aggression toward strangers that 67.5% improved at least 2 months after treatment. Sherman et al. (1996) reported from

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99 cases involving aggression between dogs outside the household that 52% reported improvement from 3 to 13 years after treatment. Galec and Knol (1997) reported from 73 cases of fear-induced aggression that 75% of the dogs improved at least 3 months after treatment. Only Galec and Knol (1997) stated the percentage of dogs (18%) that had bitten an adult or child. The other studies likely described cases that mostly involved low to moderate levels of aggression.

These studies did not state the exact methodologies used and employed many different treatment techniques. None of the studies quantified the total amount of training time that was necessary to affect treatment. Sherman et al. (1996) noted that there was a low compliance by owners using desensitization and counterconditioning, which require careful selection and gradual presentation of stimuli repeated over generally long periods to achieve lasting results (Askew, 1996; Hart & Hart, 1985; Hothersall & Tuber, 1979; Reid & Borchelt, 1996).

Numerous methods have been used for the treatment of aggressive behavior in dogs (Askew, 1996; Hart & Hart, 1985; Sherman et al., 1996). These methods range from obedience training, halter restraint, punishment (from leash corrections with choke or prong collars to electronic collars), drugs, and gradual exposure techniques such as desensitization and counterconditioning.

Rapid stimulus exposure (flooding) and response prevention have rarely been described as treatment techniques in dogs, despite evidence from several species that these procedures can quickly lead to lasting behavioral change. In laboratory rats, response prevention/flooding is the technique of choice for rapidly extinguishing well-established avoidance responses such as jumping up on a ledge to avoid foot shock (Baum, 1970; Siegeltuch & Baum, 1971). Flooding is commonly used to accustom horses to low-intensity, fear-eliciting stimuli (Voith, 1986) and to reduce fear, anxiety, and obsessive-compulsive behavior in humans (Marks, 1978, 1981, 1987; Marks, Boulougouris, & Marset, 1971).

In large farm animals, the use of halters, bits, and reins to control movement and restrain lunging and rearing, as well as guidance for general training, is a form of response prevention that has been used for several thousand years (Mountjoy, 1980). Halters for dogs have been used since the early 1980s (Borchelt, 1998). The authors' experience and personal communications from other applied animal behaviorists and dog trainers indicate that head restraint using a halter can be very effective in reducing fear and aggressive responses in dogs. However, head restraint alone proved to be inadequate in inhibiting the high levels of defensive aggressive behavior exhibited by the three large dogs in the present study.

The use of pressure and restraint as a technique for reducing anxiety and fear responses has been described for several species. Grandin (1992, 1993, 1995) designed chutes and restraint devices that apply light to moderate tactile pressure to minimize stress during the handling of cows, pigs, and sheep. Similar devices calm and restrain large animals, such as giraffes in zoos (Calle & Bornmann, 1988). Grandin (1992) and Edelson et al. (1999) employed a variation of this method using pressure to reduce agitation in autistic humans.

Full body restraint rapidly decreases fearful responses of wild horses, *Equus caballus*, to the approach and handling by people (Kurtis, 1997). The procedure involves immobilizing a horse in a livestock trailer by pouring hundreds of kilograms of grain over the animal's body, leaving the head free. People then approach and handle the horse's

head and present unusual objects, such as umbrellas. The horse rapidly habituates to these stimuli within 30 min. This method produces rapid calming, greatly decreasing the time needed to handle these horses, and increasing safety for both horse and handler.

The purpose of the present study was to investigate the efficacy of a combination of full body restraint and rapid stimulus exposure on defensive aggression in three large aggressive dogs. Each dog exhibited behaviors compatible with high levels of arousal and fear or defensive aggression (e.g., ears back and tail lowered, withdrawal responses, barking, growling, lunging, and biting or attempted biting). The postures and context for aggression were not compatible with protective or other classes of aggression. Each dog was privately owned and none of the dogs was aggressive to family members. For each of these dogs, the standard exposure techniques of desensitization and counterconditioning had been tried, but were either too difficult or too dangerous for the owners to implement, and posed potential legal liabilities as well.

