# Surgical treatment of oropharyngeal and maxillofacial tumours

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Cancers of the oral cavity constitute 6% of cancers in dogs and 3% of cancers in cats. The incidence of the different tumour types and their behaviour are different between dogs and cats but surgery remains the mainstay in their treatment. However, many oropharyngeal tumours are best treated with a multimodal approach, including various combinations of surgery, radiotherapy, chemotherapy and immunotherapy.

## Tumour types and behaviour

In dogs, the most frequently encountered malignant tumours of the oral cavity are malignant melanomas (MM; 31 to 42% of cases), squamous cell carcinomas (SCC; 17 to 25% of cases), fibrosarcomas (FSA; 7.5 to 25% of cases) and osteosarcomas (OSA; 6 to 18% of cases). In addition, odontogenic tumours are common, although their frequency is hard to estimate.
In cats, the most common oropharyngeal tumours are SCC (75% of cases) and FSA (13 to 17% of cases).

### Malignant melanomas

Oral MMs of the dog are locally aggressive, rapidly growing and frequently metastasising (50 to 80% of cases) tumours. MMs are amelanotic in one third of cases[1](#_ENREF_1) and can therefore not be ruled out in the face of a non-pigmented oral mass.

### Squamous cell carcinomas

In dogs, SCCs are locally aggressive tumours, uncommonly metastatic. When present, underlying bone is often invaded (as observed radiographically in 77% of cases) and needs to be resected en-bloc with the tumour (maxillectomy, mandibulectomy).
Tonsillar SCCs have a more aggressive behaviour. It is estimated that 90% of tonsillar SCC have already metastasised at the time of diagnosis[1](#_ENREF_1), although overt evidence of metastatic disease is found in only 10-20% of cases at presentation[2](#_ENREF_2). More generally, rostral oral SCCs have a much better prognosis than those situated in the caudal portion of the mouth (base of the tongue, tonsils, pharynx) [3](#_ENREF_3).

In cats, SCCs are more aggressive than in the dog and local recurrences are frequent after surgical excision.

### Fibrosarcomas

These tumours are locally aggressive but metastasise uncommonly (10 to 35% of cases) or lately in the course of the disease.

In many cases, in dogs, there is a discrepancy between the grade of the tumour, as estimated by the histopathologist, and its clinical behaviour[4](#_ENREF_4). Such tumours are known as “histologically low-grade but biologically high grade” FSAs, or “high-low” FSAs. These tumours may seem little aggressive (low-grade fibrosarcoma) or even benign (fibroma) histologically. However, they clinically behave as a high-grade fibrosarcoma: they are locally aggressive and metastasise in 10 to 20% of cases. Therefore, regardless of their histological characteristics and grading, canine oral fibromas and FSAs mandate aggressive treatment.

There is little information on feline oropharyngeal FSAs in cats. Aggressive surgical resection, where possible, and radiotherapy are the current recommended treatments.

###  Epulides and odontogenic tumours [5-8](#_ENREF_5)

The term epulis is non-specific, descriptive of a localised swelling of the gingiva. Epulides are either non-neoplastic (Focal fibrous hyperplasia, also called Fibrous epulis or fibromatous and ossifying epulis) lesions or benign odontogenic tumours. Most types of epulides of dogs and cats can be resected marginally, except for ameloblastoma, amyloid-producing odontogenic tumours and feline inductive odontogenic tumours (Table 3). Canine acanthomatous ameloblastomas often invade the underlying bone (in 80-100% of cases[1](#_ENREF_1)) and have a high recurrence rate if not widely excised.

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| Origin | Name | Synonyms | Behaviour | Treatment |
| Non neoplastic | Focal fibrous hyperplasia | Fibrous epulis; fibromatous and ossifying epulis | No bone invasion;Frequent recurrences | Gingivectomy |
| Odontogenic tumours originating from epithelial tissues | Canine acanthomatous ameloblastoma  | Acanthomatous epulis, peripheral ameloblastoma, basal carcinoma, adamantinoma | Benign;Invades bone;Frequent recurrences | Radical excision |
| Other ameloblastomas  | - |
| Amyloid-producing odontogenic tumour | Calcifying epithelial odontogenic tumour |
| Odontogenic tumours originating from mesenchymal tissues | Fibromatous epulis of periodontal ligament origin | Peripheral odontogenic fibroma; fibromatous and ossifying epulis | Benign;May invade bone | Marginal excision |
| Odontogenic tumours originating from epithelial and mesenchymal tissues | Odontomas | - | Benign;Within bone | Marginal excision |
| Feline inductive odontogenic tumours | Inductive fibroameloblastoma | Benign;Invades bone | Marginal to radical excision depending on bone involvement |

