



# 2025 FelineVMA feline oral health and dental care guidelines



**Abstract:** Oral and dental diseases are commonplace in cats, imposing a responsibility on primary care veterinarians to provide high quality oral healthcare for their feline patients. While patient assessment begins with an examination of the conscious cat, further assessment under anesthesia is necessary for the purposes of radiography and treatment, making anesthesia an essential component of feline dentistry. Because feline patients with oral and dental diseases, as well as those convalescing from surgery, generally experience pain, multimodal perioperative analgesia and anesthesia are standard features of oral and dental care. The '2025 FelineVMA feline oral health and dental care guidelines' are coauthored by a Task Force of board-certified veterinary specialists and a veterinary technician specialist in dentistry convened by the Feline Veterinary Medical Association (FelineVMA). These experts have compiled evidence-guided recommendations for optimal oral health and dental care, including therapeutic interventions, in general feline practice. The focus is on the most commonly encountered oral and dental diseases in cats. These include periodontal disease, early-onset gingivitis, tooth resorption, endodontic disease and tooth trauma, feline chronic gingivostomatitis, developmental abnormalities such as malocclusion, and oral masses and growths, as well as various miscellaneous conditions. An extensive bibliography provides additional resources that extend beyond the topics reviewed in these Guidelines. Caregivers should be active participants in their cat's oral and dental healthcare. Veterinary team members can empower their patients' caregivers by educating them on signs of oral and dental disease in their cats and by providing home care guidance for maintaining oral and dental health. In any high-performing practice that cares for cats, the entire practice team are advocates for oral and dental care, and are knowledgeable about the principles of prevention and treatment of this important assortment of diseases.

**Keywords:** Dental; dentistry; dental surgery; dental health; periodontal disease; gingivitis; oral surgery; oral health; anesthesia; radiography

## Introduction

Oral and dental diseases are common health problems in the domestic cat. Despite the relatively high prevalence of disease, prevention, recognition and diagnosis can be challenging both for cat caregivers and veterinary teams. With only a short period of domestication<sup>1</sup> compared, for example, with dogs, cats have retained a strong survival instinct to conceal illness and pain. Their need for the safety of their home environment results in the protective emotion of fear–anxiety when they are removed.

Caregivers can be reluctant to bring their cat to the veterinary practice due to perceived stress in their cat before, during and after the veterinary visit.<sup>2</sup> Reluctance is further increased due to caregivers' concerns related to mounting costs, the potential need for surgery and anesthesia, and the burden of

care if treatment is needed at home.<sup>3</sup> Moreover, many caregivers may be unfamiliar with signs of oral and dental disease in their cats, further limiting the opportunity for diagnosis and treatment. For the veterinary team, the cat's fear–anxiety response hampers oral examination and increases the challenge of identifying changes in the awake cat. These difficulties are further amplified if there is a need for team training in cat friendly interactions and/or a better understanding of feline oral and dental diseases.<sup>4</sup>

The '2025 FelineVMA feline oral health and dental care guidelines' provide a practical evidence-guided expert review of feline oral medicine, dentistry and oral surgery. The



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**Changes in appetite are an uncommon finding in cats with oral and dental diseases, so it should be emphasized to caregivers that a normal appetite does not always equate with a healthy mouth.**

Guidelines are directed to all members of the veterinary team and include guidance on how to support caregivers as active participants in their cat's dental healthcare. The Guidelines Task Force has provided information and recommendations based on an extensive literature review and, where published evidence is lacking, the authors' cumulative experience.

## Empowering the caregiver

Caregivers should be active participants in their cat's oral and dental healthcare. As the veterinary team, we can empower caregivers by providing guidance, along with the tools necessary to succeed. Normal anatomy can be taught to caregivers by comparing oral models and anatomical drawings or pictures of the feline oral cavity and dentition with what we see in their cat's mouth. For kittens, the veterinary team should describe the process of, and expected age for, the transition from deciduous to permanent teeth. Since cat friendly handling requires cooperation from the patient,<sup>4</sup> and time may be limited, the team should prepare the caregiver to observe the oral examination so that the opportunity is not missed. A return to the mouth later during the visit might provide a second opportunity to share our findings. Digital imaging of the cat's mouth during the awake examination may be helpful. With the use of models, drawings and related caregiver resources (eg, information on dental care provided by Cats Protection<sup>5</sup>), caregivers can be educated about common feline oral and dental diseases and how to recognize abnormalities.

Caregivers can observe for changes during the cat's normal day-to-day activities, including eating, drinking, grooming, yawning or vocalizing. The veterinary team can proactively educate caregivers about the need to seek veterinary care should they detect unexpected oral odors, red or bleeding gums, chewing on one side of the mouth or with the head tilted to one side, dropping of food, pawing at the face, facial swelling, excess salivation, abnormal oral discharge of any kind and/or inappetence. Changes in appetite are an uncommon finding in cats with oral and dental diseases, so it should be emphasized to caregivers that a normal appetite does not always equate with a healthy mouth.

To successfully empower the caregiver in the prevention of periodontal disease (PD), the entire veterinary team needs to be aligned with respect to the information and recommendations they convey (see box 'Veterinary team educational resources'). The veterinary team should be comfortable supporting and reinforcing recommendations made by the veterinarian.

### Veterinary team educational resources

- ❖ Peer-reviewed published studies
- ❖ Published guidelines:
  - These current Guidelines
  - World Small Animal Veterinary Association global dental guidelines<sup>6</sup>
  - 2019 American Animal Hospital Association dental care guidelines for dogs and cats<sup>7</sup>
- ❖ Online resources:
  - American Veterinary Dental College website – [avdc.org](http://avdc.org)

Discussion and guidance for home preventive care starts with the first kitten visit and the recommendations should be reviewed at each appointment throughout the cat's life. Caregiver resources can be found in the supplementary material accompanying these Guidelines. There is a confusing range of commercial products and procedures that make claims for the successful prevention or treatment of PD. The veterinary team will need to provide consistent messaging about what works, what is supported by science and what can be harmful. This should encompass:

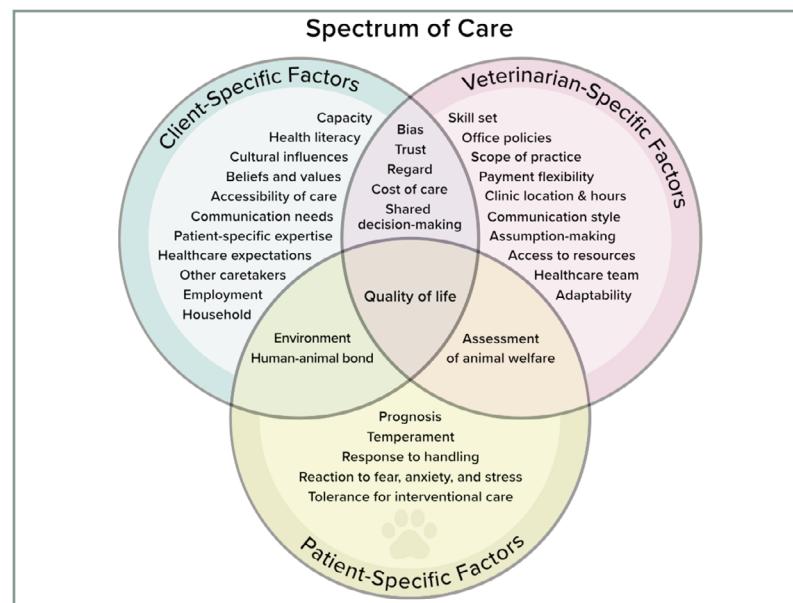
- ❖ The need for, and importance of, regular oral evaluations of the awake cat by a veterinarian;
- ❖ Counseling on diets and treats that are appropriate for the prevention of PD;
- ❖ Recommendations for dental products for home care (eg, brushing, dentifrice, water additives and wipes – see Box 1);
- ❖ The importance of oral examination under anesthesia and problems associated with non-anesthetized (anesthesia-free) dental care;<sup>8,9</sup>
- ❖ The association between dental disease and pain.

Caregivers should be guided in the regular removal of plaque through brushing or wiping. Only safe and effective products should be recommended. Cooperative care training<sup>4</sup> can help to encourage the cat to participate willingly in the oral hygiene process; educational videos that the veterinary team can share to assist the training process, which can take time and effort, are available (see Videos 1 and 2 in the supplementary material). This training can also positively impact the cat's acceptance of oral examinations at the veterinary practice.

### Box 1 /

#### VOHC Seal of Acceptance

The Veterinary Oral Health Council (VOHC) is an organization associated with the American Veterinary Dental College (AVDC) that reviews voluntary product submissions and associated scientific literature and awards the VOHC Seal of Acceptance to products that meet standards for plaque and tartar control. For a list of products that have been awarded the VOHC seal, visit [vohc.org](http://vohc.org).



**Figure 1** Client-, patient- and veterinarian-specific considerations that factor into the spectrum-of-care approach to the practice of veterinary medicine. Reproduced from Englar.<sup>3</sup> Available at: <https://journals.sagepub.com/doi/full/10.1177/1098612X231209855>. Copyright The Author(s) 2023

### Communication with spectrum of care in mind allows the veterinary team to work with the caregiver in a shared decision-making process.



#### Spectrum of care in dental health

The decision to pursue veterinary care for a feline pet is impacted by caregiver (client), veterinarian and patient factors (Figure 1). Spectrum of care includes and defines the factors that guide the veterinary team in providing individualized feline oral and dental disease management along a continuum.<sup>4</sup> This approach differs from a one-size-fits-all plan or the idea that there is only one 'gold standard' option for all patients.

Patient quality of life is a central consideration in determining a dental care treatment plan. As a result of spectrum-of-care factors, treatment expectations may not align between the veterinarian and caregiver. For example, the veterinary team may have a strong conviction of what constitutes 'ideal' care and consider that any other approach is deficient. This can be particularly difficult for caregivers to accept if they have different goals for treatment based on concerns about dental surgery or anesthesia, finances, cultural influences, difficulties with at-home care, or confusion over how the veterinary team's recommendations compare with what they are exposed to through various media.

Open dialogue about expectations and goals will help the veterinary team create trust with the caregiver. Good veterinarian–caregiver communication avoids having clients feel that their concerns are not being heard or that the care being provided is inadequate. Communication with spectrum of care in mind allows the veterinary team to work with the caregiver in a shared decision-making process that results in a plan that is individualized and appropriate for all concerned, including the patient.

## Feline oral and dental diseases

This section provides a narrative overview of the major feline oral and dental diseases, and consensus considerations for diagnosis and treatment. Table 1 lists relevant published literature and reported prevalence in relation to a number of these disease entities.

### Periodontal disease

PD is one of the most common types of dental disease in cats and is only preventable or reversible before alveolar bone loss has occurred. To the general public, the term PD is synonymous with 'gum disease', though it involves other tissues and is caused by the host's

immune and inflammatory responses to bacterial infection of the periodontal tissues supporting the teeth (periodontium); that is, the tooth cementum, gingiva, alveolar bone and periodontal ligament (which acts as a sling between the tooth cementum and alveolar bone).