General Method

Subjects

The subjects were three adult neutered Great Danes: Eagle, Ruthie, and Montana. A veterinary examination determined the dogs had no physical problem that contributed to their aggression. Evaluations of thyroid function and serum T3T4 levels were within normal limits. A veterinarian was present during at least the first restraint session for each dog.

Apparatus

The sessions took place in a well-lighted barn aisle. For full body restraint, the dogs were led into a 110 cm long x 45 cm wide x 102 cm high wooden box with supported sliding panels for the front, back, and top of the box (see Figure 1). Two leashes, one attached to a halter (Snoot Loop®) and one to a wide buckle collar, restrained the dog. The collar leash was tied to the front of the box, with the dog's neck resting on a curved, padded panel. A second curved, padded panel over the neck restrained the dog from moving upward, leaving the head and neck completely exposed during the session. A team of three to four people poured approximately 275 kg of whole, triple cleaned oats over the restrained animal to completely immobilize it in a standing position. Foam pads placed over the dogs back with a board secured over the pads prevented the dog from climbing up on the grain in the box. The team accomplished this procedure within 4-5 min. A videocassette recorder filmed the dog's responses during the sessions.

Procedure

Each dog acclimated to restraint for 10 min and appeared calm before the start of the session. Then, each dog then was sequentially exposed to a set of stimuli based on the behavioral history provided by the owner and pretest diagnosis. Numerical rating scales were designed to measure the intensity of the stimuli (0 through 14 to 15) presented to each restrained dog and the dog's responses (-5 to 15), as outlined in Table 1. Eagle and Ruthie received three sessions, varying in length, with 7 to 30 days between sessions. Montana received three consecutive sessions, varying in length, over one day. Results were compiled for each session after review of the videotapes. For each minute, the stimulus intensity and the maximum corresponding response rating was tabulated.

Each dog's first session began with a stimulus intensity rating of zero (owner or known person touching the dog). The criterion for increasing the intensity of the stimulus was that the dog remained in a relaxed or low response level on the behavior rating scale (-5 to 8 rating, indicating relaxation up to mild arousal) for approximately 3 min. If, during stimulation, the dog's response increased to a rating of nine or above (growling, snapping or lunging which indicated increasing aggressive responses), the

