Why, when and how to successfully extract a deciduous tooth

Deciduous teeth should erupt and exfoliate in the few months before a dog enters adulthood. For this reason, there is often reluctance or a lack of knowledge as to why these teeth may need to be extracted. However, there are three main indications for the extraction of deciduous teeth; injury or fracture; persistence of a deciduous tooth; or to manage a malocclusion with extractions, which is also known as 'interceptive orthodontics'. The extractions for all three indications are time sensitive. They should be viewed as urgent in the case of fractures, and procedures to perform as soon as possible for the other indications. Extraction should be done with a careful open approach; they need to be complete, and radiographs are essential.

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In the early years of the author's career in general small animal practice, deciduous teeth were normally only extracted if they persisted in a patient up to the time of routine neutering. If such a tooth was noted at induction, usually a canine (*Figure 1*), the veterinarian would ask for a luxator, and a closed extraction would be attempted with varying levels of success. To this day, conversations that the author has with veterinarians and nurses who are not immersed in the world of veterinary dentistry suggest that this is common. For some veterinarians, and certainly for a lot of owners and breeders, the idea of extracting a tooth that should soon be exfoliating is unclear. This article addresses this and gives veterinarians the confidence to know why, when and how to extract deciduous teeth.

Deciduous teeth

In normal circumstances, deciduous teeth are only present in a puppy's mouth for a few months. These teeth are fully developed at birth and begin to erupt at around 4 weeks of age, starting with the incisors (Sharpe et al, 2019). By the time puppies are 12 weeks of age, they should have the full complement of 28 deciduous teeth with the dental formula: 2 x (I3/I3, C1/C1, P3/P3).

Deciduous teeth begin to exfoliate from 4 months of age; by 7 months of age, they should all be replaced by the permanent dentition. While they are present for only a small window of time, it is in this window that the veterinary profession has a lot of contact with dogs as they present for routine health checks and vaccinations. Dental abnormalities in puppies are common, and identifying them and acting promptly with confidence can make a big difference to their teeth and comfort for the years that follow.

The three main indications for extraction that this article will cover are:

- Fractures of deciduous teeth
- Persistent deciduous teeth
- Malocclusions involving deciduous teeth.

Fractures of deciduous teeth

Deciduous teeth, in particular the canines, are commonly fractured. The length of these teeth and their prominent rostral position make them vulnerable. They have thin dentine walls with wide pulps (*Figure 2*) making them weak to forces applied in the axial plane. Puppies behaviours also make these teeth vulnerable. For example, tugging on rope toys, bar biting in crates and having access to inappropriately hard toys are major risk factors.

Fractured deciduous teeth with pulp exposure require extraction as soon as possible. Pulp is a tissue rich in nerves, and trauma and exposure to the oral cavity causes instant pulpitis. This is a painful condition, but if the tooth is not treated promptly, the pulp is rapidly infected before undergoing necrosis. Bacteria migrate apically through the pulp canal until they reach the apex. Here, they trigger periapical periodontitis. This is thought to occur more rapidly in deciduous teeth because of their wide pulp canals (Hale, 2005; Nimiec, 2010). Cellulitis in the periapical area is a common sequelae giving gross swelling clinically. This can

commonly be misdiagnosed as bee stings, so dental fractures should always be considered when presented with a puppy with a swollen face. Intraoral discharging sinuses and obvious tooth discolouration are also common clinical signs (*Figure 3*).

It is never acceptable to just monitor these teeth in the hope that the tooth will exfoliate before problems develop. This approach will leave an animal in pain, and it is also believed that the inflammation associated with a tooth root infection may inhibit the normal resorptive process and thus delay or prevent exfoliation (Hale, 2020). The developing permanent canines and rostral premolars are also very close to the apex (*Figure 2*). They are vulnerable to inflammation, meaning that developmental abnormalities may occur because of infection of the deciduous tooth (Hale, 2005).

Persistent deciduous teeth

There is a rule in veterinary dentistry: two teeth should not occupy the same position at the same time (Harvey and Emily, 1993; Hale, 2005; Sharpe et al, 2019; Charlier, 2021).

