A case of maloccluded incisor teeth in a beaver (*Castor canadensis*)

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A three-year-old female beaver (*Castor canadensis*) was referred to the Veterinary Teaching Hospital of Chungbuk National University. It had been raised in the Cheong-ju zoo and had a history of malocclusion caused by improper feeding. General anesthesia was induced, and preoperative intraoral dental radiographs of the rostal maxillary and mandibular dentition were taken and lateral and ventrodorsal extraoral radiographs of the cheek teeth were also taken. The radiographs were negative for apical pathology and revealed a normal appearance of the cheek teeth. The lesion was likely to be related to the excessive length of the maxillary and mandibular incisors. Odontoplasty was performed to reduce overgrowth of the crowns of the incisors. Sequential transverse sections were removed until the crown was reduced by approximately its original length. The pulp chamber was not approached during the operation, as confirmed by postoperative intraoral radiographic evaluation of the incisors. Recovery from anesthesia was uneventful and the beaver returned to normal masticatory activities immediately after the operation.

Key words: beaver, incisor teeth, malocclusion

Beavers (*Castor canadensis*) are the second biggest species in the largest mammalian order, Rodentia [2]. Characteristic of rodents are four prominent yellow or orange incisor teeth [2,4]. These teeth are necessary for the gnawing habits of these animals [2]. The dental formula for the beaver is $2 \times (I \ 1/1, C \ 0/0, P \ 1/1, M \ 3/3) = 20$. The incisor teeth continue to grow during the lifetime of the animal [5]. These continuously growing teeth are generally kept within appropriate sizes by attrition [1]. This unique feature sometimes contributes to a clinical problem when malocclusion or inadequate wear allows elongation of these teeth [2].

Normally, an object is gnawed by being held against the immobile upper incisors and jaw while it is cut by a fore-and-aft movement of the lower incisors and jaw [2,4]. Malocclusion is a condition in which the upper and lower teeth are malpositioned during chewing movements of the jaw. Malocclusion of the incisor in rodent is most often characterized by an altered clinical crown length, angulation and occlusal wear pattern, rather than altered positioning of the teeth.

There are several causes of malocclusion, including hereditary factors, nutritional imbalance, and lack of adequate dietary roughage. Affected animals eat less, lose weight, and waste food because of impaired prehension. A constant sign in advanced stages of the condition is excessive drooling, which causes wet, matted fur around the mouth, chin, chest, neck, and forelegs. Eventually, secondary bacterial infection and hair loss may occur. Unless corrected, death is common because of starvation or secondary complications [2].

To treat this form of malocclusion, the overgrown teeth are trimmed back to normal length and shape using instruments such as files, saws, or specialized dental equipment (a dental unit). Use of a speculum will help protecting the animal and the handler during examination and treatment. Unless the inciting cause is corrected (impossible if genetics), the corrective measure is only temporary, and the teeth will continue to grow abnormally. Animals with inherited malocclusion should not be mated [2].

A three-year-old female beaver was referred to the Veterinary Teaching Hospital of Chungbuk National University. It had been raised in the Cheong-ju zoo and had a history of malocclusion caused by improper feeding. The maxillary and mandibular incisors were maloccluded, as a result of inadequate wear and consequent elongation of the clinical crowns.