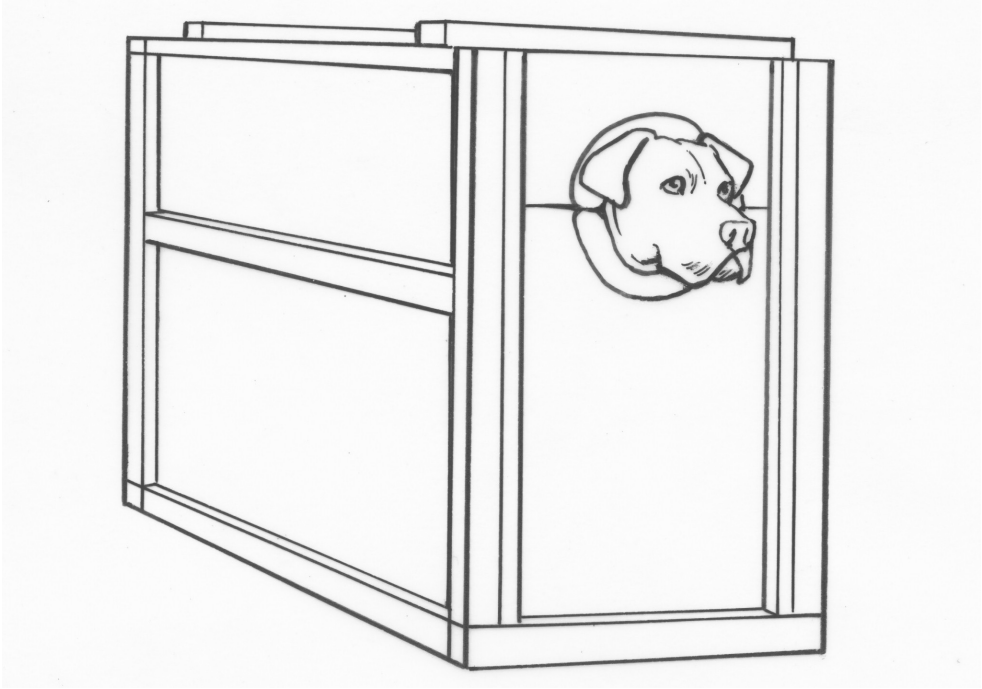

Figure 1. Dog in restraint box.

stimulus was maintained at that intensity until the dog's response dropped to a rating of seven or below and remained there for approximately 3 min. In the rare instances when the dog's response level remained at a rating of nine (or higher) continuously for more than 45 s, a handler gently closed the dog's mouth with the halter for several seconds. In order to minimize stress on the subjects, a predetermination was made that if a dog's response remained at a rating of nine (or higher) for more than 2 min the session was ended. Each dog was exposed to an increase of at least 4 to 5 steps on the stimulus intensity scale per session.

Case 1: Eagle

Eagle was a 73 kg, 2.0-year-old male, with a history of severe aggression toward all strangers. He was not well socialized. He would urinate in fear when his owner struck him with a newspaper during house training. He started to be aggressive toward strangers at 6 months of age. He consistently lunged, growled, and snapped at people who approached from approximately 9 m. This behavior started when he joined other dogs in his yard in lunging and barking at strangers who walked by the backyard fence. When he was 8 months old, Eagle bit a veterinarian in the face, resulting in minor injury. At the age of about 16 months, he was rehomed to one of the authors (NW) for training. His aggressive behavior toward strangers decreased moderately through standard desensitization and counterconditioning techniques

Table 1

Numerical Rating Scale of Stimulus Intensity and Dog's Response.

Description of stimulus intensity for aggression toward					
No.	Strangers (Eagle)	Children (Ruthie)	Dogs (Montana)	No.	Description of dog's response to stimulus
				-5	dog eats offered food, occasionally orients on stimulus
				-4	dog eats offered food, frequently orients on stimulus
				-3	no reaction but interested, orients on stimulus
				-2	head lowered, generally not focused on stimulus
				-1	head to side, generally not focused on stimulus
0	owner or known person touching dog	owner or known person touching dog	owner or known person touching dog	0	dog attempts to move backward
1	women approach, move hands at 1.5 to 3.0 m	a stranger slowly approaches & touches dog[a]	a medium dog lying down at 21 m[c]	1	frequent head movement[f]
2	same as No. 1, at 1.0 m	same as No. 1, but rapid movement at dog's face	a medium dog walks by at 6.0 to 15.0 m	2	lip licking
3	same as No. 2, & touch dog's head[a]	a child stands at 2.5 to 3.6 m	a medium dog walks by at 1.2 to 3.0 m	3	yawn
4	a man moves his feet at 2.5 to 3.0 m	same as No. 3, but with movement	same as No. 3, moves slowly, eats treats	4	pant
5	same as No. 4, & movement of hands	same as No. 4, at 2.0 to 2.5 m (sideways to dog)	same as No. 4, moves rapidly at 0.6 to 0.9 m	5	whine
6	same as No. 5, at 2.0 to 2.5 m	same as No. 5, (facing dog)	two small dogs at 6.0 to 15.0 m[d]	6	intermittently rigid, occasional orienting toward stimulus

Table 1 (continued)

Numerical Rating Scale of Stimulus Intensity and Dog's Response.

