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REVIEW

Lead pulling as a welfare concern in pet dogs: What can veterinary professionals learn from current research?

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Abstract

Veterinary professionals (VPs) are often the first source of advice for clients struggling with their dog's behaviour, and pulling on the lead is a commonplace undesirable behaviour VPs will encounter regularly in practice. Excluding bites, being pulled over while walking on a lead is the leading cause of non-fatal dog-related injuries in the UK. This narrative review investigates lead pulling as a welfare concern in pet dogs, highlighting aspects of the literature of particular interest to VPs.

Lead pulling could negatively affect walk quality, frequency and duration, causing weight gain, while decreased environmental enrichment could trigger other undesirable behaviours. Aversive equipment to prevent lead pulling can cause pain, distress and injury, but even equipment considered humane can have welfare consequences. Punitive training methods could cause dogs stress, fear and anxiety and trigger aggressive behaviour. While these lead pulling outcomes are welfare concerns in themselves, they could also weaken dog-owner attachment, a risk factor in pet dog relinquishment.

Given lead pulling could affect the welfare of patients in a VPs care, clinical implications and opportunities for client education are outlined. Educating clients on humane prevention and modification of lead pulling could make walks easier, safer and more enjoyable, with positive outcomes for clients, canine welfare and the practice.

INTRODUCTION

Physical and behavioural health are intrinsic to pet dog welfare, and behaviour changes may be veterinary professionals' (VPs) first indication of underlying disease processes and broader welfare concerns.¹ Left untreated, undesirable behaviours can compromise health; for example, recall problems causing accidents,² stress contributing to dermatitis,³ lead pulling causing injuries,⁴ separation anxiety leading to escape-related injuries⁵ and wounds from inter-dog aggression.⁶ Undesirable behaviours damage pet-owner attachment and are the leading cause of relinquishment and euthanasia in pet dogs under 3 years old.⁷ VPs are often the first source of advice for clients struggling with their dog's behaviour and early interventions can prevent escalations.⁸ Effective recommendations can increase compliance, not just with behavioural therapies but also medical treatments.⁹ Thus, it is in VP's interests to routinely

discuss behaviour, as part of a holistic, preventative healthcare approach.

VPs can augment this approach to patient care by discussing with clients the importance of regular, appropriate walking.¹⁰ Walking is essential to pet dog welfare, providing outlets for exercise,¹⁰ social interactions,¹¹ species-specific behaviours,¹² appropriate challenges and pleasurable activities.¹³ While research suggests owners recognise these benefits,^{13,14} 15% of UK owners do not walk their dogs daily.¹⁵ Multiple barriers and motivators may contribute, including social and environmental constituents, but the most influential factors are dogs themselves.

Breed, size, age,¹⁶ health and walking capacity¹⁷ are important walking incentives and disincentives for owners, but the strength of attachment owners feel towards their dogs is key.^{13,14,18–20} Owners report wanting to meet their dog's exercise needs and that provision and participation in an activity their dog enjoys provides motivation.^{13,14} However, owners of

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older, overweight or arthritic dogs may still be strongly attached but find daily walks challenging,¹⁷ and undesirable behaviour may affect the quality, frequency and duration of walks owners can provide. Research has focused on positive outcomes of dog walking for humans^{13,14,16,20}; negative outcomes of dog walking are less clear.

Inappropriate socialisation is one such outcome, now recognised as a pre-eminent welfare concern.²¹ During the first wave of the Covid-19 pandemic in 2020, UK and Spanish owners reportedly walked their dogs on a lead more than they had previously.^{22,23} Some owners expressed concerns on-lead walks provided insufficient exercise, mental stimulation and social outlets for their dogs.²⁴ However, others frequently report off-lead dog behaviour on walks as problematic.^{20,21,25} Studies have found dogs—particularly juveniles aged under 16 months²⁵—are more likely to approach conspecifics when off-lead.¹¹ While off-lead interactions increased play opportunities, they more than doubled the risk of aggressive responding among dogs.²⁵ Indeed, 13% of UK dog owners, primary concern when walking is fear of their dog being attacked by another dog.¹⁵ Despite acknowledging lead use curtails unwanted behaviours, many dog owners still consider off-lead walking integral to welfare,^{20,26} even when their dog presents a risk to dogs, people and wildlife.²⁷

