



Elongated mandibular incisors following traumatic loss of the opposing teeth in a Syrian hamster

Management of Rabbit and Rodent Tooth Elongation!

by

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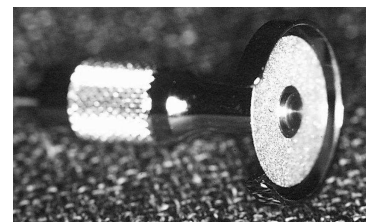
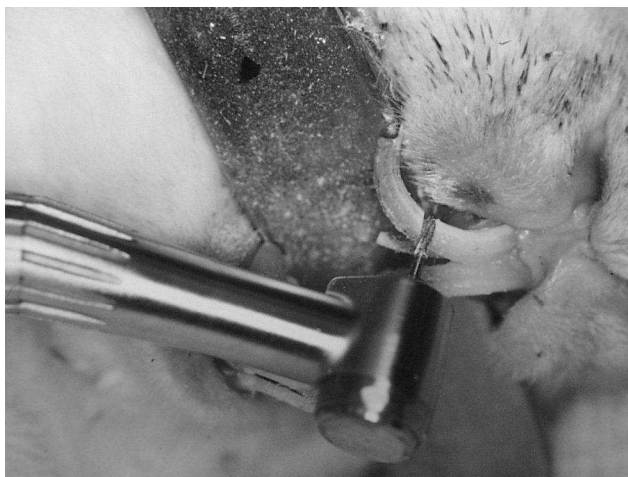
Introduction

Malocclusion and overgrowth of continuously growing teeth is a frequently seen problem in domestic rabbits, guinea pigs and chinchillas. It is also encountered in other rodents, particularly when they are not provided with appropriate material to gnaw. Whilst incisor malocclusions may be temporary, for example; while an opposing incisor tooth grows back following fracture, in those species in which all the teeth grow continuously (rabbits, guinea pigs and chinchillas) it is more often an on going problem secondary to elongation of the cheek teeth.

When maloccluded incisor teeth are non-functional they hinder rather than assist prehension, also interfering with jaw movement and preventing adequate mastication of food. This results in abnormal wear of the cheek teeth further exacerbating the situation. If not treated, the incisor teeth may grow in such a way that they damage adjacent tissues. Untreated, animals loose weight, becoming debilitated and prone to opportunistic infections from which they can die.

Coronal reduction : Incisor teeth

Incisor overgrowth can be safely and effectively managed by trimming the teeth using either a thin cutting bur such as a tapered coarse grit diamond bur or a thin cross cut fissure tungsten carbide bur. Cutting is most efficient when a high speed air turbine handpiece is used (using FG class burs), however, both a low speed latch grip contra-angle handpiece (RA class burs) and a straight handpiece (HP class burs) can also be used. In fact the power source for low speed cutting of teeth can even be from a Dremmel tool or hobby drill. The speed of cutting and life varies with bur type. Crosscut tungsten carbide taper-fissure burs cut fast when new and have a reasonable life, but should be replaced after use dry on 4 sets of incisor teeth. Use with water spray increases bur life slightly. Steel burs are a waste of money as they blunt very quickly. Coarse diamond burs are the most economic to use, having the longest life, but they abrade their way through the teeth rather than cutting, so trimming is slightly slower. Diamond burs also require maintenance to remove tooth debris that otherwise clogs the surface reducing their efficiency.

