

Effectiveness and Comparison of Citronella and Scentless Spray Bark Collars for the Control of Barking in a Veterinary Hospital Setting

This study was designed to evaluate the efficacy of a citronella bark collar and a new, scentless spray bark collar in a veterinary hospital or a similar kennel-type environment. Forty-one dogs were included in the study. The efficacy of each collar was evaluated independently in comparison to control as well as in a crossover design. Thirty of the dogs were evaluated with the citronella collar, with 76.7% showing a reduction in barking. Twenty-nine dogs were evaluated with the scentless collar, with 58.6% showing a reduction in barking. The improvement over the control collars was statistically significant with both the citronella and scentless collars.

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Introduction

Excessive barking is one of the most common complaints of dog owners. It has been reported that as many as 35% of dog owners have problems with barking,¹ and barking problems represent 5% or more of cases seen at behavioral referral practices.²

Barking is a form of communication in the domestic dog that may arise in a number of contexts. Dogs may bark when greeting, in defense or play, as a lone call, to solicit attention, or as a warning.³ Dogs may also bark in situations of conflict or anxiety, in response to pain, or as a group-facilitated behavior in response to the vocalization of other dogs.⁴ Dogs in a kennel or veterinary facility might bark as a threat, as an attention-seeking behavior, as a territorial or protective display, in response to other dogs barking, or as a result of stress or anxiety.⁵

In a number of studies, the citronella spray collar has shown to be effective for a variety of barking problems. The product is sold under the name of Aboistop in Canada and Gentle Spray (formerly ABS) in the United States. The spray contains 0.5% citronella essence in an ozone-friendly propellant that is also used in human asthma inhalers. A microphone within the collar detects the bark, which triggers the electronic valve to release a spray of citronella under the dog's muzzle from a reservoir on the collar. The spray disrupts or deters barking by stimulating one or more of four senses: hearing, smell, sight, and touch (pressurized spray and cooling through vaporization of the propellant).⁶

The effectiveness of the citronella collar has been previously assessed in a number of in-home trials.⁷⁻¹⁰ In the first of these studies, owners compared the efficacy of an electronic shock collar to the citronella bark collar.⁷ Of the owners involved, 88.9% expressed satisfaction with the results of the citronella collar compared to 44.4% satisfaction with the shock collar, but there were only nine dogs enrolled in the study; overall, the citronella collar was effective in reducing the incidence of barking in 77.8% of the cases.⁷ In another study of 30 dogs, the citronella collar led to a significantly lower frequency of barking over the 3-week trial,

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especially toward television and traffic-directed barking; however, barking increased over the period of time the collar was being worn, albeit at frequencies lower than prior to the trial, indicating some degree of habituation to the effects of the collar.⁸ A third investigation in dogs exhibiting territorial barking at passersby evaluated the use of the citronella collar followed by an owner-initiated play session in comparison to a spray of water from a garden hose as a punishment.⁹ Both techniques were successful at reducing barking frequency, but the use of a disruptive stimulus (i.e., the citronella spray collar) followed by play was more effective at preventing recurrence than punishment alone (with the garden hose), and the relapse rate at 90 days was 86% in the punishment group and only 3.8% in the “disruptive group.”⁹ In another study, nine of 10 dogs improved within the first few trials with the citronella collar, but on follow-up only five dogs maintained this improvement.¹⁰

Barking in a veterinary hospital provides a unique application in which the citronella collar may be utilized. Often, as might be the case for day boarding or pets that are admitted for routine preventive surgery, only short-term control of the barking is required. This means that habituation to the effects of the spray over time is not likely to be an issue. In addition, a barking dog may stimulate other dogs to begin barking in the kennel, which can lead to a dramatic increase in noise levels for staff, clients, and other pets that might be ill, fearful, or anxious. Neighborhood noise bylaws may also be an issue, depending on the location and construction of the facility.¹¹ Barking dogs can easily exceed safety standards as outlined by the Occupational Safety and Health Administration (OSHA). One investigator reported decibel (dB) levels consistently above 100 in a kennel environment.^a Occupational Safety and Health Administration standards require a hearing conservation program when workers are exposed to noise levels that may have a ≥ 8 -hour time-weighted average of 85 dB.¹² Noise levels from an individual barking dog are reported to reach 130 dB^a [Figure 1].

