

Feline Dentistry Mini Series

Session One: Oral and Dental Examination and Investigation

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DENTAL ANATOMY & PHYSIOLOGY

Relevant Anatomy of the Head

- Maxilla- upper jaw
- Mandible - lower jaw
- Temporomandibular joint (TMJ)- allows jaw movement by articulating the maxilla & mandible
- Orbit – houses the eye ('globe').
- Infra-orbital foramen – the hole through which infra-orbital vessels exit.
- Mental foramen- hole through which the mandibular vessels exit.
- Nasal cavity
- Symphysis – cartilage joint between the two mandible halves

It is vital to be aware of this anatomy as disease processes or iatrogenic damage may affect a number of areas.

Different head shapes exist:

- Brachycephalic – shortened face
- Mesocephalic – normal facial proportion
- Dolicocephalic – elongated face

Different species have specific head shapes and are designed to deal with different food types.

Tooth Anatomy

Each tooth consists of a crown and root.

Crown: The visible part of each healthy tooth is known as the crown.

The shape allows specific function. Its shape ('enamel bulge') can deflect chewed material from the gum margin, preventing damage.

Root: The tooth roots are hidden by bone and soft tissue. Provides mechanical support for each tooth. May be single, double or triple rooted; multiple roots are divergent to assist mechanical attachment.

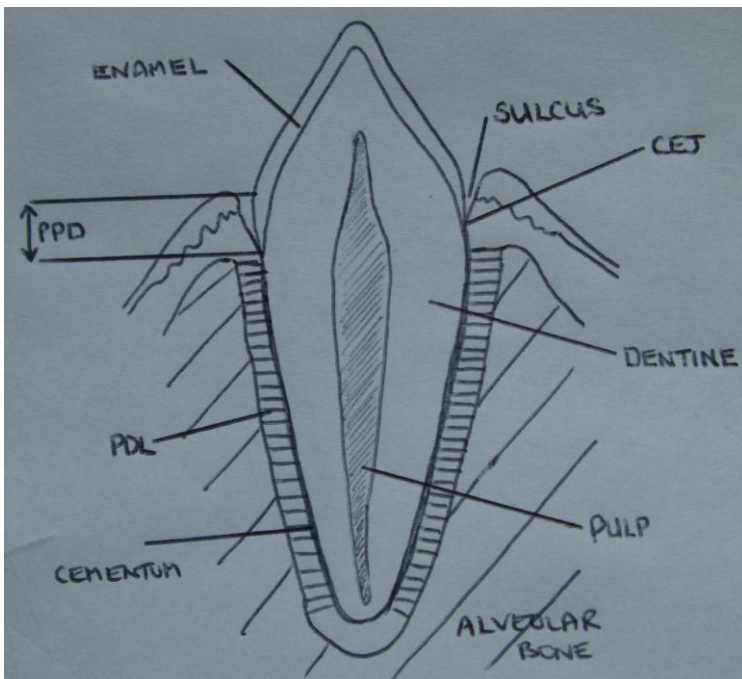
They form the majority of each tooth, approx 60-70%.

Dental Tissues

ENAMEL: coats the crown, very hard, dense tissue. Glassy-smooth, ceramic. Thin, no regrowth.

DENTINE: hard but 'porous' due to tubules radiating out from the pulp towards the outer surface of the dentine. Produced by the pulp and forms the bulk of the tooth. Increases in thickness with age.

PULP: the living centre of each tooth; includes nerves, bloodvessels, lymphatics, connective tissue etc. Senses temperature and pain. Produces dentine thus narrows with age.



Periodontal Anatomy

GINGIVA – gum. Keratinised, protective collar for tooth.

ALVEOLAR BONE – bone of the socket/ 'alveolus'

PERIODONTAL LIGAMENT – fibrous, sensitive (pain and pressure) attachment between socket and root

CEMENTUM – thin outer covering of roots; allows root-to-periodontal ligament attachment

Oral Soft Tissues

Oral Mucosa

- Oral mucosa is the epithelial lining of the mouth.
- Gingiva is specialised, toughened mucosa.
- Thin, sensitive oral mucosa lines the cheeks and palate beyond the gingival cuff.
- The meeting point of thin mucosa and gingiva is seen as a the 'MUCOGINGIVAL LINE'

Gingiva

- Free gingiva – (gum margin) unattached, out-most rim of gingiva
- Junctional epithelium – gingiva-to-tooth attachment
- Sulcus – tiny gap around each tooth, between free gingiva and tooth. Its base is the attachment point of junctional epithelium to tooth
- Attached gingiva – thick collar of tough, keratinised gingiva attached to bone by fibres

Neurovascular bundles

- consists of blood vessels and nerves.
- run within bony canals in the head
- infra-orbital bundle runs through its canal in the maxilla and exits at the infra-orbital foramen
- inferior alveolar/ mandibular bundle runs through its canal in the mandible and exits at the mental foramen

Descriptive Nomenclature & Dental Formulae

Oral Nomenclature

The head may be divided into 4 quadrants:

- Maxillary (left & right)
- Mandibular (left & right)

Areas are further described using the titles below:

- Labial – adjacent to lips
- Buccal – adjacent to cheek
- Palatal – adjacent to palate
- Lingual – adjacent to tongue

- Occlusal – adjacent to the surface of teeth which meets those of the opposite jaw (ie usually the uppermost surface)
- Coronal – towards the crown
- Apical – towards the root tip (apex)

- Mesial – close to anterior midline
- Distal – far from anterior midline

- Posterior – caudal
- Anterior - rostral

Combining the above descriptive terms with the tooth identification system (Triadan system, below) enables oral areas, individual teeth and specific sites on teeth to be described.