The term PD encompasses gingivitis, which is the early reversible stage of the disease process, and the progressive changes leading to periodontitis, where there is an irreversible loss of the supporting structures of the teeth. In gingivitis, the gum tissue may be erythematous, swollen or painful. Clinical signs of PD might also include halitosis, loose teeth, bleeding gums, gingival recession, inappetence and discomfort, as displayed by facial

**Table 1** Prevalence of oral and dental diseases in cats by published source

| Study   | Prevalence  |
|---|---|
| <b>Periodontal disease (PD)</b>   |   |
| Periodontal disease in cats under primary veterinary care in the UK: frequency and risk factors (O'Neill et al <sup>10</sup> )  | 1-year period prevalence of 15.2%   |
| Prevalence and risk factors for gingivitis in a cohort of UK companion cats aged up to 6 years (Williams et al <sup>11</sup> )  | Gingivitis in 24.5% of cats <12 months of age and 56.3% of cats 5–6 years of age  |
| Periodontal health status in a colony of 109 cats (Girard et al <sup>12</sup> )   | Gingival inflammation in 96% of cats<br>Periodontal bone loss in 98.2% of cats<br>Aggressive PD in 12.8% of cats        |
| Periodontology (in 'Wigg's veterinary dentistry: principles and practice') (Stepaniuk <sup>13</sup> )   | 80–85% in cats over 2 years of age*   |
| <b>Tooth resorption (TR)</b>  |   |
| Oral and dental anomalies in purebred, brachycephalic Persian and Exotic cats (Mestrinho et al <sup>14</sup> )  | TR in 70% of 50 cats  |
| Periodontal health status in a colony of 109 cats (Girard et al <sup>12</sup> )   | Missing teeth with evidence of root apices in 34% of cats   |
| Identifying early osteoclastic resorptive lesions in feline teeth: a model for understanding the origin of multiple idiopathic root resorption (DeLaurier et al <sup>15</sup> ) | Early identification of TR in 85% of cats<br>38% of teeth had lesions at the cementoenamel junction                     |
| Prevalence of odontoclastic resorption lesions and periapical radiographic lucencies in cats: 265 cases (1995–1998) (Lommer and Verstraete <sup>16</sup> )                      | Radiographic evidence of TR in 60.8% of cats  |
| Prevalence of tooth resorptive lesions in 120 feline dental patients in Israel (Cohen-Mivtach <sup>17</sup> )   | Radiographic evidence of TR in 66% of all cats studied<br>Radiographic evidence of TR in 83.3% of cats >10 years of age |
| Tooth resorption in cats: pathophysiology and treatment options (Gorrel <sup>18</sup> )   | Radiographic evidence of TR in 29% of cats  |
| A large case-control study indicates a breed-specific predisposition to feline tooth resorption (Vapalahti et al <sup>19</sup> )  | TR in 3.9% of all cats studied<br>21% of cats diagnosed with oral or dental disease                                     |
| <b>Feline chronic gingivostomatitis (FCGS)</b>  |   |
| Prevalence of feline chronic gingivo-stomatitis in first opinion veterinary practice (Healey et al <sup>20</sup> )  | FCGS in 0.7% of all cats studied  |
| Periodontal health status in a colony of 109 cats (Girard et al <sup>12</sup> )   | 3.7% of cats had buccostomatitis<br>1.8% of cats had caudal stomatitis  |
| Prevalence of feline chronic gingivostomatitis in feral cats and its risk factors (Kim et al <sup>21</sup> )  | FCGS in 26.6% of feral cats studied in Korea  |
| <b>Malocclusions</b>  |   |
| Oral and dental anomalies in purebred, brachycephalic Persian and Exotic cats (Mestrinho et al <sup>14</sup> )  | 72% of cats studied had malocclusions   |
| Clinical characterisation of caudal traumatic malocclusions and treatment outcomes in cats (2018–2022) (Hamilton and Hiscox <sup>22</sup> )                                     | Malocclusions were more common in Maine Coon and Persian cats   |

\*Aggregate range of prevalence

## Stages of periodontal disease

| Stages of periodontal disease (PD) |   |
|------------------------------------|---|
| Stage                              | Description   |
| Normal (PD0)                       | Clinically normal; no clinical evidence of gingival inflammation or periodontitis (Figure 2)  |
| Stage 1 (PD1)                      | Gingivitis only, without attachment loss; the height and architecture of the alveolar margin is normal (Figure 3)   |
| Stage 2 (PD2)                      | Early periodontitis; <25% attachment loss* or, at most, there is stage 1 furcation involvement in multirooted teeth. There are early radiographic signs of periodontitis (Figure 4) |
| Stage 3 (PD3)                      | Moderate periodontitis; 25–50% attachment loss* or stage 2 furcation involvement in multirooted teeth (Figure 5)  |
| Stage 4 (PD4)                      | Advanced periodontitis; >50% attachment loss* or stage 3 furcation involvement in multirooted teeth (Figure 6)  |

Information based on O'Neill et al<sup>10</sup> and Wolf et al<sup>23</sup>  
 \*Loss of periodontal attachment is determined either by probing the clinical attachment level or by radiographic measurement of the distance of the alveolar margin from the cementoenamel junction relative to the length of the root



**Figure 2** Normal periodontal tissues (PD0). Neither gingival inflammation nor periodontitis is clinically evident (radiographs are required to confirm absence of bone loss). Image courtesy of Heidi Lobprise



**Figure 3** Thickened gingiva but no pocket depth due to attachment loss (PD1) (radiographs are required to confirm absence of bone loss). Image courtesy of Heidi Lobprise



**Figure 4** Early periodontitis (PD2). Left maxilla showing deposits of calculus and marginal gingivitis, with possible gingival recession at the maxillary canine tooth (204) (periodontal probing and radiographs are required to confirm <25% attachment loss). Image courtesy of Heidi Lobprise



**Figure 5** Moderate periodontitis (PD3). Image courtesy of Heidi Lobprise



**Figure 6** Advanced periodontitis (PD4). Image courtesy of Heidi Lobprise

rubbing and being 'mouth shy', although in many cases clinical signs are absent.

Since a patient may have multiple teeth that have different stages of disease (see box 'Stages of periodontal disease'), the severity of PD is determined on a tooth-by-tooth basis.<sup>7</sup> PD alternates between episodes of disease activity and quiescence. If untreated, PD progresses from mild inflammation to severe tissue destruction.

### Pathogenesis

PD is a complex disorder resulting from an interplay between genetic predisposition, dysbiosis of the microbiome (involving bacteria, fungi and viruses) and the immune-inflammatory environment. Oral microbiota dysbiosis may cause disease through several molecular mechanisms.<sup>24</sup> Finely tuned 'crosstalk' between the oral microbiota, immune cells and epithelium is crucial for maintenance of the mucosal architecture and homeostasis.<sup>25</sup> There is also evidence to suggest that perturbations in the mucosal microbiota can modulate innate and adaptive immune responses, with inflammation arising due to changes in the balance of commensal or pathological microorganisms.<sup>26</sup>

### Diagnosis

Periodontitis may occur as a focal or localized disease, a semi-generalized disease or generalized disease (involving the entire dentition). Thus, a diagnosis of PD should consist of a tooth-by-tooth assessment. An anesthetized, comprehensive oral and periodontal examination with dental charting and full-mouth dental radiographs or advanced imaging is essential for this evaluation.

Complete periodontal assessment includes:

- ❖ Assignment of a plaque index, calculus index and gingival index (Table 2);
- ❖ Six separate points of measurement along the gingival sulcus/pocket (in mm);
- ❖ Measurement of gingival recession or gingival hyperplasia (in mm);
- ❖ Evaluation of furcation involvement of multirooted teeth (Table 2); and
- ❖ Mobility scoring (Table 2).

The veterinarian can then determine the level of periodontal attachment loss for each tooth. This guides the prognosis for tooth retention within the mouth.

### Radiography

Full-mouth dental radiography will allow the amount of alveolar bone loss for each tooth to



**Figure 7** Radiograph of the left mandible of a cat with horizontal bone loss across several teeth. Image courtesy of Heidi Lobprise

be ascertained, and whether attachment loss is horizontal or vertical (Figure 7). Additionally, the shape of furcation lesions is revealed, as well as the presence of concomitant pulp infection (ie, periodontal-endodontic lesions).

#### Treatment

Plaque control with comprehensive supra- and subgingival plaque removal is at the heart of PD prevention and treatment. Tooth extraction may be necessary. Antibiotics are rarely indicated in the treatment of PD (see 'Use of systemic antibiotics').<sup>26,28</sup> Once the cat has recovered from periodontal care under anesthesia, caregivers can be advised to attempt oral home care, potentially including use of VOHC-approved products (see Box 1). For protective cats with fear-anxiety and pain, this may not be possible.

#### Early-onset gingivitis

Early-onset gingivitis, also referred to as feline juvenile gingivitis, is observed clinically as marked gingival erythema in cats around 6–8 months of age (Figure 8), and confirmed radiographically by bone loss representative of moderate-to-severe PD and histologically by neutrophilic lymphoplasmacytic inflammation.<sup>29,30</sup> The etiology is unknown.<sup>29</sup> Early intervention under general anesthesia is warranted to provide comprehensive periodontal treatment with extractions, as dictated by periodontal disease indices (Table 2). Follow-up evaluations are necessary as early-onset gingivitis can progress to aggressive periodontitis or feline chronic gingivostomatitis (FCGS).<sup>30</sup>



**Table 2** Periodontal disease indices

| Index                                   | Description   |
|---|---|
| <b>Plaque index (PI)<sup>27</sup></b>   |   |
| PI 0                                    | No observable plaque  |
| PI 1                                    | Plaque covers <1/3 of buccal surface  |
| PI 2                                    | Plaque covers between 1/3 and 2/3 of buccal surface   |
| PI 3                                    | Plaque covers >2/3 of buccal surface  |
| <b>Calculus index (CI)<sup>27</sup></b> |   |
| CI 0                                    | No observable calculus  |
| CI 1                                    | Calculus covers <1/3 of buccal surface  |
| CI 2                                    | Calculus covers between 1/3 and 2/3 of buccal surface   |
| CI 3                                    | Calculus covers >2/3 of buccal surface  |
| <b>Gingival index (GI)<sup>27</sup></b> |   |
| GI 0                                    | Normal healthy gingiva with sharp, non-inflamed edges   |
| GI 1                                    | Marginal gingivitis: minimal inflammation at the free margin; no bleeding on probing  |
| GI 2                                    | Moderate gingivitis: wider band of inflammation; bleeding on probing  |
| GI 3                                    | Advanced gingivitis: inflammation clinically reaching mucogingival junction; spontaneous bleeding sometimes present   |
| <b>Furcation involvement*</b>           |   |
| Stage 1 (F1)                            | Furcation 1 involvement exists when a periodontal probe extends less than halfway under the crown in any direction of a multirooted tooth with attachment loss                                    |
| Stage 2 (F2)                            | Furcation 2 involvement exists when a periodontal probe extends more than halfway under the crown of a multirooted tooth with attachment loss, but not through and through                        |
| Stage 3 (F3)                            | Furcation 3 involvement (furcation exposure) exists when a periodontal probe extends under the crown of a multirooted tooth, through and through from one side of the furcation and out the other |
| <b>Tooth mobility index*</b>            |   |
| Stage 0 (M0)                            | Physiologic mobility, with movement up to 0.2 mm  |
| Stage 1 (M1)                            | Mobility is increased in any direction, other than axial, with movement >0.2 mm and up to 0.5 mm  |
| Stage 2 (M2)                            | Mobility is increased in any direction, other than axial, with movement >0.5 mm and up to 1.0 mm  |
| Stage 3 (M3)                            | Mobility is increased in any direction, other than axial, with movement >1.0 mm, or any axial movement  |
| <b>Additional findings</b>              |   |
| Any tooth abnormalities                 | Recorded using AVDC abbreviations (see box 'Dental terminology and anatomy')  |
| Radiographic findings                   | Abnormal radiographic findings should be recorded on the dental chart   |

\*Based on American Veterinary Dental College (AVDC) nomenclature ([avdc.org/avdc-nomenclature](http://avdc.org/avdc-nomenclature))

#### Chronic osteitis/alveolitis

Chronic osteitis/alveolitis is a form of chronic periodontitis with buccal bone expansion that is seen most often in older cats (Figure 9). The inflammatory process will frequently involve crown or root resorption and extrusion (super-eruption) of the tooth or multiple teeth.<sup>31</sup> The maxillary canine teeth are most commonly affected, with some mandibular canine involvement; often there is periodontal bone loss and even mobility. Extraction is frequently necessary.

**Figure 8** Early-onset gingivitis, characterized by marked gingival erythema and even proliferation. Image courtesy of Heidi Lobprise



**Figure 9** Buccal bone expansion of the maxillary canines (104 and 204) in an older cat with super-eruption of all canines. Image courtesy of Heidi Lobprise

### Developmental abnormalities

While oral and dental diseases often occur in adult patients, there are a variety of developmental abnormalities that may be diagnosed in young cats. These can be related to maxillo-facial development or to tooth development. In some cases, the abnormalities are observed as incidental findings, while for other feline patients they will cause significant clinical signs and pain.<sup>29</sup>

### Malocclusions

Malocclusions can either be developmental or acquired (eg, as a result of trauma or tumors). The focus of this discussion is developmental malocclusions, which should be treated when abnormal contact is causing trauma to soft tissue or to other teeth. See box 'Normal occlusion' for a description of the ideal dental alignment and Table 3 for a summary of how malocclusions can be divided into different classes based on whether they are primarily dental (only affecting teeth) or caused by

### Normal occlusion

Normal (or class 0) occlusion describes the dental alignment where the mandibular canine teeth are positioned between the maxillary third incisors and the maxillary canine teeth. These teeth fit together in a scissor-like formation (Figure 10).