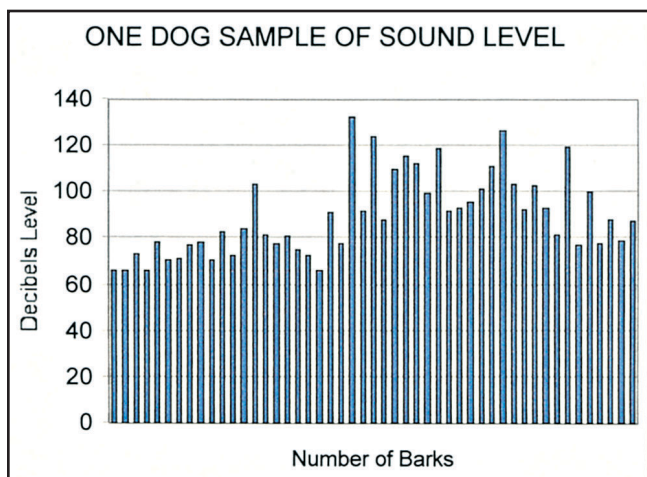


Figure 1—Bark sound level over 1 minute of barking from a single dog, as measured by the Extech sound meter. Note that decibel levels reach as high as 130 dB.^a

Two investigations have looked at the effectiveness of citronella collars on dogs that were barking in a veterinary hospital and a kennel environment.^{13,a} The first was a study using healthy dogs that were presented to a veterinary hospital for either elective surgeries or boarding purposes.¹³ If the dog barked sufficiently to disrupt the staff or other patients, a citronella bark collar was placed on the dog and the pet was evaluated as to whether the bark frequency had lessened. Between the two veterinary hospitals (one in the Toronto area and one in San Diego), 62 dogs were evaluated. Barking ceased in 40 dogs while they were wearing the collars, and barking was reduced in 17 dogs.¹³ This particular study did not utilize a control group, and the protocol was not standardized as to acclimation time or bark assessment. In addition, a scentless collar was not available for testing. The citronella collar was also evaluated in a research colony of 31 beagles at Saint Hyacinthe Veterinary College in Quebec, in order to determine whether it was effective in significantly decreasing the noise levels in this setting.^a Six measurements using a sound level meter^b were made at 2-hour intervals throughout the workday, and on the following day, bark-activated citronella collars were applied to each dog. The use of citronella collars significantly decreased barking from an average of 106.1 dB to an average of 70.45 dB^a [Figure 2]. Again, no scentless collar was available, and the investigator evaluated noise levels in the entire environment rather than the effect of the collars on individual dogs. Therefore, the present study was undertaken with individual barking dogs using citronella and scentless spray collars in comparison to a control collar. The scentless product uses the same spray mechanism as the citronella collar. The spray consists of HFC134A tetrafluoroethane, a pharmaceutical-grade, ozone-friendly propellant that is used in human asthma inhalers.

Materials and Methods

Criteria for Case Selection

Dogs weighing >6 kg that were admitted to one of the two veterinary hospitals (i.e., a large general practice and referral hospital in Mesa, Arizona, and a smaller referral and general practice in Thornhill, Ontario) for boarding or preventive elective surgeries (e.g., neutering) were considered eligible for enrollment; dogs that were hospitalized due to illness or dogs that might be aggressive were excluded from study enrollment. Dogs that had been in the hospital for at least 30 minutes and had barked at least five times (or five episodes) per minute for the previous 5 minutes (as per grading scheme in Table 1) were enrolled in the study independent of the number of dogs in the kennel environment. Subjects were accumulated from January 2001 to July 2001 when the primary investigators were available.