Tooth types

Teeth vary in shape with different species and the function they perform. The teeth of carnivores have a short crown and larger, true root; these are termed 'brachydont'.

- INCISORS: grooming and nibbling
- CANINES: catching and holding prey
- PREMOLARS: holding and cutting food into segments
- MOLARS: grinding food; however mandibular molars in carnivores ('lower carnassials') also have a cutting function (sectorial teeth)

The cat is a true carnivore. It has evolved to have only those teeth essential to groom, catch prey and cut food. It has fewer teeth than the dog and only one flat-surfaced molar in each side of the maxilla.

Teeth also differ with maturity.

Like us, cats and dogs have deciduous ('primary' / 'baby' / 'milk') teeth which are shed and replaced by permanent ('secondary' / 'adult') teeth as the animal matures.

Tooth Nomenclature & Formulae

Tooth types may be abbreviated:

Incisors= I

Canines= C

Premolars= P

Molars= M

Figures then denote the total number of teeth, of that type, per side.

Teeth in the maxilla are numbered first, while mandibular teeth follow an oblique.

Eg C1/1 = one upper and lower canine normally present on each side of the mouth. There are thus 4 canines in the mouth in total.

The dental formulae for carnivores:

DOG= 2x (I3/3: C1/1: P4/4: M2/3)

This creates a total of 42 teeth in the normal dog.

CAT: 2x (I3/3: C1/1: P3/2: M1/1)

A total of 30 teeth in the normal cat.

Description of each tooth may be added by describing first left or right (L/R) then upper or lower (U/L) then the tooth type & number. Eg LLPM4 = left lower 4th premolar.

Modified Triadan System

This also describes teeth. It uses numbers only and is the classification on most dental charts.

Each tooth is assigned a three digit number eg 104

The first number denotes quadrant of the mouth (ie left or right, upper or lower section) in which the tooth lies.

- 1= right maxillary
- 2= left maxillary
- 3= left mandibular
- 4= right mandibular

The second number eg '04' of 204, denotes the specific tooth and position.

Certain teeth may be useful to act as locators:

Canines- end in '04'

1st Molars- end in '09'

Thus the number '109' would refer to RUM1 (right upper 1st molar), '304' refers to the left mandibular/lower canine (LLC).

Species Differences

In different species the number of tooth types varies.

The Triadan system is used, but some numbers will be missing as these teeth do not exist in that species.

The teeth present do not change number however; canines are always '04', 1st molars always '09'.

Similarly, if an animal has extractions, we do not re-number the remaining teeth!

Eg Feline:

2x (I3/3: C1/1: P3/2: M1/1)

Note the low number of premolars and molars compared to the dog.

The cat is a true carnivore. It has evolved to have only those teeth essential to groom, catch prey and cut food. It has fewer teeth than the dog and only one flat-surfaced molar in each side of the maxilla. The cat does not have 105,205,305,306,405,406 thus numbering reads eg 104 followed by 106 (ie RUC followed by RUPM2) or 304 followed by 407 (LLC followed by RLPM3).

Eruption Times

DOG

Eruption times vary. Below is a general guide to time range:

	DECIDUOUS	PERMANENT
INCISORS	3-5weeks	3-5months
CANINES	3-5weeks	4-6months
PREMOLARS	4-6weeks	4-6months
MOLARS	-	4-7months

CAT

Eruption times vary. Below is a general guide to time range:

	DECIDUOUS	PERMANENT
INCISORS	2-3weeks	3-4months
CANINES	3-4weeks	4-5months
PREMOLARS	3-6weeks	4-6months
MOLARS	-	4-6month

Since the deciduous teeth shed and permanent teeth erupt over different time ranges for each tooth type, puppies and kittens often have both deciduous and permanent dentition present at any one time. This is known as 'mixed dentition'.

Prior to the time when the permanent, adult dentition erupts only deciduous teeth can be seen. The developing, permanent teeth ('buds') are present - hidden within the bone. These teeth can thus be damaged before they erupt or are seen.

Deciduous teeth have thin, fragile roots. Prior to the time when the permanent, adult dentition is due to erupt these thin roots begin to disappear.

This 'programmed resorption' allows the primary teeth to shed ('exfoliate') easily and allow normal eruption of the permanent dentition.

The immature, permanent tooth has thin walls and an open root tip or 'apex'.

The pulp is wide and the tooth is fragile. As the animal and its teeth mature, dentine is laid down. The walls thicken and the space for pulp narrows with time. The root apex closes gradually, eventually leaving only tiny holes for vessels to enter and exit; this is the 'apical delta'.

Occlusion

An animal's 'bite' or way the upper and lower jaws meet is known as the 'occlusion'. The relationship between the jaws should be balanced in the natural 'mesocephalic' situation. Normal occlusion creates a comfortable and functional bite to allow unhindered eating and grooming.

Oral & Dental Investigation

The high prevalence of dental diseases is well accepted. The significance of this to our patients is marked and choosing appropriate treatment is essential. In order to effectively identify pathology types, severity and location thorough oral investigation is required. Minimal investment in equipment, man-power and time is needed to vastly improve our diagnostic work-up.

The results should be analysed both as a general view of the animal's oral status and on an individual tooth-by-tooth basis. The notion of each tooth being regarded as an individual patient is a useful one. The findings for a mouth, and the dentition within, will commonly span a number of pathologies and potential treatments. Assessing each while also balancing client expectations, compliance and patient factors guides treatment.