The cusps of the mandibular incisors should be immediately palatal to the maxillary incisors, resting on the cingulum of the maxillary incisors when the cat's mouth is closed. The mandibular premolars sit lingually in relationship to the maxillary premolars. There should be no traumatic contact between the maxillary fourth premolars and the soft tissue adjacent to the mandibular first molars.

While malocclusion may be part of the breed standard for some cats (eg, brachycephalic breeds), these cats should still be evaluated carefully for trauma to soft tissue and teeth.



**Figure 10** Normal occlusion. The mandibular canine teeth (304 and 404) are positioned between the maxillary third incisors (103 and 203) and canines (104 and 204). Image courtesy of Heidi Lobprise

skeletal abnormalities (involving abnormal relationships between the maxillae and mandibles).

After careful evaluation of a malocclusion and consultation with the caregiver about their goals for the cat's health, treatments should be offered that prioritize creation of a functional and pain-free occlusion. In contrast to human dentistry, treatments that involve purely

**Table 3** Classification of feline malocclusions

| Class              | Origin   | Description   | Associated trauma  |
|--------------------|----------|---|--|
| Class 1<br>(MAL 1) | Dental   | Normal maxillomandibular relationship, with one or more teeth out of alignment                        | Linguoversion of the mandibular canines (ie, positioned too far towards the midline of the mandible), for example, may lead to trauma to the palate  |
| Class 2<br>(MAL 2) | Skeletal | Mandibular distocclusion (overbite)   | The most common location for trauma with this malocclusion is the palate, caused by the mandibular canine teeth  |
| Class 3<br>(MAL 3) | Skeletal | Mandibular mesiocclusion (underbite)  | If not severe, this malocclusion may cause attrition between the distal aspect of the maxillary third incisors and the mesial aspect of the mandibular canine teeth. If more severe, there may be trauma to the gingiva lingual to the mandibular incisors, caused by the maxillary incisors (Figure 11) |
| Class 4<br>(MAL 4) | Skeletal | Variations involve asymmetry in one of several directions: rostrocaudal, side-to-side or dorsoventral | A side-to-side malocclusion may result in traumatic contact between the maxillary fourth premolars and the gingiva and mucosa just buccal to the mandibular first molar (Figure 12)  |

Based on American Veterinary Dental College nomenclature ([avdc.org/avdc-nomenclature](http://avdc.org/avdc-nomenclature))



**Figure 11** MAL 3 on the right side of a mandibular mesiocclusion. This case was asymmetrical (the left side was not as severe). Image courtesy of Heidi Lobprise



**Figure 12** MAL 4 side-to-side malocclusion with damage to the mucosa buccal to the right mandibular first molar (409) caused by contact trauma from the right maxillary fourth premolar (108). Image courtesy of Heidi Lobprise

cosmetic changes should not be offered as an option for feline dental patients. In addition, most skeletal malocclusions should be considered as potentially familial or genetic in origin, so breeding counseling may be needed. It is important to note that when malocclusions are identified in the deciduous dentition, treatment options may need to be considered in both the deciduous and permanent dentitions.

### Abnormal dental anatomy

Variations in dental anatomy seen in cats include supernumerary teeth and roots, fused roots and hypodontia (absence of some teeth, leading to an incomplete permanent dentition). When evaluating abnormal dental anatomy, it is important to complete an anesthetized oral examination with radiographs to determine whether the abnormal teeth are vital and whether there are unerupted teeth. Supernumerary teeth that are not causing overcrowding can be maintained in the oral cavity.

### Maxillofacial clefts

Maxillofacial clefts are recognized in cats,<sup>32</sup> and are abnormalities that involve failure of the two developmental halves of the maxillofacial structures to fuse during fetal development. Complete clefts that create a communication between the oral and nasal cavities typically require surgical correction in order for the cat to avoid future clinical problems, such as aspiration of food, chronic rhinitis and the risk of aspiration pneumonia.

### Feline chronic gingivostomatitis

Stomatitis is classically defined as inflammation of the mucous membranes lining the mouth, a condition that causes pain and discomfort. FCGS is a more severe and persistent form of stomatitis. This painful oral disease is characterized by gingival inflammation extending into the mucosa, with erythema, ulceration and proliferation, and may involve the caudal oral cavity (Figure 13). (The terms fauces and faucitis were previously used but are less accurate.) Extension of inflammation into the esophagus has also been reported.<sup>33</sup> Cats with FCGS commonly have PD and tooth resorption,<sup>34</sup> although some cats will have no dental disease.

### Etiology and diagnostic criteria

The etiology of FCGS is likely multifactorial because the oral mucosa is constantly challenged by antigens derived from multiple sources, including food, grooming, and viral, bacterial and fungal microorganisms, as well as being impacted by the local and systemic immune system. Newer studies have evaluated the role of calicivirus,<sup>35</sup> the oral microbiome,<sup>24,36</sup> and immune and inflammatory genes and pathways.<sup>37</sup>

**Figure 13** Feline chronic gingivostomatitis, with involvement of the caudal oral cavity. Image courtesy of Heidi Lobprise

Generally, diagnosis of FCGS is based on its clinical manifestations rather than histopathology or other clinicopathological findings. Hyperglobulinemia is common and may be pronounced.<sup>34</sup> Recent routine testing for feline immunodeficiency virus and feline leukemia virus is an important part of a cat's evaluation prior to treatment because of the prognostic significance.

### Treatment

Therapy is based on a thorough anesthetized oral examination and full-mouth dental radiographic evaluation. In most cases, it may be better to manage this disease rather than expect to treat and resolve it.<sup>38</sup> Traditionally, antimicrobials and immunosuppressive drugs (eg, corticosteroids) have been used as first-line treatments, yielding some positive response. However, chronic steroid usage and indiscriminate use of antimicrobials is not recommended since it does not resolve the disease nor treat related pain (and also raises issues regarding antimicrobial stewardship [see 'Use of systemic antibiotics']).

Until we learn more about its etiology, surgical intervention is the most effective method for management of FCGS. Two approaches are recommended. One is partial caudal mouth extractions, including extraction of the premolar and molar teeth. The other is full-mouth extraction of all of the dentition. Both options require extraction of retained roots and alveoloplasty. Appropriate analgesic therapy before, during and after extractions is essential. For some general practitioners, these procedures may require referral to a Board-Certified Veterinary Dentist® (see Box 2).

The consensus of the Guidelines Task Force is that early intervention is preferred. Whether full or partial mouth extractions are performed depends on the extent of inflammation around the incisors and/or canines. In cases where there is no inflammation around these teeth, partial mouth extractions can be performed provided caregivers are committed to regular follow-up.



## Box 2

## The consensus of the Guidelines

Task Force is that early intervention is preferred in cases of feline chronic gingivostomatitis.



In one study of 95 cases, 39% of patients showed substantial clinical improvement postextraction and 28% experienced complete resolution of stomatitis.<sup>39</sup> In spite of this, many patients will require continued medical management. Use of a scoring system such as the Stomatitis Disease Activity Index (SDAI)<sup>40</sup> – based on erythema and ulceration and/or proliferation of the oral mucosal tissues – may assist in determining the response to therapy and help to frame discussions with the caregiver regarding a patient's prognosis (Table 4).

**Table 4** Stomatitis Disease Activity Index (SDAI) scoring criteria

| Erythema and proliferation score* | Caregiver evaluation        | Body weight change   |
|-----------------------------------|-----------------------------|----------------------|
| 0 = None                          | 0 = Significant improvement | >1 lb (0.45 kg) gain |
| 1 = Mild                          | 1 = Mild improvement        | <1 lb (0.45 kg) loss |
| 2 = Moderate                      | 2 = No improvement          | >1 lb (0.45 kg) loss |
| 3 = Severe                        | 3 = Worse                   |                      |

Based on Anderson<sup>40</sup>

\*Areas scored include the maxillary gingiva, maxillary buccal mucosa, mandibular gingiva, mandibular buccal mucosa, palatoglossal arch, sublingual tissue and molar flap

More information on the SDAI scoring system is available in the supplementary material

## When to refer a patient to a specialist

There are no specific rules specifying what types of cases should be referred to a specialist for advanced care, and under what conditions. That decision depends on the primary care provider's experience, skill level, equipment availability, and access to intra- and postoperative care. It is always helpful for clinicians to develop a relationship with referral practices. This will allow for good communication with a dental specialist and access to clinical guidance on cases. Information in the form of a case summary, including photographs and radiographs, can be extremely beneficial when consulting with a colleague about a case.

Common examples of cases that are referred for dental and oral procedures include:

- ❖ Patients with retained or displaced root tips, maxillofacial trauma or jaw fracture, or oral masses.

- ❖ Systemically unwell patients or those at high risk for anesthesia.
- ❖ Patients who are not responding to standard therapies.
- ❖ Patients requiring extensive extractions (eg, full-mouth extractions in cases of FCGS), root canal therapy or orthodontic treatment.
- ❖ Patients attending primary care practices where there is a lack of intraoral radiography or patients for which a challenging extraction is anticipated (eg, high risk of iatrogenic jaw fracture).

Ultimately, the partnership between primary veterinarian and referral specialist should be beneficial for all parties, especially the patient. Referral will not always be possible, however, because of limited caregiver resources or availability of a Board-Certified Veterinary Dentist<sup>®</sup>.

**The partnership between primary veterinarian and referral specialist should be beneficial for all parties, especially the patient.**

Cases are considered refractory when there is a lack of response to tooth extraction therapy at least 6 months after surgery.<sup>38</sup> Numerous therapeutic regimens have been suggested for cats who are refractory to partial or full-mouth extractions (Table 5).

**Table 5** Treatment regimens evaluated in cases of refractory feline chronic gingivostomatitis

| Regimen                             | Local treatment | Systemic treatment | Response  | Supporting evidence   |
|-------------------------------------|-----------------|--------------------|---|---|
| Corticosteroids (prednisolone)      |                 | ✓                  | 23% cure or marked improvement<br>7% clinical remission | Hennet et al <sup>41</sup>  |
| Ciclosporin                         |                 | ✓                  | 52.7% improvement in SDAI scores                        | Lommer <sup>42</sup>  |
| Recombinant feline interferon omega | ✓               | ✓                  | Variable, based on dose and route                       | Southerden and Gorre <sup>43</sup><br>Hennet et al <sup>41</sup><br>Matsumoto et al <sup>44</sup> |
| Stem cell therapy                   |                 | ✓                  | Up to 72% positive response rate                        | Arzi et al <sup>45</sup>  |
| CO <sub>2</sub> laser               | ✓               |                    | 100% (1/1 case)   | Lewis et al <sup>46</sup>   |
| 1-Tetradecanol complex              | ✓               |                    | Unknown   | Anecdotal   |
| Frunevetmab*                        |                 | ✓                  | Unknown   | Anecdotal   |
| Probiotics                          |                 | ✓                  | Unknown   | Anecdotal   |
| Hyaluronic acid periodontal gel     | ✓               |                    | Unknown   | Anecdotal   |

\*Represents off-label use. SDAI = Stomatitis Disease Activity Index

## Three types of tooth resorption are recognized.



### Classification of tooth resorption in cats

| Classification | Description   |
|----------------|---|
| Type 1         | Inflammatory tooth resorption that results in focal or multifocal loss of mineralized tooth structure, but otherwise normal radiopacity and an intact periodontal ligament space (Figure 14). This type of tooth resorption is commonly associated with periodontitis |
| Type 2         | Replacement resorption whereby dental hard tissues are replaced by bone. Radiographically, there is absence of a clear periodontal ligament space, and the remaining root structure looks more radiolucent and can develop a striated appearance (Figure 15)          |
| Type 3         | A combination of type 1 and type 2 radiographic features affecting the same tooth (Figure 16)   |

Based on Gorrel,<sup>18</sup> Ingham et al,<sup>49</sup> DuPont,<sup>50</sup> DuPont and DeBowes<sup>51</sup> and the American Veterinary Dental College (avdc.org/avdc-nomenclature)

### Classification of tooth resorption



**Figure 14** Type 1 tooth resorption affecting the left mandibular fourth premolar (308) and first molar (309). Image courtesy of Cornell University



**Figure 15** Type 2 tooth resorption affecting the left and right mandibular canines (304 and 404). Image courtesy of Cornell University



**Figure 16** Type 3 tooth resorption affecting the left mandibular first molar (309). Image courtesy of Cornell University

An open and honest discussion early on with the caregiver about the prognosis for cats with FCGS is essential. It is also important to emphasize the need for regular visits with the veterinarian following full or partial mouth extractions.