Study Protocol

Each study site was supervised by one of the two principal investigators (Moffat, Landsberg), although data was collected by a veterinary technician employed at the respective clinic. Dogs selected for the trial were first objectively

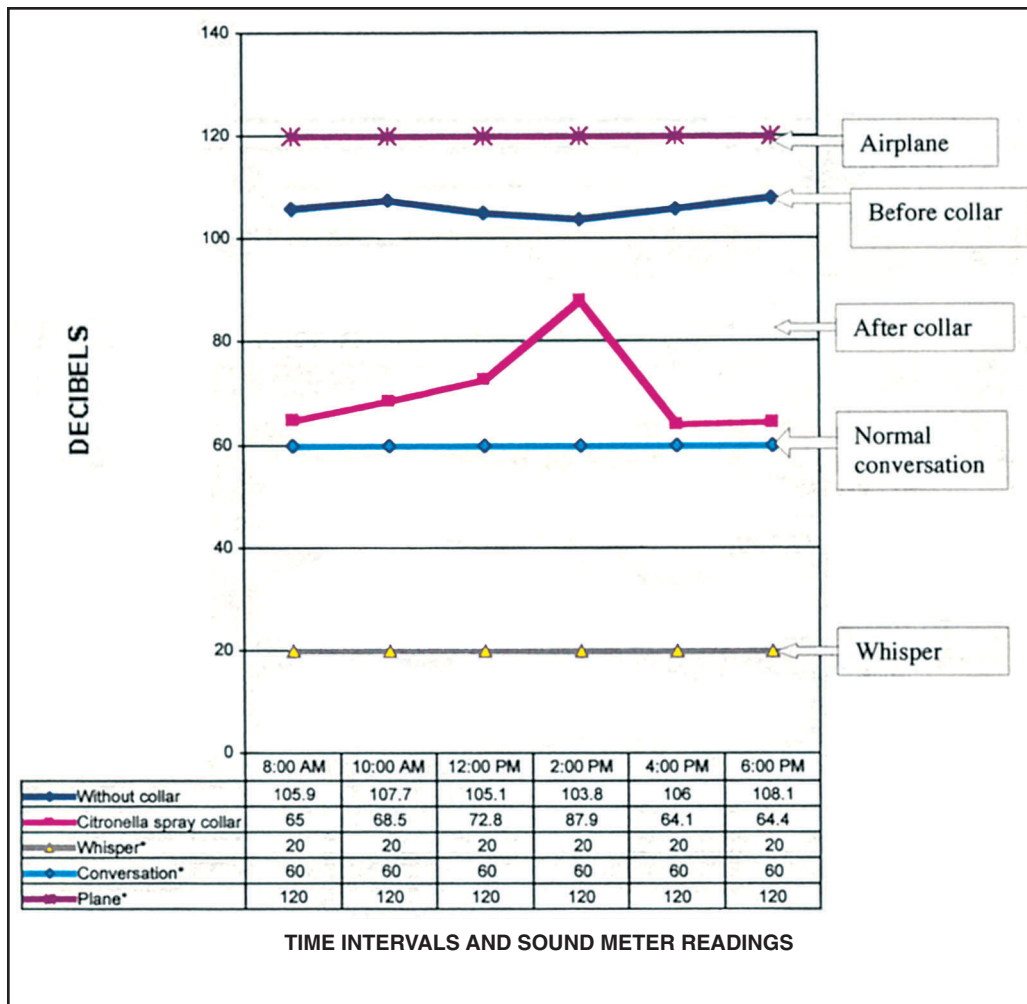


Figure 2—Barking levels monitored at 2-hour intervals over two consecutive days. On day 2, each dog wore a citronella spray collar.^c

* Occupational Safety and Health Administration 1995. Human Resources Development Canada Labour Program, Canada Communication Group, Publishing Ottawa, Ontario, http://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html

assessed for their baseline barking level [Table 1] and were rated subjectively for anxiety based on a rating of none, mild, or severe. Anxiety was identified in patients exhibiting pacing, whining, panting, increased vigilance, and increased activity in the kennel. If the dogs met all of the inclusion criteria as stated in the selection of cases above, they were fitted with a control collar (i.e., an antibark collar with batteries removed) and observed for the following 5 minutes. Each dog was then evaluated subjectively as to whether the anxiety was the same, increased, or decreased.

