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DENTAL DISEASE IN GUINEA PIGS: ANATOMY, PATHOGENESIS, DIAGNOSIS AND TREATMENT

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Like rabbits, guinea pigs have hypsodont teeth (teeth with a long crown), elodont teeth (teeth that grow continuously) and aradicular teeth (teeth without anatomical roots), which predisposes them to dental malocclusion in the event of an imbalance between growth and wear. However, unlike rabbits, the lack of wear is not due (as is most often the case) to a diet low in hard fibres, but to pain that makes chewing difficult, which existed before the malocclusion appeared. Therefore, if the origin of this dysphagia is not determined, there is a risk of treatment failure.

1) PRESENTATION

Patients usually present with non-specific signs, such as a decrease in food intake and a deterioration in general condition. Appetite is usually maintained, but chewing food appears difficult, leading the animal to give up feeding. The food bolus, although chewed, may not be swallowed and may fall out of the mouth. Hypersalivation is frequently present. The owner may also report observing the animal using its front paw to press on the side of its mouth or, occasionally, opening its mouth wide as if trying to relieve discomfort. Finally, in the event of infection, mandibular abscesses or exophthalmos secondary to a retrobulbar abscess may be observed. Secondary digestive signs may constitute associated complications.

2) CLINICAL EXAMINATION

a. Examination of the incisors

The incisors very often reflect a condition affecting the molars in this species. This examination is easy to perform on a conscious animal. In the presence of pathology, the examination reveals elongation and occlusion defects in the incisors, resulting from rostral displacement of the mandible. Bevel wear is frequently observed, associated with lateral mandibular deviation (Fig. 2). These changes are secondary to abnormal growth of the clinical crowns of the molars. Therefore, the length of the incisors should not be reduced without simultaneously treating the molars, as this will aggravate the patient's clinical condition.

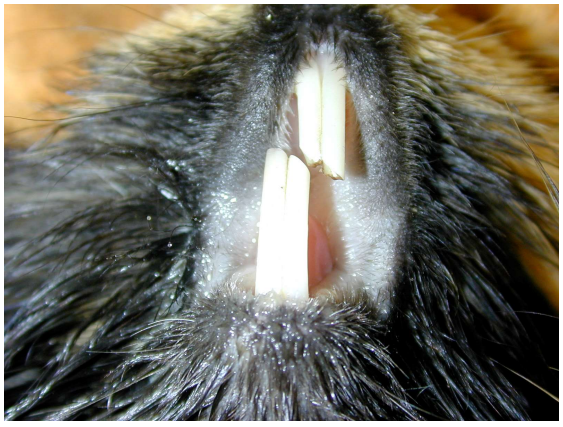


Fig. 1: Appearance of the incisors of a guinea pig with dental malocclusion: bevel wear, coronal elongation and lateral mandibular deviation to the right. (Credit JRN – CHV Anicura ADVETIA)

b) Examination of the cheek teeth

Examination of the oral cavity in a conscious guinea pig is difficult and often incomplete. In addition, guinea pigs usually have physiological food debris in the oral cavity, which complicates visualisation. Rinsing the mouth with water beforehand facilitates examination. The use of anaesthesia allows for a complete examination of the oral cavity.

The molar teeth show a 30° inclination of the dental crowns, and their occlusal surfaces are normally smooth. The dental crowns of each hemimandible are symmetrical and comparable in size. Each oral quadrant has a block of four jugal teeth (1 premolar and 3 molars).

The set of four jugal teeth in each quadrant functions as a masticatory unit. Chewing movements are rostro-caudal. Figure 2 illustrates the physiological dental occlusion of the guinea pig.