Owners of off-lead dogs are less likely to pick up after them,¹¹ increasing risks of intraspecific and zoonotic infection.^{28,29} Off-lead dogs killed approximately 15,000 sheep in the UK in 2016,³⁰ costing farmers over a million pounds, despite 64% erecting signage, and dog owners being liable to prosecution.^{30,31} In March 2021, an off-lead dog fatally injured a Thames harbour seal in London, UK.³² Road traffic accidents cause 12% of deaths in dogs under 3 years old.⁷ Lead use is a simple, affordable, immediate intervention that can reduce conspecific aggression,²⁵ zoonoses, intraspecies infections,²⁹ death by injury⁷ and predation.^{26,28} Internationally, dog control laws introduced to address these concerns^{33–37} mean it is imperative owners are willing and able to walk their dogs on a lead safely and humanely.

Excluding bites, being pulled over by a dog on-lead while walking is the foremost cause of non-fatal dog-related injuries to patients attending Accident & Emergency departments in the UK.³⁸ Over 12 months, Cornwall NHS Trust reported 30 incidences of injuries from lead use, prompting the British Society for Surgery of the Hand to warn pet owners about the dangers.³⁹ Two large-scale US studies identified lead pulling as a significant public health risk, particularly for the elderly.^{40,41} Israeli military dog handlers had significantly higher risks of injury than controls, where other occupational hazards were controlled for.⁴² Lead pulling has sparked litigation, awarding substantial damages against the liable dog owner.⁴³ While these findings suggest lead pulling is a prolific public health concern, surprisingly little is known about its impact on pet dog welfare.

This narrative review explores potential risks to welfare associated with lead pulling, highlighting gaps in the current knowledge on this commonplace behaviour and recommending future research avenues. Given VPs role in promoting welfare-centred husbandry, training and equipment for dogs in their care and the wider population, and that lead pulling is a prolific training problem VPs are likely to encounter in practice, welfare-centred recommendations for client education are discussed.

DISCUSSION

Lead pulling and welfare

The 2020 UK PDSA Animal Wellbeing (PAW) report found lead pulling to be the dog behaviour pet owners most wanted to change (24%)¹⁵; perhaps because lead pulling directly affects owner wellbeing daily, more than fireworks fear (22%) for example.¹⁵ However, owners may be unaware that lead pulling has serious implications for their dog's welfare. Lead pulling itself, and equipment and training used to address it, may have direct and indirect consequences for welfare, including pain, fear, injury, disease, reduced outlets for canine behavioural expression and diminished pet-owner attachment. Understanding the potential risks of lead pulling to an individual patient's welfare can inform the VPs' approach to client education.

Reduced exercise

Of owners who walked their dogs for less than 30 minutes daily, 10% cited their dog's behaviour on walks as the reason¹⁵; lead pulling could be one such behaviour. Walking and 'excitable' behaviours were negatively correlated in Australian pet dogs,⁴⁴ and 'obedient' Argentine dogos received longer walks than those deemed less obedient.⁴⁵ While homogenous sampling limits generalisability of these findings, it seems probable lead pulling might impact the quality, duration and frequency of walks dogs receive. If dogs that pull are walked less, or not at all, they could be more prone to resultant weight gain. Overweight and obese dogs exercise less⁴⁶ and live shorter,⁴⁷ poorer quality lives,⁴⁸ with increased risk of comorbid pathologies.⁴⁹

Multiple studies detect a relationship between reduced walking and weight gain in dogs,^{10,46,50–53} although conflicting methodologies, age, neutering, diet, owner behaviour, breed and genetics confound the results. In one large UK study ($n = 11,154$), a relationship between overweight, exercise and undesirable behaviours was identified.⁵⁴ Overweight dogs were walked less⁴⁶ and more likely to flee, be fearful, aggressive, or pull on lead.⁵⁴ However, the direction of the relationship remains unclear; undesirable behaviours such as lead pulling may prevent owners from walking their dogs, resulting in weight gain, or

weight gain may prevent owners walking their dogs, resulting in undesirable behaviours.