### Tooth resorption

Tooth resorption is a common, progressive and often painful condition, with a reported prevalence in cats ranging from 28.5% to 67%.<sup>12,16-18</sup> Abnormal activation of multinucleated odontoclasts results in resorption of mineralized tissues on the root surface that eventually extends coronally.<sup>47,48</sup> The three types of tooth resorption recognized are described in the box 'Classification of tooth resorption'.

Despite various hypotheses, the etiology of TR remains unclear.<sup>24,51-53</sup> Studies have shown an increase in prevalence with increasing age,<sup>47,54</sup> while findings regarding a specific breed predisposition have not been consistent.<sup>18,55</sup> Although any tooth may develop resorptive lesions, the mandibular premolar teeth are most commonly affected, making them useful teeth to focus on during routine examination.<sup>47</sup>



**Figure 17** While not appearing inflamed, gingival tissue is encroaching into the resorptive lesions of the crowns of the third premolar (407) and first mandibular molar (409). Image courtesy of Heidi Lobprise



**Figure 18** Late-stage tooth resorption. Note the complete gingival coverage of the left mandibular third premolar (307). Image courtesy of Cornell University

### Diagnosis

❖ **History** Signs of oral pain may include jaw chattering, changes in chewing behavior, avoidance of hard foods and facial rubbing, as well as changes in activity and play behavior. However, it is not unusual for no abnormalities to be noted by the caregiver in the home environment.

❖ **Visual inspection** On oral examination in the awake patient, it may be possible to see advanced tooth resorption that has extended into the crown. Findings often include inflamed granulation tissue or gingival enlargement that is engulfing the crown of the tooth (Figure 17). Late-stage tooth resorption may appear as a mound of intact gingiva covering the area where the tooth was once located (Figure 18).

❖ **Detailed examination under general anesthesia** Lesions that involve the cementoenamel junction subgingivally can be detected using a dental explorer (Figure 19; see box 'Equipment considerations for feline patients').



**Figure 19** Detection of a tooth resorptive lesion using a dental explorer. Image courtesy of Heidi Lobprise

❖ **Full-mouth intraoral radiography** This modality is essential for firstly identifying early lesions that affect only the root surface and, secondly, characterizing the type of tooth resorption.

### Treatment

The principal aim of treatment is the alleviation of pain. Unfortunately, no prevention for tooth resorption has been found and there is no method of stopping the progression of an already existing lesion. Intervention options are outlined below, and the treatment of advanced tooth resorption is described in Box 3.

❖ **Tooth extraction** For teeth affected by type 1 tooth resorption, extraction of the entire tooth (crown and roots) is indicated. Postoperative radiographs are obtained to confirm complete extraction.

❖ **Crown amputation** In cases of replacement resorption (ie, type 2 tooth resorption), removal of the crown (coronectomy) followed by apposition of the gingiva is ideal. Postoperative radiographs are recommended to determine intentional root retention.

❖ **Monitoring** This option is limited to early lesions affecting the root only, with no coronal extension and no signs of pain on exploration. Tooth resorption will progress over time; however, with careful clinical and radiographic monitoring, it may be possible to maintain the tooth for some time.

### Follow-up

Given the progressive nature of this condition, once a cat has been diagnosed with tooth

### Box 3 /

#### Treatment of advanced tooth resorption

Type 3 tooth resorption can be challenging to treat. In cases where a two-rooted tooth may have a type 1 root and a type 2 root, the decision is straightforward – extract the type 1 root and amputate the crown of the type 2 root. However, the challenge arises when a single-rooted tooth, like the canine, is affected by type 3 tooth resorption. In that case, all efforts should be made to extract as much of the tooth as possible, knowing that a more apical amputation may be necessary.



resorption, it is likely that more lesions will develop in currently unaffected teeth. Caregivers should be informed that radiographic re-checks are necessary, ideally on an annual basis.

### Oral and dental trauma

#### Tooth trauma

Tooth trauma leading to pulp exposure is the most common cause of endodontic disease in cats (Figure 20a). Endodontic disease is defined as inflammation and infection of the pulp complex within a tooth, resulting in pulp necrosis. Tooth fractures can be classified based on whether or not pulp exposure has occurred (Table 6),<sup>56</sup> and evaluation of the involvement of pulp is important when determining what treatment should be given.

**Tooth fractures can be classified based on whether or not pulp exposure has occurred.**

**Table 6** Types of tooth trauma and recommended treatment

| Fracture type                     | Description  | Recommended treatment  |
|-----------------------------------|--|--|
| <b>Complicated fractures</b>      |  |  |
| Complicated crown fracture        | A fracture through enamel and dentin, exposing the pulp cavity   | Root canal therapy or complete surgical extraction   |
| Complicated crown-root fracture   | A fracture through enamel and dentin that extends below the free gingival margin and involves the cementum and dentin on the root. This type of fracture (rare in cats) exposes the pulp cavity  | Surgical extraction  |
| <b>Uncomplicated fractures</b>    |  |  |
| Enamel fracture                   | Fracture of enamel only, with no dentin involvement. Rare in cats and must be distinguished from a tooth resorative lesion   | Thorough evaluation during an anesthetized oral examination, with intraoperative radiographs to rule out pulp necrosis. Thereafter, regular monitoring |
| Uncomplicated crown fracture      | Fracture through enamel and dentin that does not expose the pulp cavity. Rare in cats due to close proximity of the pulp cavity and enamel   | Thorough evaluation during an anesthetized oral examination, with intraoperative radiographs to rule out pulp necrosis. Thereafter, regular monitoring |
| Uncomplicated crown-root fracture | Fracture through enamel and dentin that extends below the free gingival margin and involves the cementum and dentin on the root. This type of fracture does not involve exposure of the pulp cavity. Rare in cats due to close proximity of the pulp cavity and enamel | Surgical extraction. These teeth are highly predisposed to developing periodontitis  |

Based on information from the American Veterinary Dental College (avdc.org/avdc-nomenclature)



**Figure 20** (a) Complicated crown fracture with dental explorer inserted into exposed pulp in the left maxillary canine (204). (b) Radiographic examination revealed signs of root resorption in the affected tooth. Extraction is indicated in such cases. Images courtesy of Heidi Lobprise



Diagnosis is based on examination of tooth structures combined with radiographic findings consistent with endodontic disease, including periapical lucency, inflammatory root resorption (Figure 20b), failure of the pulp cavity to narrow with age and condensing osteitis adjacent to the apex.<sup>57</sup>

Treatments for endodontic disease include surgical extraction or root canal therapy if there is no resorption present. Complicated fractures involving the pulp cavity require treatment even if the cat is not showing overt signs of pain. Uncomplicated fractures may still result in pulp necrosis and must be evaluated prior to recommending a monitoring approach to the tooth in the oral cavity.

#### Tooth luxation/avulsion

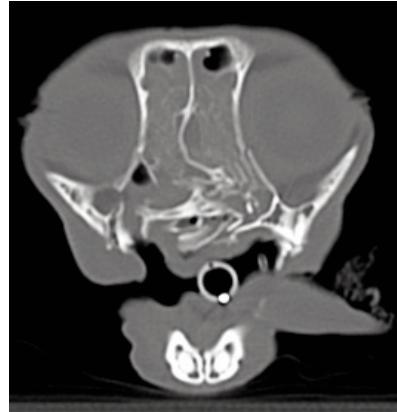
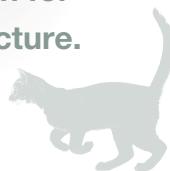
Tooth luxation is the displacement of a tooth from its alveolus, while avulsion is the complete removal of a tooth from its alveolus; in both cases there is damage to the structures of the periodontium. While sometimes due to external trauma, luxation or avulsion can also be a sequela of advanced PD or neoplasia. In rare cases of luxation, tooth repositioning can be considered. More commonly, diagnostic radiography is needed to evaluate the cause and extent of the injury, followed by extraction with closure of the site.

#### Maxillofacial trauma

Maxillofacial trauma can result in soft tissue injuries, fractures, symphyseal separation or temporomandibular joint luxation.<sup>58,59</sup> Cats have a fibrocartilaginous joint at their mandibular symphysis, which may have a degree of laxity normally. If there is no soft tissue involvement with mild symphyseal laxity, no treatment is necessary.

Due to the complexity of feline maxillofacial anatomy, intraoral radiography can only provide good imaging of the dentate portion of

The involvement of pulp is an important determinant of the treatment approach for tooth fracture.



**Figure 21** Conventional CT image of a cat with extensive trauma to the craniofacial region, including the maxillary, palatine, pterygoid and nasal bones. Image courtesy of the Department of Dentistry and Oral Surgery, Colorado State University

the jaw. Skull radiographs are limited in their diagnostic relevance because of superimposition of osseous structures. Depending on the nature of the traumatic injury, multiple fractures may be missed. In the absence of referral to a specialist, a combination of intraoral and skull radiography may allow for conservative management of maxillofacial trauma. Three-dimensional imaging such as CT or cone beam CT is much more ideal for evaluating complex maxillofacial trauma involving the caudal maxilla, mandible and temporomandibular joint (Figure 21). In such cases, a referral specialist may facilitate advanced maxillofacial repair.

#### Oral masses and growths

Caregivers should be encouraged to report any observations suggestive of a growth in their cat's mouth, which should trigger prompt assessment by a veterinarian. Assessment may start with a conscious oral examination, but will likely involve diagnostic imaging and biopsy to better define and diagnose the lesion. Thorough oral examination at every visit may reveal preclinical lesions. Clinical signs will vary depending on the type of mass and its location. Most overt clinical signs are associated with advanced disease and can include changes in chewing behavior, decreased appetite, reduced grooming, halitosis, oral bleeding, ptyalism, facial deformity and muscle wasting.

It is important that veterinarians initially consider the differential diagnoses for oral masses broadly (neoplastic vs non-neoplastic), and narrow their list based on signalment, history, clinical signs, lesion location and

**Table 7** Types of oral masses in the cat

| Neoplastic status and lesion type | Examples of lesions   |
|-----------------------------------|---|
| <b>Neoplastic masses</b>          |   |
| Non-odontogenic neoplasms         | <i>Malignant:</i> squamous cell carcinoma (Figure 22, Box 4), fibrosarcoma, melanoma, lymphoma, osteosarcoma, mast cell tumor, hemangiosarcoma<br><i>Benign:</i> plasmacytoma, osteoma, sarcoid |
| Odontogenic neoplasms             | Amyloid-producing odontogenic tumor, feline inductive odontogenic tumor (Figure 23), peripheral odontogenic fibroma, odontoma   |
| <b>Non-neoplastic masses</b>      |   |
| Developmental                     | Dentigerous cyst  |
| Inflammatory                      | Eosinophilic granuloma (Figure 24), pyogenic granuloma (Figure 25), radicular cyst  |
| Infectious                        | Odontogenic infection (tooth root abscess), feline calicivirus infection, papillomavirus infection  |
| Drug-induced                      | Ciclosporin-induced gingival enlargement, bisphosphonate-related osteonecrosis of the jaw (see 'Medication-related osteonecrosis of the jaw')   |
| Miscellaneous                     | Sialocele (eg, ranula formation), trauma (acute hematoma vs chronic periosteal reaction or thickening)  |

Based on Mikiewicz et al,<sup>60</sup> Gieger and McEntee,<sup>61</sup> Fiani et al,<sup>62</sup> Bell and Soukup,<sup>63</sup> Fiani et al,<sup>64</sup> Roy et al,<sup>65</sup> Verstraete and Chamberlain,<sup>66</sup> Greenwood et al,<sup>67</sup> Egberink et al,<sup>68</sup> Latimer et al,<sup>69</sup> Omelchenko et al,<sup>70</sup> Hatunen et al<sup>71</sup> and Popov<sup>72</sup>

#### Box 4

#### Oral carcinomas in cats

As many as 68% of oral lesions in cats have been reported as being malignant, with squamous cell carcinoma the most common tumor type by far.<sup>60,73</sup> Due to the aggressive nature of oral carcinoma and its association with a relatively short survival time, early diagnosis is critical.<sup>74,75</sup> Veterinarians should be diligent during their oral examination and encourage biopsy of any suspicious lesion. A good example of an easily overlooked lesion is focal periodontitis. If a single region in the dentate jaw is affected by gingivitis and attachment loss, neoplasia should be given serious consideration as being the underlying cause.

appearance.<sup>60</sup> Table 7 outlines a systematic approach to evaluating oral masses in the cat according to neoplastic status. Detailed discussion of each differential diagnosis is beyond the scope of these Guidelines, but is accessible in the literature cited.