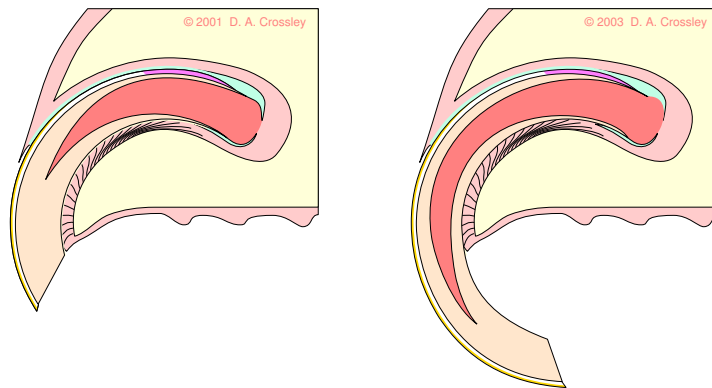


Trimming of incisor teeth is easily done using a high speed dental handpiece even in conscious animals. Whilst diamond discs work, they are dangerous to both the operator and patient! If a diamond disc is used, a safety guard is required. Safety goggles should always be worn during use of any cutting equipment.

Low speed cutting is far slower and less convenient than use of an air turbine handpiece, particularly for work on conscious animals, however, when incisor trimming is performed in

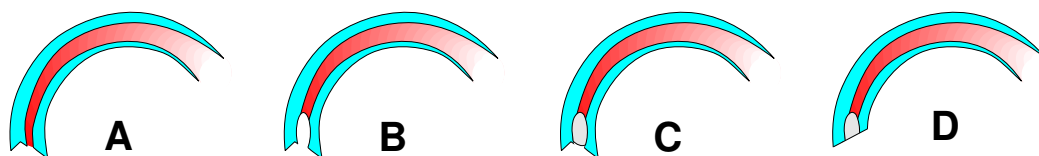
conscious patients any water spray should be turned off, otherwise it tends to cause distress and struggling. Whilst a safety-guarded diamond disc in a low speed handpiece is also effective for incisor trimming, much greater care is required with this instrument both as far as the risk to the patient and to the operator. Eye protection is required by the patient, operator and any assistants and observers whenever power equipment is being used.

The incisor teeth are cut with a bur by repeated gentle strokes across the tooth surface. If using a tapered bur it should be drawn out of the cut as it is made so as to avoid the bur jamming. Only light force should be applied to avoid applying too great a pressure to the teeth and to minimise heat build up which blunts the bur and burns the tooth.



Unopposed continuously growing teeth do not just become elongated, their rate of growth and eruption increases. As it takes a constant time (about 6 weeks in rabbits and chinchillas) for the pulp to become obliterated coronally, the pulp cavity elongates when the eruption rate increases. The effect is usually greatest in mandibular incisor teeth as the growth and eruption rate of mandibular teeth is higher than that of maxillary teeth, and maxillary incisors generally contact the mandible despite not occluding with the mandibular teeth so they rarely become totally unopposed.

When incisor teeth are grossly elongated the pulp cavity often extends above the gingival margin. A good quality radiograph will give a fairly accurate indication of the extent of the pulp so that the safe level for trimming can be determined beforehand. Even so, it is wise to remove the excess tooth length in stages, checking the cut surface for signs of pink coloration, indicative of underlying pulp, to minimise the risk of pulp exposure. Should the pulp be exposed, anaesthesia is required so that a partial pulpectomy and pulp capping procedure can be performed. Providing the pulp was healthy, this will encourage healing and minimise the risk of pulpitis, pulp necrosis and abscessation. Partial pulpotomy and pulp capping can also be used when the pulp has been recently exposed but not grossly contaminated by a traumatic tooth fracture.