The term 'persistent deciduous tooth' is used to describe a deciduous tooth that is not shed when its permanent counterpart erupts (Charlier, 2021). The permanent tooth does not need to be fully erupted before the deciduous tooth is considered persistent. The exfoliation of deciduous teeth is thought to be initiated when the crown of the developing permanent tooth makes contact with the root of the deciduous tooth, stimulating a resorptive process (Lemmons and Beebe, 2019). Therefore, a common reason for deciduous teeth to remain in the mouth is because a permanent counterpart has failed to develop. These teeth do not necessarily need extracting if they appear healthy clinically and radiographically (*Figure 4a*). However, it is prudent to monitor such teeth. It has been reported (Sharpe et al, 2019), and it is also the author's experience, that such teeth can undergo partial delayed resorption with the potential for inflammation, pain, pulp exposure and fracture (*Figure 4b*).

Knowing how to identify deciduous teeth radiographically is important. In dogs that are around 7–11 months of age, permanent dentition should have extremely wide pulps and immature open apices. Deciduous teeth should have closed apices as well as slender root morphology (*Figure 4a*). This is particularly useful to keep in mind when presented with a toy breed dog with multiple persistent deciduous incisors, canines and premolars. In these cases, the permanent counterparts are usually present, giving a double row appearance to the dentition (*Figure 5a; 5b; 5c*). It is easy to appreciate why the term 'shark mouths' has become popular when describing these cases.

Another general rule that can help determine permanent from deciduous dentition is that the permanent dentition will develop and erupt on the lingual or palatal aspect of the deciduous dentition. An exception is the maxillary canine which erupts mesial to the deciduous predecessor and the maxillary fourth premolar which erupts mesiobuccally to its deciduous predecessor (Gracis, 2018). This rule generally works but it is not completely watertight. The author has seen permanent dentition erupting buccal to the deciduous teeth, particularly with the fourth mandibular premolar (*Figure 6a; 6b*).

Figure 1. A retained deciduous left mandibular canine. The classical clinical picture of a retained deciduous tooth.

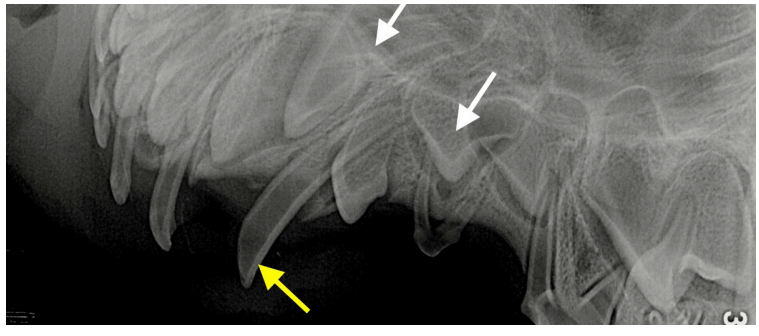

Figure 2. A radiograph of a fractured left maxillary deciduous canine (yellow arrow). Note how thin the dentine walls are and the close proximity of the root apex to developing permanent dentition (white arrows).

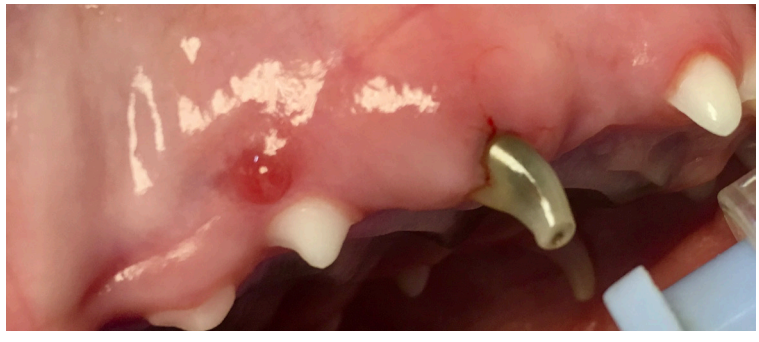

Figure 3. A fractured right maxillary deciduous canine with obvious discolouration and a discharging sinus associated with periapical disease.