#### Diagnostics

❖ **Detailed oral examination** Although some masses may be visible during oral evaluation of an awake patient, many cats do not tolerate a prolonged examination. Thorough assessment under sedation or general anesthesia is typically necessary to allow for better visualization of oral masses.

❖ **Diagnostic imaging** Whenever a mass is involving the maxillae or mandibles, radiographic imaging is indicated. CT is considered the gold standard for imaging the oral and maxillofacial region, especially when neoplasia is suspected.<sup>76</sup> However, that modality is not

**Thorough assessment under sedation or general anesthesia is typically necessary to allow for better visualization of oral masses.**



**Figure 22** Gingival squamous cell carcinoma. Image courtesy of Cornell University



**Figure 23** Feline inductive odontogenic tumor in the right maxilla. Image courtesy of Cornell University



**Figure 24** Eosinophilic granuloma. Image courtesy of Cornell University



**Figure 25** Pyogenic granuloma at the site of an extracted mandibular first molar (408) due to contact trauma from the right maxillary fourth premolar (108). Image courtesy of Heidi Lopprise

always readily available. Initial intraoral radiography will give the practitioner a good idea of the size, extent and behavior of the lesion, and involvement of the jaw. Due to the complexity of the cat's head, skull radiographs are of limited use.<sup>77</sup>

❖ **Biopsy and histopathology** Obtaining a representative tissue sample via incisional biopsy is aided by familiarity with the regional anatomy; other important factors are location on the mass where samples are obtained and use of appropriate instrumentation, as well as sample depth and size.<sup>77</sup> An intralesional incisional biopsy is recommended whenever possible. This adheres to the oncological principle of keeping the margins of a mass intact if there is an index of suspicion for a neoplastic process. The goals of this approach are to prevent seeding or enlargement of the tumor and to allow for accurate margin calculation if further surgery is indicated.<sup>78</sup>



**Figure 26** Cat with bullous pemphigoid lesions on the (a) tongue and (b) ear.  
Images courtesy of the Department of Dentistry and Oral Surgery, Colorado State University



Although fine-needle aspiration and cytology of oral masses has been reported as being an appropriate diagnostic method,<sup>79</sup> it is not always definitive and histopathology will often still be necessary.

#### Miscellaneous conditions

**Medication-related osteonecrosis of the jaw**  
Cats treated with a bisphosphonate or anti-resorptive drug for idiopathic hypercalcemia can be at risk for medication-related osteonecrosis of the jaw.<sup>71</sup> If possible, any dental surgery should be performed prior to the use of bisphosphonates. Oral discomfort and swelling, with a draining tract or abscess at a focal, non-healing extraction site, is the most common presentation.<sup>71</sup> Aggressive debridement and appropriate antibiotic use are indicated, and revision surgeries are often required.

#### Patellar fracture and dental anomaly syndrome

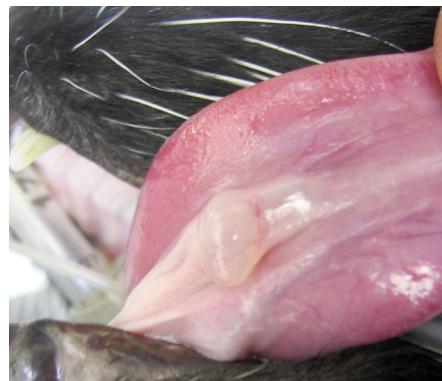
Patellar fracture and dental anomaly syndrome is characterized by atraumatic (patellar) bone fractures, persistent deciduous teeth and impacted permanent teeth in young cats.<sup>80</sup> Jaw swelling, osteomyelitis and necrotic bone may also be present.<sup>81</sup> Given the severity of osteomyelitis, early and aggressive surgical intervention is warranted. Extraction of persistent deciduous teeth and impacted permanent teeth, along with debridement of affected bone, is typically necessary for optimal results.<sup>82</sup>

#### Autoimmune oral diseases

Autoimmune blistering skin diseases can have oral manifestations (Figure 26).<sup>83</sup> In cases of mucous membrane pemphigoid, the oral cavity (gingiva, soft and hard palate) is the most common site for lesions.<sup>83</sup> Fragile vesicles and bullae that progress to ulceration and deep erosion can also be seen in pemphigus foliaceus and, rarely, pemphigus vulgaris.<sup>84</sup> The vesicles and ulceration should be differentiated from calicivirus lesions. While there

have been historical reports of drug-induced pemphigus foliaceus, underlying triggers in pemphigus foliaceus and autoantibody targets in pemphigus vulgaris have not been identified.<sup>84</sup> Vasculitis from reactions to drugs, vaccines, trauma or infections may cause deep erosions and ulcers with scarring.

Perilesional biopsy (lesion bordered with normal tissue) should be performed for any suspicious lesion, unless a full vesicle can be obtained. Treatment usually follows the general principles of immunosuppressive therapy.



**Figure 27** Sublingual sialocele. Image courtesy of Heidi Lobprise

#### Sialocele

Sialocele, the submucosal or subcutaneous collection of saliva, is uncommon in cats.<sup>85</sup> When present, clinical signs include dysphagia, ptyalism and swelling of the neck.<sup>86</sup> The sublingual (Figure 27) and cervical regions are most commonly affected (ie, involving the mandibular and sublingual glands and their ducts). Typically, the cause is unknown. Surgical removal of the affected gland(s) is recommended, as marsupialization or drainage alone often leads to recurrence.

#### Feline orofacial pain syndrome

Feline orofacial pain syndrome (FOPS), likely a neuropathic disorder impacting the trigeminal nerve, presents with signs of oral and facial discomfort (licking, chewing, tongue mutilation, pawing at the face).<sup>87</sup> Disease episodes, which are usually unilateral, seem to be triggered by stimuli such as erupting teeth, PD, tooth resorption and stress, and these need to be addressed. Typical pain management regimens are insufficient to provide relief, although anticonvulsant medication can be helpful. Most commonly seen in Burmese cats, FOPS is considered to be a heritable disease.

## Patient assessment, evaluation and documentation

### History and physical examination

Whenever possible, it can be helpful to have caregivers fill out a patient history form in advance of the visit. This may include information on lifestyle, nutrition, dental history, current home care and medications, and behaviors observed at home. Receiving this information in advance of an appointment can help alert the practitioner to areas of concern.

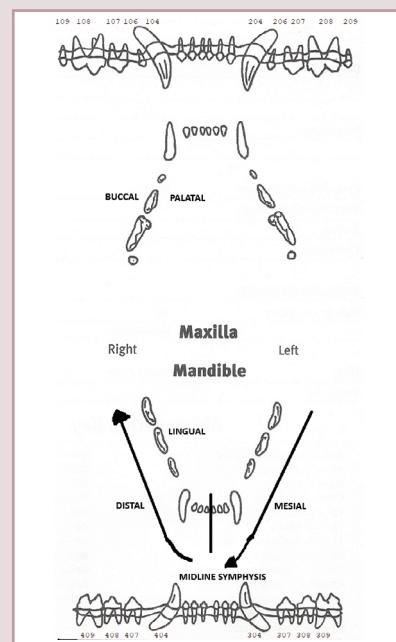
Any comprehensive oral evaluation must start with a non-anesthetized patient and include a preoperative medical history and complete physical examination.<sup>88</sup> This will allow the veterinarian to identify conditions that might impact the ability to safely anesthetize a patient, and can help determine whether the patient is experiencing pain and might benefit from analgesia before the anesthetized procedure. It can also give clues to oral and dental diseases that may be affecting the cat's overall health. For example, unilateral nasal discharge can be a sign of endodontic disease. A poor haircoat might be associated with decreased grooming, which can point to

oral pain. Other information collected in the medical history that might indicate oral disease include facial rubbing, ptalism, decreased appetite, food avoidance or changes in food texture preferences. Subtle behavioral changes can also be significant in cats. Use of open-ended questions about the cat's behavior will help to identify non-specific signs of pain including decreased activity or decreased sociability with caregivers or other animals in the home.

Careful auscultation of the heart and lungs, palpation of the abdomen, and evaluation of trends in the patient's body weight, body condition score and lean muscle mass are all important screening tools for a patient who will be considered for an anesthetized procedure. Certain cases may require additional pre-anesthetic screening. Blood pressure testing should be included for patients over 9 years of age and those with evidence of target organ damage (hypertensive retinopathy, cardiac changes, behavioral changes related to cognitive and neurological function, evidence of kidney disease).<sup>89,90</sup> Completion of blood pressure assessment early in the evaluation process is consistent with cat friendly principles.<sup>2</sup>

## Dental terminology and anatomy

To document accurate information in patient dental records, it is important to use correct maxillofacial and dental terminology (Figure 28).<sup>91,92</sup> Likewise, when completing a dental chart (see example in the supplementary material) it can be helpful to use established systems of abbreviations. The table lists commonly used standardized abbreviations provided by the AVDC. Correct use of dental terminology and abbreviations is an important communication tool, providing consistency and clarity both within the veterinary practice and during patient referral.



**Figure 28** Directional terminology of the maxilla and mandible. Image courtesy of Heidi Lobprise

### Commonly used abbreviations for recording oral and dental disease in cats

|      |   |
|------|---|
| ABE  | Alveolar bone expansion                         |
| ATE  | Abnormal tooth extrusion (super-eruption)       |
| CU   | Contact mucositis or contact mucosal ulceration |
| DT   | Deciduous tooth                                 |
| DT/P | Persistent deciduous tooth                      |
| EOG  | Eosinophilic granuloma                          |
| FX   | Fracture (tooth or jaw)                         |
| GE   | Gingival enlargement                            |
| OM   | Oral/maxillofacial mass                         |
| ONF  | Oronasal fistula                                |
| PD   | Periodontal disease                             |
| TMJ  | Temporomandibular joint                         |
| TR   | Tooth resorption                                |
| U*   | Ulcer (not contact ulcer)                       |
| X    | Closed extraction of a tooth                    |
| XSS  | Open or surgical extraction of a tooth          |

From the American Veterinary Dental College (AVDC)<sup>93</sup>

\*Not included in the AVDC list

**Correct use of dental terminology and abbreviations provides consistency and clarity both within the veterinary practice and during patient referral.**



### Awake oral and dental examination

A thorough, non-anesthetized oral examination in cats who will allow it, or sedated examination in cats who will not, is a critical part of preparing the patient and caregiver for a future dental procedure. It will also allow the veterinarian to schedule the procedure appropriately, factoring in enough perioperative time for complicated cases. Additionally, this is an excellent time to evaluate the patient's emotions and related behaviors and to make determinations about treatment and management of transportation, hospitalization-related stress and the need for any previsit medication. In some cats, procedural sedation and analgesia can be very effective for allowing an oral examination (see 'Anesthesia and analgesia').<sup>94</sup> The preliminary awake-patient examination should incorporate cat friendly techniques to minimize fear-anxiety and pain associated with interactions and handling, and in order for the examination to be completed efficiently.<sup>4</sup>

Findings of the examination help guide communication with caregivers about what to expect during an anesthetized dental procedure.<sup>95</sup> Many caregivers have concerns about the possibility of tooth extraction and the risks associated with anesthesia. Good veterinarian-caregiver communication can make this a less stressful experience for them. The awake-patient examination also allows the veterinary professional to provide the caregiver with a more accurate fee estimate so that surprises on the day of the procedure are kept to a minimum.

The non-anesthetized oral examination can be broken down into four steps – extraoral examination, examination of occlusion, examination of oral soft tissues and examination of tooth structures. Each of these steps can take just a few moments and can deliver a wealth of information (see Video 3 in the supplementary material).

❖ **Extraoral examination** Even in a patient who will not allow a conscious intraoral examination, the extraoral examination can still provide a helpful evaluation of facial symmetry. Unilateral or bilateral maxillary or mandibular swelling, nasal and ocular discharge, and facial lesions may be observed in a patient with oral disease.

❖ **Examination of occlusion** Occlusion should be evaluated not just as part of the non-anesthetized oral examination, but at every visit. While developmental malocclusions may be present in young cats (see 'Developmental abnormalities'), acquired forms of malocclusion can be associated with trauma, PD or oral tumors.

❖ **Examination of oral soft tissues** The gingiva, mucosa, palatal structures and tongue are important reservoirs of oral disease. As part of the evaluation of these structures,

any deviation from normal anatomical shape, color and size, as well as any asymmetry, should be noted.