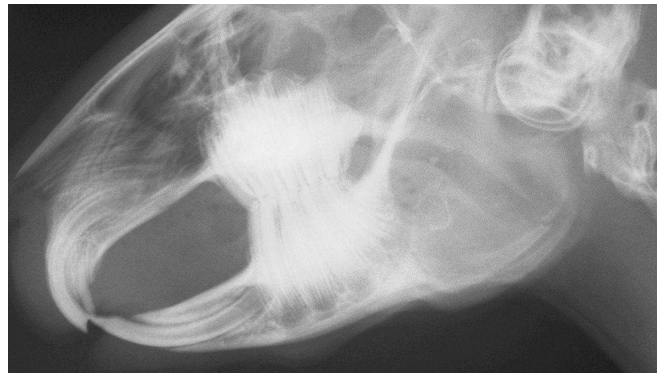


Partial pulpectomy must be performed in as near aseptic conditions as possible. The tooth requires cleaning and disinfection. A sterile bur is used to create a retentive cavity and remove the superficial pulp. Haemorrhage is arrested and the cavity filled with a calcium hydroxide setting cement. This will act as both a dressing and a temporary filling. Hard filling materials should be avoided as they inhibit tooth wear. The tooth surface is returned to as near normal shape as practical. Perioperative antibiotics are indicated and the animal monitored long term for tooth eruption and wear. Root abscessation is likely if the pulp fails to recover.

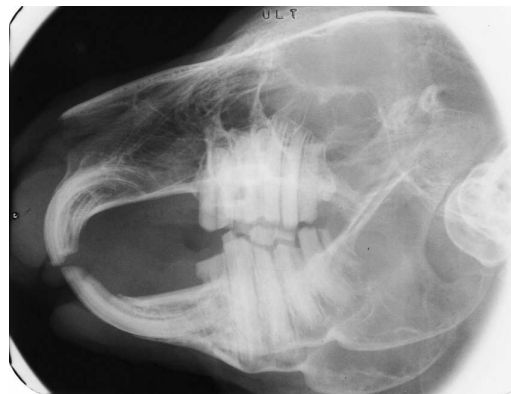
Incisor trimming often has to be repeated at 3 week intervals as the incisor teeth normally grow and erupt around 3mm per week, this rate increasing to as much as 1mm per day when they are unopposed. A more satisfactory solution in cases of persistent or recurrent incisor overgrowth is extraction of the offending teeth.

Coronal reduction : Cheek teeth

Incisor extraction alone may be sufficient for those individuals with traumatically induced or skeletal malocclusions, providing the cheek teeth are normal. However, in cases with cheek tooth overgrowth, coronal reduction and occlusal equilibration of these teeth is also required to restore the oral cavity to as near a healthy condition as possible. Accurate assessment of the degree of elongation and other dental changes requires radiography.



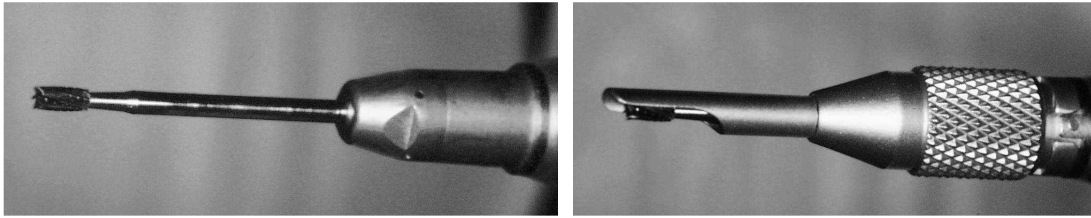
A lateral radiograph of a domestic rabbit with very early cheek tooth elongation. This animal can be treated by dietary modification. Feeding of a diet based on grass, i.e. fresh growing grass, hay and dried grass, will encourage prolonged chewing in a natural chewing pattern and normal wear of the teeth due to the high content of abrasive silicate phytoliths in grasses. Whilst leafy vegetation derived from natural dicotyledenous plants can be included in the diet, the content should be minimal as this is poorly abrasive and will not provide adequate tooth wear. The vegetables we eat are not natural, they which have been bred for high food content and are not suitable for herbivores with continuously growing teeth.



A more typical radiograph: The mouth is held open by elongated cheek teeth, resulting in a secondary incisor malocclusion (occlusal adjustment will return the incisor occlusion to normal). There are marked apical changes affecting the incisors and cheek teeth. In particular note that incisor eruption has been impeded and as a result the pulp cavities are shorter than normal!