The components of investigation are:

- History
- Clinical examination (conscious)
- Pre operative testing
- Exam under GA - probe & chart
 - intra-oral radiography
 - biopsy

History

A thorough history is required to assess the nature, pattern, location and progression of any presenting problem. Indicators for other disease processes and potential anaesthetic and medication implications are explored. At this stage the wishes and concerns of the client are also often evident. It is important to gauge what client compliance (eg to homecare) may be expected.

Clinical Examination

This should involve the entire animal, including cardio-vascular and respiratory parameters, with focus on the mouth and teeth as the final part of examination. Inevitably general anaesthetic is required for full oral examination and safety is thus paramount.

Head examination includes:

- General shape & symmetry
- Lymph nodes & salivary glands
- Mucous membrane colour & CRT
- Globe retropulsion (gentle!)
- Muco-cutaneous border examination
- Oral examination - teeth: colour, shape, missing teeth, abnormalities
 - soft tissues: lips, cheeks, tongue

Proceed with caution in animals with uncertain nature.

Oral assessment in the conscious animal is always compromised and may be useless as well as dangerous in a fractious animal. Ensure safer and more thorough investigation by advising anaesthesia if in doubt.

Conscious Oral Examination

Technique relies on firm but gentle handling in the following order:

- Mouth closed, anterior cheek teeth (labial surface, premolars & canines)
- Mouth closed, posterior cheek teeth (buccal surface, premolars & molars)

- Mouth closed, mesial teeth (incisors & canines)
- Mouth open, posterior then anterior teeth (lingual, palatal & occlusal surfaces)

This order progresses from the most to least tolerated mouth manipulations.

The posterior cheek teeth may be clearly viewed despite cheek tissue as this is normally very elastic and may be retracted adequately at the commissure of the lips.

The pathology noted at this stage is likely to be only part of the true picture. This should be explained to the owner. However, the pathology noted (or any unidentified oral discomfort/ signs) act as the 'admission pathology' for general anaesthesia, thorough investigation and thus ability to gain the full picture.

Pre-Operative Tests

These should be elected as appropriate based on history and clinical signs. This will include non-oral aspects which may affect treatment or anaesthetic protocol eg renal status as well as specific tests for oral disease. It should be noted however that oral and dental status can have a bearing on systemic health. Most typically one may consider the effects of bacteraemia. Other complex relationships also exist and the oral cavity can affect and act as an indicator for disease eg diabetes (two-way deleterious influence with periodontal diseases), renal compromise (oral mucosal ulceration).

Testing considered:

- Biochemistry
- Electrolytes
- Haematology
- Urinalysis (dipstick & refractometer SG)
- Viral testing – blood eg FeLV, FIV
 - oral swab FCV, FHV

Oral disease is disease! Where unusual or advanced disease pattern is noted testing is advised eg 3yr old feline with severe periodontitis.

Assessment Under General Anaesthetic

Full oral assessment requires general anaesthesia:

- Operator safety – sedated animals may still bite (you & films/ sensors!)
- Patient safety – protection of the airways; especially with liquids usage
- Examination quality – enables more thorough examination
- Treatment – treatment required, including surgery, may be performed

General oral view

The opportunities to obtain an 'overview' of the mouth prior to intubation should not be missed! This is especially true for fractious animals where conscious view may be impossible and for occlusion assessment.

Induction: Accurate assessment of occlusion cannot be performed in the intubated animal. The tongue must also be temporarily tucked back into the oropharynx in these cases. Ensure adequate anaesthetic depth for operator safety and pre-oxygenation for patient safety first!

Intubation: Good opportunity for examination of the oropharynx, tonsils, epiglottis & fauces.

Chlorhexidine 'Prep': This is performed once the patient is established as stable under general anaesthesia. Topical antimicrobial activity creates a safer and more pleasant environment for both patient & operator. During application teeth are over-viewed and all soft tissues are examined. This includes all surfaces of:

- Lips
- Vestibules
- Tongue
- Palate
- Cheek lining

Probe & Chart

The initial stage of detailed patient assessment, once under general anaesthetic is probing and charting. This requires:

- **periodontal probe** (depth gauge) - rounded tip: soft tissue evaluation
- **explorer probe** – sharp tip for hard tissue tactile investigation
- **dental chart** - 'dentition map'

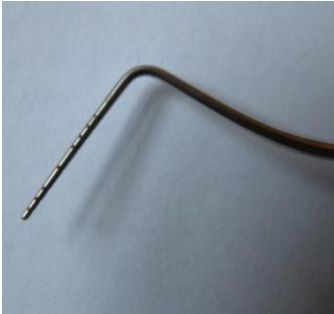
It is essential that all findings are accurately documented for diagnostic, monitoring and medico-legal purposes.

Dental chart: use writing and drawing space to note all findings in detail, many diseases are site specific, which affects prognosis

Investigation should be carried out in a methodical, sequential manner. Begin at the front of the mouth and work backwards (caudally/ distally) in a tooth-by-tooth fashion. Repeat for each quadrant of the mouth. This is more thorough and actually faster than 'jumping around the mouth'.

1. Periodontal probe: has millimetre delineations to enable measurement and a smooth tip for use on soft tissues. A pattern with delineations close together (eg Williams) enables more accuracy of measurement.