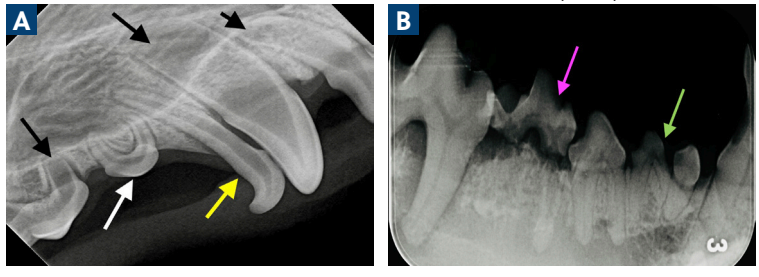

Figure 4. a) A lateral radiograph of a 7-month-old Jack Russel Terrier's right rostral maxilla. A persistent deciduous canine (504) is highlighted with a yellow arrow and persistent premolar (506) is highlighted with a white arrow. The latter may be left in the mouth. The permanent first and second premolars have failed to develop. Open apices of the permanent teeth are highlighted with black arrows. b) A lateral radiograph of right rostral mandible of a 5-year-old Yorkshire Terrier. Arrows highlight two persistent deciduous premolars. The deciduous third premolar (pink arrow) has suffered severe delayed tooth resorption.

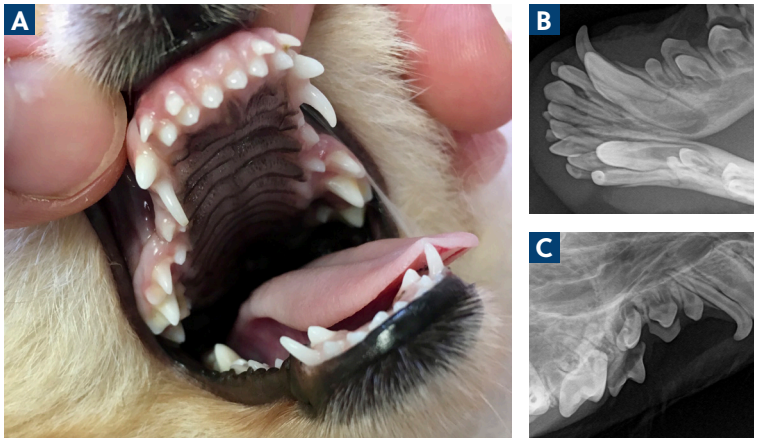

Figure 5. a) The clinical appearance of a 'shark mouth.' This is an 8-month-old Pomeranian cross with almost complete retained deciduous dentition. b) A lateral radiograph of the rostral left mandible showing the mixed dentition. c) A lateral radiograph of the rostral right maxilla in the same patient.

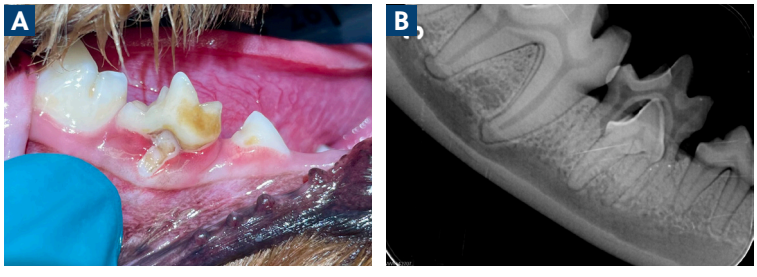

Figure 6. a) A clinical photo of an infra-erupted permanent right mandibular fourth premolar on the buccal aspect of a retained deciduous third mandibular premolar. b) The radiograph of the same case.

Figure 7. A right lateral view of the permanent dentition of a 3-year-old whippet showing normal occlusion with interdigitation of the opposing permanent canines and lateral incisors.

Most veterinarians seem to be aware that they should extract persistent deciduous teeth, since the presence of these teeth contributes to poor periodontal health (Legendre, 1994; Fulton et al, 2014). The gingival attachment or gingival collar around the cervical region of the tooth is compromised by the additional tooth in very close proximity. The extra tooth and overcrowding also promotes plaque accumulation as well as the trapping of hairs, fibres and other materials. Over time, the almost inevitable periodontitis would likely necessitate the extraction of both deciduous and permanent teeth.