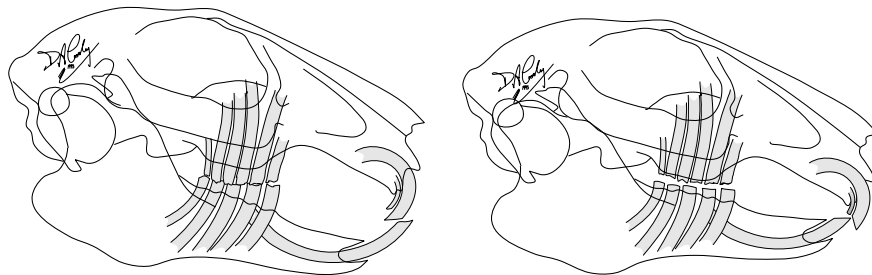
Coronal reduction of the cheek teeth should be performed using power equipment as this allows rapid removal of tooth substance without risking the damage to the periodontal and periapical tissues caused by use of a rasp (or worse, clippers). The end of a flat fissure bur is used, advancing

it along the dental arcade one tooth at a time, to remove the bulk of the exposed crown, the end of the bur guard (“soft tissue protector”, Veterinary Instrumentation, Sheffield, UK) being placed on the coronal surface of the tooth and used to guide the bur. Work progresses one tooth at a time to both prevent heat buildup and to allow powdered tooth to be wiped away at intervals using a damp cotton bud. Once the teeth have been brought to the correct height the side of the bur can then be used to smooth the occlusal surfaces and restore the normal angulation as necessary.



This HL flat fissure bur (left) has both end and side cutting properties. It is used in a straight dental handpiece (the type that will accept polishing heads) along with a guard called a “soft tissue protector” (right). The guard minimises the risk of soft tissue injury. Care is required when working on third molars as the end of the guard can damage the large vein present in that region.

Providing a “soft tissue protector” is used with the bur, there is minimal risk of iatrogenic soft tissue injury. When there is insufficient space for use of a soft tissue protector a coarse grit diamond flat fissure bur can be used. Coronal reduction is slower using diamond burs and they need frequent unclogging to maintain their effectiveness, but they causes much less damage on contact with soft tissues than when tungsten carbide burs are used in the same situation.



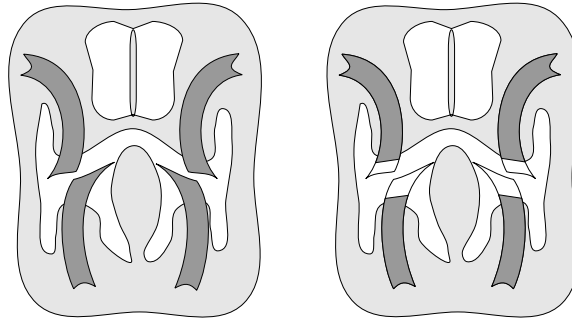
Diagrammatic representation of the effect of adequate coronal reduction. Both the cheek and incisor regions require coronal reduction in order to re-establish normal occlusion. In many cases the incisors will not return to occlusion as the mandibular teeth tend to straighten when they have been able to erupt unopposed for a while.

If necessary a fine textured diamond coated file can be used for final finishing of the occlusal edges, however, it is important that the edges of the occlusal surfaces should be sharp in order to allow effective chewing.

Whilst pulp exposure is highly unlikely when shortening cheek teeth as the pulp is usually shorter than normal due to the eruption having been impeded, exposure of sensitive dentine is possible and it is often necessary to remove some gingival tissue to ensure adequate coronal reduction (gingiva and alveolar bone tend to elongate as well as the exposed crowns), so analgesia should be continued for a few days post treatment. Supportive feeding is also likely to be required for a few days whilst the jaw muscles re-adapt to closing the mouth fully and until the occlusal surfaces wear back into function (burring removes the surface ridges required for effective chewing). At this stage a high fibre, high energy food is appropriate, but it should be withdrawn as soon as possible. If a commercial herbivore support diet is not available then one can be improvised by

liquidising a commercial pelleted diet with cucumber!