Studies on the effects of exercise on undesirable behaviours suggest it is not exercise per se but its quality that affects behaviour. Gentle, outdoor, accompanied exercise lowered stress and improved behaviour in shelter dogs,⁵⁵ while kennel pacing increased in shelter dogs after running on-lead.⁵⁶ Olfactory stimulation induced calmer states in shelter dogs,^{57,58} while high-intensity exercise increased cortisol in sled dogs.⁵⁹ It seems plausible high-intensity activity such as lead pulling could elevate heart rate, blood pressure and corticosteroids in dogs,⁵⁹ resulting in heightened arousal; manifesting behaviourally as alertness, restlessness and hypervigilance.⁶⁰

Dogs are a social and olfactory species⁶¹ and sniffing is positively correlated with optimism⁶² and calm behavioural states.⁶⁰ Regular walking may be a pet dog's only opportunity to engage in vital canine behaviours such as sniffing, social interactions and scent marking.^{12,62} Lead pulling could reduce access to these, triggering other undesirable behaviours^{61,63}—digging, destruction, excessive vocalisation and escape attempts. Furthermore, if lead pulling causes, or is a sequela of, acute or chronic stress and accompanying hyperarousal, dogs that pull might be less likely to engage in species-specific behaviours when walking. Lead tension could also limit a dog's behavioural responses to stimuli, increasing barrier frustration; a phenomenon associated with redirected aggression.⁶⁴ Lead pulling could then be symptomatic of, or a precursor to, a broader suite of stress or frustration-related behaviours on walks—excessive vocalisation, hyperarousal, dog and human-directed aggression. Thus, VPs should take reports of lead pulling seriously, as they may indicate deeper welfare concerns for patients.

Training methods

Training loose lead walking may require more time and skill than owners anticipate⁶⁵ and the desire for 'quick fixes' could prompt owners to choose punitive training⁶⁶ which appears effective at face value.

Evidence on the efficacy of punishment (lead corrections/electronic stimuli/verbal corrections) and reward-based (food/toys/praise) training methods is contradictory. Training methods utilising positive reinforcement—whereby a rewarding stimulus follows a desirable behaviour—were as effective as punishment in some studies;^{67–69} however, Schalke et al.⁷⁰ found opposing effects, aversives were more effective for learning. From a welfare standpoint, efficacy is not the sole consideration when evaluating training methods. While punitive training can suppress behaviour, it may cause injury,⁷¹ aggression,⁷² fearfulness,⁷³ anxiety and stress⁷⁴ in dogs; negative outcomes which may be heightened when punishment is poorly applied.⁶⁷ Furthermore, owners who utilise punitive training are reportedly less satisfied with their dog's ability to walk on lead than those who

use positive reinforcement.^{68,75} However, owners who use punitive methods may be more inclined to do so in the first place, precisely because their dog is difficult to walk.

The dog training and behaviour industry is unregulated and, while numerous self-regulatory organisations exist, standards and methods vary widely between them and membership and adherence to ethical codes are voluntary. Furthermore, ongoing debate exists between professionals regarding punishment versus reward-based training methods. Misconceptions of dominance and pack theory persist among VPs⁶⁶ and paraprofessionals⁷⁶ alike. This inconsistent messaging likely confuses owners who may implement ineffective or dangerous advice⁷² from hobbyists, websites, television or social media.¹⁵ Thus, VPs have a crucial role to play in promoting evidence-based, humane training methods for lead pulling, in accordance with the British Small Animal Veterinary Association⁷⁷ and the American Veterinary Society of Animal Behaviour⁷⁸ position statements on punishment in dog training.

Equipment

Lead pulling has spawned a plethora of equipment designed to prevent and modify it. While some are at worst ineffective, others could cause conditioned negative associations,⁷⁹ stress,⁸⁰ ophthalmic⁴ and orthopaedic damage⁸¹ and even death.⁷¹

E-collars utilise negative reinforcement to train lead walking; an electronic stimulus applied when the dog walks out of position, is removed when they return to position by the handler's leg.⁸² The risk here is the dog associating the aversive stimulus with people, animals or things in their environment rather than lead pulling, resulting in fear-based aggression.⁷⁹ That risk is exacerbated by pet owners poor timing, misunderstanding of conditioning, and potential applying the electronic stimulus at levels exceeding requirements.⁶⁷ While some trainers advocate for e-collars as effective, positive reinforcement has been shown to be as successful when training.⁶⁷ However, there is no current evidence on the specific efficacy of e-collars for lead pulling. Research on the welfare implications of e-collars has prompted varying restrictions on them; from none in some countries to bans on their use and/or sale in others.⁸³ The European Society of Veterinary Clinical Ethology⁸⁴ and the BVA⁸⁵ recommend against using e-collars in dog training.

