Commentary

The case against the use of dental implants in dogs and cats

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Veterinary dentistry has made great strides providing treatments that were once available only to people. When performed for the medical benefit of animals, procedures such as professional dental cleaning, root canal treatment, and even, in selected cases, periodontal surgery and orthodontic correction can prevent and treat disease, improve quality of life, and enhance and sustain the human-animal bond.

Veterinarians are now being urged to provide for dogs and cats another sophisticated procedure that has become common in human dentistry: dental implants (ie, implants designed to replace missing teeth, consisting of a metal part inserted into the underlying bone to support a prosthodontic appliance). We argue, however, that data suggesting dental implants are safe and beneficial in humans cannot be extrapolated to animals, that evidence regarding the safety and efficacy of dental implants in dogs and cats is currently insufficient to justify their use, and that the claimed medical and quality-of-life benefits associated with dental implants in dogs and cats do not outweigh the potential risks associated with them. For these reasons, we do not believe that dental implants should be placed in dogs and cats.

It is not possible to estimate how many dogs or cats in the United States have received implants, although the number thus far appears to be small. We are aware that dental implants have been placed in privately owned dogs by diplomates of the American Veterinary Dental College (AVDC), and it is likely that some general veterinary practitioners have placed implants in dogs and cats. It may also be the case that human dentists have placed dental implants under the supervision of veterinarians. Although the number of veterinarians presently placing dental implants in dogs and cats is probably limited, this could change, and quickly. Lectures, workshops, textbooks, and lay publications seek to train veterinarians to perform dental implant procedures in dogs and cats. Brochures, websites, and advertisements proclaim medical and quality-of-life benefits for patients, happiness for clients, and financial advantages for veterinarians. Some general veterinary practitioners and veterinary dental specialists may be unable to resist the temptation to expand their technical skills by learning and performing another complex procedure. The revenue that implants could generate may be appealing. Some animal owners familiar with the use of dental implants in people might be attracted to a procedure that, in their minds, would treat a beloved pet just like the human members of their families. It is precisely because dental implants are not yet routinely offered that it is now important for all veterinarians to appreciate the issues raised by these procedures.

History, Nature, and Current Practice of Dental Implants in Humans

Origins, scientific foundations, and acceptance—To appreciate the problems associated with the use of dental implants in dogs and cats, one must understand certain key facts about implantology in human dentistry. The foundations of modern dental implantology derive from the work of Dr. Leonard Linkow, who began installing dental implants in people in the 1950s and who for decades was at the forefront of the development of implant materials and techniques.1 In 1971, a US patent was granted for a dental implant with the same basic design that is still commonly used today: a screw installed in the mandible, incisive bone, or maxilla to which a denture or prosthetic tooth is attached.2 Experimental and clinical studies3–7 have subsequently investigated implant osseointegration, short- and long-term implant success rates, and potential complications such as peri-implantitis. Numerous short-, medium-, and long-term studies7,8 of human patients have shown that dental implants have success rates ranging from 90% to 95%. Implantology has become part of the mainstream of human dentistry. General dentists and specialists in prosthodontics routinely refer patients to periodontists or oral surgeons for implant installation. Some general dentists and prosthodontists also install implants.

Medical and quality-of-life benefits—Dental implants can be beneficial for people in whom tooth loss...
would result in migration and malocclusion of neighboring teeth or would cause opposing teeth to loosen and exfoliate. Implants can be helpful when a patient has full or partial dentures that do not allow enjoyment of certain foods or cause discomfort because they become loose or fit poorly. Many people obtain implants to restore a natural appearance or smile; this can improve self-esteem and provide added confidence among family and friends and in the workplace.9

Implantology procedures—A wide variety of approaches to dental implantology in human patients have been developed. When > 1 tooth is missing, it is sometimes possible to install implant-supported dentures, which are full or partial (bridge) dentures that rest on implants. There are fixed implant-supported dentures, which can be removed only by the dentist, and snap-on implant-supported dentures, which the patient can easily remove for cleaning or sleep. The other major type of dental implant is the single-tooth implant to which a single prosthetic tooth is attached; this can involve replacement of multiple teeth, but each prosthetic tooth is attached to one implant. Single-tooth implants are not removable.