Each dog also was rated objectively [Table 2] as to whether the barking was reduced or entirely controlled by the collar in comparison to the baseline score [Table 1].

If barking subsided or was reduced with the control collar, the dog was removed from the trial. If the dog continued to bark at the same level while wearing the control collar, the collar was removed, and if the barking remained at the same level over the next 5 minutes, either a citronella or scentless collar was applied.^c The type of collar placement could not be blinded because of the scented and unscented nature of the product. The order of collar placement (whether citronella or scentless was utilized first) was selected by the investigator so that approximately equal numbers of each collar were utilized. The dog's response was then assessed using the same objective and subjective scoring as discussed above for the next 5 minutes, and the collar was removed. If the barking returned to the previous score [Table 1] over the subsequent 5 minutes, a crossover study (i.e., application of the other collar) was then performed, and the dog was again assessed for 5 minutes using the same rating system. The dogs were also evaluated objectively and subjectively each time a collar was removed to determine if any reduction in barking was maintained.

Table 1
Grading of Barking Episodes Per Minute

Grade	Barks Per Minute
A	>20
B	10-20
C	5-10

Table 2
Evaluation and Grading of Barking Frequency

Grade	Description of Barking Behavior and Frequency
1	Controlled: Barking ceased, although an occasional single bark was heard that was disrupted by the collar
2	Improved: Barking was reduced by >50%
3	No improvement: Barking that was not improved or reduced by <50%
4	Worse: Barking became worse (increased intensity/volume or frequency of the barks)

Statistical Methods

In order to evaluate the individual groups as to whether the citronella and scentless collars were effective in the particular orders in which they were used and if the order of collar placement had any effect, a nonparametric repeated measures analysis of variance (ANOVA) (Friedman test) and Dunn's multiple comparisons test were utilized. The Mann-Whitney test was applied to the subjective anxiety ratings in order to statistically compare the anxiety scores prior to the trial with that of the control, citronella, and scentless collars.

Results

Forty-one dogs were enrolled in the study. Sixteen dogs at the Mesa facility and 25 dogs at the Toronto location were evaluated. Twenty breeds were represented along with mixed-breed dogs. Labrador retrievers accounted for four cases, which were more than any other breed. This likely reflected the popularity of the breed at both clinics. All results were pooled as similar results were obtained at each site. Three dogs were removed because the control collar was effective in reducing their barking. Eighteen dogs had the citronella collar placed first, and 20 dogs had the scentless collar applied first. The use of either the citronella collar or the scentless collar resulted in statistically significant reduction in barking over the use of a control collar ($P>0.01$). The reduction was significant regardless of which collar was applied first. Combining all citronella collars ($n=30$) and comparing to control and combining all scentless collars ($n=29$) and comparing to control, there was a highly significant reduction in barking for each collar ($P>0.001$). The citronella collar trended toward greater improvement in reducing barking compared to the scentless collar, but these results were not statistically significant ($P>0.05$) [Figure 3].

After the initial application and assessment of the citronella or scentless collar, the collar was removed. Nine dogs that had improved with the citronella collar and eight dogs that had improved with the scentless collar remained partially or entirely under control (i.e., they did not return to their pre-

vious level of barking). Therefore, these dogs were not evaluated as part of the crossover portion of this study. In total, 30 dogs were tested with the citronella collar, 29 dogs were tested with the scentless collar, and 21 dogs were evaluated in the crossover (i.e., direct comparison) study. In the 30 dogs evaluated with the citronella collar, 18 (60%) dogs were controlled while wearing the collar, five (17%) were improved, five (17%) had no change, and two (7%) were evaluated as worse. By comparison, of the 29 dogs evaluated with the scentless collar, 13 (45%) dogs were controlled while wearing the collar, four (14%) were improved, 10 (34%) had no change, and two (7%) were worse. In total, 23/30 (76.7%) cases were controlled or improved while wearing the citronella collar, whereas 17/29 (58.6%) cases were controlled or improved while wearing the scentless collar.