❖ **Examination of tooth structures** Calculus deposition is only one of the factors that must be assessed in this final portion of the non-anesthetized oral examination. Other parameters that should be evaluated are tooth shape and size, and the number of teeth. It is important to remember that there is very little variability in the shape of teeth between cats. Changes in tooth shape and size often relate to tooth resorption but can also be associated with developmental abnormalities or tooth trauma. Where missing teeth are identified, possibilities include tooth loss, previous extractions, embedded teeth, hypodontia or end-stage tooth resorption. Supernumerary teeth, while rare, may need to be extracted depending on whether they are causing overcrowding.

### Oral and dental examination under anesthesia

Preparation for anesthesia includes a comprehensive physical examination and interpretation of appropriate clinicopathological tests, followed by assignment of an American Society of Anesthesiologists (ASA) physical status classification (Table 8).<sup>96</sup> Assessment of preanesthetic health can be challenging in cats because they often hide disease. Clinicopathological tests that should be considered in assignment of ASA status include, as a minimum, blood urea nitrogen,

**Table 8** ASA physical status classification system modified for cats

| Physical status | Definition   | Description and examples  |
|-----------------|--|---|
| I               | Healthy patient  | Patient with no systemic disease  |
| II              | Patient with mild systemic disease                                     | Patient has been diagnosed with a disease process that is stable and well controlled<br><i>Examples:</i> obesity, hypertension, well-controlled diabetes, well-controlled hyperthyroidism   |
| III             | Patient with severe systemic disease                                   | Patient has been diagnosed with systemic disease that is associated with clinical signs<br><i>Examples:</i> renal insufficiency (greater than IRIS stage 2), feline asthma, hyperthyroidism prior to control, hypertension prior to control |
| IV              | Patient with severe systemic disease that is a constant threat to life | Patient has been diagnosed with a severe systemic disease and is regularly clinically affected<br><i>Examples:</i> severe feline asthma or lung disease, diabetic ketoacidosis, hemorrhagic shock   |
| V               | Patient is not expected to survive without immediate surgery           | Patient has been diagnosed with severe disease or trauma that cannot be managed prior to life-saving, immediate surgery<br><i>Examples:</i> severe head trauma, uncontrolled cavity hemorrhage  |

Based on Brodbelt et al<sup>96</sup>

ASA = American Society of Anesthesiologists; IRIS = International Renal Interest Society

creatinine, hematocrit, total protein, alanine transferase and alkaline phosphatase values. In most cats, a more complete pre-surgical screening is appropriate, with test selection being patient dependent. Testing may include N-terminal pro B-type natriuretic peptide, thyroid panel, urinalysis, complete blood count and additional blood chemistry tests (eg, blood glucose, symmetric dimethylarginine and electrolytes). Additional screening tests may be deemed necessary based on increasing ASA status, including thoracic radiographs, electrocardiography and pre-operative blood pressure measurement.

The majority of dentistry patients will be in the I, II and III ASA classifications. A cat's age is a risk factor independent of ASA status, especially for cats over 12 years of age.<sup>97</sup> However, in one study looking at 138 cats undergoing more than 30 mins of general anesthesia, veterinary ASA status (as derived from the human literature), but not age, was considered a risk factor for the development of perianesthetic complications.<sup>98</sup> In a recent large prospective study, the rate of anesthesia-related deaths was only 0.63% in cats; however, nearly 75% of mortalities occurred in the postoperative period, highlighting the need for careful postoperative monitoring.<sup>99</sup>

After a cat has been determined to be an appropriate candidate for anesthesia and the caregiver has been prepared for the

**It is important to develop a system for the anesthetized oral examination procedure that can be performed in a similar way by everyone in the practice. This avoids missed steps.**



procedure, with an understanding of the cost, the team can proceed. When implementing a plan for anesthetic procedures, it is important to develop a system that can be performed in a similar way by everyone in the practice. This approach avoids missed steps in the anesthesia and examination protocol. The findings of the awake and anesthetized oral examination must be evaluated in relation to the patient's radiographic findings. In other words, both the awake and anesthetized physical examination findings and the radiographic results should be considered together to develop an appropriate treatment plan for the patient.

A comprehensive anesthetized oral examination allows the veterinarian to evaluate structures that would not be visible in an awake patient. These include the tonsils, soft palate and sublingual region. All findings should be recorded on a dental chart (see supplementary material for an example). This oral examination is important for numerous reasons, including as a screening tool for oral cancer. Any abnormalities identified should be photographed and a determination made about whether an oral biopsy should be obtained. Before-and-after photographs of the oral cavity are recommended for documentation/tracking of disease progression and response to therapy, and for caregiver education.

Following examination of the oral cavity, the teeth should be evaluated one at a time,

## Equipment considerations for feline patients

### Periodontal equipment

❖ **Periodontal probe** This instrument has either a flat or round tapered end and lines or grooves that correspond with millimeter measurements (Figure 29). The probe is used to determine if there is abnormal pocket depth in the sulcus around the base of the tooth (taking care not to drag the instrument, to avoid damaging the sensitive sulcus epithelium) and also used to measure gingival recession. It may additionally be used to measure the size of other oral pathology such as inflammatory lesions and oral masses.



**Figure 29** Two periodontal probes with lines marked for measuring in millimeters. Probes differ in terms of their measurement markings, so it is important to know what the specific instrument measures. Image courtesy of Heidi Lobprise

❖ **Dental explorer** This is an important tool for evaluating the presence of tooth resorptive lesions (it is essential for detection of supragingival tooth resorption) and tooth fractures. Both dual-ended explorer-probes and stand-alone instruments are available. The dental explorer is sharp (see Figures 19 and 20a) and should only be used in contact with the surface of the tooth, to avoid damaging soft tissue.

### Equipment care and maintenance

Hand instruments should be inspected regularly for damage and sharpened frequently (ideally after each procedure so they are ready for later use). Manufacturers' instructions should be followed closely when caring for the dental unit and power instruments. Sterilization of all periodontal and extraction equipment after each use is an important step in preventing transmission of disease between patients.

❖ **Tartar-removing forceps** Use of extraction forceps, rongeurs or so-called 'tartar-removing' forceps to detach large pieces of calculus is strongly discouraged as they can result in painful tooth fissures and fractures.

❖ **Ultrasonic scaler** Ultrasonic scaler tips vary in length and size. Practices should invest in scalers that are narrow enough to fit comfortably below the gingival margin in cats. The tip of the scaler should be regularly checked against a wear guide provided by the manufacturer to ensure that the instrument is still functioning optimally (see inset box for further advice on equipment care and maintenance).

❖ **Hand curette** This instrument is essential to clean the tooth surfaces in any periodontal pocket region.

**(Continued on next page)**

(continued from previous page)

### Extraction equipment

❖ **Dental handpiece** The oral cavity of cats is small and visibility can be challenging. It is helpful to use a high-speed handpiece with a small head and built-in LED light.

❖ **Dental burs** Extraction kits contain a variety of sizes and lengths (standard and surgical) of both round and tapered dental burs (Figure 30). Access to a selection of burs gives the operator options when extracting teeth of varying sizes and when attempting to extract retained root tips. Burs should be replaced after each use since they become blunt quickly, which can lead to inefficiency and thermal injury to bone tissue.

#### ❖ **Periosteal elevators**

Feline gingiva and mucosa are thin and fragile tissues.

The use of small, round, sharp periosteal elevators designed for oral surgery



**Figure 30** Examples of standard and surgical length carbide dental burs.  
Image courtesy of Cornell University

can help reduce tearing and trauma.

❖ **Dental elevators and luxators** Good quality elevators or luxators that are appropriately sized for feline patients (1–3 mm) and regularly sharpened (including intraoperatively) can help reduce extraction trauma and avoid common complications such as slipping and laceration.

#### ❖ **Root tip picks, elevators and forceps**

Feline teeth are fragile, especially those undergoing resorption. Practical additions to extraction kits are root tip picks, elevators and forceps, ensuring that they are readily available during any extraction procedure (Figure 31).



**Figure 31** (a) Root tip pick and (b) root tip forceps. Images courtesy of Cornell University

with findings recorded on the dental chart. Parameters that should be recorded for each tooth include the level of gingivitis, gingival recession, probing depth, mobility, furcation exposure and the presence of pathology, using the indices described in Table 2. This charting is performed with the aid of a probe and dental explorer, which may be stand-alone instruments or combined as a dual-ended explorer-probe (see box 'Equipment considerations for feline patients').

**Both the awake and anesthetized physical examination findings and the radiographic results should be considered together to develop an appropriate treatment plan for the patient.**



### Box 5 /

#### Evolving role of the veterinary technician

Under the supervision of the veterinarian, credentialed veterinary technicians and nurses play an important role in the care of the dental surgery patient. This may variously involve anesthetic induction and monitoring, performing the initial oral and dental examination under anesthesia, dental charting, supra- and subgingival calculus removal, polishing of tooth surfaces, obtaining full-mouth diagnostic radiographs, performing regional nerve blocks as prescribed by the veterinarian, and taking care of instrument and equipment maintenance. Credentialed veterinary technicians also play an essential role in caregiver education and as a point of contact for the caregiver. As advocates for the patient, technicians are integral in providing a consistent message about the importance of regular oral home care and helping caregivers overcome barriers to treatment.

Veterinary technician specialists in dentistry have undergone the highest level of training and mastered advanced-level skills in dentistry. Undoubtedly an asset to any veterinary practice, they provide technical support to the veterinarian as well as training for others. The ultimate responsibility for obtaining and interpreting diagnostics and for planning treatment, however, remains with the veterinarian.

To make the anesthetized oral examination as efficient as possible, it is ideal to perform 'four-handed dentistry'. One person (two hands) performs the oral examination utilizing the probe and explorer, while a second individual (two additional hands) records the information on the dental chart.<sup>100</sup> Both individuals must be appropriately trained to avoid missing pathology or confusing tooth names and numbers. If a veterinary technician or nurse is performing the oral examination (Box 5), then a veterinarian must confirm the findings and interpret the dental radiographs prior to planning treatment.

Radiography has been discussed throughout the Guidelines, as it pertains to the evaluation of oral and dental disease, as well as therapy assessment. Appropriate care for a patient requires, at a minimum, complete intraoral radiography.

All abnormal findings from the anesthetized oral examination must be recorded, particularly if an extraction is considered necessary. The completed dental chart is an important communication tool between veterinary professionals and should document all procedures performed (see box 'Dental terminology and anatomy').<sup>101</sup>

## Anesthesia and analgesia

Acknowledgement that oral and dental diseases, including assessment and treatment, can be painful is a strong rationale for analgesia. While good perioperative analgesia is critical, it is also important to provide the patient with pain management once disease is identified during the awake oral and dental examination, and until the procedure can be performed. The FelineVMA and the Guidelines Task Force oppose anesthesia-free dentistry and endorse previously published position statements concerning anesthesia-free dental treatments.<sup>7,102</sup>

This section covers some of the key principles of anesthesia and analgesia in the context of feline dentistry and oral care. For further guidance, the reader is referred to the following resources:

- ❖ AAFP feline anesthesia guidelines.<sup>103</sup>
- ❖ 2020 AAHA anesthesia and monitoring guidelines for dogs and cats.<sup>104</sup>
- ❖ 2022 AAFP/ISFM cat friendly veterinary interaction guidelines: approach and handling techniques.<sup>4</sup>
- ❖ 2022 AAHA pain management guidelines for dogs and cats.<sup>105</sup>
- ❖ The American College of Veterinary Anesthesia and Analgesia small animal anesthesia and sedation monitoring guidelines.<sup>106</sup>

### The FelineVMA and the Guidelines Task Force oppose anesthesia-free dentistry.

#### Box 6 /

##### Recommendations regarding chronic medications prior to anesthesia

The following list is not all-encompassing but focuses on medications that it is strongly recommended are either continued or ceased prior to anesthesia.

###### Continue the following medications as scheduled:

- ❖ Thyroid medications (thyroid supplement or methimazole)
- ❖ Behavioral and analgesic medications – sudden withdrawal of these medications is not advised
- ❖ Oral anxiolytics to minimize fear-anxiety
- ❖ Cardiac medications (eg, pimobendan, furosemide)
- ❖ Antibiotics
- ❖ Steroids – sudden withdrawal of these medications is not advised
- ❖ Amlodipine<sup>107</sup> – other hypertensive medications should be discontinued (see below)

###### Discontinue the following medications on or before the day of anesthesia:

- ❖ Antihypertensive medications – angiotensin-converting enzyme inhibitors (eg, enalapril, benazepril) and angiotensin II receptor blockers (eg, telmisartan) should be discontinued at least 24 h prior to general anesthesia. Amlodipine is an exception (see above) and should not be discontinued prior to anesthesia<sup>107</sup>
- ❖ Anticoagulants – these medications may need to be discontinued 2 weeks prior to anesthesia, depending on the patient's risk of bleeding

###### Administer based on specific recommendations to the caregiver:

- ❖ Insulin – a full dose should not be administered to fasted patients because of the risk of hypoglycemia. The following recommendations have been made:<sup>103</sup>
  - If blood glucose is <8 mmol/l (<145 mg/dl), no insulin is required
  - At 8–15 mmol/l (145–270 mg/dl), half the cat's regular dose of insulin is given
  - At >15 mmol/l (>270 mg/dl), the full dose of insulin is administered

## Presurgical considerations

During the awake examination, a comprehensive physical assessment is just as important as a detailed oral examination in determining a full list of concerns and for recommending clinical pathology testing.