7	same as No. 6, at 1.5 to 2.0 m	a child stands still at 1.2 to 2.0 m	two small dogs stand at 4.5 to 6.0 m	7	frequently rigid, tendency to freeze and stare
8	same as No. 7, at 1.0 to 2.0 m	same as No. 7, but with movement	two small dogs stand at 1.8 to 3.0 m	8	intense focus on stimulus, rigid posture
9	same as No. 8, owner not in sight	a child pretends to bounce a ball at 1.2 to 2.0 m	two small dogs stand at 0.6 to 1.8 m	9	growl, no motion forward
10	fence placed in front of dog, dog fed treats[b], owner in sight	a child stands still with a basketball at 1.2 to 2.0 m, behind a fence[b]	two small dogs walk at 0.6 m around Montana	10	snarl
11	same as No. 10, & movement by fence	same as No. 10, but throws ball at fence	two small dogs & one large dog walk at 6.0 to 21.0 m[e]	11	growl and/or bark, intermittent motion forward
12	fence removed, touch dog's face[a], no food	two children bounce a basketball, no shouting, at 1.2 to 2.0 m	same as No. 11, at 2.4 to 3.0 m	12	snaps toward stimulus
13	same as No. 12, but owner not in sight	same as No. 12, shouting, & throw ball at fence	same as No. 12, at 0.6 to 2.4 m	13	rapid motion forward continuously, growl and bark
14	Same as No. 13, but rapidly touches & feeds dog	same as No. 13, but children repeatedly run up to fence with ball	small dog on a table, face to face with Montana at 0.6 to 0.9 m	14	rapid motion forward, growl and snap
15		child approaches, no ball, & touches fence	same as No. 14, small dog stares at Montana	15	rapid motion forward and upward, growl and snap

[a] A plastic model hand was used to reach near or touch the dog in most instances.
[b] A section of fence was placed 0.6 m in front of the restrained dog, simulating the situation under which the dog was aggressive.
[c] A medium size dog that was trained to ignore other dogs.
[d] Two small dogs were introduced, the medium dog was removed.
[e] A large dog was introduced in addition to the small dogs and then removed at stimulus No. 14.
[f] Could include vocalization, panting or struggling.

over a 9-month period, involving over 150 h of exposure to approximately 70 stimulus persons. NW used a halter (Snoot Loop®) in an attempt to inhibit his aggressive displays, but he continued to lunge at people who moved rapidly from distances of 3 to 5 m.

We based the stimulus sequence on increasing proximity and movement of strangers, first with women, then with men, starting at several meters distance and ending with touching and hand feeding.

Case 2: Ruthie

Ruthie was a 55 kg, 1.5-year-old female, with a history of severe aggression toward strangers, particularly children. Ruthie was not well socialized. She started lunging at strangers at 7 months old and was very aggressive toward neighborhood children playing basketball. Ruthie bit five adults, which resulted in slight to moderate injuries. Her owner was not able to physically control Ruthie's growling and lunging, even on a halter.

We based the stimulus sequence on increasing proximity and movement of strangers, first with adults, then with children playing with a basketball starting at several meters distance, ending with a child standing within 1.0 m.

Case 3: Montana

Montana was a 57 kg, 2-year-old female, with a history of severe aggression toward dogs that she encountered on daily walks. Montana lived with one other dog, a 4-year old, neutered female Great Dane. The owner reported that Montana was friendly toward other dogs until a neighborhood dog attacked her at 4 months of age (no injury resulted). During the next month, Montana joined the other family dog in barking and lunging at neighborhood dogs during walks. Montana's behavior escalated until her owner was unable to control her during walks, even using a halter. After several months, Montana redirected bites that resulted in serious bruising to the owner's legs and arms. On one occasion, Montana became aggressive toward a dog during a walk, and redirected her aggression toward a parked car, biting and damaging the bumper. The owner reported that Montana broke loose from her leash on one walk and seriously injured a small dog. At this point, the owner stopped walking Montana in public.

We based the stimulus sequence on increasing proximity and movement of dogs, first with one dog at greater than 20 m distance, then with multiple dogs actively moving, ending with a dog facing and staring at Montana within one meter.