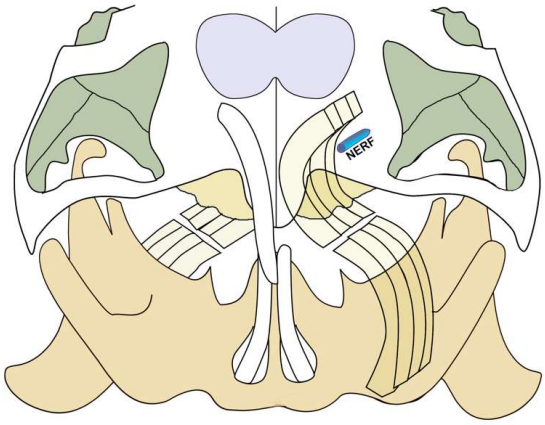
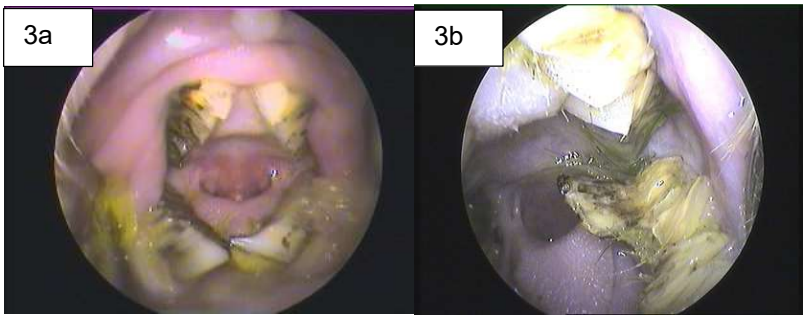


Fig. 2: Physiological dental occlusion of the guinea pig (anterior-posterior view), showing the 30° inclination of the dental crowns of the jugal teeth. When the jaw is at rest, the molars are in occlusion, while the incisors are not in contact. In blue, location of the maxillary nerve. (Credit JRN – CHV Anicura ADVETIA)

Unlike rabbits, in which isolated dental deformities are very common, dental lesions in guinea pigs usually affect an entire dental block. The most frequently observed anomalies are asymmetry in the wear of the dental crowns with respect to the opposite side of the oral cavity, reflecting a chewing defect on the side of elongation, and generalised dental elongation with the formation of a mandibular dental bridge at the level of the first jugal teeth (Fig. 3a). However, coronal deformities may also be observed, with isolated dental peaks or a deformation of the crown forming a crest at a right angle to the buccal side. These anomalies are usually associated with a tooth that is larger than the others (Fig. 3b).



Figures 3a, 3b: Different oral lesions observable in cases of malocclusion in a guinea pig. (Credit JRN – CHV Anicura ADVETIA)

3) PATHOGENESIS

The origin of the lack of wear on the dental crowns is not clearly understood. However, unlike in rabbits, it seems that primary pain that hinders chewing movements, whether of dental origin or from neighbouring structures (otitis, temporomandibular joint involvement, etc.), is the main contributing factor.

A retrospective radiographic study showed that guinea pigs with dental disorders frequently had a dental anomaly called macrodontia, which causes chronic oral pain due to abnormally large teeth.

The anatomical and physiological characteristics of this species allow us to understand the consequences of this deficit in dental wear, which manifests itself mainly in two alterations: intraoral elongation of the jugal tooth crowns and retrograde overgrowth of the reserve crowns.

a) The intraoral elongation of the crowns of the jugal teeth causes a mechanically forced mouth opening, which favours secondary excessive growth of the incisors, as well as a rostral displacement of the mandible due to the characteristic inclination of the dental crowns. This mandibular displacement, in turn, causes misalignment of the molars, leaving the first two jugal teeth and the last maxillary molar without antagonists. As a result, a mandibular bridge is formed by the first two lower premolars, while the last maxillary molar grows (elongates), acting as a caudal stop that blocks the jaw in a dislocated position. Under these conditions, the animal loses the ability to swallow properly, as it cannot push food with its tongue towards the hard palate and then towards the pharynx. If it tries to close its mouth by forcibly contracting the mandibular muscles, this can lead to complete dislocation of the temporomandibular joint. (Figs. 4 and 5)