Prior to the procedure itself, guidelines for recognition and management of protective emotions should be followed,<sup>4</sup> as a cat's fear-anxiety can increase their perception of pain (see 'Awake oral and dental examination'). An ASA classification should be assigned (see Table 8) and any comorbidities identified, such as endocrine, renal or cardiac conditions. Some patients may require additional stabilization of their condition prior to anesthesia.

All medications and supplements administered to the patient should be reviewed. Drugs that impact blood pressure, heart rate and cardiac or respiratory function should be evaluated for administration (or cessation) prior to the procedure and anesthetic event (Box 6). If it has been determined that previsit pharmaceuticals are warranted, such as anxiolytics (eg, gabapentin, pregabalin), antinausea agents or antacids, they should be given according to the manufacturer's instructions and the findings of any related peer-reviewed studies. Antinausea drugs may be more effective if administered the night before the procedure. Food should be withheld for 4–6 h in healthy patients, 2–4 h in diabetic patients and 6–12 h in those patients at risk for regurgitation.<sup>108</sup> Water should not be withheld.



All medications and supplements administered to the patient should be reviewed prior to anesthesia.



While one study has shown that gabapentin may decrease systolic blood pressure in healthy cats as well as those with chronic kidney disease, this is likely more important in the context of monitoring or treating feline hypertension, and less relevant to blood pressure under anesthesia.<sup>108</sup> Given the benefits of decreasing stress levels and potential hypertensive responses to procedural stimuli, gabapentin should still be considered for use in order to alleviate fear-anxiety and increase compliance.<sup>4</sup>

### Anesthetic considerations

Preoperative medication should include analgesia and sedation appropriate to the patient's ASA status, pain levels and comorbidities.<sup>103</sup> Induction followed by inhalant anesthesia or total intravenous anesthesia with oxygen support requires intubation and protection of the airway. Airway-related complications include tracheal tears<sup>109</sup> and an increased risk of high airway pressure damage due to the small lung capacity of cats.<sup>97</sup> Use of anesthetic checklists can help coordinate the team's efforts.

Placement of an intravenous catheter and administration of intravenous fluids is critical in general anesthesia. Given their relatively low blood volume (50–60 ml/kg), most cats require a fluid rate of 3 ml/kg/h.<sup>110</sup> For patients with renal compromise (International Renal Interest Society stage 3 or higher), at least 4 h of preoperative fluid therapy, at a rate of 3–5 ml/kg/h while monitoring for evidence of fluid overload, is recommended.<sup>111,112</sup>

Dental procedure times can vary dramatically in length and may be unpredictable due to the severity and extent of disease.

**Preoperative and intraoperative analgesia**  
In addition to any analgesia provided during the preanesthetic period, other techniques such as local and regional blocks, and constant rate infusions (CRIs) can be employed for the dental surgery patient.

### Local and regional blocks

Local and regional blocks are critical multimodal pain management techniques that are used to enhance perioperative patient comfort, help improve anesthesia stability and safety, and ease the transition to postoperative pain management.<sup>7</sup> Local anesthetic choice is dependent upon availability and surgeon preference.

There are several different approaches to block various regions of the mouth. Some commonly used regional blocks include inferior alveolar nerve blocks (eg, mandibular block; Figure 32), infraorbital nerve block (Figure 33), caudal maxillary nerve block (Figure 34) and mental nerve block. When regional blocks are not possible, another option may be to infiltrate local anesthetic in the mucosa at

**Figure 32** Intraoral approach to the inferior alveolar nerve block. Image courtesy of the Department of Dentistry and Oral Surgery, Colorado State University



**Figure 33** A 27 gauge needle is inserted into the infraorbital foramen, dorsal to the maxillary third premolar (107). This foramen is located at the most rostral aspect of the zygomatic arch. Image courtesy of the Department of Dentistry and Oral Surgery, Colorado State University



**Figure 34** Subzygomatic approach to the caudal maxillary nerve block. Image courtesy of Heidi Lopprise

### Local and regional blocks are critical multimodal pain management techniques for perioperative patient comfort.



the surgical site to help block regional soft tissues.

When planning a caudal maxillary nerve block on a cat, for example, it is important to be aware that the infraorbital canal is on average 3 mm long, regardless of skull shape. With any technique, extreme care must be taken with needle placement, including when confirming negative aspiration prior to injection.<sup>113</sup> In one study involving injection of dye and radio-contrast material, there was no significant difference in the distribution of injected material between an infraorbital technique (ie, needle not advanced into the infraorbital canal) and a caudal maxillary approach (percutaneous).<sup>114</sup>

Analgesia in the oral cavity should be the goal during postoperative recovery (see 'Post-operative recovery and discharge'). This can be achieved by repeating regional blocks at the end of the procedure or utilizing longer-acting agents. The duration of effect of a local anesthetic agent such as bupivacaine can be prolonged with the addition of opioids or vasoconstricting agents (eg, alpha-2 agonists, epinephrine).<sup>115</sup> Addition of epinephrine to oral local anesthesia may result in complications.<sup>116</sup> Longer-acting bupivacaine products are not labeled for use in the oral cavity, but may be considered.

### Postoperative recovery and discharge

Monitoring and appropriate management of surgical patients is critical in the postoperative period, with over 60% of all anesthetic-related deaths in cats occurring within the first 3 h of the recovery period.<sup>117</sup> While some cats may be susceptible to hypothermia when under anesthesia, others may experience rebound hyperthermia, potentially associated with hydromorphone as well as other medications.<sup>118</sup>

Use of multimodal analgesia extends into the postoperative and discharge periods. Non-steroidal anti-inflammatory drugs, opioids (some with longer duration), gabapentinoids, N-methyl-D-aspartate (NMDA) receptor agonists and adjunct modalities (eg, cool compresses, targeted pulsed electromagnetic fields, cold laser, acupuncture) can optimize patient comfort. Patients identified as having neuropathic pain (eg, FOPS) may require a comprehensive management plan before, during and perhaps long-term after the procedure.<sup>87,119</sup>

### Oral and dental surgical care under anesthesia

Anesthetic care,<sup>103</sup> dental radiography<sup>120</sup> and dental surgical care<sup>121</sup> for the feline patient have been covered in detail elsewhere. The focus in these Guidelines is specific practical considerations in reference to cats undergoing oral and dental surgery.

#### When should the first dental procedure be considered?

In the absence of any developmental abnormalities or juvenile manifestations of oral disease, clinicians may consider dental and oral assessment under anesthesia for patients beginning at 2 years of age. This would encompass careful assessment of the oral soft tissues as well as collection of baseline intra-oral radiographs to help evaluate the teeth for PD/periodontitis and/or tooth resorption.

#### General considerations for feline dental procedures under anesthesia

**• Patient positioning** Patients may be positioned in lateral or dorsal recumbency based on surgeon/technician preference. Regardless of initial positioning, any repositioning of the patient during the procedure can increase the risk of tracheal tears.<sup>113</sup> Therefore, the endotracheal tube should be disconnected from the anesthetic circuit during repositioning. After every repositioning, airway security should be reassessed and cuff inflation re-evaluated.

**• Thermoregulation** Dental procedures utilize a great deal of water, resulting in the accumulation of moisture around the head, which can lead to a rapid onset of

hypothermia. Active warming of the patient (eg, using devices with conductive fabric or forced-air warming) is necessary, along with regular monitoring of body temperature during and immediately after the procedure.

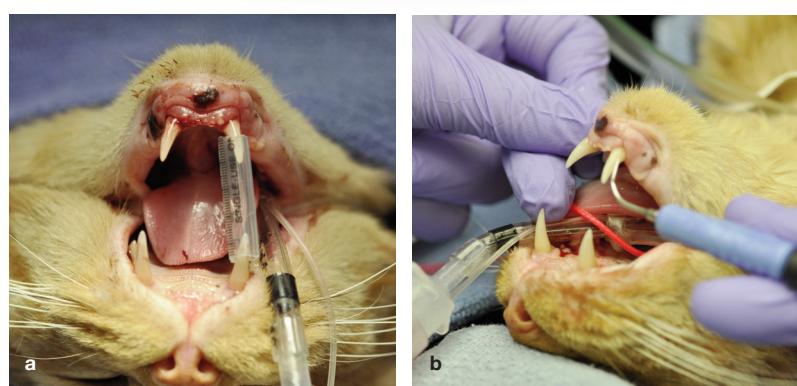
**• Airway protection** Airway protection is important to avoid aspiration pneumonia as a result, for example, of inhalation of water used to cool mechanical instrumentation and flush debris during dental procedures. Intubation should be performed with a cuffed endotracheal tube of the correct size.<sup>121</sup> A gauze pack should be placed in the pharynx to help reduce the accumulation of fluid. Care should be taken to avoid having too large a pharyngeal pack in situ for a prolonged period, since this can result in venous obstruction and sublingual edema. Removal of the gauze pack prior to extubation is a safety priority. Use of suction throughout the procedure is not only helpful for airway protection but also aids with visibility of the surgical site.

**• Ocular care** The large, prominent eyes of cats create a risk of corneal injury during dental procedures under anesthesia. It is recommended that eye lubricant be applied preoperatively and then reapplied throughout the procedure and during the recovery period.

**• Appropriate use of mouth gags and props** Spring-loaded mouth gags apply constant force to the mouth, causing bulging of the soft tissues between the mandible and tympanic bulla, and compression of the maxillary artery. The resulting hypoxic insult can lead to central neurological deficits, including blindness.<sup>122</sup> It is best either to avoid gags altogether or consider the use of a system that holds the mouth open but avoids hyperextension of the



**It is best either to avoid mouth gags altogether or consider the use of a system that holds the mouth open but avoids hyperextension of the jaws.**



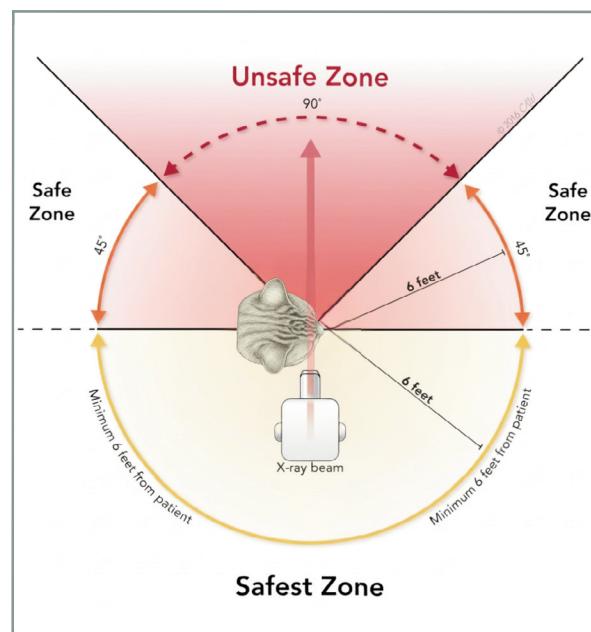
**Figure 35** Methods of holding the mouth open for oral and dental surgery: (a) a portion of a syringe used as a mouth prop and (b) the surgeon's/technician's fingers wedged gently in the mouth. In both cases, prolonged opening of the oral cavity should be avoided. *Images courtesy of Cornell University*

jaws (Figure 35), such as a 1 ml syringe cut to size. Prolonged procedures during which the mouth is persistently held open also pose a risk for central neurological deficits.<sup>123</sup> To minimize the risk, consideration should always be given to how long the mouth is being held open (in the same way that tourniquets would not be left occluding a blood vessel).