If developing periodontitis was the only concern, there would not be any real urgency in extracting persistent deciduous teeth. Veterinarians may be forgiven for 'watching this space' and extracting the offending teeth when it is next convenient. However, this is not at all recommended because there is a much more pressing concern and a reason to extract promptly.

What seems to be less understood is that persistent deciduous teeth can cause eruption and positioning abnormalities of the permanent teeth (Legendre and Reiter, 2018). They may cause infra-eruption (partial eruption) of a permanent tooth (*Figure 6*) and can also prevent permanent teeth from 'tipping' into the positions required for a normal and atraumatic occlusion – as a result, malocclusions can occur. It is out of the scope of this article to detail all the malocclusions that retained deciduous teeth contribute towards, so it will focus on the most common and notable issues seen by veterinarians.

A malocclusion is any deviation of normal occlusion. In normocclusion, the mandibular canines sit in a diastema between the maxillary canine and the lateral incisor (*Figure 7*). This diastema is just big enough to accommodate the mandibular canine and there is little room for error. A certain amount of movement is required from the permanent canines as they erupt to achieve this neat arrangement. When the permanent mandibular canine starts to erupt it is lingual to the deciduous counterpart, but as the deciduous mandibular canine exfoliates, it will start to tip out labially. When the permanent maxillary canine erupts, it is mesial to its deciduous counterpart, but as the deciduous tooth exfoliates it is able to tip back distally. This movement opens up the diastema for the mandibular canine to slot into once it has tipped out sufficiently.

If deciduous canines fail to exfoliate, they can prevent these tipping movements of the permanent teeth potentially causing:

- A diastema that is too small to accommodate the mandibular canine
- A mandibular canine that has not tipped labially enough (linguoversion).

The result is traumatic contact from the cusp of the mandibular canines on the opposing soft tissues (*Figure 8a; 8b*). If left untreated, these lesions can be dramatic and range from deep infected ulcers to severe periodontal disease and even oronasal fistula formation (Legendre and Reiter, 2018). Treatment of established lesions will also be far more complicated.

The best outcomes occur when cases are identified promptly and extractions are performed early enough to allow natural orthodontic movement to occur without any other intervention. *Figures 9a* and *9b* show a case that was just on the cusp of where normal occlusion might be successfully achieved from extractions of the deciduous teeth alone.

Malocclusions involving deciduous teeth

Mandibular distocclusion (class 2) and mandibular mesiocclusion (class 3) are skeletal maloclusions where there is a mismatch in the lengths of the mandibles relative to the maxillae. With mandibular distocclusion, the mandibles are relatively short (brachygnathism) and with mandibular mesiocclusion, the man-

dibles are relatively long (prognathism). As well as classes 2 and 3, there is also a type of class 1 malocclusion that commonly calls for interceptive orthodontics. In a class 1 malocclusion, there is no discrepancy in jaw length but one or more teeth may be malpositioned. Linguoversion of the mandibular canines (MAL1/LV) is the malocclusion seen most by the author.

Skeletal malocclusions

Both mandibular distocclusion (*Figures 10a; 10b*) and mandibular mesiocclusion are likely to negatively affect the position of the deciduous mandibular canines. Just as with the permanent teeth, there is no room for error when it comes to the positioning of the mandibular canine and it is likely to miss the diastema and so make contact with the soft tissues. Veterinarians will be familiar with how sharp and pointed puppy teeth are, so it is inevitable that they will traumatise the opposing soft tissue. For this reason alone, prompt extraction of the deciduous teeth is needed.

The growth of all four jaw quadrants happens independently of one another (Stockard, 1941; Hennet and Harvey, 1992). A young dog with a skeletal malocclusion at 8 weeks of age may have the genetic potential for an increased rate of growth of the mandibles relative to the maxillae or vice versa as it ages, meaning the malocclusion could normalise in time. However, once the canines are embedded in the opposing soft tissues, they create an 'interlock' when the mouth is closed, which prevents this independent growth. With mandibular disocclusion, there may also be ventral bowing of the jaw, caused by an inability of the mandibles to grow rostrally (Lobprise, 2019) and abnormal forces through the temporomandibular joint. These interlocks can also be caused by dentition getting stuck on the 'wrong side' of the opposing dentition (ie an inverse rostro-caudal relationship between the deciduous maxillary and mandibular canines) (*Figure 11*).