Results

Figure 2 shows, for Eagle, Ruthie, and Montana respectively, the minute-by-minute changes in stimulus and response ratings across all sessions. In any individual stimulus presentation, an increase in level of responsiveness was followed by a rapid decrease in response rating within a few minutes. By the end of the third session for each dog, the highest level of stimulus intensity yielded very low levels of responsiveness.

Follow-up

After the sessions, Eagle displayed much less aggression toward strangers, allowing a closer approach with more stimulation (i.e., a person could move his or her hands). Several months after restraint sessions, Eagle tolerated handling and exhibited friendly behavior toward an unfamiliar woman. However, during a subsequent encounter five months after the restraint session, the woman extended her hands rapidly toward him. He quickly grabbed her hand in his mouth, without barking or growling and immediately withdrew, leaving no mark on her hand. Despite progress, Eagle was euthanized later as his owner did not want him returned to their home, and his history precluded adoption.

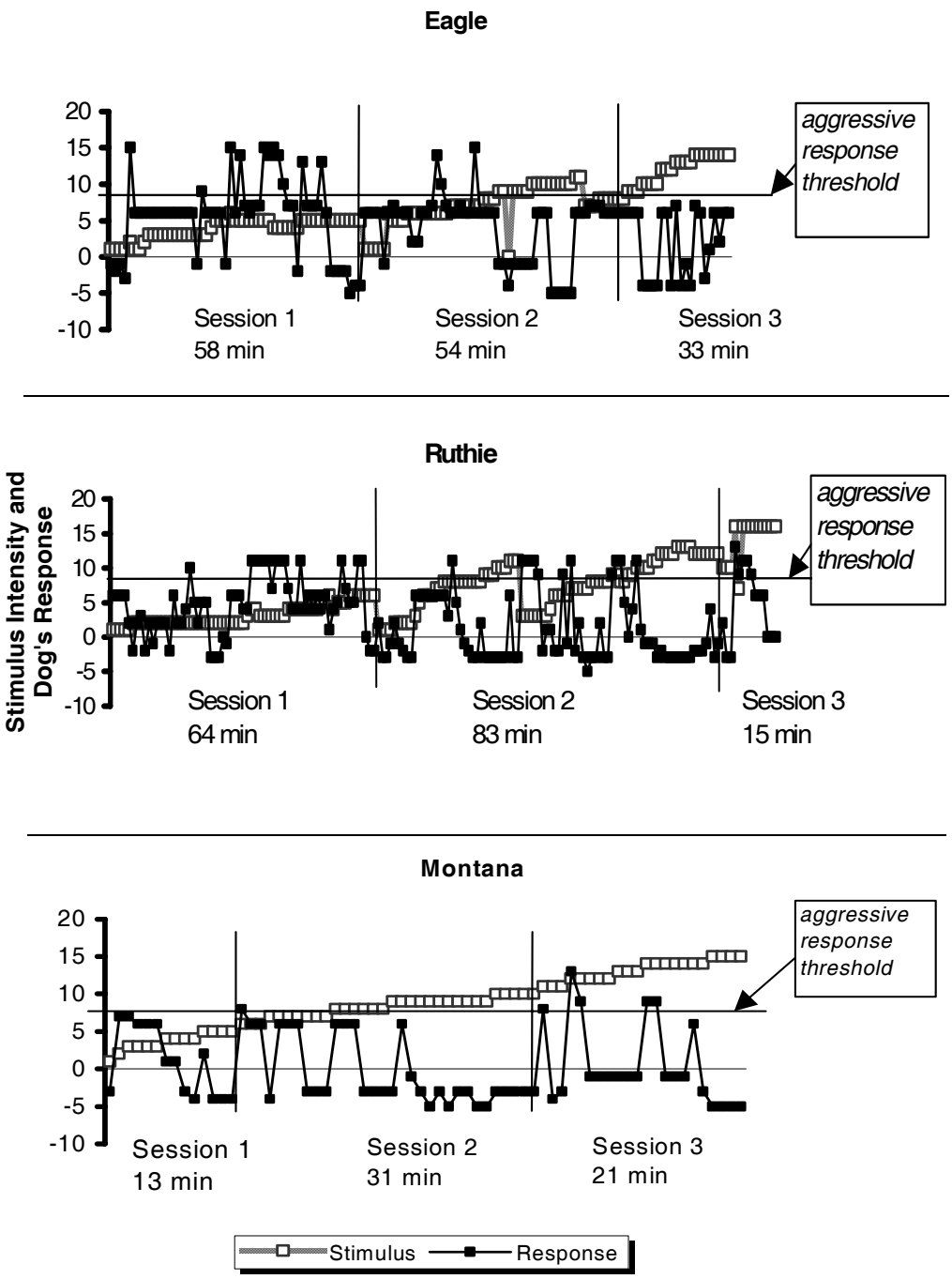

Figure 2. Stimulus intensity and maximum response ratings per minute for each dog.

Follow-up interviews with Ruthie's owner over the next 30 months indicated that Ruthie had exhibited a dramatic decrease in aggression towards adults and children. Her owner reported that Ruthie, for the first time in her adult life, had tolerated some handling by unfamiliar adults without exhibiting aggression. There were no further reported biting incidents for 3 years following her sessions.

A videotaped session of Montana handled by one of the authors (NW) 3 months

after the restraint session demonstrated a dramatic decrease in her level of response to other dogs on a walk, and she initiated play with one of the dogs. The owner was inconsistent in the recommended follow-up exposure to dogs and after 4 months, Montana showed a low level of aggression to some other dogs, but still was able to be walked safely in public. The owner reported an overall decrease of about 75%, in Montana's aggressiveness for up to a year after her restraint sessions, and was living with two other new dogs, four years later.

Discussion

Full body restraint and rapid stimulus exposure resulted in a marked decrease in the aggressive response ratings to the set of aggression-eliciting stimuli in each of the three dogs tested. We did not observe any adverse effects in any of the three dogs during full body restraint. Furthermore, on subsequent sessions, each dog entered the box without hesitation. No session had to be terminated due to a continuous response rating of nine or higher for more than 2 min.