Table 3: Main epulides and odontogenic tumours in dogs and cats

## Treatment

Treatment of oral tumours should aim at controlling the local disease as well as controlling the potential systemic disease.
Most tumours of the oral cavity are locally invasive are require wide excision for optimal local control. Therefore, in spite of great advances in other therapies (chemotherapy, radiotherapy, immunotherapy)[9-12](#_ENREF_9), surgery remains the mainstay in the treatment of most oral tumours. Adjuvant radiotherapy can be considered whenever the excision could not be achieved with sufficient margins because of the anatomical constraints of the area.
In addition, a number of oral tumours such as MMs, tonsillar SCCs or OSAs have a high metastatic potential mandating a systemic adjuvant treatment, such as chemotherapy or immunotherapy.

### General principles of surgical treatment

The local conditions of the oral cavity (limited availability in loose soft tissues, constant movements, bacterial charge) make wound dehiscence a common complication after surgery. However, the use of a proper technique limits the incidence of wound dehiscence.

It is recommended not to use electrocautery near the edges of the wound. Incisions using diathermy increase the risk of wound dehiscence. Where cautery is required in depth of the wound, it is best applied with bipolar forceps to limit its effect on surrounding tissues and decrease vascular damage.
As for any other surgery, careful respect of tissues and their vascularisation is critical. A good knowledge of the vascular anatomy (e.g. course of the palatine arteries) facilitates resection of oral tumours as well as elevation of mucosal or mucoperiosteal flaps. Such flaps must be elevated a minima to cover the oral defect, in order to minimise vascular injury. During section of bones, the tissues must be constantly irrigated to prevent extensive thermal necrosis.

Brisk haemorrhage is commonly encountered during mandibulectomies and maxillectomies. Blood loss and intraoperative hypotension have been reported as the most common intraoperative complications with such procedures[13-15](#_ENREF_13). Such haemorrhage can hardly be avoided, especially in maxillectomies, as the responsible blood vessels are contained within the resected osseous cavities. It can however be anticipated and its duration kept to a minimum by a judicious order in bone sections. In mandibulectomies, the mobility of the mandibles allows performing haemostasis after each bone section when necessary, by exposing the alveolar canal containing the alveolar mandibular artery and vein. During maxillectomies, significant haemorrhage can be delayed as much as possible by performing the bone sections most likely to sever a large vessel last. In a first step, all bone section lines are marked with the oscillating saw. As a rule, rostral and sagittal or parasagittal sections are cut first, leaving the most caudal transverse section last. Once brisk haemorrhage occurs, the resection must be completed promptly without controlling the haemorrhage: attempts at stopping the haemorrhage prior to mobilisation the cut osseous block will only increase its duration and haemostasis is unlikely to be achieved. Instead, if the bone sections have been performed in a judicious order, the resection can be completed rapidly and the osseous block be elevated, exposing the bleeding vessels (e.g. maxillary, infraorbital, sphenopalatine or major palatine artery and vein) and allowing their ligation or electrocoagulation.

Closure of oral wounds is made in 1 or 2 layers, depending on the estimated risk of wound dehiscence. The author routinely uses 2-layer closures after maxillectomy and mandibulectomy. Monofilament absorbable 3-0 to 4-0 (dec 1.5-2) sutures swaged on round or tapercut needles are recommended.

Surgical techniques have been extensively described elsewhere[1](#_ENREF_1), [13](#_ENREF_13), [14](#_ENREF_14), [16-25](#_ENREF_16).

### Labial and palatal resections

In most cases, labial masses are best resected by full-thickness excision of a portion of lip. Lips are most often reconstructed by simple apposition in a three-layer closure, but advancement or rotation flaps[22](#_ENREF_22) are sometimes required for large resections or in animals with limited availability of labial tissue.

Reconstruction of the palate after tumour resection can be more challenging. Tumours of the hard palate are excised with the underlying portion of the palatine bone. Tumours of the soft palate require full-thickness resection. Simple closure can be used for small and pediculated tumours of the soft palate. For tumours of the hard palate and large tumours of the soft palate, a number of reconstruction techniques involving mucosal and mucoperiosteal flaps have been described and recently reviewed[18](#_ENREF_18). Modified cutaneous axial flaps have also been used for reconstruction of oral defects[26](#_ENREF_26).