Immediate or postponed installation of an implant after tooth extraction—Many dental implants are inserted following extraction of a single tooth or multiple teeth because of severe tooth injury or advanced periodontal disease. An initial decision must be made whether to install the dental implant at the time of the extraction or to place it later. The former approach is apparently becoming more common when there is sufficient bone immediately after extraction to receive the implant, however, many dentists still prefer to delay the implant procedure, to ensure bone healing prior to implant installation. There are 2 general approaches for placement of implants. The most extensively researched and apparently still most commonly used method is often called the 2-stage technique because it requires 2 surgical procedures. This approach involves installing a titanium or zirconium screw in the mandible, incisive bone, or maxilla; recessing the screw into the gum; and covering the implant with gingival tissue. Several months later, the implant is uncovered and a metal cylinder (called an abutment) onto which the prosthetic tooth or denture will be installed is screwed into it. This approach typically consists of 3 general steps (here, described for a single-tooth implant and with separate extraction and implant installation). First, the tooth is extracted. The gingiva is sutured closed over the extraction site. Healing is allowed to occur for several months. Second, an incision is made in the gingiva and alveolar mucosa, creating a flap, and the titanium or zirconium screw is installed into the mandible, incisive bone, or maxilla. Intraoral radiographs are obtained to ensure proper placement of the implant. If there is insufficient alveolar bone or there is space around or near the implant, a bone graft or substitute material is also placed. The flap is sutured closed to cover the recessed screw. Healing is allowed to occur for several months. Third, the implant is surgically uncovered. The abutment is screwed onto it. Radiographs are obtained to assure proper attachment of the abutment to the implant. An impression is made so that a prosthetic tooth can be fashioned by the dental laboratory. A temporary crown is placed on the abutment. Fourth, when the fabricated crown is ready, the temporary crown is removed, and the prosthetic crown is installed on the abutment. Fifth, after several weeks or months, the implant and prosthetic crown are rechecked by means of clinical examination and radiographs. Further recheck examinations are scheduled when appropriate.

In contrast, with the single-stage technique, an implant that protrudes above the gingival margin is installed (although it can be covered with a temporary protective cap until the impression is obtained). This method obviates the need for a second surgery to uncover the implant but still requires several months' healing before the abutment is attached to the implant and an impression is obtained. Studies have indicated that in some circumstances, single-stage implants are effective, but many dentists prefer the 2-stage technique because recessing and covering the implant prevents stresses on it during osseointegration resulting from chewing, tongue movement, or infection.

In some instances, additional or alternative procedures may be performed during implant installation. For example, bone grafting may be necessary prior to implantation if there is insufficient bone to receive the implant. Some dentists puncture a hole in the gingiva to install or uncover the implant, rather than creating a gingival flap. Under some circumstances, some dentists perform what is termed immediate occlusal loading of the implant by placing a fully functional prosthesis immediately or within 2 weeks after implantation. Some dentists may place a temporary nonfunctional crown, bridge, or full denture on a temporary abutment immediately or within 2 weeks after implantation, with the permanent abutment and prosthesis attached later. There is vigorous debate among implantologists regarding when single-stage implants are appropriate and whether and when immediate loading of fully functional or temporary prosthetic crowns or dentures is effective.10

Objections to the Use of Dental Implants in Dogs and Cats

At first glance, it might seem that the long history and demonstrated benefits of dental implants in people would suggest that they could and should be used in dogs and cats. However, we contend that evidence of dental implant benefits and success in people is not applicable to animals, that there is insufficient evidence of long-term implant efficacy and safety in dogs and cats, and that the potential medical and quality-of-life benefits of dental implants do not outweigh the potential risks and costs associated with their use.

Inapplicability of evidence of dental implant success in humans—We contend that the efficacy, safety, and medical and quality-of-life benefits of dental implants in dogs and cats cannot be extrapolated from findings for people. Occlusal loads, oral hygiene standards, and functional demands are quite different in people than in dogs and cats. It is no small matter that most hu
mains do not, like dogs, eat kibbled or uncut food; chew on rawhide or natural or artificial bones; or play with toys or other objects that they chew, grab, or pull with their teeth. Furthermore, not all dog and cat owners provide the frequency and quality of oral care most people provide for themselves, including daily toothbrushing and periodic dental check-ups. Also crucially important, some dental implant procedures (eg, single-stage procedures and procedures that result in immediate occlusal loading) that have been found to be effective in people cannot or should not be used in dogs and cats because they require that the patient be careful when eating or chewing until a permanent prosthesis is installed.

Insufficient evidence of long-term implant efficacy and safety—Fundamentally, veterinarians should not offer procedures to their clients unless there is a reasonable amount of scientific evidence to suggest that those procedures will be efficacious and safe. However, we believe that the current evidence regarding long-term efficacy and safety of dental implants in dogs and cats is insufficient to justify their use.