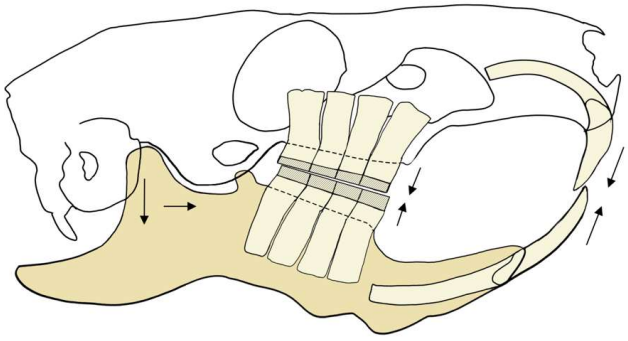


Figure 4: Overgrowth of the molar crowns (grey area) causes forced mouth opening and displaces the jaw rostrally, thus promoting misalignment and elongation of the incisors. (Credit JRN– CHV Anicura ADVETIA)

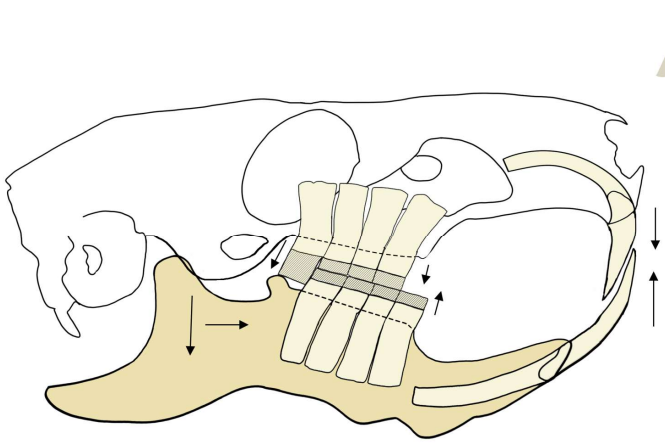


Figure 5: The rostral displacement of the mandible misaligns the molars, forming a mandibular bridge and a maxillary stop that block occlusion, prevent normal swallowing and can lead to temporomandibular dislocation. (Credit JRN – CHV Anicura ADVETIA)

b) Retrograde overgrowth of the reserve crowns: Unlike rabbits, in which the incisors of caviomorphs are not in contact at rest, their molars remain in complete occlusion. For this reason, when elongation of the clinical molar crowns occurs, the axial occlusal load on the affected teeth is permanent, inducing rapid retrograde overgrowth of the apices. These then tend to perforate the apical bone layer and reach the sensitive periosteal layer, causing pain and decreasing chewing ability.

This discomfort can worsen to the point of becoming intense pain in the maxillary region, given that, due to the curvature of the teeth, the apices of the maxillary teeth grow laterally and can come into contact with the maxillary nerve, located laterally to these apices. This could explain the existence of constant nerve irritation pain that prevents the guinea pig from chewing properly.

Secondary inflammation of the apices can lead to a decrease in dentine production, causing tooth fragility and possible longitudinal fractures. An infectious complication in this area can lead to the formation of apical abscesses. The preferred sites for the formation of these abscesses in guinea pigs are the last two mandibular molars and the last two maxillary molars, the latter of which can cause a retro-orbital abscess.

Imaging diagnosis is essential for visualising and characterising dental deformities.

4) DIAGNOSTIC IMAGING

Although computed tomography is very useful in allowing structures to be superimposed and all dental aspects to be visualised, a great deal of data can also be obtained through radiographic study, provided that all the necessary incidences are used.

a) Performing radiographic projections
The four main views commonly used in rabbits are employed: lateral-lateral, dorsal-ventral, and right and left lateral oblique, to which the rostro-caudal view can be added. In addition, there are

two specific views that allow only the mandibles or only the maxillae to be isolated. To obtain quality images, the guinea pigs must be anaesthetised.