Extracting teeth to remove these interlocks is referred to as interceptive orthodontics. Acting early with the deciduous teeth gives the permanent teeth the best possible chance of a more normal occlusion, however it does not guarantee that this will happen.

"These procedures do not alter the animal's genetic make-up nor do they make anything happen. Rather, they allow the animal to express its full genetic potential by removing any mechanical impediment to growth." (Hale, 1999)

Figure 8. a) A 1-year-old German Shepherd with a persistent deciduous left mandibular canine. As a result, the permanent canine has failed to tip out labially (it is linguoverted). b) In this photo, the point of traumatic contact can be seen where a small ulcer is forming.

Figure 9. a) Linguoverted permanent canines due to persistent deciduous mandibular canines. b) A lateral view of the same case showing a mesioverted left maxillary canine due to a retained deciduous counterpart. This photo gives a good idea of how far away the mandibular canine is from occupying the diastema which is currently too narrow. White arrows show the accumulation of plaque and foreign material typical of these cases.

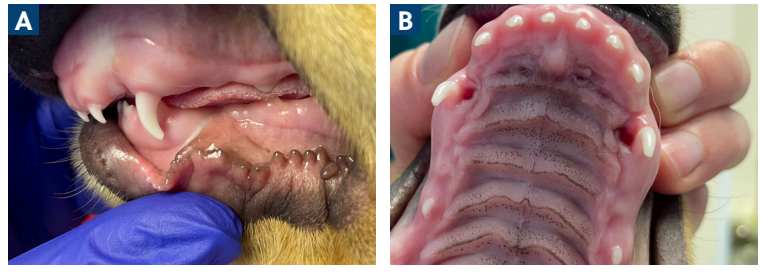

Figure 10. a) A lateral view of a 10-week-old Labrador with mandibular distocclusion. b) A view of the same patient's palatal mucosa showing two deep ulcers on the palatal aspect of the deciduous maxillary canines.

Figure 11. A lateral view of an 8-week-old Newfoundland with a problematic dental interlock caused by an inverse rostro-caudal relationship between the deciduous maxillary and mandibular canines with buccal tipping of the deciduous canine.

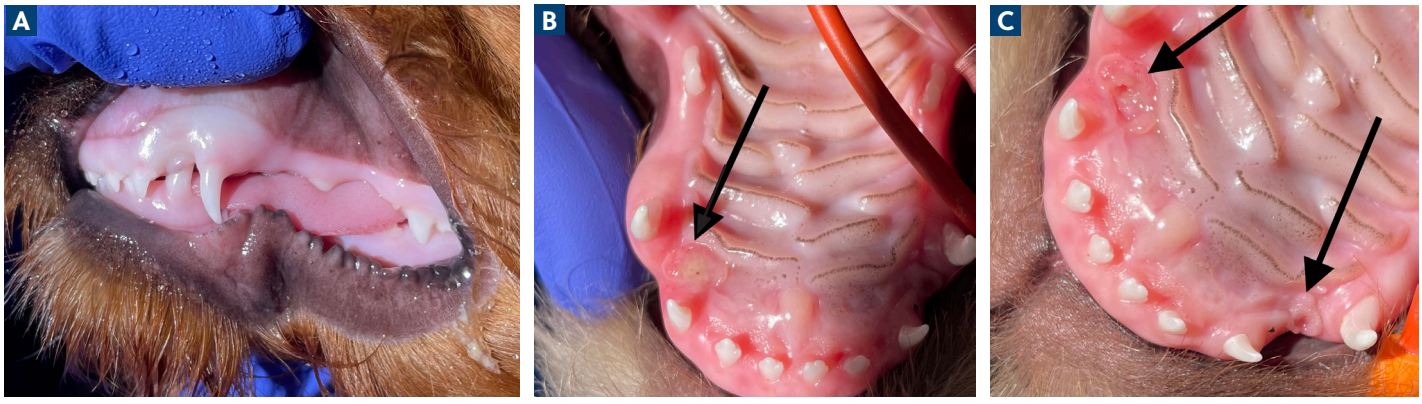

Figure 12. a) A left lateral view of a 10-week-old puppy with linguoversion of the deciduous mandibular canines. b) Purulent material over a traumatic contact point. c) The same case with the purulent material cleaned away.