Animal studies,11–15 specifically experiments involving dogs, have played an instrumental role in the development of dental implants for humans. These experiments have provided basic biological and physiological information and have laid the foundation for subsequent development and testing of implants in people. However, most of these studies were performed on small numbers of dogs under experimental conditions. The dogs lived in research facilities and did not experience the full range of real-life activities that place stress on the crowns and roots of the teeth of pet and working dogs. These research dogs did not have periodontal disease (which could confound experimental results but is a major cause of tooth loss in dogs) and received strict oral care (which relatively few pet dogs receive). Often, at the end of the experimental period (usually 3 to 6 months), the animals were euthanized.

As a result, these studies do not provide reliable evidence regarding the long-term efficacy and safety of dental implants in dogs living in typical surroundings and engaging in typical behavior, much less in dogs with poor oral hygiene or a history of abnormal occlusal loads. Moreover, we are not aware of any published peer-reviewed studies of the long-term efficacy and safety of dental implants in pet or working dogs. Similarly, to our knowledge, there are no published peer-reviewed studies of short-, medium-, or long-term efficacy and safety of dental implants in cats, and the development of dental implants for humans has not involved testing on cats.

Potential medical and quality-of-life benefits versus potential risks and costs—A fundamental principle of veterinary medical ethics is that the potential benefits of a procedure must outweigh the potential risks and costs. This principle is easily stated but can be difficult to apply because there can be disagreements about what is good or harmful for animal patients and their owners and because what might be good for an individual patient could conflict with the owner’s desires or best interests.16

Potential benefits of medical procedures for dogs and cats include cure, palliation, or prevention of disease, infirmity, or pain; a continuing life; and a good quality of life. Potential benefits for their owners are the ability to continue to enjoy the human-animal bond and the continued use of a service or working animal.

Potential risks and costs of medical procedures for dogs and cats include the risk of death that might be associated with a procedure; pain, distress, or discomfort in association with or as a result of the procedure; and a poor or unimproved quality of life. Potential costs for their owners include the financial costs of the procedure and the physical and psychological burdens of caring for the animal during and after the procedure.

Purported benefits of dental implants in dogs and cats—To our knowledge, there are no available peer-reviewed scientific studies demonstrating that dental implants in dogs and cats would be medically beneficial or necessary to maintain an excellent quality of life in animals with missing teeth. Following extraction of a single tooth or multiple teeth, dogs and cats are fully functional without substantial negative influence on their quality of life.17,18 They are able to not only eat and play but also engage in the gamut of activities that allow companion animals and their owners to enjoy the benefits of the human-animal bond. These favorable outcomes of tooth extraction have never been challenged in the scientific literature.

A provider of training and materials for dental implantology in dogs and cats states that the “[b]iggest reason for placing dental implants in cats and dogs is to improve the animal’s function and bone integrity” and asserts that the “main function of natural teeth is to maintain jaw bone, but once a tooth is lost, the jaw bone will shrink back in all directions. And continues to shrink until it reaches a level equal to when the animal was a pup or kitten, resulting in a [weakened] jaw.” When a tooth is extracted or exfoliates in a dog or cat, the alveolar bone does undergo a certain degree of well-documented resorption and decrease in height and once a tooth is lost or extracted, the part of the alveolar bone that had been carrying the tooth will undergo atrophy. If the teeth in an entire quadrant are extracted, the atrophy will be more pronounced. Bone can also be lost because of periodontal disease, the most common cause of tooth loss in dogs, or because of alveolectomy and alveoplasty performed as part of a surgical extraction. However, we are unaware of any scientific studies demonstrating that the jaw of an adult dog or cat without an implant will “shrink” to the level of a puppy or kitten jaw. It is also stated that dental implants in dogs and cats can “promote the health of neighboring teeth, limit the movement of teeth, reduce the amount of root exposure, keep the tongue from ‘lolling’ and protect opposing teeth and gums from trauma.” With the exception of a protruding tongue (depending on which teeth are extracted), we know of no scientific studies that confirm these assertions. Additionally, while a protruding tongue might be esthetically displeasing to some (we believe very few) owners, it rarely seems to bother the animal or represent a medical problem.
The provider of dental implant training and materials also describes a dog in which the absence of 2 mandibular incisor teeth “greatly affected the way she ate” and states that because of dental implants, this dog is “now back to happily chewing on her favorite toy.”26 We cannot contest this anecdotal report, nor would we deny that missing teeth can sometimes affect how some dogs and cats eat or might sometimes prevent enjoyment of a particular toy or activity. However, we are not aware of any available scientific studies demonstrating that even in such cases is overall quality of life seriously affected by a missing tooth or teeth. In our personal experience observing dogs and cats that required extraction of all of their teeth, these animals were not reluctant to chew and some preferred a dry kibble diet following healing of the extraction sites. Indeed, the provider of dental implant training concedes that “[y]our beloved pet can have a happy long life without teeth.”25