These three cases strongly suggest that a combination of full body restraint and rapid stimulus exposure safely facilitate the reduction of defensive aggressive behavior in dogs toward strangers and other dogs. Each of three dogs showed rapid decreases in levels of aggression, even to intense eliciting stimuli, during a relatively short period of restraint, while posing no danger to stimulus persons/dogs or to handlers. According to owners, the dog maintained dramatic improvement in the home environment several months to years later.

The mechanism by which full body restraint and rapid stimulus exposure seems to yield quick and long-lasting reduction of defensive behavior in dogs and horses is unknown. The effect may be due to restraint (inability to escape or avoid), pressure, reduction in physiological arousal, or some other factor. To investigate if rapid exposure-restraint was accompanied by changes in physiological responses, one year after the present study was completed, Montana was fitted with a Holter monitor to collect electrocardiographic (ECG) data during a second full body restraint session, while being exposed to a stimulus dog at close range indoors (Williams, Borchelt, Sollers, Gasper, Thayer, 2003).

Montana showed a decrease in heart rate and an increase in heart rate variability during the period of full body restraint and during the posttest (see Stein & Kleiger, 1999, for a review of HR and HRV). This is consistent with reduced physiological arousal and increased parasympathetic activity. Importantly, these data reflect our observation of behavioral relaxation during full body restraint.

Although the procedures used in the present study are not very practical, at least for in-home treatment, they are safe (for dog and human), work quickly and apparently have long-term effects. The outcome was consistent and dramatic, but only three dogs were tested and the results need replication. Additional research should be conducted on the number and duration of sessions that are necessary to effect change in the dog's behavior. In addition, the collection and interpretation of physiological data during sessions may further improve treatment outcome.

We are currently investigating easier and more practical methods of full body restraint while recording cardiovascular activity. Full body restraint may be effective for other types of aggressive behavior, or other nonaggressive defensive or fear-related problems (anxiety, phobias).

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