



Lesley is a self-employed dog trainer and behaviourist working in Dublin, Ireland. Lesley has a Master's in Clinical Animal Behaviour (distinction) from the Royal (Dick) School of Veterinary Studies at the University of Edinburgh, where she has been a member of the vet peer tutoring team. Her company, Clever Companions, specialises in pet-dog training and behaviour and her passion is improving pet-dog welfare through owner education and engagement. Email: Clevercompanions@gmail.com

Bangers, rockets and fireworks – oh my! Fireworks reactivity as a behaviour concern for pet-dogs

Lesley Townsend, MSc CAB, CBTT, CAP

University of Edinburgh Institute of Governance, Edinburgh, UK

ABSTRACT: Fireworks are the most common cause of noise aversion in pet-dogs, eliciting potentially severe and prolonged behavioural responses, yet owners rarely seek treatment. This article discusses the scale of the problem, aetiology and differential diagnoses. By educating clients on prevention, management and modification of firework reactivity, an opportunity exists for registered veterinary nurses to improve pet-dog welfare during firework season, and throughout the year.

Keywords: fireworks; noise reactivity; dog behaviour; welfare; client education

Introduction

Each Halloween and Bonfire night, thousands of dogs experience adverse reactions to fireworks (Sherman & Mills, 2008). From 2013 to 2018, the RSPCA reported a 12% increase in calls regarding fireworks and animal welfare (RSPCA, n.d.). In 2019, 51% of veterinary surgeons (VS) reported increased cases of firework aversion (You Gov, 2019), prompting the British Veterinary Association (BVA) to request urgent reform of firework regulations (BVA, 2019). In the U.K. 80% of dogs react to fireworks at some point in their lives (Blackwell et al., 2013) with 50% of owners considering it a recurring problem (Sherman & Mills, 2008).

Veterinary practices are often the primary source of behaviour advice for dog-owners and registered veterinary nurses (RVNs) are uniquely placed to support canine behavioural and physical health (RCVS, 2016; Roshier & McBride, 2013). Behaviour is often the first indication of undiagnosed health problems and broader welfare concerns (Adams & Frankel, 2007). Behavioural responses to fireworks, such as escape attempts and destruction (Figure 1) may result in broken teeth and nails, cuts, abrasions and fractures, and defaecation and urination are not only distressing for the dog but possibly the owner too (Ballantyne, 2018; Sheppard & Mills, 2003).

Left untreated, behaviour concerns may damage the human animal bond, potentially resulting in punishment, increased risk of relinquishment

and euthanasia (Patronek et al., 1996). Providing clients with effective strategies to manage and treat firework reactivity can improve pet-dog welfare, build client trust and generate referrals for the practice (Aitken, 2014).

Terminology

Adverse responses to fireworks are variously described as fear, anxiety, phobia or reactivity (Sherman & Mills, 2008). Fear is a normal, adaptive response to present danger, although when experienced frequently and unnecessarily it may be detrimental to welfare (Storengen & Lingaas, 2015). Anxiety is an anticipatory, adverse response to environmental triggers which predict stimuli perceived as dangerous, which may or may not be identifiable (Sherman & Mills, 2008). Phobia is a maladaptive, prolonged and excessive adverse response, even at low levels of exposure (Blackwell et al., 2013). In reality, these terms are often used interchangeably. The term reactivity is used here, indicating a general lowering of the threshold for response to stimuli, rather than the underlying motivation for the behaviour (Overall et al., 2016).

Behavioural manifestations

Riemer (2019) found 15% of dogs take several days to recover from fireworks exposure. The most frequently reported behavioural responses



▣ **Figure 1.** Destruction caused by a medium sized dog, left alone during a fireworks event (image author's own).

are trembling, shaking and pacing, although being overt and analogous to human fear responses, owners may recognise them more easily than subtler stress responses (Figure 2) (Dale et al., 2010; Mariti et al., 2012). Other behaviours include hiding, escape, restlessness, hyper-salivation, inappetence, destruction, urination and defaecation (Cracknell & Mills, 2008) (Figure 3).

Aetiology

The pain threshold for noise in dogs is 95 decibels (DB); fireworks average 140-150DB (RSPCA, n.d.). Fireworks noise is accompanied by flashes and distinctive smells and is unpredictable with varying pitch, making habituation — the process whereby dogs adapt to stimuli with repeated exposures — less likely, or even transient (Appleby et al., 2002). Random, intense fireworks exposure, with long intermittent periods of non-exposure may result in sensitisation — whereby reactivity develops with repeated exposures and resulting stress responses (Burch & Bailey, 1999).

This may explain why owners consistently report their dog's firework reactivity has worsened over time and with age (Blackwell et al., 2013; Dale et al., 2010; Fagundes et al., 2018; Overall et al., 2016). However, owners subjective interpretations of behaviour may be unreliable and owners may miss earlier, subtler signs of distress (Dale et al., 2010; Mariti et al., 2012), in fact firework reactivity may already be established in dogs by 20 months of age (Overall et al., 2016).