Less is known about the physical and behavioural outcomes of prong (pinch) and choke collars when used to train loose lead walking. These also use negative reinforcement; pressure is exerted on the dog's neck when they pull and released when they walk on a loose lead. Prong collars were found to elicit more pronounced behavioural indicators of stress than e-collars or a verbal cue.⁷⁰ Owners using choke and prong collars reported lower satisfaction levels with their dog's lead-walking behaviour than owners who did not use those collars,⁷⁵ although less satisfied

owners may be more inclined to use them in the first instance. One death by strangulation resulting from excessive force on a choke chain has been reported, but the dog was suspended from, rather than pulling on the chain; albeit only for 60 seconds.⁷¹ While research on the welfare outcomes of lead pulling on a choke or prong collar are lacking, studies highlighting the risks of pulling on a flat collar suggest a smaller contact area—such as a chain or metal prongs—could concentrate pressure and force in that area, increasing the potential for nerve and skin damage.⁸⁶

Anecdotally, owners report their dogs cough and hack while pulling on a collar and lead, and research supports the hypothesis that lead pulling could cause neck injuries. In Hunter et al.,⁸⁶ three different flat collars exerted sufficient pressure to cause ischaemic necrosis in dogs. However, the small sample ($n = 8$) consisted of dogs of varying coat and conformation, which could have influenced the results. Surprisingly, padded collars exerted the highest pressure; perhaps, the authors suggest, because the convex design concentrates pressure and force around the neck.

Carter et al.⁸⁷ used a simulated neck model to measure collar pressure on a dog's neck under consistent (lead pulling) and acute (lead jerking) force.⁷³ While a plastic model cannot replicate responses of neck tissue to pressure, or account for intraspecies variability, every collar tested created pressure exceeding that which causes tissue damage in humans. Pauli et al.⁴ found dogs experienced significantly higher intraocular pressure (IOP) when force was applied to a collar than a harness and suggested these effects could be heightened when actively lead pulling, due to the Valsalva manoeuvre. Persistently elevated IOP increases the likelihood of visual field loss in humans,⁴ suggesting dogs that pull on lead might be at similar risk.

Pulling on a collar and lead has been shown to increase the risk of permanent tracheal, laryngeal, oesophageal and ophthalmic damage in all dogs^{4,88} but could be particularly problematic in brachycephalic breeds where airway compromise⁸⁹ and ophthalmic problems⁹⁰ are endemic. With the current popularity of brachycephalic breeds,⁹¹ VPs have a responsibility to educate clients on the heightened risk of lead pulling and the safest equipment choices available for them. Harnesses are now widely recommended for brachycephalic dogs⁹² and limited evidence suggests they are a superior choice when eye and respiratory health are particular concerns.

Broadly speaking, there are two styles of harness—those with a chest strap forming a Y-shape above the dog's shoulders (Figure 1) and those with a chest strap sitting across the dog's chest (Figure 2). Both styles may clip either between the shoulders, or on the sternum, with some attaching at both points. Lafuente et al.⁸¹ explored the hypothesis that harnesses with a strap sitting across the dog's chest (described as 'restrictive' by the authors); might impair shoulder and thoracic limb extension more than harnesses that form a Y-shape above the dog's shoulder. Their findings did not support this hypothesis; both styles of harnesses decreased shoulder extension in dogs walking



FIGURE 1 A non-restrictive Y-shaped harness, which clips at the back. Some styles feature an additional clip at the sternum