Conceivably, for police, military, emergency rescue, and other service dogs in which the use of strategic teeth (primarily the canine teeth) might sometimes be crucial in enabling them to perform essential tasks, dental implants could theoretically result in a functional improvement following loss of these teeth. In our experience, however, loss of these strategic teeth in working dogs does not have a substantial negative impact on the dogs’ ability to perform their expected functions. More importantly, there are no available studies demonstrating the long-term success of dental implants to replace these types of strategic teeth in working dogs. Indeed, it seems likely that such implants will not be able to sustain the substantial occlusal forces placed on them. The bite forces of military and police dogs are difficult to quantify, owing to the variety of forces (eg, shear, torque, intrusion, and extrusion) and their vector nature.27 The few available studies28,29 on occlusal overload on implanted teeth in dogs have examined mandibular premolar and molar teeth, not canine teeth. As with other research on dental implants in dogs, these studies involved a small number of animals under experimental conditions, with careful oral hygiene and a relatively short follow-up period. The forces exerted on and the conditions that apply to the teeth of working dogs differ from such experimental conditions. The lateral stresses to which the canine teeth of working dogs are subjected (as when a police or military dog bites and tugs on clothing or a limb) are quite high, as demonstrated by the typically oblique fracture pattern found in the canine teeth of working dogs.30 But dental implants are not designed to withstand high lateral stresses. Additionally, there is conflicting evidence in human and animal studies regarding the negative impact of occlusal overload on the biological and mechanical load-bearing capacity of dental implants and the contribution of occlusal overload to prosthesis failure.31–35

At end, it appears that the only benefits of dental implants in dogs and cats are esthetics. Owners may enjoy seeing that their pet has a full or more complete set of teeth (where dental implants are visible) or simply knowing that their pet has a full or more complete set of teeth. Owners might also experience enjoyment at seeing their dog or cat play with a familiar toy or engage in a particular activity that would not be possible with missing teeth.

Potential risks and costs of dental implants in dogs and cats—Because dental implants are still uncommon in dogs and cats, it is not possible to identify what could be termed a standard procedure in these animals. However, clinical use of dental implants in animals clearly presents certain risks and costs, some of which can be extrapolated from human implantology.30

In humans, swelling and some pain after extraction, implantation, and attachment of the abutment are commonplace and can be expected in dogs or cats. Early complications associated with dental implants in people can include severe pain, infection, and occasionally neuropathy. Severe early complications such as hemorrhage are rare but can occur. Long-term complications can include implant fracture or loosening as a result of a lack of osseointegration and peri-implantitis. The long-term outcome in humans can be affected by local (eg, periodontitis) or systemic (eg, neoplasia or immunosuppression) diseases. Maintaining a high standard of oral hygiene in which a well-harmonized interface between the soft tissues and dental implant exists is essential for a successful outcome.36–38 If this demand is not met, peri-implant mucositis and peri-implantitis will occur. In conjunction with periodontitis, these are the most commonly observed complications in humans, and they result in implant failure.35,36,38 Notably, periodontitis is common in companion animals and is the most frequent cause of tooth loss.39–41 And human patients with a history of periodontitis are at higher risk of developing peri-implantitis.42 Because, even with the best of care, the daily oral hygiene of companion animals is suboptimal, compared with that in humans, the potential for dogs and cats to develop peri-implantitis and related implant failure as well as pain and discomfort is most likely high. Even without the development of these complications, the possibility of eventual implant failure (and the need for additional treatment, pain, and discomfort) cannot be dismissed, owing to the lack of studies on long-term efficacy and safety.

An unavoidable risk of dental implants in dogs and cats is the requirement for multiple episodes of general anesthesia. Although general anesthesia is a relatively safe procedure in animals, given current multimodal anesthetic protocols and patient monitoring techniques, the number of anesthetic episodes should still be minimized. Nearly every veterinary dental procedure and most follow-up monitoring requires general anesthesia. This is fundamentally different from the case for human dentistry, where many procedures can be done without any anesthesia or require only local anesthesia or sedation.