The practice of filing off “spurs” and “spikes” is largely a waste of time as it does nothing for the underlying problems, the tooth elongation and increased tooth curvature that develops when there is increased occlusal stress and a reduced eruption rate due to inadequate tooth wear.



Diagrams showing the effect of sufficient coronal reduction on dental spikes/spurs. Note the 10 to 12 degree angulation of the occlusal surfaces after occlusal adjustment. In most cases the maxillary cheek teeth need reducing to gingival level. The mandibular first cheek tooth will need to be reduced to the level of the gingiva at its caudal surface, the gingiva naturally recedes exposing the front of this tooth, whilst the other mandibular cheek teeth generally need to be taken to or just below the level of the gingiva.

A diet of fresh growing grass, hay and dried grass with small quantities of unimproved herbage (i.e. wild type, not commercially grown herbs and vegetables) is very effective at keeping the teeth worn down as it requires prolonged chewing using the full surfaces of the cheek teeth. This type of diet should be introduced as soon as possible post treatment. When clinical problems have been identified early and the cheek teeth are fully functional, the teeth will be kept short by feeding a natural diet, however, several treatments may be required, at 4-8 week intervals, before structure and function improve in mildly affected animals. Unfortunately most cases are not seen until irreversible apical changes have occurred, so life-long treatment is frequently required.

Cheek tooth extraction is possible, but unlike incisor extraction it is not a practical solution for cheek tooth problems. Cheek tooth extraction tends to be quite traumatic as the teeth become elongated and deformed preventing simple removal by simple elevation. Removal of more than one or two teeth in one session is likely to result in peri-operative fatality due to the level of stress.

Clipping of teeth

This barbaric practice results in a great deal of pain and suffering. Not only are the teeth left with sharp fractured surfaces that irritate the oral soft tissues, longitudinal cracks are also common involving sensitive dentine and often allowing infection into the pulp even if there is no direct pulp exposure. The resultant pulpitis is likely to be painful and pulp necrosis and apical abscessation are common. The forces applied to the teeth during clipping far exceed physiological limits and there is tearing of the periodontium and apical contusion resulting in ongoing pain and exacerbation of tooth growth abnormalities.

The use of tooth rasps (coarse surfaced instruments as opposed to files) is just as bad as again the forces required exceed physiological limits and rock the teeth in their sockets causing further periodontal and apical damage. Even the use of fine diamond files can loosen teeth.

Suggested protocol for dealing with dental problems in rabbits and rodents

1. Perform a full physical examination and obtain a detailed history. Advise general anaesthesia for further assessment and radiography if suspicious of dental problems. Give dietary advice. Advise regarding the physiology of continuously growing teeth and the need for ongoing care in all cases. Advise of possible treatment strategies and associated complications (root fracture, tooth regrowth, etc. associated with extraction).
2. Trim elongated incisor teeth using either a crosscut taper fissure bur in a high speed dental handpiece or a shielded diamond disc in a low speed handpiece. Avoid exposing the pulp. The pulp elongates and often extends above gingival level in overgrown teeth.
3. If the animal is debilitated give supportive therapy, fluids + force feeding. Analgesics often help and a response to their administration can be used as a diagnostic indicator confirming that pain (or inflammation if NSAIDS used) was present. Often trimming elongated incisors allows a return to self feeding.
4. Re-examine in 1 to 7 days for debilitated patients and those with multiple problems, 3 weeks if it appears to be purely an incisor problem.
5. Assess response to supportive care. Continue longer if necessary. Catabolic patients are a high anaesthetic risk.
6. General anaesthesia for further assessment including anatomical view skull radiography. Perform corrective treatments, i.e. coronal reduction and occlusal equilibration of cheek teeth (just removing dental spikes only scratches the surface of the problem - the teeth must be shortened to have any real effect) and palliative measures such as periodontal debridement and perioceutic treatment of periodontal pockets. Advise re the need for post-treatment supportive care and the need to return to a 'natural' diet as soon as possible. Continue analgesics for several days post treatment.
7. Assess welfare and response to treatment at 1 to 7 days then at 3 to 6 weeks. If there is a significant improvement in occlusion, repeat treatment. If not, consider extracting affected teeth, remembering that cheek tooth extractions tend to be traumatic and worsen the prognosis. Consider arresting eruption of mandibular cheek teeth.
8. If quality of life cannot be maintained then perform euthanasia.