Periodontal probe detail - note millimetre delineations



This instrument is used for every tooth **and** over edentulous areas with any signs of inflammation. It gives information regarding:

- Gingivitis – severity (bleeding tendency: score 0-3)
- Periodontitis - Pocket depth (mm)
 - Gingival recession & root exposure (mm)
 - Furcational bone loss (score 0-3)
 - Mobility (score 0-3)
- Lesion quantification – stomatitis & ulceration surface area
 - epulides: hyperplasia to melanoma!
 - measurement and associated damage
- Fracture depth (mm)
- Tract detection & exploration - eg abscess, root remnants

Technique:

- Insert the periodontal probe is inserted into the sulcus
- **gently** advance vertically
- **stop** when light pressure is resisted by attachment tissues
- guide the probe around the tooth circumference 'feeling' for this 'stop'

Any abnormalities eg bleeding, increased probing depth via pockets or gingival hyperplasia (overgrowth) are noted.

Caution: excessive force will damage attachment tissues.

In the case of multi-rooted teeth the probe is used to assess the amount of bone present in the furcation (space between roots of an individual tooth).

Furcation assessment is performed by:

- insert probe into the sulcus as above
- attempt gently angling the probe perpendicular to the tooth at the furcation
- assess whether the probe can be inserted to any depth between roots
- repeat for all furcations from all aspects

Mobility assessment is performed by:

- Shoulder of probe placed against tooth
- Gentle pressure applied to tooth
- assess movement in each horizontal plane
- assess movement in an vertical (out-of-socket) plane

2. Explorer: The sharp-tipped explorer is used ONLY on hard tissues. It gives visual and tactile information plus an audible metallic ‘ting’ on catching a rough edge of enamel.

It is used primarily to aid diagnosis of:

- Fractures - including enamel chips & hairline fractures
- Resorptive lesions – including those just subgingival (care!)
- Caries – like pushing into rubber or old chewing gum!
- Restoration flaws
- Pulp exposure - eg via tooth wear (abrasion or attrition)

3. Charting: Ensure that all abnormal findings are recorded on the chart and, where possible, give details including location, severity, size (mm) & direction. Examples include:

- Periodontal disease
- Missing teeth
- Damaged teeth
- Abscess & tracts
- Resorptive lesions
- Oral masses
- Pre & Post Tx eg extraction

Filling in the Chart & Disease Scoring

Most charts have a key to aid appropriate indication of pathologies and treatments. Some common examples are:

- Missing tooth – circle tooth number
- Resorptive lesion – RL
- Fractured tooth - #
- Extract tooth – single oblique line through the tooth number to identify pre-extraction, finalised as a cross on completion of extraction.

The majority of periodontal pathology is described by millimetre measurement as noted previously. However a grading system exists for many pathology types eg furcational bone loss via periodontal disease and tooth mobility.

Furcation score:

- Grade F0 = normal
- Grade F1 = <33%
- Grade F2 = >33%
- Grade F3 = 100%

Mobility score:

- Grade M0 = normal
- Grade M1 = horizontal movement \leq 1mm
- Grade M2 = horizontal movement $>$ 1mm
- Grade M3 = vertical & horizontal movement
or
(multi-rooted) horizontal movement \geq 1mm

Calculus and plaque indices are not required- although some advocate their inclusion the fact that these parameters are not in themselves disease, are expected to be present and will be removed causes this author and many colleagues to view this as unnecessary. One may make a note of general pattern if desired which may be of assistance regarding homecare guidance. It is likely however that gingivitis and other periodontal health indicators would fulfil this role.

Making the Chart Work

Thorough probing and charting of the resultant information is extremely efficient. A completed chart negates the need to then keep rechecking the probing – trust the chart and use it as your guide! This does of course make doing it correctly the first time critical!

The finished chart should be archived with any associated material eg laboratory results, history, dental radiographs in a clear wallet within a ring-binder arranged in chronological order. Correctly completed charts have multiple benefits:

- Efficient - maximal information in minimal time & writing
- Permanent record – no memory required!
- Educational tool for clients and colleagues
- Monitoring
- Medico-legal document

Radiography

Intra-oral radiography is mandatory for full diagnostic investigation. Omission of radiography will result in the operator missing enormous amounts of pathology, as the roots remain invisible. Clearly this is of detriment to patient, client and practice alike. Human dental films or digital dental sensors should be used. Normal Xray machines can be utilised but a dental Xray machine gives great benefit in speed and ease of use. This equipment is relatively cheap and investment in it and learning intra-oral radiological (bisecting angle) technique will pay dividends.

Biopsy

Biopsy should be performed for **all** masses & abnormal lesions!!!

The information you gain from the histopathologist is essential but only as good as the sample you send. The following steps should be adhered to in order to obtain a good and diagnostic sample:

- Wedge biopsy
- Avoid tissue heating & trauma
- Sufficient size
- Adequate depth – including underlying bone where relevant
- Avoid ulcerated / inflamed areas – this compromises interpretation
- Label / orientate on dental chart – ensure you can identify in retrospect!
- Twin with radiography – where a mass is near any underlying bone
- Oral pathologist – try to send to one with an interest in oral pathology
- Discuss, refer, resample - if the results don't match the clinical picture

Summary

It is this investigatory information which, combined and considered, will determine what diagnosis made and thus what treatment is elected. The quality of the information is therefore critical to outcome success and ultimately patient welfare. Error or complacency at any stage will produce a 'domino-effect' leading to potentially wrong or compromised treatment. Ensure that a meticulous and thorough investigatory approach is used in every case!

FELINE ORAL PATHOLOGY & TREATMENT

Trauma

The mouth and teeth are areas frequently affected by trauma such as road traffic accidents, falls or chewing and catching hard objects. Pain and further problems are common sequelae.