- Isolated mandible: The patient is placed in the prone position, with the head extended upwards and the mouth wide open using loops passed behind the mandibular and maxillary incisors. The beam is directed towards the middle of the intermandibular region. This prevents overlap with the maxillary area, achieving complete visualisation of the apices and all dental structures.

- Isolated maxilla: The patient is placed in the supine position, with a foam roller/towel approximately under the neck, allowing for caudo-dorsal hyperextension of the head. This prevents overlap of the mandible, providing a clear image of the maxillary molars.

b) Interpretation
The structures to be evaluated in a dental radiograph of a guinea pig are: the general bone structure, the teeth (length, width, shape, curvature, position, apices and radiotransparency of the germinative tissue), the occlusal surface, the temporomandibular joints and the tympanic bullae (thickening of the wall, opacification indicative of otitis).

In a lateral-lateral view, with normal occlusion, the incisors do not touch; the mandibular incisors are located behind the maxillary incisors. The occlusal surface is flat, but since the molars are curved at approximately 30°, it does not appear as a clearly visible line. The maxillary and mandibular molars are of similar height and are exactly opposite their antagonist teeth. The mandibular cortical bone should not show deformities or perforations due to retrograde dental overgrowth.

The reference lines, illustrated in Fig. 6, allow abnormal dental growth and retrograde overgrowth to be identified.

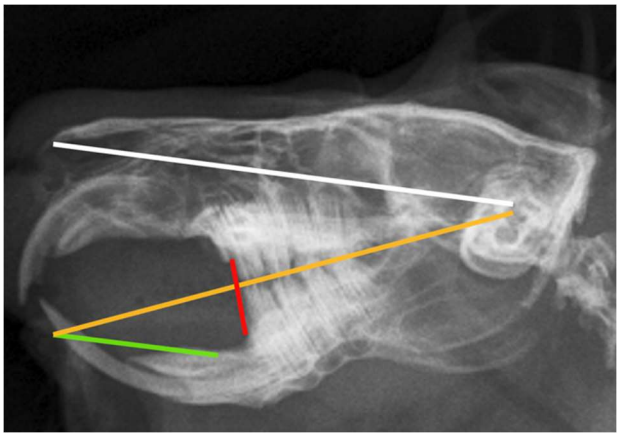


Fig. 6: Radiograph of a guinea pig in a physiological state, latero-lateral view. Reference lines according to Böhmer and Crossley. The reference point for the start of the reference lines is located at the midpoint of the length of the tympanic bulla and three-quarters of its height. A first line (white), which starts from this point to the rostral end of the nasal bone, traces the normal limit of possible retrograde overgrowth of the maxillary teeth. The yellow line allows the normal position of the occlusal surface of the molars to be determined. It extends from the same point on the tympanic bulla to the extension of the line formed by the mandibular bone, reaching the anterior limit of the mandibular incisors (green line). The red line highlights the normal alignment between the mandibular and maxillary teeth. (Credit JRN– CHV Anicura ADVETIA)

b) Main anomalies

The main anomalies found are: elongation of the clinical crowns of the mandibular incisors, retrograde overgrowth of the maxillary or mandibular molars, elongation of the clinical crowns of the molars, and alterations in the structure or size of some teeth (macrodontia). The elongation of the clinical crowns of the mandibular molars causes a rostral displacement of the jaw in guinea pigs, which is evidenced by a misalignment between the mandibular and maxillary molars (Fig. 7).