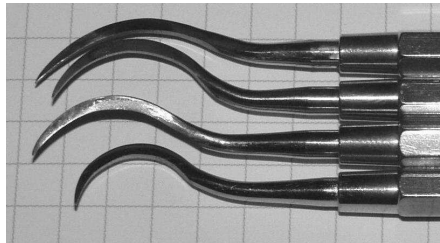
Extraction of continuously growing teeth

Non-functional and diseased teeth are often best extracted. In the case of continuously growing teeth it is not just a matter of loosening and removing the hard tooth substance as this may leave the growing tooth germ in situ. It is important that this germinal tissue is removed or destroyed at the time of extraction as remnants of odontogenic tissue continue forming dental tissue following extractions. Depending on the level of damage inflicted, the regrowing 'tooth' may vary between an amorphous mass of dentine like material and an anatomically normal tooth. As total destruction of the apical germinal tissues is unlikely, radiographic follow-up is indicated after 6-8 weeks and again at 6 months to monitor for continued deposition of mineralised dental tissue.

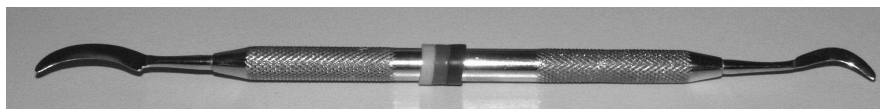
It is important that incisor extraction is not seen as a cure-all. Whilst complete removal of the incisors with destruction of the growing apical tissues eliminates these teeth from the clinical picture, cheek tooth problems will persist unless they are also addressed. Extraction of cheek teeth is also an option, however, complications are more likely than with incisor extraction and the trauma of removing more than three cheek teeth at one sitting frequently kills small herbivores. For mandibular cheek teeth, apicoectomy to arrest tooth growth may be preferable to extraction. Unfortunately this technique cannot be applied to the maxillary cheek teeth.