FRACTURE

Fracture of teeth may be at any level through crown and/ or the root with variable depth and direction.

UNCOMPLICATED FRACTURE: the pulp is NOT exposed

- a layer of dentine +/- enamel remains
- may be sufficient to protect the pulp

COMPLICATED FRACTURE: pulp exposed

- fracture passes through dentine to expose pulp at the fracture site.
- fresh fractures bleed and cause pain.
- bleeding ceases, bacteria invade the pulp
- pulp inflammation ('pulpitis') and infection result
- pulp changes from pink to red to brownish.
- infection and inflammation works towards the root tip ('apex')
- pulpitis is painful and may result in bone damage around the apex
- eventual 'pulp necrosis'.
- abscess may form causing pain and bone damage.

'Slab fractures' affect the side of a tooth. These often extend under the gum and may be uncomplicated or complicated.

Treatment:

1) UNCOMPLICATED

- Enamel damage only – smoothing/ 'odontoplasty' of sharp edges
- Superficial enamel & dentine - smoothing/ 'odontoplasty' of sharp edges & seal/ restoration
- Deep enamel & dentine – as for complicated fractures

2) COMPLICATED

- Periodontitis / deep subgingival fracture line – extract
- Healthy attachment - extract or root canal (endodontic therapy)

Fractured teeth **MUST** be treated as discomfort may be experienced at any point. Abscessation is a late stage and extremely painful. 'Wait and see' is **NOT** an option!!

DISCOLOURED TEETH

Tooth discolouration varies from pink to purple, brown and grey and is often associated with a prior traumatic event.

- pulpal bleed secondary to trauma
- blood pigments and breakdown products taken up by dentine
- tooth stained pink-purple
- pulpitis and pain
- pulp may either recover or die
- pulp necrosis may result in abscessation

Radiography is essential to assess whether the tooth is dead.

Pulp deposits dentine, thickening the tooth walls. A dead tooth has thinner walls than its live counterpart. Left and right comparison views are needed to assess this. The difference is only visible after sufficient time for disparity. Grey discolouration may also occur due to presence of black, necrotic pulp. Potential causes include:

- Thermal damage – polishing, scaling, heat-cautery/ diathermy
- Fracture
- Periodontitis

Treatment:

Discoloured dentition should be either extracted or undergo restorative root canal therapy to save the tooth. Restoration is less traumatic and invasive but requires specialist treatment, may be more costly and is not possible in every case.

1) NO RADIOGRAPHIC PATHOLOGY

- Recent trauma - radiographic monitor repeated in 3-6months
- Historic trauma – radiographic monitor in 12months
- Signs of discomfort – as below

2) RADIOGRAPHIC PATHOLOGY/ DISCOMFORT (NON-VITAL PULP)

- Periodontitis / deep subgingival fracture line – extract
- Healthy attachment - extract or root canal (endodontic therapy)

Discoloured, non-vital teeth **MUST** be treated as discomfort may be experienced at any time. Abscessation is a late stage and extremely painful.

SUBLUXATION

Horizontal trauma results in tooth loosening via periodontal ligament damage. Tooth and/or socket bone may suffer fracture during the traumatic incident. The blood supply to the tooth may be damaged thus tooth may be left in situ if immobile but must be radiographically monitored for pulp death (loss of pulp vitality).

LUXATION

Tooth and/or socket bone may suffer fracture during the traumatic incident.

LATERAL LUXATION: Lateral trauma pushes crown in one direction and the root in the opposite. Alveolar bone fracture is associated.

INTRUSION: Vertical trauma pushes the tooth into the socket.

EXTRUSION: Trauma pulls the tooth out of the socket.

AVULSION: Total loss of tooth from alveolus.

The blood supply to the tooth is often compromised and may result in pulp necrosis.

Treatment:

- 1) NO OTHER PATHOLOGY - Stabilisation by splinting & endodontic treatment once stable

- 2) OTHER PATHOLOGY – extract

Periodontal Disease

This may be divided into gingivitis, periodontitis and gingivostomatitis according to the tissues involved with the inflammatory process.

GINGIVITIS

- Gingival inflammation
Severity determined by the Modified Loe & Sillness bleeding score, from 0-3

- Plaque caused
Gingivitis is a result of host immune response to antigenic stimulation and inflammatory mediator release

- Juvenile form / 'eruption gingivitis'
Noted in some individuals during the dentition transition stage (deciduous to permanent). It is usually transient (several weeks) and resolves spontaneously on full eruption of permanent teeth.

Clinical signs

- red, swollen, gums. Bleeding on probing in severe cases (score 2-3)
- halitosis
- hyperplasia in some individuals
- discomfort is unusual and more likely to be seen in juvenile form

Treatment

- Homecare: daily brushing +/- chlorhexidine gluconate oral rinse
- Topical Antimicrobials: chlorhexidine gluconate oral rinse
- Antibiotics: used only in severe cases (eg some juvenile cases where topical application is impossible or ineffective). Short term only.