FIGURE 2 A restrictive harness which crosses the dog's shoulder joint and clips at the sternum. Some styles also clip at the back

on a treadmill. It could be hypothesised pulling on a harness while moving at different speeds, across different substrates outdoors, produces greater effects than those in the study. Furthermore, the cohort was small and varied ($n = 9$), so conformation, function, gait or coat could have confounded results. The harnesses were altered with additional weights possibly compromising their functional integrity. While acknowledging this flawed methodology, the authors suggest prolonged use of what they describe as restrictive harnesses could potentially cause tendinopathies.⁸¹ Grainger et al.⁸⁸ found no differences between flat collar and harness use on either behavioural indicators of canine stress (lip licking, panting, pawing, lowered body position, etc.) or behavioural measures of restricted movement (i.e. sniffing, tracking and stopping). However, the study sample was small ($n = 30$) and the harness manufacturer funded the research. More recently, Shih et al.⁹³ found dogs pulled significantly harder in back connection harnesses than

neck-collars in trials with food but not with toys. This suggests that for larger, stronger dogs that pull or those with comorbid behaviours requiring modification, headcollars might be more effective than harnesses.

Headcollars comprise a strap around the dog's muzzle below their eyes that interconnects with a neck strap to secure the fit. A lead is attached either beneath the dog's chin or at the back of their head. Anecdotally, owners report poor tolerance of headcollars by dogs, if applied without prior desensitisation, resulting in nose pawing, rubbing face and muzzle against surfaces, refusing to walk or thrashing on lead. These behavioural responses are in themselves a welfare concern being acute stress indicators⁹⁴ and potentially causing injury to the owner, dog or both. They may also cause owners distress, reducing compliance with headcollar use and subsequently exercise or behaviour modification protocols.⁹⁵ Haug et al.⁹⁵ found dogs habituated to headcollars with just intermittent use over 6 weeks, suggesting adverse behavioural responses to headcollars may be partly due to novelty; however, the sample did not include dogs that pulled on the lead.

Ogburn et al.⁹⁶ observed that naïve dogs pawed their noses and fought the lead more frequently in head than neck collars. However, physiological stress indicators did not vary between dogs walked on either, perhaps because physical and behavioural indicators of stress are not always associated, as cortisol fluctuations are multifactorial.¹

Dogs were reportedly easier to control and more 'subordinate' in headcollars, but the authors' interpretations of dog's behavioural motivations were based on now debunked dominance theory, which could have prompted misinterpretations of behavioural suppression as compliance.

Inappropriate equipment can be detrimental to pet dog welfare. Clients may find choosing the right equipment overwhelming and ask VPs for recommendations. Given the limited evidence surrounding the behavioural and physical impacts of equipment for dogs that pull, critical evaluation of the potential risks and benefits of each, is key to make welfare-centred recommendations.

Strength of owner attachment

An indirect impact of lead pulling on welfare is a potential weakening of pet-owner attachment. Several of the aforementioned outcomes—comorbid undesirable behaviours, aversive equipment⁷⁵ and punitive training⁹⁷—have inverse relationships with pet-owner attachment, although these are correlational rather than causal. Importantly, owners who walk their dogs consistently report higher attachment than owners who do not.^{19,20,98} Whether dog walking increases attachment, attachment increases dog walking, or a bidirectional relationship exists remains unclear. Regardless, weakened attachment is a risk for relinquishment and euthanasia, with undesirable behaviours being an aggravating or perhaps initiating

factor.⁷⁵ It is imperative VPs proactively advise on lead pulling prevention and modification, to preserve the human animal bond, a key component of owner retention.

AVENUES FOR FUTURE RESEARCH

Approximately 90% of dogs exhibit undesirable behaviours⁵⁴ and as many as 82% pull on lead,⁹⁹ but the relationship between lead pulling and pet dog welfare has yet to be studied. Research is needed to quantify lead pulling in pet dog populations and its effect on walk frequency and duration. The impact of lead pulling on species typical behaviours on walks warrants observational analysis, as engagement in these may indicate positive welfare while walking and in broader terms.

Surprisingly little is known about equipment owners use to walk dogs and why, and the physical and behavioural outcomes of those for dogs that pull. A leash tension meter (see Shih et al.¹⁰⁰), which measures lead pulling and whether the handler, dog or both are exerting pressure, could provide an objective means of measuring equipment and training efficacy.