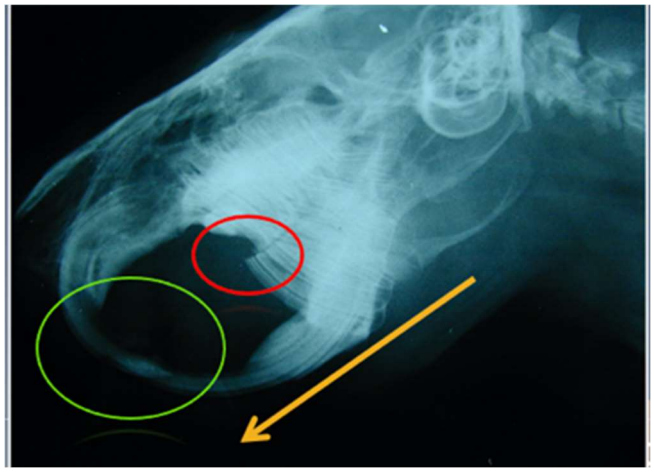


Figure 7. X-ray of a guinea pig, lateral view, showing elongation of the incisors (in green) and rostral mandibular displacement (yellow arrow), manifested by a misalignment of the mandibular molars with respect to the maxillary molars (red circle). (Credit: JRN– CHV Anicura ADVETIA)

A dental anomaly particular to guinea pigs is macrodontia. This is the presence of abnormally large teeth, especially in width. This condition had previously been described sporadically, but a recent retrospective study (Köstlinger et al 2021), conducted on 131 patients, showed its presence in 89% of X-rays taken of guinea pigs with dental disease. Radiologically, it is defined as an increase in the width of the dental crown associated with an alteration in the structure of the tooth (Fig. 8), with the disappearance of the regular pattern of internal striations corresponding to the alternation of enamel and dentine. These lesions probably reflect a loss of dental enamel, the presence of dysplastic dentine and obliteration of the pulp cavities.

These anomalies are often associated with widening of the periodontal space and thickening of the alveolar bone cortex, suggesting that macrodontia could be a progressive syndrome that would alter the dental support structures over time. The most favourable radiographic views for detecting these anomalies are those that isolate the mandible and maxilla, respectively. The teeth most frequently affected are the mandibular incisors and the two distal maxillary and mandibular molars.

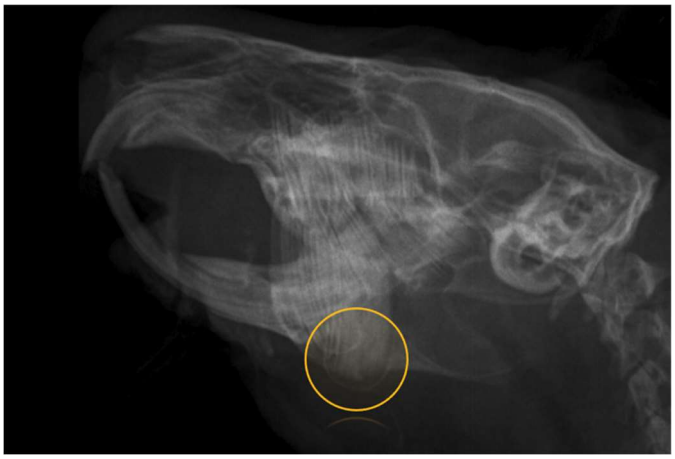


Fig. 8: Radiograph of a guinea pig, lateral oblique view. Macrodontia of the last right mandibular molar (yellow circle). (Credit JRN– CHV Anicura ADVETIA)

5) **TREATMENT**

Treatment can be demanding for the guardian and, despite the care taken, can be disappointing, as failure is possible, either because the guinea pig is too weak or because the source of the primary pain has not been identified or treated.

Treatment is structured in two stages: the first consists of reducing the coronal elongations of the teeth to allow the jaw to return to a normal position, which alleviates the pain and makes it easier for the animal to gradually resume feeding. This filing may be accompanied by the drainage of any dental abscesses. The second stage, once the animal has stabilised, consists of treating the primary cause of the pain that led to the malocclusion.

a) Coronal reduction

This is performed under anaesthesia. Generalised coronal reduction of the molars to the gingival level appears to be the best option. A common cause of failure of tooth filing is insufficient reduction of the last maxillary molar, which acts as a pivot in the malocclusion. Reducing only the molars that form the dental bridge provides temporary relief: the animal can swallow its food, but the mouth cannot close properly and recurrence is rapid. Finally, a last argument in favour of complete coronal reduction is that this procedure decreases abnormal occlusal pressure on the dental apices, thus significantly reducing periosteal pain.