Periodontitis

- Inflammation of the periodontal tissues
Gingiva, periodontal ligament, alveolar bone, cementum

- Plaque caused

- Progression
 - Damage causes increased plaque retention and stagnation thus periodontitis is self worsening.
 - Teeth may no longer be viable

- Juvenile
 - dentition transition period
 - rapid progression, extractions likely

Clinical signs

- periodontal pockets, gingival recession, root exposure, furcational bone loss, tooth mobility
- halitosis

Treatment

- Homecare: daily brushing +/- chlorhexidine gluconate oral rinse
- Topical Antimicrobials: chlorhexidine gluconate oral rinse
- Antibiotics: used only in severe cases (eg some juvenile cases where topical application is impossible or ineffective). Short term only.
- Extraction: non-viable teeth and where homecare is not possible

GINGIVO-STOMATITIS

Gingivostomatitis refers to inflammation of gingiva and mucosa, where stomatitis relates to the mucosal component. Feline chronic gingivostomatitis 'FCGS' is often called 'plasmacytic-lymphocytic stomatitis', this merely describes the cell types found histopathologically and would be expected with the inflammatory condition.

- Inappropriate immune response to plaque antigens– likely shift of immune response from Type1 (cellular) to mixed Type1&2 (humoral) response.

Factors

Gingivostomatitis is a multifactorial disease and depends on both the animal's immune status and dental status.

- **Immune Status**

This may be broadly divided into systemic and local immunities:

- Systemic immune status

Organ function – renal compromise, diabetes etc

Viruses – FeLV, FIV

- Local immune status

Genetic variation

Viral – eg FCV / calicivirus

- **Dental Status**

The vast majority of cases exhibit dental pathology however this is often unclear without detailed oral investigation including intra-oral radiography.

- No dental pathology

- Periodontitis

It is difficult to discern whether periodontitis (loss of attachment) was present prior to the onset of stomatitis or is a later development as a result of the inflammation.

- Resorptive lesions

- Fractured teeth

Radiography is essential!!!

Clinical Signs

- Severe inflammation
- Ulceration
- Hyperplasia
- Granulation
- Pain!!
- Dysphagia & eating difficulty
- Grooming difficulty
- Weight loss
- Halitosis
- hypersalivation

Disease Patterns

Inflammatory extension within the oral cavity may be described; inflammation most localised/ focal to the dentition appears most responsive to treatment anecdotally.

- **Gingivitis+stomatitis:** localised to teeth. Distal dentition most affected
- **Stomatitis+gingivitis:** diffuse/ generalised; buccal mucosa, tissue anterior to the palatoglossal folds. Very painful!
- **Faucitis:** mucosa of the fauces; tissue of and between the palatoglossal and pterygopalatine folds/ 'pillars', ie throat.

Investigation

It is essential to consider the cat as a whole and perform general testing before focussing on swabs for FCV. FIV and FeLV results may alter the owner's wish to pursue treatment further while FCV is primarily of use for potential adjunctive Interferon treatment if required. Detailed oral assessment is essential to guide treatment and surgical approach.

- Blood testing
 - Organ status: biochemistry
 - Viral: FIV, FeLV
- Oral Assessment
 - Probe & chart
 - Radiography
- Swab sampling (oropharyngeal)
 - FCV (by virus isolation, University of Glasgow Veterinary School) - however this rarely affects initial treatment & is found in most cases.
- Biopsy
 - Cytology / histopathology –wedge biopsy is useful to rule out SCC; cytology is of minimal value. Biopsy of asymmetrical, unusual or non-healing tissue is advised.

Treatment

Treatment of gingivostomatitis is essentially surgical. Extraction of associated teeth removes the non-shedding tooth surfaces and the antigenic load of plaque bacteria. If meticulous tooth-brushing, thus mechanical removal of plaque, could be performed on a daily basis it is likely that this would greatly assist resolution, however this is rarely a practical option in these cats due to pain.

Medical treatment is adjunctive and the vast array exists as none have proven fully successful alone. Interferon too is designed to be used in addition to radical extractions where this alone fails. Appropriate treatment should be instituted as soon as possible for both the immediate welfare reasons and the potential for neoplastic transformation (squamous cell carcinoma) with chronic inflammation.

- **Medical**
 - Address underlying disease
eg stabilisation of diabetic patients. This may be more difficult where unchecked oral inflammation and infection exists and oral surgery may first be necessary.
 - Antimicrobials
Systemic eg amoxicillin clavulanate, clindamycin. Metronidazole are beneficial where anaerobes are suspected and may also give an immunomodulatory effect.
Topical – chlorhexidine gluconate oral rinse; oral pain may prevent this
 - Analgesia
NSAIDs- meloxicam at standard, long term dose rates where renal function is appropriate
Opioids- Buprenorphine is useful short term but can suppress appetite after 2-3days
 - Interferon- in FCV +ve cases. Care in additionally FeLV / FIV cases
Most effective by intra-lesional injection, BUT ££!

Subgingival/ intra-lesional: 1million units (1MU)

Subcutaneous: 1MU/kg EOD, 10days then twice weekly. Cease treatment once 3swabs (once weekly) give negative FCV results.

- Diet- anecdotally, hypoallergenic/ additive-free diets have been of merit eg Butcher's Classic Cat Food, Hill's a/d, Applaws, Lily's. Antioxidant food additives have been reported as helpful. Balance of omega oils may be beneficial (feeding white fish 1-2x per week).
- Bowl material- avoidance of plastic, metal and artificial coatings. Use ceramic.
- Corticosteroids- avoid! especially with viral +ve cats. Initial improvement is followed by reflex worsening of inflammation with increasingly poor response to subsequent doses.
- Other...cimetidine – to restore the Type1 immune response
slippery elm (& clove oil) & honey
lactoferrin
gold salts.....?!

Unfortunately medical Tx is usually of adjunctive only help.