Certain breeds were found to be more reactive to fireworks than others (Blackwell et al., 2013). Perhaps unsurprisingly, gundog breeds, were less reactive than crossbreeds, presumably because gundogs were selectively bred to tolerate sudden loud noises (Storengen & Lingaas, 2015). However behavioural differences within breeds may be more substantial than between breeds and limited evidence exists on breed as a risk factor (Duffy et al., 2008). Some studies found male dogs more reactive to fireworks (Blackwell et al., 2013), others female dogs (Storengen & Lingaas, 2015) others no gender



▣ **Figure 2.** Indicators of fearful behaviour: ears pinned back, mouth drawn closed in a line, tension around the mouth and eyes and enlarged pupils (image author's own).

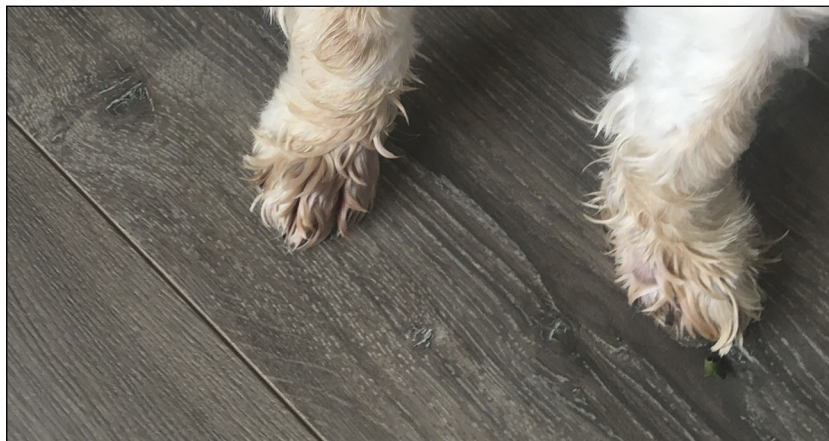
effects (Dale et al., 2010); these conflicting results may be attributable to diverse study populations.

Traumatic exposure may cause firework reactivity but not always (Sherman & Mills, 2008). Gradual, appropriate exposure may have protective effects, particularly during the critical socialisation window of development in puppies, from 3-13 weeks (Appleby et al., 2002; Limura, 2006). Anxiety may have a genetic basis which predisposes dogs to firework reactivity; it has been suggested dogs with firework reactivity may be more fearful in other situations (Storengen & Lingaas, 2015). Perhaps because fear responses are adaptive, firework reactivity easily generalises to other noises i.e. gunshot/traffic/thunderstorms; early diagnosis and interventions are vital (Ballantyne, 2018; Overall et al., 2016).

Differential diagnoses

A full physical exam and behavioural history are the first step in treatment. When clients present with sudden or late onset firework reactivity, pain (Fagundes et al., 2018), cognitive dysfunction (Landsberg et al., 2012), auditory changes (Scheifele et al., 2016), and iatrogenic causes (Notari et al., 2015) should first be eliminated. Where toileting presents in a previously housetrained dog, conditions and medications causing incontinence should first be considered (Ballantyne, 2018). Of noise reactive dogs at a UK clinic, older dogs were more likely to be diagnosed with comorbid musculoskeletal pain (Fagundes et al., 2018). The authors suggest startle responses to noise may cause tension — exacerbating pain — leading to classically conditioned fear/anxiety. Dogs presenting with suspected musculoskeletal pain and firework reactivity, may require synchronous treatment modalities — analgesia and behaviour modification (Fagundes et al., 2018).

Firework reactivity may be comorbid with separation anxiety and confinement issues, 41% of noise reactive dogs attending a behaviour clinic also experienced separation anxiety (Sherman & Mills, 2008). Fireworks or other noise when isolated or confined could partially explain this (Blackwell et al., 2013). If suspected, videoing the dog when alone or confined and logging firework events, can establish triggers for the behaviour. Only once these physical



■ **Figure 3.** A dog's paws or chest may be wet when the owner returns, indicating excessive licking or hypersalivation resulting from stress. Owners could easily miss this indicator or misinterpret it (image author's own).

and behavioural differentials are rejected or addressed, should treatment for firework reactivity be implemented.

Treatment

Although firework reactivity is commonplace, provoking severe behavioural responses, only 7% of dog-owners seek help from their VS (Blackwell et al., 2013) this in itself is a welfare concern. Perhaps owners are unaware treatment exists (Ballantyne, 2018) or consider firework reactivity 'normal' for dogs (Dale et al., 2010). Some owners may only seek help in the weeks preceding fireworks, without considering the behaviour problematic throughout the year (Bolster, 2012). While any efforts to reduce their dogs distress should be welcomed, 'quick fixes' are not replacements for behaviour modification (Riemer, 2020). However, some simple, short-term interventions may provide immediate relief and improve welfare, with or without pharmaceutical support. Providing these solutions can build client trust — potentially encouraging commitment to longer term strategies.