Incisor extraction

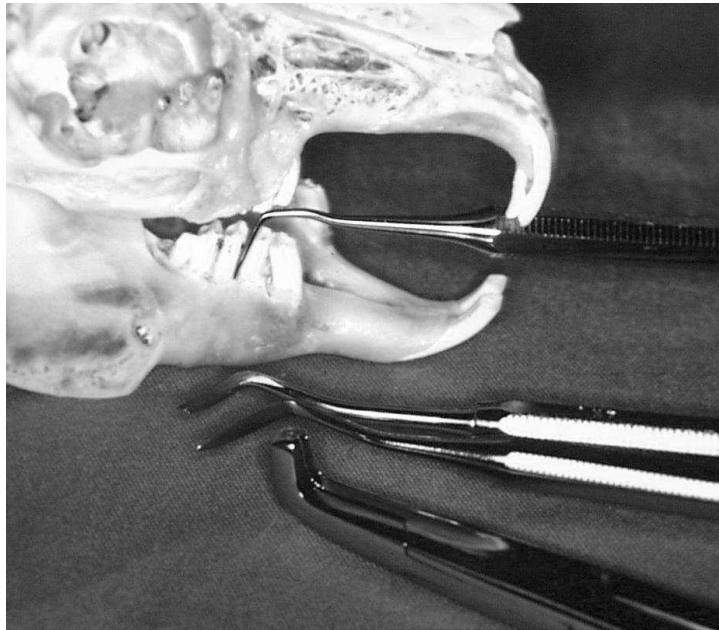
1. General anaesthesia, thorough intra-oral examination and skull radiography. Check the radiographs for tooth curvature and root deformities. If the roots are deformed or ankylosed a surgical approach is required.
2. Trim elongated incisor crowns to about 5mm above the gingiva using a dental bur.
3. Coronal reduction, occlusal equilibration, periodontal curettage and possibly extraction of cheek teeth are performed before incisor extraction.
4. Soft tissue lesions, periodontal pockets, cheek and tongue ulcers, iatrogenic wounds etc. also require appropriate treatment.
5. Extract incisor teeth :
 - a. Clean and disinfect the operating area.
 - b. Cut the epithelial attachment within the gingival sulcus around each incisor tooth extending the incision as far down the periodontal ligaments as possible on the medial and lateral surfaces.
 - c. In rabbits, the maxillary second incisors (peg teeth) can be extracted using a fine dental elevator. If this is done before working on the large first incisors there is a reduced risk of the small peg teeth fracturing.
 - d. To extract the remaining incisor teeth, select an incisor luxator blade matching the tooth size and curvature as seen on the lateral radiograph and insert it alternately lateral and medial to each tooth, working in sequence. The luxator needs to be held under longitudinal pressure for 15-20 seconds in each position so that its wedge shape forces the tooth sideways and both strains and tears the periodontal ligament fibres in areas inaccessible to the instrument



Various sizes and types of commercially available incisor luxator



- e. Keep repeating the luxation process (d.) until the teeth have loosened. A few minutes patience will be well rewarded.
 - f. When the teeth appear mobile, apply intrusive pressure to tear the remaining periodontal attachment. If this does not work repeat the luxation process.
 - g. Once the teeth are loose within their sockets they should be rocked gently whilst applying intrusive pressure to help detach and destroy the apical growing tissues.
 - h. Extract the loose teeth with fingers or gentle use of forceps, pulling them along the curved path of eruption as shown by the lateral radiograph.
 - i. Check that the pulp has been removed with the tooth. If not, curette the alveolus, using a sterile instrument, to destroy any remaining germinal tissue.
 - j. Haemorrhage is usually minimal. If the gingiva has been torn or haemorrhage persists, suturing is advised using a very fine absorbable material (1 or 1.5 metric Monocryl ® Ethicon) with a swaged on cutting needle
 - k. Infected sockets should be thoroughly flushed with an isotonic solution and either left open to drain or they may be filled with Doxyrobe perioceutic gel (Pfizer Animal Health).
6. Systemic antibiotics are only indicated if there is evidence of active infection.
 7. Most patients will be eating within a few hours of recovering from anaesthesia following incisor extraction, but it often takes longer if cheek tooth coronal reduction has been performed. Analgesia and supportive feeding is advised for a few days.
 8. Maintain long term follow-up, including radiography to check for continued “tooth” growth. If found, surgical access is indicated for removal of the remaining tissues.



Although a variety of mouth gags and cheek dilators have been around for many years, it was not until recently that manufacturers considered producing other dedicated instrumentation for use in rabbits and rodents. Now the range of suitable equipment is increasing every year. Cheek tooth extraction instruments, illustrated, are not often required as the prognosis is usually very poor following cheek tooth extraction.

Extraction of continuously growing cheek teeth

Extraction of the cheek teeth is similar to incisor extraction except that the curvature of the tooth roots is usually much less pronounced and the incidence of gross deformity is high. Following cleansing and disinfection the teeth can sometimes be loosened using a molar luxator, intruded to detach remaining periodontal fibres, intruded and rocked to destroy the apical tissues and then removed using molar forceps. When this method of mandibular cheek tooth extraction is impractical it is possible to make a surgical access through the ventrolateral border of the mandible and elevate the teeth from the apical end, either repelling them into the oral cavity, or extracting them via the surgical wound. The sockets can be filled with Doxyrobe perioceutic gel to eliminate any infection and reduce food contamination during healing.