Secondly, since the length of the incisors depends on that of the molars, once the latter have been reduced, the clinical crowns of the incisors can be trimmed (if necessary) to restore normal occlusion.

The patient is discharged with analgesic treatment, antibiotics if necessary (depending on the results of the culture, if possible) and instructions for assisted feeding. Since the temporomandibular joints have been subjected to considerable functional stress, osteopathic treatment can contribute significantly to recovery. The animal is checked at 8-10 days. At that time, an examination of the oral cavity is performed under anaesthesia to assess the regrowth of the crowns, and adjustment filing may be performed at this time.

b) Treatment of the primary source

Determining the primary source of pain is often complicated. In fact, not all dental abnormalities identified on radiographic examination are painful. For example, mandibular cortical perforations

following retrograde dental overgrowth seem, in general, to be relatively well tolerated by the patient. In contrast, maxillary retrograde overgrowth of the molars can be more painful, as it irritates the maxillary nerve (Fig. 2). It is important to identify macrodontia, as this can be painful. On the other hand, the primary pain may not be of dental origin, but may be located in the temporomandibular region (joint involvement of the temporomandibular joints, such as osteoarthritis or arthritis) or in neighbouring structures (otitis).

Teeth with macrodontia or retrograde overgrowth capable of irritating the maxillary nerve should be extracted or undergo apicoectomy. The same applies to teeth affected by an abscess.

c) Apicoectomy

It is a less aggressive alternative to extraction, with a lower risk of complications, which consists of the surgical removal of the dental apex of the affected jugal teeth, with the aim of stopping their growth (Fig. 9). This procedure is indicated when crown reduction alone is not sufficient to resolve apical complications, or in cases of repeated reductions in close succession.

Surgical access to the apices of the jugal teeth is always extraoral and delicate. Therefore, precise knowledge of these structures, adequate equipment and complete mastery of the surgical technique are required.

Although apicoectomy can improve the animal's comfort and prolong residual dental function, it does not treat the underlying cause of chronic dental disease, so teeth other than those treated may cause problems later on. Therefore, clinical monitoring is essential.

Possible complications associated with this surgery include bone fracture, infection, or damage to adjacent structures.

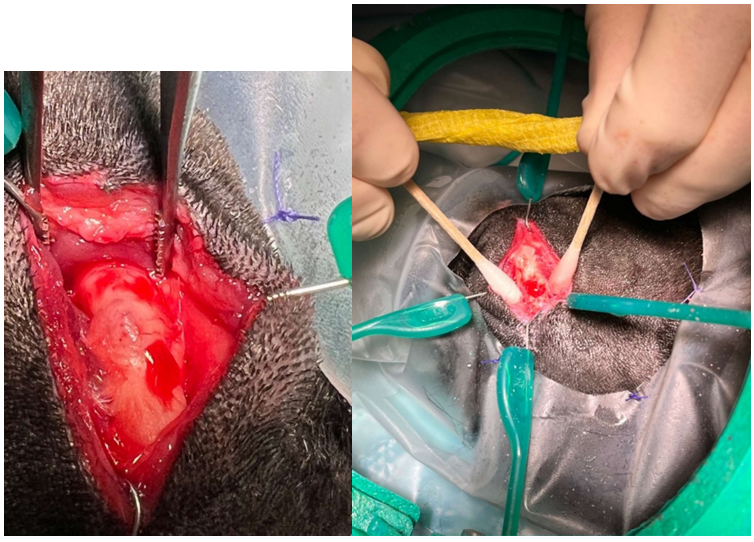


Figure 9: Illustrations of the apicoectomy technique performed on a guinea pig with retrograde overgrowth of three molars in the right mandible. (Credit JRN– CHV Anicura ADVETIA)

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