Environmental modification

During fireworks season, owners should secure property boundaries and update their dog's microchip and tag. Dogs should ideally be walked before dark, on lead. Dogs should be kept indoors, in a quiet room where owner and dog can spend time together comfortably. Low volume television, radio or white noise may reduce external sounds; closing curtains will limit accompanying light flashes. Confinement is best avoided, but providing a safe space with food and water i.e. a covered, open crate, or comfortable, safe area under furniture, may help some dogs (Ballantyne, 2018). No-one should approach the dog whilst they are in their safe space.

Owner behaviour

Conflicting opinions surround the need to ignore dogs reacting to fireworks (Ballantyne,

2018). While behaviours can be reinforced by owner interactions, the emotions underpinning them cannot and ignoring behaviour can cause escalation in the form of extinction bursts (Burch & Bailey, 1999; Sherman & Mills, 2008). Ignoring a distressed dog is challenging and potentially upsetting for owners; rather calm reassurance is recommended if it soothes the dog (Sheppard & Mills, 2003). Punishment may lead to anxiety and potential confrontation (Hiby et al., 2004), instead each firework noise should be immediately followed by food or another pleasant stimulus (Sheppard & Mills, 2003). Unavoidable stressors i.e. fireworks; may cause dogs to respond aggressively (Flint et al., 2017) and some anxiolytics, can cause behavioural disinhibition (Herron et al., 2008). While children and dogs should always be carefully supervised, this is particularly important at Halloween, when children may be wearing costumes and masks.

Calmatives and anxiolytics

Stuffed food toys, chews (Ballantyne, 2018) and social play (Affenzeller et al., 2017) may serve as calmatives for some dogs; creating positive associations with fireworks. Dog Appeasing Pheromone (DAP, Adaptil®, Ceva), a synthetic simulant of pheromones produced by lactating bitches, has been associated with increased calm and reduced reactivity during fireworks, although owner placebo effects may have contributed (Levine et al., 2007).

King et al. (2014) found pressure wraps (Thundershirts®, Thunderworks) reduced heart rate but not behavioural responses in dogs with separation anxiety. No evidence exists for applying pressure wraps during fireworks, although 44% of owners reportedly consider them successful (Riemer, 2020), again placebo effects may be relevant here. Some dogs find wraps aversive, causing behavioural inhibition, which owners may mistake for calm. Pressure wraps are not recommended for dogs sensitive to handling or wearing equipment.

There is almost no evidence to support homeopathy (Cracknell & Mills, 2008), alpha-casozepine (Zylkene®, Vetoquinol) (Buckley, 2017) or L-theanine (Anxitane®, Virbac) (Pike et al., 2015) as calmatives in dogs, however clients may favour 'natural' remedies over pharmaceuticals because of concerns about side effects — particularly sedation (Herron et al., 2008). Non-judgemental discussions may assuage these concerns. Fortunately a non-sedative anxiolytic — dexmedetomidine, oromucosal gel (Sileo®, Zoetis UK) is now licensed for use for noise aversion (Riemer, 2020), with 72% of owners satisfied with use during fireworks, in placebo controlled clinical trials. Emesis was the only side effect, reported in 4% of dogs (Korpivaara et al., 2017). In severe cases and presentations with co-morbidities, ongoing psychopharmacology may be necessary in conjunction with behaviour modification.

Behaviour modification

Desensitisation and counter-conditioning (DS/CC) are central to behaviour modification for firework reactivity (Levine et al., 2007). The dog is exposed to recorded fireworks noise at levels whereby no reaction occurs (desensitisation), while exposure is associated with pleasurable stimuli (counterconditioning), usually food (Ballantyne, 2018). Noise is gradually increased over time. DS/CC alongside DAP, reduced firework reactivity by 60%, over 60 days of treatment but only in one setting (Levine et al., 2007). Teaching relaxation protocols, may be a useful adjunct; 69% of owners found relaxation training successful (Riemer, 2020). DS/CC requires gradual, systematic exposure to avoid sensitisation and regular repetition to maintain efficacy (Sheppard & Mills, 2003). Behaviour modification requires considerable time and commitment, so owner expectations need careful management (Levine et al., 2007); ongoing support and professional guidance are essential.

Opportunities for education

Early interventions can prevent firework reactivity emerging, escalating and generalising. Puppy consults, puppy classes and client evenings provide excellent opportunities to educate owners on recognising signs of distress and intervening before firework reactivity becomes established or escalates (Marshall, 2016). Seasonal waiting room displays and handouts can offer general guidance and prompt owners to seek further advice from their RVN (Aitken, 2014). Seasonality aside, behaviour should be discussed at every visit, alongside physical exams. VSS can then refer clients to RVN's with the relevant skills to advise on short-term interventions and behaviour modification as appropriate. Following up with clients at subsequent visits will maintain motivation and increase compliance and are key to the success of any treatment (Casey & Bradshaw, 2008).

Conclusion

Firework reactivity is prevalent amongst pet-dogs, presenting serious welfare concerns. Combining relaxation training, DS/CC, environmental modification and anxiolytics, may be the optimal treatment, however owner compliance is key.

Disclosure statement

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