❖ **Radiation safety** Numerous intraoral radiographs are obtained throughout dental procedures, and care must always be taken to follow local regulations and manufacturers' recommendations (Figure 36).<sup>124</sup> As a rule, no team member should be within 180° of the primary beam or closer than 6 ft (1.8 m) to the dental x-ray generator during use. Lead gowns are recommended if hand-held x-ray generators are used.<sup>125</sup> Without these precautions, the eyes, reproductive organs and breast regions of personnel are exposed to unnecessary radiation.<sup>125</sup>

❖ **Microbial aerosol exposure** Protection of personnel against intraoperative microbial exposure is especially important given the potential for transmission of feline zoonotic infections.<sup>126-128</sup> Personal protective equipment (mask, eye protection, gloves) should be used by the veterinarian/technician performing the procedure, as well as anyone who is in the immediate vicinity of the patient, especially when ultrasonic scaling or a high-speed handpiece is in use.

❖ **Surgical ergonomics** Operator comfort is essential for health and wellbeing, and to minimize frustration resulting from physical strain and fatigue. The ergonomics of veterinary dental procedures have been described.<sup>129,130</sup> Considerations include appropriate chair/table height and distance from the patient, as well as use of instrumentation designed to reduce the risk of injury and improve access to the oral cavity. Given the size of the feline patient's oral cavity, magnification and a surgical headlight can contribute greatly to operator comfort.



**Figure 36** Dental radiology safety chart. Adapted with permission from Cornell University

**As a rule, no team member should be within 180° of the primary beam or closer than 6 ft (1.8 m) to the dental x-ray generator during use.**



### Typical workflow and staging of procedures

Box 7 describes the typical workflow for a feline patient undergoing a dental procedure as a series of steps. In some cases, there may be a necessity to consider staging of the procedure, particularly if more extensive oral surgery needs are found or if the procedure is prolonged. The initial assessment with radiographs, scaling and polishing, and simple extractions may be performed immediately, with either the advanced oral surgical procedures scheduled for a later date or the patient recommended for referral to a dental specialist (see Box 2).

#### Box 7

##### Typical workflow for feline patients undergoing a dental procedure

- ❖ Obtain full-mouth radiographs.
- ❖ Perform a thorough oral examination, including periodontal probing and charting.
- ❖ Develop a treatment plan based on diagnostics.
  - Communication with the caregiver is encouraged, especially if surgical intervention is anticipated.
  - Staging of treatment over more than one anesthetic event may be necessary.
- ❖ Perform periodontal treatment, including supra- and subgingival ultrasonic scaling ± hand scaling.
- ❖ Perform tooth surface polishing (optional).
- ❖ Complete other procedures (tooth extraction, coronectomy, etc), as needed, ensuring adequate anesthesia/multimodal analgesia. Regional anesthesia may be considered prior to scaling if the patient shows a pain response under anesthesia.

In some cases, there may be a need to consider staging of the dental procedure.



## Box 8 //

## Potential complications during and following tooth extractions

- ❖ Incomplete extraction with retained tooth roots (Figure 37)
- ❖ Displacement of root tips into the mandibular canal or nasal cavity (Figure 38)
- ❖ Dehiscence of the surgical site secondary to inadequate tension, release of flaps or undiagnosed neoplasia
- ❖ Oronasal fistula formation (Figures 39 and 40)
- ❖ Maxillary lip entrapment after extraction of a maxillary canine tooth (Figures 40 and 41)
- ❖ Pyogenic granuloma postextraction; most commonly develops after extraction of a mandibular first molar, potentially associated with trauma to the lingual molar salivary gland (see Figure 25)
- ❖ Hemorrhage
- ❖ Nerve damage
- ❖ Inadvertent lingual nerve anesthesia during inferior alveolar nerve block, leading to chewing and trauma of the tongue during the recovery period (rare)
- ❖ Ocular trauma secondary to poorly performed regional anesthesia or extractions
- ❖ Inadvertent fracture of, or trauma to, adjacent teeth
- ❖ Iatrogenic mandibular fracture and/or symphyseal separation secondary to mandibular canine tooth extraction
- ❖ Air embolism secondary to use of a high-speed handpiece or air/water syringe in extraction sites (rare)



Most complications can be avoided with appropriate instrumentation, good surgical technique and familiarity with regional anatomy.



**Figure 37** Retained mesial root tip following incomplete extraction of the right mandibular first molar (409). Image courtesy of Heidi Lobprise



**Figure 38** Displacement of the mesial root tip (and incomplete extraction of the distal root) of a left mandibular molar (309). Image courtesy of the Department of Dentistry and Oral Surgery, Colorado State University



**Figure 39** Dehiscence and persistent oronasal fistula formation at the extraction site of a maxillary canine tooth (204). Image courtesy of the Department of Dentistry and Oral Surgery, Colorado State University



**Figure 40** Lip entrapment trauma and oronasal fistula formation. Image courtesy of the Department of Dentistry and Oral Surgery, Colorado State University

### Specific considerations in relation to tooth extraction

#### Extraction kit

Extraction technique and appropriate armamentarium for feline patients have been thoroughly described elsewhere.<sup>131-133</sup> Some practical pointers regarding the extraction kit are given in the box 'Equipment considerations for feline patients'.

#### Postsurgical complications

Potential complications during and following extractions have been described in the literature<sup>134-138</sup> and are listed in Box 8. Most complications can be avoided with appropriate instrumentation, good surgical technique and familiarity with regional anatomy.

### Postoperative considerations

The following actions should be part of a post-operative checklist:

- ❖ Remove pharyngeal gauze pack.
- ❖ Suction any remaining fluid.
- ❖ Check oral cavity and pharynx for debris (a laryngoscope is helpful).
- ❖ Dry the patient's head.
- ❖ Reapply eye lubrication.



**Figure 41** Lip entrapment in an awake cat. Image courtesy of Naomi Hoyer

## Analgesia indications

Analgesia is always indicated following any surgical procedure, including tooth extraction. Consideration should be given to re-administering regional blocks if the procedure was more than 2–3 h in duration. Administration of analgesics (injectable or, for example, an opioid or ketamine CRI) can be initiated or continued in the immediate post-operative period, especially for patients undergoing extensive surgery. Use of long-acting opioids may be considered as part of a multimodal analgesia protocol, where available.

Oral analgesia choices will depend on the patient's age and general health. Generally, a multimodal approach with 3–7 days' post-surgical analgesia is adequate for most procedures. Postoperatively, the response to analgesia should be monitored using a validated pain-scoring system such as the Feline Grimace Scale.<sup>139,140</sup> This particular scale has been validated for use both in the veterinary practice setting and at home by feline caregivers.<sup>141,142</sup>

## Nutritional support

Postoperatively, some cats may be inappetent, particularly those who have undergone extensive procedures such as full-mouth extractions. Ensuring adequate intra- and postoperative analgesia will minimize oral pain that would otherwise discourage cats from eating. Patients may also need appetite stimulants and, in certain situations, preemptive placement of an esophageal tube.<sup>143</sup>

## Use of systemic antibiotics

Systemic antimicrobials are usually not indicated for routine dental prophylaxis or after tooth extractions. In cases of periodontitis, systemic antimicrobials are not a substitute for surgical treatment. In most cases of periapical tooth root abscesses, debridement of infected tissue is sufficient to control infection.<sup>144</sup>

The Guidelines Task Force supports the pursuit of good antimicrobial stewardship. The use of systemic antimicrobials is generally not indicated before, during or after comprehensive oral examination and treatment under anesthesia. Antimicrobials have been routinely overused and misused, in some cases for unnecessarily prolonged periods associated with dental surgery.<sup>145</sup> The Task Force endorses the '2022 AAFP/AAHA antimicrobial stewardship guidelines'.<sup>144</sup>

Antibiotic use in dentistry should be based on several patient factors. The patient's

immune status and the potential for immunosuppression are important considerations when deciding if antibiotics are indicated. Antimicrobials should not be used 'just in case'.

The following recommendations are made for the use of systemic antibiotics when treating PD and performing dental extractions:

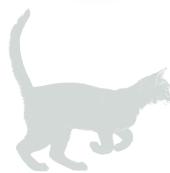
❖ **Preoperative use (1–2 weeks before periodontal treatment)** Given that PD is a plaque-induced inflammatory disorder, systemic antibiotics are not considered an appropriate therapy prior to periodontal treatment under general anesthesia. In patients who may not receive dental surgical care, antibiotic use is not appropriate.

❖ **Intraoperative use (at the time of anesthesia induction)** When considering the use of antimicrobials in a patient undergoing periodontal treatment, the objective is to address bacteremia rather than local oral tissue infiltration. In immunocompetent patients, bacteremia is cleared in a short period of time (20–30 mins).<sup>146</sup> However, immunosuppressed patients, or those with aortic stenosis, a previous history of endocarditis or with surgical implants (cardiac, orthopedic) are at increased risk of hematogenous infection.<sup>145</sup>

❖ **Postoperative use (1–2 weeks following a procedure)** Antimicrobial use is never indicated following periodontal cleaning alone. Its use is also rarely necessary even when the patient undergoes tooth extraction. Antimicrobial use during this phase is targeted at local oral tissues and should only be considered on the rare occasion where a patient might be predisposed to local infection. Examples include cases with poor tissue quality (eg, chronic stomatitis, irradiated tissues) or if the patient is severely immunosuppressed (eg, due to chemotherapy, diabetes mellitus).

These recommendations for systemic antimicrobial use in PD are generally applicable to other feline oral and dental diseases.

Antimicrobials  
should not  
be used  
'just in case'.



## Conclusions

The '2025 FelineVMA feline oral health and dental care guidelines' present evidence-guided recommendations for optimal oral and dental care, including therapeutic interventions, in general feline practice. An up-to-date review of common feline oral and dental diseases is provided, focusing on the role of prevention and early diagnosis and treatment. Moreover, a detailed discussion of assessment of the feline oral cavity encompasses both the awake and anesthetized examinations. As such, these Guidelines offer valuable reading and reference material for the entire veterinary team.

## SUMMARY POINTS

- ❖ Oral and dental diseases are commonplace in cats.
- ❖ Veterinarians and veterinary teams have a responsibility to provide high-quality oral healthcare for their feline patients.
- ❖ The '2025 FelineVMA feline oral health and dental care guidelines' provide up-to-date information about feline oral and dental diseases, including best practices for prevention, diagnosis and management.
- ❖ The entire practice team need to be advocates for oral and dental care, and knowledgeable about the principles of prevention and treatment of this important assortment of diseases.
- ❖ Preventive care strategies assist in maintaining feline oral health and achieving early diagnoses.
- ❖ Working closely with the caregiver is integral to fostering a good relationship that will increase caregiver receptiveness to guidance in home preventive care and in the pursuit of targeted treatment.



Veterinary team members provide ideal care when knowledge is shared and there is uniformity in the recommendations given to caregivers. Therefore, the goal is to foster collaborative relationships with caregivers that provide consistent messaging and an understanding of their cat's oral and dental needs, and how to safely address them.

## Supplementary material

The following supplementary material files are either available via the links below or at [go.jfms.com/2025FelineVMAGLs\\_supplementarymaterial](https://go.jfms.com/2025FelineVMAGLs_supplementarymaterial) and at [catvets.com/dental](https://catvets.com/dental):

- ❖ Feline dental chart.
- ❖ Video 1: How to clean your cat's teeth/feline dental care. [catvets.com/how\\_to\\_clean\\_teeth](https://catvets.com/how_to_clean_teeth). *Courtesy of Cats Protection.*
- ❖ Video 2: Helping your cat accept having its mouth checked. [catvets.com/mouth\\_check](https://catvets.com/mouth_check). *Courtesy of International Cat Care.*
- ❖ Video 3: Non-anesthetized oral examination. [catvets.com/feline\\_oral\\_exam](https://catvets.com/feline_oral_exam). *Courtesy of CSU VetCE at Colorado State University.*
- ❖ FelineVMA client brochure: 'Feline dental care'.
- ❖ Periodontal disease: [catfriendly.com/periodontal](https://catfriendly.com/periodontal).
- ❖ Caring for your cat's teeth: [catfriendly.com/dentalcare](https://catfriendly.com/dentalcare).
- ❖ How to brush your cat's teeth: [catfriendly.com/howtobrush](https://catfriendly.com/howtobrush).
- ❖ Feline Stomatitis Disease Activity Index (SDAI) scoring chart.
- ❖ 2022 ISFM consensus guidelines on the management of acute pain in cats. [go.jfms.com/Acute\\_Pain\\_GLs](https://go.jfms.com/Acute_Pain_GLs).

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This work did not involve the use of animals (including cadavers) and therefore informed consent was not required. For any animals or people individually identifiable within this publication, informed consent (verbal or written) for their use in the publication was obtained from the people involved.

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