- **Surgical**

Radical extraction is the most effective treatment. Success rates have been listed as around 70-80% (two studies) however this is in a referral situation with radiographic control and 'perfect' extractions. Poor curative response will be observed in patients where this is not the case; root remnants, missed pathology and trauma at extraction sites (eg spicules of alveolar bone) will inhibit healing and resolution. Funds are best spent on surgery before advancing to costly medication.

- Detailed oral investigation is essential
- Intra-oral radiography is essential to guide surgery
- Dentition adjacent inflammation should be removed
- Start distally (ie cheek teeth; molars and premolars) in patients showing inflammation in only the posterior regions
- Full mouth extractions/ clearance is often required in cases with widespread inflammation

Ensure extractions are perfect!

Owners should be advised of options available and the potential for variable response to treatment. Some individuals will remain visually inflamed while returning to normal feeding and grooming while others appear improved but fail to resolve sufficiently. Cases may exhibit apparently spontaneous resolution weeks to months after treatment and require adjunctive medication after surgery. Re-checks and monitoring via telephone are performed as required and dependant on post-operative recovery however a rough guide is: 1-2days, 5-7days, 10-14days, 28days. Some colleagues advise routine feeding tube placement and 24-48hr hospitalisation however this author has not found that necessary and an individual approach is used. Where sutures are inhibiting resolution these may be removed from 7days onwards. This author prefers closed extraction where possible to avoid any foreign material.

Resorptive Lesions

Also previously described as 'Neck lesions' or 'FORL' (Feline Odontoclastic Resorptive Lesions), these lesions are caused by external resorption. They are classified as Types 1 & 2. While painless when evident in the root only, they are thought to cause sensitivity on advancement towards the crown and resultant exposure to the oral cavity.

- **Type 1:**
 - Inflammatory cause
 - Associated with periodontal disease
 - neck / cervical area lesion location
- **Type 2:**
 - Idiopathic, ?abfraction, Vitamin D etc?
 - Replacement resorption: root material replaced by bone
 - Ankylosis: periodontal ligament loss is often the earliest sign
 - Usually cats >4yr old

Diagnosis

- **Visual** – irregular focal gingivitis; inflammatory tissue
- **Tactile** - use of sharp explorer probe, supra & subgingivally; the sharp tip catches on enamel irregularities and produces a metallic sound.
- **Radiographic** - Both resorptive lesion types initiate on the root therefore only late lesions are observed at the crown. Many lesions will be missed entirely while the true extent of other lesions remains undetected without radiography. This is critical for diagnosis and guiding a treatment plan.
 - RL screen: 307,407 are most frequently first affected thus this two film approach provides a good 'screen' in apparently 'normal' mouths.
 - Full-mouth series: indicated where any RLs are noted

Treatment

Extraction remains the gold standard treatment. Feline extraction is notoriously difficult due to:

- feline dental anatomy – fragility, tiny size, irregular root tips
- periodontal ligament loss & ankylosis – normal loosening difficult
- replacement resorption – altered root anatomy

All teeth require sectioning into individual root portions whether simple (closed) or surgical (open) extraction is used.

- **Type 1 lesions** – no ankylosis however lesions often increase fragility.
 - Simple: possible for the majority of teeth.
 - Surgical: difficult extractions, especially mandibular canines.
- **Type 2 lesions** – ankylosis, fragility, areas of root replacement.
 - Simple: where periodontal ligament space remains (radiographic)
 - Surgical: difficult extractions via tooth type, ankylosis, replacement resorption.
 - Coronal amputation: **ONLY** if radiographic confirmation of ghosting (complete replacement resorption) is present.

WARNING: Coronal amputation is NOT atomisation of root remnants. Atomisation is NOT an appropriate treatment for resorptive lesion-affected teeth or root remnants. Coronal amputation is performed only where no root exists (replaced by bone material). This cannot be guessed! Inaccuracy will result in welfare compromise.

Coronal Amputation:

- Raise gingivoperiosteal flap as if performing surgical extraction
- Amputate the crown at alveolar crestal bone level
- Remove 2mm of 'ghost' root to create a small circular bone 'well' (ie a depression in the bone matching the ghosted root's circumference)
- Allow a clean blood clot to form in each 'well'
- Close the flap with absorbable monofilament suture material
- Recheck at around 7days then every 3months (sooner if concerned)
- Monitor radiographically in 6-12months; earlier if any reactivity

Orofacial Pain Syndrome

These are the cats that tell you there is dental pathology!

Orofacial pain syndrome (trigeminal neuralgia) resulting in self trauma is frequently triggered by oral pathology. It is mainly found in Burmese, Ballinese, Burmese crosses but also Siamese and occasional domestic short haired cats. Common contributory factors include periodontitis, resorptive lesions, root remnants and fractured teeth. Underlying dental disease must be dealt with however surgery itself can also be a trigger. Intra-oral radiography and precise surgery are essential.

Treatment

Short term:

Treatment of oral pathology. Extractions must be in toto and performed atraumatically.

Analgesia - buprenorphine, meloxicam.

If refractory to standard analgesia, antidepressant and anti-seizure medication may be used for their analgesic effects.

Post-operative: analgesia. If signs continue Phenobarbitone may be required to control this while healing occurs (1-2weeks).

Long term: Phenobarbitone, Feliway, stress factor reduction. If this is insufficient further behaviour modification drugs may be required.

Dosages:

Buprenorphine = 0.05-0.07ml/ kg sc/im/iv e6-8hrs for up to 3days

NB po route convenient but care! may trigger signs

Meloxicam = 0.05mg/kg PO SID for chronic pain

Anti-seizure medications

Phenobarbitone = 2-3mg/kg BID.

Check serum concentration after 2weeks.