General anesthesia was induced with 10 mg/kg ketamine (Ketamine, Yuhan Co.) administered intramuscularly. Once the animal was recumbent, preoperative intraoral dental radiographs were taken of the rostal maxillary and mandibular dentition using both dorsoventral and bisecting angle techniques at a range of exposure to acquire diagnostic
radiographs. Lateral and ventrodorsal extraoral radiographs of the cheek teeth were taken (Fig 1). The radiographs showed no apical pathology associated with maxillary and mandibular incisors and revealed normal appearance of the occlusion of the cheek teeth. The original lesion was considered likely to be related to the excessive length of the maxillary and mandibular incisors from insufficient dental attrition causing malocclusion (Fig 2). In order to minimize the duration of anesthesia, radiographic examination and surgical procedure were carried out in a series. Odontoplasty was performed to reduce the overgrowth of the crown of the incisors using a flat and taper diamond bur (10 mm length) and a water-cooled, high-speed handpiece. Sequential transverse sections were removed until the crown was reduced to approximately its original length. The crown reduction described here was performed to prevent the occurrence of self trauma to the oral vestibule resulting in facial wound. The pulp chamber was never approached during the operation, as confirmed by postoperative intraoral radiographic evaluation of the incisors (Fig. 3). Recovery

Fig. 1. Preoperative intraoral and extraoral radiographs of incisor teeth overgrowth in a female beaver. Intraoral dental radiographs of maxillary incisors (A) and mandibular incisors (B). Ventrodorsal extraoral (C) and lateral extraoral (D) radiographs of a whole skull. These radiographs do not reveal any periapical pathology involving the maxillary and mandibular incisors.

Fig. 2. A case of malocclusion and subsequent overgrowth of incisor teeth in a beaver (Castor canadensis). Four prominent yellow or orange incisor teeth, as shown in these pictures of a beaver are a characteristic feature of rodents.
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from anesthesia was uneventful and the beaver had returned to normal gnawing activities immediately after the operation.

Dental procedures are sometimes conducted on exotic species in less than optimal facilities, and require a flexible approach. The aggressive nature of many exotic animals, including beavers, may delay timely oral health care for logistical and personnel reason [3]. General anesthesia is necessary to enable thorough oral examination and dental treatment [4].

Malocclusion in rodent can be classified in traumatic and atraumatic [4,6]. Atraumatic malocclusion is normally not attributed to trauma. One of three basic forms of the atraumatic malocclusion is caused by improper wear. This is a result of functional problems such as abnormal chewing habits and eating behavior [4]. In this case, nutritional problem with bad feeding was thought as a cause of an atraumatic malocclusion that resulted in improper tooth alignment. The beaver was developed improper mastication, impaired oral closure and loss of appetite, but there was no evidence of severe weight loss, infection and so on.

Oral examination and radiographic evaluation of dental problems in rodents have been reported [4,6]. The location of the pulp chamber may vary between individual animals or between the mandibular and maxillary incisors. In addition, local occlusal and environmental factors may affect the location of the pulp chamber relative to the incisal margin of the tooth [3]. In this case, a thorough oral examination and intraoral and extraoral dental radiographs of the maxillary and mandibular incisor teeth was performed to rule out apical pathology and to decide reduction range of a crown. In visual examination of the periodontal problems and cheek teeth overgrowth, no significant abnormal conditions were founded.

When not complicated by involvement of the cheek teeth, overgrowth of the incisor can usually be treated and controlled by odontoplasty, apicoectomy or extraction. Confirming the location of the pulp chamber is of considerable importance before crown reductions are performed to ensure that the pulp is not penetrated during odontoplasty. In the present case, radiographs of the rostral incisors showed no pulp chambers present close to the incisal edge (Fig. 1). The crowns of the incisors were reduced in transverse sections using a dental unit, in order to promote normal dental attrition [6]. A diamond bur was used to trim the beaver’s teeth because its permits rapid and accurate shaping and smoothing, unlike other implements such as bone cutters which crush, fracture or split the teeth, often resulting in exposure of the pulp. Pulp exposure may occur even when teeth are cut using a bur, requiring vital pulp therapy if the pulp chamber is exposed inadvertently, but there was no evidence of perforation of the pulp chamber in this case.

As the problem in this case was caused by poor husbandry rather than genetic abnormality, the procedure was not needed to be repeated regularly. Now, the zoo is modifying the environmental conditions, diet, and husbandry procedures of its animals in order to promote normal dental attrition and minimize the incidence of traumatic crown loss.

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