Seventeen dogs did not return to the previous level of barking after the initial placement of the scentless or citronella collar. Therefore, in 21/38 cases, both collars could be compared in the crossover design portion of this study. In comparison, the citronella collar was effective in five cases where the scentless collar produced no change (i.e., no response for better or worse). Four of these five dogs had the citronella collar placed after the scentless collar. In four dogs where both collars were effective at reducing barking, the citronella collar was rated as more effective than the scentless collar in two of the cases. In one of these cases, the scentless collar was placed second, and in the other case, the scentless collar was placed first. In two cases in which the scentless collar was more effective at reducing barking than the citronella, the scentless collar was applied first in one case and the citronella collar was applied first in another. In no case was the scentless collar effective where the citronella collar was not. Therefore, by direct comparison, the citronella collar was effective in five cases where the scentless collar was not, the citronella collar was more effective than the scentless collar in two additional cases, and the scentless collar was more effective than the citronella collar in two cases. There was no significant effect in which collar was applied first when comparing efficacy in the crossover design.

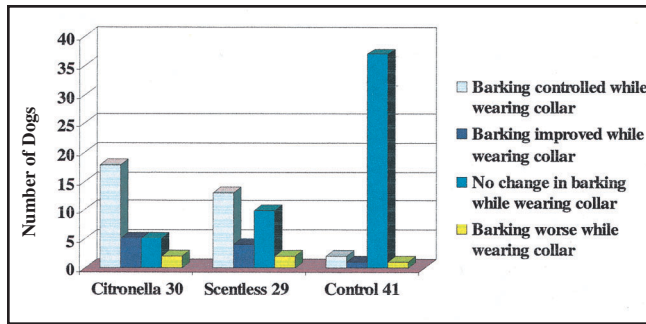


Figure 3—Effects of a citronella collar (n=30) and scentless collar (n=29) on barking frequency in comparison to a control collar (n=41).

The anxiety level was subjectively evaluated and recorded in each dog prior to the trial, and then it was compared to the anxiety level while wearing the control collar, citronella collar, and scentless collar. For most dogs, the collar had no appreciable effect on the anxiety when compared to the control collar, with 20/30 patients wearing the citronella collar and 20/29 patients wearing the scentless collar showing no change in their subjective anxiety scores. Four patients wearing the citronella collar and five patients wearing the scentless collar were reported to be less anxious, while six patients wearing the citronella collar and four patients wearing the scentless collar appeared to be more anxious. When evaluated statistically, there was no difference in the anxiety levels of the dogs with the citronella or scentless collars when compared to the control collar (two-tailed *P* value, 0.3858).

Discussion

The efficacy of the citronella bark collar has been previously evaluated in a number of studies; however, none of the studies used a control group for comparative purposes, and none evaluated the use of the collar in a veterinary hospital setting.⁷⁻¹⁰ There was also a question as to whether a scentless product would be as effective as the citronella. Barking in a veterinary kennel might be difficult to control, given the many varied reasons that these dogs might bark, the number of dogs present, and the confined space in which these patients are kept. This study was performed in two actual hospital kennel settings using patients admitted for elective procedures or for boarding.

This study found that the citronella and the scentless collars were effective at reducing barking in the majority of dogs in which they were utilized. Although the findings were not significant, the trend toward a slightly higher efficacy with the citronella product supports the concept that odor is a factor in the collar's efficacy for some dogs. Since the scentless product contains HFC134A, there may indeed have been some effect of odor to the dog, although it is far less pungent than the citronella. However, the scentless collar may be an effective alternative for owners who find the citronella odor unpleasant or offensive or when there is a

sensitivity or allergy to citronella in humans or other animals in the home (e.g., feline asthmatics).