Identifying possible risk and protective factors—whether breeds selectively bred for carting and sledging pull more frequently, whether life stages or sourcing are aggravating factors and whether puppy class attendance is preventative—could inform best practice approaches for VPs. If a relationship exists between lead pulling and aggression on walks, identifying it is vital, given aggression is a primary cause of relinquishment in pet dogs.¹⁰¹

CLINICAL IMPLICATIONS

Puppy consultations present excellent opportunities to discuss lead pulling, associated welfare risks and proactive prevention. These should be discussed—regardless of breed—but with specific consideration for brachycephalics.⁹² Recommendations could form a dog-walking 'toolkit'¹⁰² alongside information on equipment, training, exercise, weight management and legal obligations. While 79% of owners of 9-month-old dogs reported lead-pulling behaviour, only 5% of them considered it problematic,¹⁰³ indicating some owners underestimate the challenges and welfare implications lead pulling may present as their dog matures. By adulthood, lead pulling may already be chronic, with a well-established reinforcement history—thus early interventions are critical.

Owners may choose aversive equipment out of safety concerns while walking, being unaware of associated welfare risks.⁷² As certain equipment may be more effective and appropriate for some dogs than others, a risk assessment, considering the individual dogs behavioural and physical needs and the owner's abilities,¹⁰² is essential before making recommendations (Figure 3). Selling equipment in