Finally, even if dental implants are eventually proved through appropriate controlled studies to be as effective (in the sense that they remain in place) and safe in dogs and cats as they are in people, there will remain one clear and substantial drawback to their use: the financial expense. Because dental implants are still uncommon in dogs and cats, it is difficult to determine a typical charge, but it has been estimated that the cost of a single-tooth implant in a person could...
range from $3,000 to $4,500, depending on where the patient lives, and this estimate does not appear to include the cost of tooth extraction. Even if veterinarians would charge clients less than human dentists charge for their professional services, the cost of anesthesia alone would likely make tooth replacement in a dog or cat at least as costly as an implant for a human patient.

Of course, economic considerations alone do not mean that costly veterinary procedures should not be performed. Many costly procedures provide genuine benefits for animals and their owners and are clearly appropriate. The problem with dental implants, we submit, is that until implants are shown to be effective and safe in dogs and cats, the substantial potential risks in combination with the modest benefits these procedures might bring would not justify the high economic cost.

**Ethical and Other Considerations**

Along with the concerns already stated, we contend that providing dental implants for typical pet dogs and cats violates key ethical principles of the veterinary profession. The Principles of Veterinary Medical Ethics of the AVMA states that “veterinarians should first consider the needs of the patient: to relieve disease, suffering, or disability while minimizing pain or fear.” For typical pet dogs and cats, dental implants would not relieve any disease, suffering, or disability and an implant procedure would not minimize pain or fear. Indeed, because of the need for multiple general anesthetic episodes and procedures, we believe that placing a dental implant would likely result in more pain or fear for patients than would dental extraction. Similarly, the core provision of the Veterinarian’s Oath states that veterinarians should use their “scientific knowledge and skills for the benefit of society through the protection of animal health and welfare, the relief of animal suffering, the conservation of animal resources, the promotion of public health, and the advancement of medical knowledge.”

We believe that dental implants would do nothing to protect the health and welfare of animals or to relieve suffering.

If it can be shown that certain working dogs, such as police, military, emergency rescue, and other types of assistance or service dogs, do indeed require certain strategic teeth to perform their essential functions, then it might be plausible to suggest that studies of the efficacy and safety of dental implants for the replacement of such teeth in working dogs should be undertaken. Importantly, such studies should include sufficiently large numbers of working dogs to ensure that results are reliable. Before any such studies could be undertaken, however, it would first be necessary to determine how many working dogs have missing strategic teeth and how many of these dogs truly cannot function without those teeth.

**Conclusion**

In 2008, the AVMA declared as official policy that it “opposes ear cropping and tail docking of dogs when done solely for cosmetic purposes.” In explaining the policy regarding ear cropping, the AVMA stated that the desire of an owner to have an animal with a certain appearance does not justify the risks of anesthesia, the discomfort during the postoperative care, or the potential complications of infection or necessity of repeating the procedure if it fails to produce desired results. It seems clear to us that if esthetic considerations cannot justify cropping a dog’s ears, neither can a client’s esthetic preferences for a pet with substitute teeth justify placing dental implants in dogs or cats. The risks and costs associated with dental implants are far greater than those associated with ear cropping.

At end, we argue that veterinary dental specialists should not routinely provide dental implants for pet dogs and cats at the present time, nor should they learn the procedure if their intent is simply to do so. Veterinary general practitioners should also not perform this procedure and should advise owners of pet dogs and cats against referral to a specialist for this procedure, given the lack of information on long-term efficacy and safety and the lack of clear medical or quality-of-life benefits.

We also recommend that the AVMA and AVDC both consider adopting policies advising against placing dental implants or performing other dental procedures in pets that do not provide medical or quality-of-life benefits, require general anesthesia, and subject patients to pain or discomfort and the possibility of complications unless and until sufficient scientific evidence exists to support their clinical use. At the very least, we recommend that the AVDC not approve, endorse, or promote the procedure or include it in residency training as a requirement for board certification.

The veterinary profession continues to develop treatments that prevent, alleviate, and cure medical problems in animals. Even if dental implants in dogs and cats are some day proved to be effective (in the sense that they remain in place) and safe, they would still, in most cases, not represent a procedure developed in response to a problem. Veterinarians risk damaging their image as caring and trustworthy by developing and offering procedures that do not serve the true needs of patients and clients.

**References**


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