### Maxillectomy and mandibulectomy

As most malignant tumours and ameloblastomas invade bone, their wide excision requires partial maxillectomy or mandibulectomy. Alternatively, in large dogs with small lesions of the lower dental arcade with minimal bone involvement, a more conservative excision technique preserving the ventral cortex of the mandible may be possible[16](#_ENREF_16), [17](#_ENREF_17).

A minimum of 2-cm margins is sought for excision of mandibular and maxillary malignant tumours. Mandibulectomies and maxillectomies can be unilateral or bilateral and rostral, lateral/segmental or caudal. Extensive mandibulectomies and maxillectomies are very well-tolerated in dogs[1](#_ENREF_1), [10](#_ENREF_10), [14](#_ENREF_14), [15](#_ENREF_15), [27-29](#_ENREF_27). Much less information is available in the literature for cats, but functional recovery has been reported to be much less satisfactory compared with dogs[30](#_ENREF_30). Patient selection is therefore paramount in cats, and owners must be warned about the likelihood of acute and long-term adverse after-effects. However, owner satisfaction rates are above 80% after maxillectomy or mandibulectomy in dogs[1](#_ENREF_1) and mandibulectomy in cats[30](#_ENREF_30).

### Glossectomy

Tumours of the tongue are uncommon in dogs and cats. In one retrospective study of 1196 cases of lingual lesions in the dog, 54% were tumours and 33% were inflammatory (glossitis)[31](#_ENREF_31). Lingual lesions are 2.3 times more likely to be tumoral when affecting large breed dogs than small breed dogs[31](#_ENREF_31). In addition, lingual tumours are more frequently malignant in large breed dogs than in small breed dogs. Overall, lingual tumours are malignant in 2/3 of cases[31](#_ENREF_31), [32](#_ENREF_32). There is no apparent sex predilection[31](#_ENREF_31).

Among malignant tumours, the most frequent are malignant melanomas, squamous cell carcinomas, haemangiosarcomas and fibrosarcomas. Malignant melanomas account for 23% of lingual tumours. Chow-chow and Shar-Pei dogs are at higher risk of lingual malignant melanoma (40 and 24 times, respectively) compared to other breeds[31](#_ENREF_31). Squamous cell carcinomas account for 18% of lingual tumours in the dog. They are twice more common in females[31](#_ENREF_31). The most commonly affected breeds are Poodles, Labradors and Samoyedes[31](#_ENREF_31). Haemangiosarcomas account for 6% of lingual tumours in dogs and Border Collies have been reported to be 11 times more frequently affected than other breeds[31](#_ENREF_31). Fibrosarcomas account for 5% of lingual tumours and are more frequent in Golden Retrievers[31](#_ENREF_31).

The benign tumours encountered the most frequently on the tongue are squamous papillomas, plasma cell tumours and granular cell tumours[31](#_ENREF_31). Squamous papillomas accounted for 11% of all lingual tumours and were suspected to have a viral origin in 46% of cases in one study[31](#_ENREF_31). Plasma cell tumours account for 10% of all lingual tumours in dogs and more frequently affect small breed dogs, especially Cocker Spaniels[31](#_ENREF_31). Granular cell tumours account for 6% of canine lingual tumours and more frequently affect small breed dogs[31](#_ENREF_31).

A classification of glossectomies has been described by Dvorak et al[33](#_ENREF_33). The resection of lingual lesions may be marginal or involve a full-thickness resection of a portion of the tongue. A glossectomy is referred to as partial when a portion of the tongue is resected, regardless of the location of the resected portion. Similarly, the amputation of the cranial portion of the tongue is referred to as partial glossectomy if it only involves its free portion (rostrally to the frenulum). When the amputation extends caudally to the insertion of the frenulum but involves less than 75% of the tongue, the glossectomy is subtotal. When more than 75% of the tongue is amputated, the glossectomy is near-total. Total glossectomy refers to the amputation of the tongue in its entirety.

Glossectomies are not technically difficult procedures. Their goal is to achieve sufficient margins (>1 cm) while preserving as much of the tongue as possible. In one study, it appeared that the excision of lingual tumours had been complete in 100% (n=7) of cases in which margins of 1 cm or more had been sought, whereas it had only been complete in 1 out of 3 cases when narrower margins had been sought[32](#_ENREF_32). Animals whose tumour had been incompletely resected appeared to be 3.6 times more likely to die from the disease and 3 times more likely to develop local recurrence or metastatic disease[32](#_ENREF_32). Depending on the type of resection (longitudinal, cuneiform, transverse), preserved portions of the tongue can be transposed to obtain as normal a lingual shape as possible.