Aim is 20-25mg/l (100-120umol/l). Annual liver function test if prolonged.

Carbamazepine = 25mg/cat BID (care re haematological parameters, liver compromise, sodium levels).

Gabapentin = 3mg/kg PO SID (?up to 5-10mg/kgBID-TID?)

Also?

Pregabalin = ? start at 2mg/kg PO TID and taper up to 3-4mg/kg

Levetiracetam = 10-30mg/kg PO BID-TID

Antidepressants

NB Avoid with MAO inhibitors, drugs metabolised by cytochrome P450 e.g. cimetidine, combining with other antidepressants & anti-seizure medications.

Amitriptyline = 0.5-1.0mg/kg PO SID (Bitter taste- may cause ptyalism)

Also?

Clomipramine = 0.25-1.0mg/kg PO SID

Doxepin = 0.5-1.0mg/kg PO SID-BID

Appetite Stimulants

Periactin = 0.1-0.5mg/kg

Mirtazepine = 2mg PO every 3rd day- EOD

Oxazepam = 0.2-0.4mg/kg PO SID-BID. Max= 2.0mg/cat/24hr

Ensure patient suitable for any drugs listed. Ensure off-license permission.

Limited data on effect, safety and interaction is available for many of these drugs.

Many drugs may cause xerostomia (dry mouth) exacerbating some oral problems.

Malocclusion

An animal's 'bite' or the relationship between upper and lower jaws is known as the 'occlusion'. This should be balanced in the natural situation such as that of the mesocephalic beagle.

Normal occlusion creates a comfortable and functional bite to allow the animal to eat and groom normally without trauma to any adjacent teeth or tissues.

The **dental interlock** holds the upper and lower jaws in synchrony as they grow. It consists of the lower canine fitting along a groove between the last (3rd) upper incisor and the upper canine and the incisor scissor bite

Malocclusion refers to the ABNORMAL fit of teeth and/ or jaws. This may result in trauma to other teeth or soft tissues. Traumatic malocclusion affects the animal's comfort and function and thus requires treatment. It may be seen with deciduous and permanent teeth.

Malocclusion may be due to:

- position of individual teeth 'dental malocclusion'.
- relative jaw sizes 'skeletal malocclusion'.
- Both individual teeth and relative jaw size combined

Most commonly brachycephalics show malocclusion!

Deciduous teeth which fail to shed before the adult teeth erupt are known as 'retained' or 'persistent' primary dentition. This may cause or worsen malocclusion by obstructing the normal eruption path of the following permanent tooth. This may occur with any tooth type but is commonly most severe with canine teeth.

Adult lower canines erupt medial ('lingual'-close to the tongue) to the deciduous/ temporary canines. Persistent deciduous canines thus force the adults to erupt 'inside' them, resulting in canines which damage the roof of the mouth (palate).

Areas of tooth overcrowding retain plaque, are hard to clean and thus predisposed to periodontal disease. Persistent primary teeth thus cause risk both to themselves and the permanent counterpart.

Succession: only one tooth of any tooth type should be present at a location at one time- ie one should not find both primary tooth plus its adult counterpart together.

'OVERSHOT': The maxilla is relatively longer than the mandible and lower canines may be more likely to damage the palate. In severe cases oronasal fistulae may form.

'UNDERSHOT': The maxilla is short relative to the mandible length; upper teeth may damage lower teeth and adjacent tissues.

Each quadrant may have a different growth rate and potential. The dental interlock maintains overall co-ordination of growth. Where co-ordination is lost and one side grows more than another we get 'WRY BITE'

Treatment:

Dental treatment may only be planned correctly where an accurate diagnosis has been made from appropriate investigation. **Orthodontics** refers to treatment to restore normal jaw and tooth relationships to ensure a comfy and functional bite - NOT for cosmesis!!!

Where abnormal jaw or tooth positioning cause damage options may be:

- 1) Extraction - may be complicated; ensure radiographic examination first!
- 2) Shortening - involves endodontic treatment, NEVER simply cut the top off!
- 3) Tooth movement - complex, NEVER experiment eg with bands!

Extraction alternatives:

- Atraumatic, retain tooth, retain bone
- Referral required, cost, occasional further treatment/ monitor

Clients should be made aware of treatment options available, and the relative advantages and disadvantages of each, in order to make an informed choice for their pet.

OTHER ABNORMALITIES

A vast array of congenital, hereditary & developmental abnormalities exist. The approach should be the same for all instances:

1. thorough oral assessment via probe & chart
2. dental / intra-oral radiography
3. biopsy where applicable

Enamel dysplasia appears as patches or bands of abnormal enamel (often yellow-brown & flaky) or missing enamel areas on one or more teeth. Sufficient enamel may never have formed (enamel hypoplasia) or formed abnormally (eg enamel hypomineralisation). Upon eruption teeth may initially appear normal. Chewing then leads to loss and staining of abnormal enamel and evidence of the condition often arises at 6-12m of age.

The cause may be pyrexia, drugs (often leading to multiple affected teeth) or trauma (usually one or two teeth in a localised region affected) occurring during enamel formation of the developing tooth in puppies or kittens.

Poor enamel renders the tooth susceptible to ingress of toxins or bacteria with eventual pulpitis and infection possible, as well as weakening the tooth. In addition root formation may also be abnormal.

Treatment:

Consists of removal of abnormal enamel and seal of the underlying dentine. More advanced restoration may be performed for more extensive patches, especially on canines. Radiographic monitoring is performed to ensure normal tooth development thereafter.