When designing the study, the authors hypothesized that inhibiting barking may lead to a decrease in arousal and anxiety so that the dogs might habituate more quickly to the kennel environment. For most dogs, there was no appreciable change in anxiety; while a few dogs did seem to improve, a few were also reported as getting worse. Of the dogs that became more anxious, most had a higher subjective anxiety rating prior to collar application, and one dog was later determined to have a diagnosis of separation anxiety. On the other hand, anecdotally, the staff noted that their own level of anxiety and stress, as well as perhaps that of the other pets in the hospital, was decreased when the barking could be controlled in the problem dogs. Since the anxiety did appear to increase in a small percentage of dogs, the authors suggest monitoring the dogs when the collar is first applied and removing the collar if there is any apparent increase in anxiety (or, for that matter, any quantitative increase in barking).

The primary goal of this study was to compare the efficacy of scentless and citronella collars in reducing barking. The authors chose a 5-minute assessment period after collar removal to try to prevent any residual effects of the collar. However, even though dogs only wore the collars for 5 minutes, 17 of 38 dogs did not return to their original barking levels after the collar was removed, and a small number of dogs had an appreciable reduction in anxiety. Had the collars been left on for a longer time frame, there may have been greater improvement in anxiety and a lower level of recurrence when the collar was ultimately removed.

The owners of the patients used in this particular study were not routinely questioned as to whether their dog had been previously familiarized to a bark collar. Therefore, it is unknown whether prior experience may have contributed to the cessation of barking in the three cases in which the control collar was effective alone. Similarly, the authors do not know whether previous habituation to the citronella collar negatively affected the outcome. The dogs in the control group may have also improved because of the interaction by the handler or because of some deterring or distracting effect of the collar itself.

Although the veterinary behavior consultant at each practice oversaw the data collection for this trial, the case selection and measurements were performed by veterinary technicians on actual clinical cases. This may have had some influence on the results, as there was no attempt made to categorize the type of vocalization and, as mentioned, previous experience may have influenced the response to the collars. Again, it should be noted that the collars were only used on barking dogs that were in the hospital for boarding or routine preventive procedures and were not utilized on dogs that were sick, aged, or aggressive. This likely eliminated most cases of pain-induced, defensive, and protective forms of vocalization, leaving anxiety and conflict, attention-seeking, group-facilitated communication, and alarm barking as the most likely causes of barking in the dogs of this study.

Because of the study design and the use of a control group, the application of the collars was neither blinded nor randomized. In order to represent a true clinical setting, a veterinary technician at each hospital was responsible for selecting the cases and assessing the response to each collar. The control collar was utilized first, and then the citronella and scentless spray collars were alternated as to which was applied next, so that equal numbers of each could be tested. It was also the technician's responsibility to ensure that the reservoir was filled and the collar was working properly before each application. Therefore, it would have been impractical to blind the observer from the sound, sight, and scent of the propellant.

In many of the home studies reported in the literature,⁸ it was found that some dogs habituated to the effects of the collar over time, without concurrent retraining. However, this is not generally an issue for the veterinary hospital environment since dogs might only be boarded for a few days and might only be in the hospital for a few hours before they receive sedation or anesthesia for surgery. Therefore, the authors feel that this study accurately represents the improvement that is likely to be seen when these collars are applied in a clinical setting.

Conclusion

Both spray collars significantly reduced the barking of dogs in the hospital, although the citronella collar was effective in a number of cases where the scentless spray collar was not. Overall, staffs at both hospitals were extremely pleased with the efficacy of the collars in reducing noise in the workplace. They noted that by quieting the instigator or the most vocal dogs, the other dogs in the clinic were less likely to bark, so patients that were ill or recovering from surgery were less likely to be disturbed. In addition, even though the collar did not appear to reduce the anxiety of most barking dogs, the resultant reduction in barking may have reduced the anxiety level of the staff and other pets in the hospital. The use of spray collars has now become a regular part of the authors' hospital routine for those dogs that are disturbing staff or other pets.

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^a Beaudet R; MultiVet, Saint-Laurent, Quebec, Canada, personal communication, 2001.

^b Extech instrument /4 07736 sound level meter; Instrument Corporation, Walton, MA

^c Gentle Spray (formerly ABS Antibarking System); Premier Pet Products, Inc., Richmond, VA. Aboistop; Multivet International, Inc., Hyacinthe, Canada.