It is generally reported that most animals tolerate well resections of up to 60% of the tongue[1](#_ENREF_1), [21](#_ENREF_21). More recently, it was reported that near-total and total glossectomies can also be well tolerated, provided the animal is able to adapt and modify its eating and drinking techniques[32](#_ENREF_32), [33](#_ENREF_33). In one study of 13 glossectomy cases (12 partial, 1 subotal), 54% of animals (7/13) had short-term complications: ptyalism (5/13; 38%) and wound dehiscence (3/13; 23%). The vast majority of dogs (6/7) were able to eat without assistance within 3 days after surgery[32](#_ENREF_32). Three of 13 cases (23%), including the subtotal glossectomy, showed long-term difficulties in eating and drinking[32](#_ENREF_32).

In one study, the mean survival time of dogs with benign tumours was not reached after 1607 days. The mean survival time of dogs with malignant lingual tumours was 286 days (222 days for malignant melanomas, 301 days for squamous cell carcinomas) [32](#_ENREF_32).

### Tonsillectomy

Tonsillectomy is performed from an intra-oral approach. Complete excision of tonsillar tumours requires excision of the tonsillar crypt together with the tonsil. Whenever possible, regardless of the aspect of the contralateral tonsil, tonsillectomy is performed bilaterally because a significant proportion of tonsillar tumours will show bilateral involvement[1](#_ENREF_1), [34](#_ENREF_34). When performing bilateral tonsillectomy with only one tonsil being enlarged, care must be taken not to excise the normal-size tonsil too widely in order to leave enough pharyngeal mucosa to close the wounds without tension.

## Prognosis

For an equivalent tumour type and grade, rostral tumours are associated with a better prognosis. This is partly due to the fact that they are diagnosed earlier and more amenable to complete excision. Unsurprisingly, when complete excision can be achieved, the better prognosis is better. However, some tumours such as SCC may also have a different behaviour depending on their location, with a rostrocaudal gradient in aggression: caudal tumours metastasise more often than rostral ones.

Tumour size is also a clear prognostic factor in animals treated with surgery or radiotherapy. The smaller the tumour, the more likely it is to be completely excisable with sufficient margins and the greater the efficacy of radiotherapy.

### Malignant melanoma

The mean survival time (MST) without treatment is 65 days. With surgery only, the MST is reported to be 5 to 17 months with 1-year survival rates of 0 to 35%. The prognosis is better for tumours of less than 2 centimetres in diameter (MST=511 days) than for larger tumours (MST=164 days). With radiotherapy, 6 to 19 months progression-free survival (PFS) times have been reported.

### Squamous cell carcinoma

After surgical resection only, MST of 3 to 26 months and 57 to 91% of 1-year survival rates have been reported. Canine SCCs are very responsive to radiation therapy and 7 to 28 months PFS are reported after radiotherapy.

In cats, surgery alone has been reported to result in MST of 2 months and in 1-year survival rates of less than 10%. In addition, this tumour is less sensitive to radiotherapy in cats than in dogs. However, in one study involving 7 cats, combination of surgery and radiotherapy has resulted in a median survival time of 14 months [35](#_ENREF_35). Other treatment combinations of surgery, radiotherapy and/or chemotherapy have resulted in MST ranging from 2 to 6 months.

### Fibrosarcoma

In dogs, surgery alone is associated with MSTs of 9 to 12 months. Mandibulectomy resulted in 1-year survival rates of 23 to 50%. Although FSAs are widely regarded as poorly responsive to radiotherapy, 26 months PFS and 7 to 45 months MST have been reported with radiotherapy.

There is little information on feline oropharyngeal FSAs in cats.

### Osteosarcoma

Oral OSA has a better prognosis than appendicular OSA because of a lower metastatic potential. After mandibulectomy, MSTs of 6 to 18 months and 35-71% 1-year survival rates have been reported. After maxillectomy, MSTs have been 4 to 10 months and 1-year survival rates 17-27%. Local recurrence is a major concern after surgery, reported in 15-44% of cases after mandibulectomy and 27-100% of cases after maxillectomy. Many dogs die from failure to control local disease rather than metastatic disease. However, completely excised oral OSA is associated with a fair prognosis (MST greater than 1500 days). On the contrary, incompletely excised oral OSA resulted in a MST of 199 days. An aggressive surgical approach is therefore warranted, especially as the combination of surgery with radiotherapy or chemotherapy has not proved to improve the outcome when oral OSA are incompletely excised[1](#_ENREF_1).

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