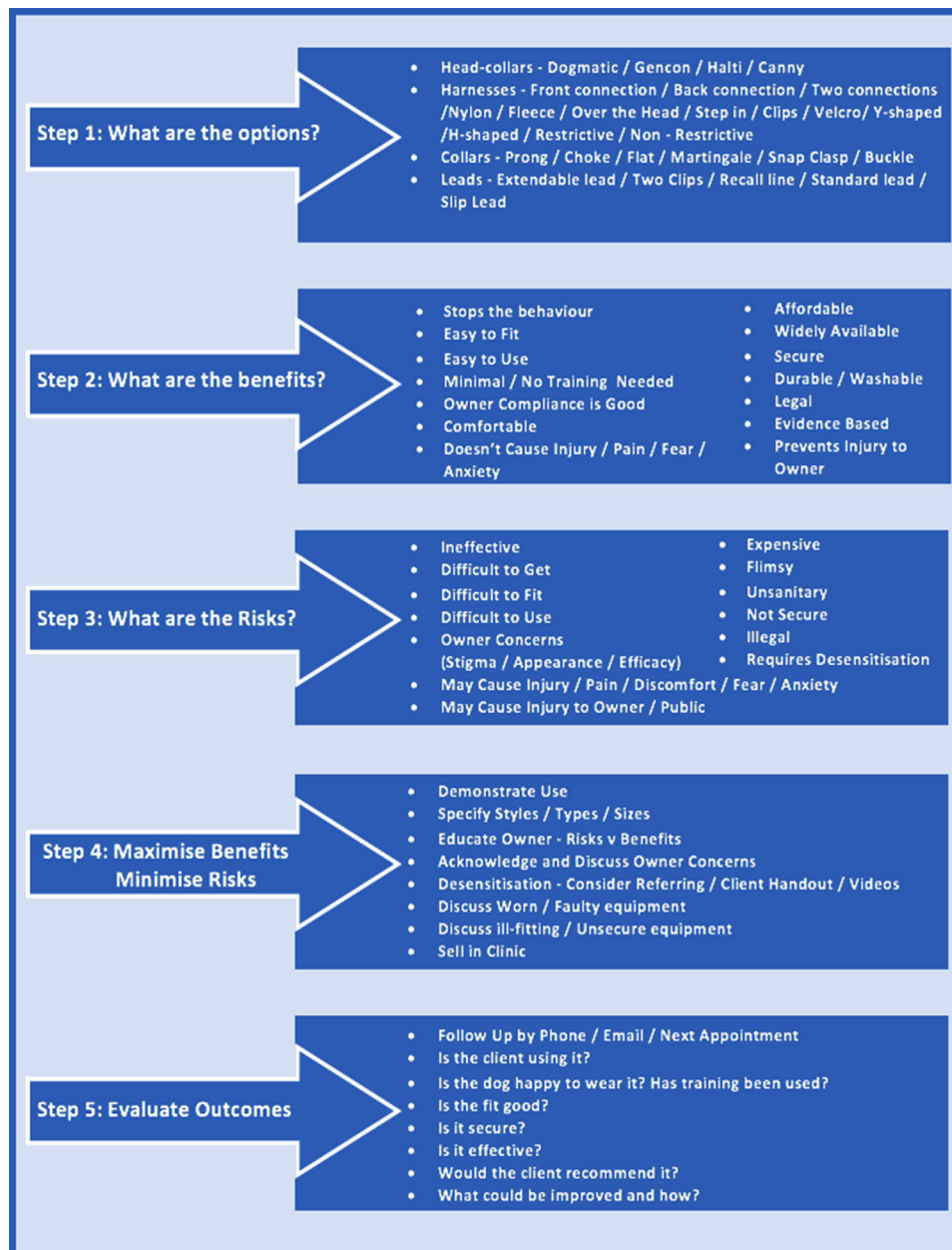


FIGURE 3 A simple risk assessment tool for discussing dog-walking equipment with clients

practice creates opportunities for client education while generating revenue and footfall.¹⁰⁴

Teaching owners to fit and use equipment reduces stress, frustration and injury risk, increasing compliance and satisfaction and enhancing welfare.⁹⁵ For example, using a double-ended lead, attached to both the headcollar and the neck collar or harness can increase safety and control, while reducing force on the head and neck. A dog may not tolerate equipment simply because it is humane, and stress signalling should be observed during fittings, ensuring the dog is not just enduring the item but is comfortable wearing it. Desensitisation and counter conditioning protocols can increase acceptance; associating equipment with rewards, in gradual approximations at a tolerable level for the individual dog.¹⁰⁵ Desensitisation protocols can be lengthy, so managing client expectations is vital, but owners are more likely to use equipment

their dog finds comfortable.⁹⁵ If a dog must wear something every day, the goal from a welfare perspective should be willing compliance resulting in enriched walking experiences for both species, rather than simply suppression of lead pulling. Guides to desensitisation are available from Denenberg¹⁰⁶ and Dogs Trust UK.¹⁰⁷ Figures 4 and 5 illustrate simple techniques to utilise when fitting equipment.

Equipment is an important consideration in safe handling practice where slip leads are used to move dogs quickly. Dogs that are stressed in clinic¹⁰⁵ may pull on a slip lead, exerting concentrated pressure around the neck. VPs should consider alternatives, or use the client's equipment, particularly for dogs with compromised airways.

Least aversive/minimally invasive, reward-based training methods should be utilised for lead pulling, as these support good welfare.⁶⁸ This is critical as pet



FIGURE 4 Stuffed food toys can be used to enhance acceptance of headcollars and harnesses when fitting



FIGURE 5 Scattering food can briefly station a dog while fitting or putting on a harness

owners' poor skills and timing⁷⁹ may aggravate negative outcomes of punitive techniques. Where in-house training expertise is lacking, VPs can refer clients to behaviourists and trainers accredited with the Animal Behaviour and Training Council.¹⁰⁸

Handouts, books and posters in the waiting room¹⁰⁴ are an efficient means of providing advice to a captive audience of owners. Dogs Trust¹⁰⁹ and PDSA¹¹⁰ have free resources on lead training using positive reinforcement. If severe lead pulling prohibits walking, other outlets—private hire fields, playing tug, enrichment and scent work—should be recommended to fill the behavioural void short-term reduced exercise likely brings, while training is undertaken. The book 'No Walks, No Worries'¹¹¹ is an excellent resource to stock in practice for reference or sale.

Annual vaccinations, puppy parties and weight loss clinics are good opportunities to discuss behaviour and training concerns. A genuine, non-judgemental interest in their dog's welfare builds client trust and adherence with guidance.¹¹² Working collaboratively with owners to resolve lead pulling could improve general compliance, generating return business and referrals for the practice.

SUMMARY

The evidence presented here suggests a relationship exists between pulling on the lead and pet dog welfare, the nature and scope of which warrants empirical study. VPs should be cognisant of potential risks lead pulling poses to the individual dog and educate clients on humane means of mitigating them. Fostering enjoyable, symbiotic walking experiences can increase enrichment and exercise, reducing stress and aversion for pet dogs, while improving owner attachment, collectively contributing to higher welfare.

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AUTHOR CONTRIBUTIONS


All three authors made substantial contributions to conception, drafting and revision of this manuscript and have given final approval for this version to be published.


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