Potential complications of extraction

Extraction is a delicate surgical procedure requiring a gentle technique in order to avoid root or jaw fracture and extensive soft tissue damage. Fractures of the lower jaw are a potential serious complication which can be avoided by using a gentle touch whilst supporting the bone throughout extraction. As accurate reduction and stabilisation of fractures is difficult in rabbits and rodents, a secondary cheek tooth malocclusion almost always results, leading to an ongoing need for monitoring and treatment.

When discussing cases prior to treatment, clients should routinely be advised of the possibility that the procedure will not be completed in a single sitting. If a root fractures it is often best to leave the residual fragments in situ, radiograph them and advise the owners accordingly, making arrangements to assess the patient for regrowth of the affected tooth/teeth at intervals. If regrowth of such a tooth is not apparent within two months, repeat radiography is indicated as it is likely that damage to the apical tissues has caused abnormal growth and impaction of the tooth remnant.

Except in the case of the peg teeth, a full surgical approach is then required to expose the whole length of the remaining tooth for extraction. Regrowth of a completely normal tooth allows a second attempt at closed extraction, though it is worth remembering that this is likely to be a weakened tooth and that re-fracture may occur.

Difficulties in clinical examination and radiographic interpretation lead to gross under-diagnosis of dental disease, particularly periodontal pocketing, which are, however, found on post-mortem examination. This accounts for many treatment failures.

Arresting growth of continuously growing teeth

Apicoectomy, surgical removal of the growing tooth apex, is a straightforward method for preventing further tooth growth of mandibular cheek teeth. The location of the apices are identified radiographically and any pathology noted. The apices are approached through an incision over the ventrolateral border of the mandible and the periosteum is elevated to expose the bone overlying the apices, the rostral border of the masseter muscle being retracted caudally if necessary. As the apices are frequently elongated they are usually easy to find. A sterile round bur in a low speed handpiece is used to penetrate the bone under a stream of sterile physiological saline and remove the apex of each tooth plus its associated soft tissues. Serious haemorrhage is unlikely in rabbits and chinchillas, what there is normally being easy to control with pressure from a damp swab. The wound is then irrigated and sutured closed.

Apicoectomy has also been applied to the mandibular incisor teeth in larger rodents. The treated teeth may then remain as they are, no longer erupting, become ankylosed and start resorbing, or continue erupting until they wear away or fall out. Whichever happens, the opposing teeth will still require ongoing maintenance, however, the maxillary teeth tend to erupt more slowly and sometimes stop erupting after a variable interval.



Discussion

In uncomplicated cases of incisor elongation or malocclusion, rabbits chinchillas and guinea pigs cope very well with hay and cut grass after extraction of the incisor teeth. Food should not routinely be liquidised except for assisted feeding of severely debilitated patients (cucumber, tomato and rabbit pellets make a syringeable paste in this situation) as normal chewing activity is required to maintain the cheek tooth occlusal surfaces. In many cases where animals with only mild disease are placed on a natural diet and repeated occlusal equilibration is performed there is a successive increase in the interval before further recurrence. Unfortunately we do not see enough cases at this treatable stage of disease.

If there is significant cheek tooth malocclusion on radiographic or visual examination, extraction of maloccluded incisors will only give temporary relief. Owners must be advised accordingly and animals monitored to ensure their welfare. Euthanasia should be performed if a satisfactory quality of life cannot be maintained. Major surgery, such as removal of large amounts of bone or many cheek teeth usually causes further serious problems so it is best to perform the simplest procedure that is likely to control the problem.

NOTE : Extraction of continuously growing teeth is not a suitable treatment for wildlife casualties which are to be released back into their natural habitat as they require a full functional dentition to survive.

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