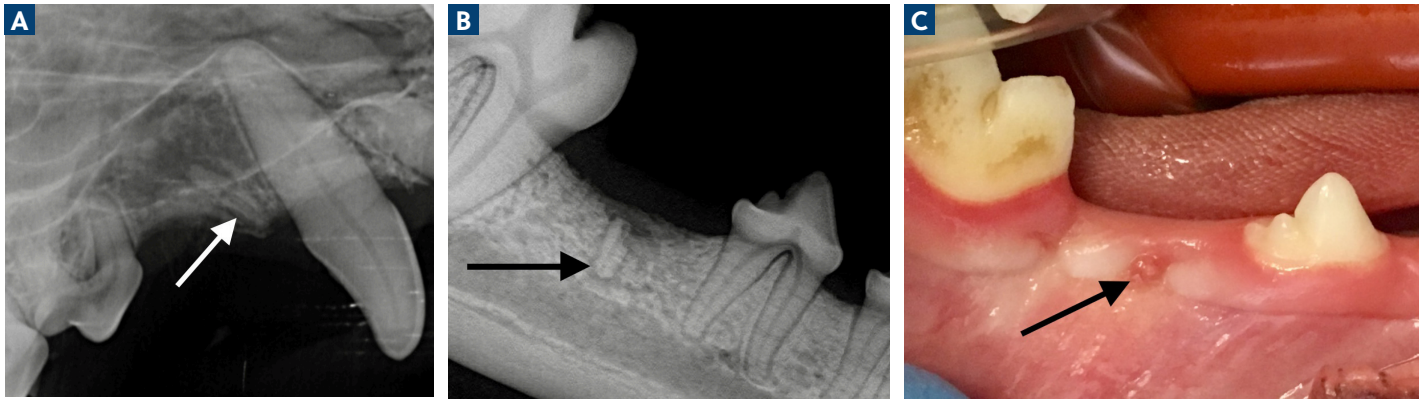

Figure 13. a) A lateral radiograph of the right rostral maxilla of a 9-year-old Chihuahua. Arrow highlights a retained deciduous canine root with surrounding bony lysis. b) A lateral radiograph of a 2-year-old cross breed's right mandible showing a retained deciduous root from the third deciduous premolar. The permanent fourth premolar is missing. c) Clinical photo from the same case as b) with a discharging sinus demonstrating that the root is not 'sitting quietly.' There is a marked inflammatory response.

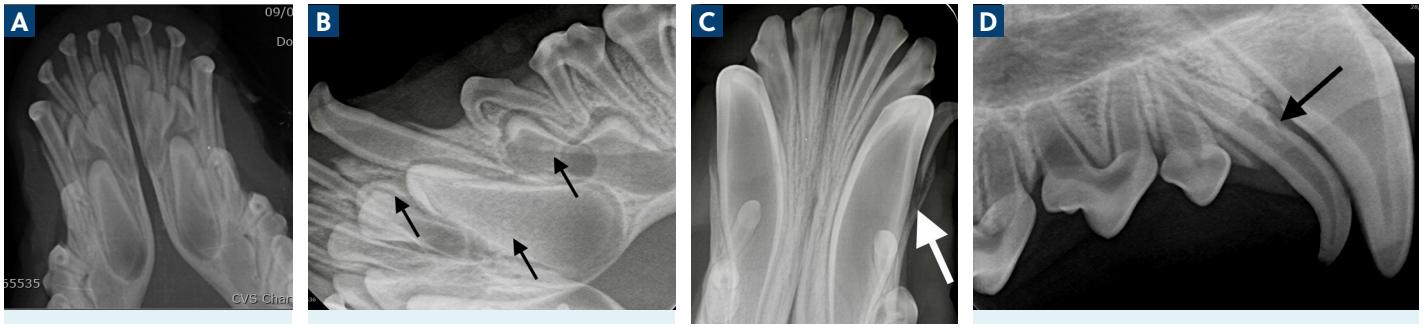

Figure 14. a) An occlusal view of the rostral mandibles of a 10-week-old poodle cross. Note the lingual position of the developing permanent canines. b) A lateral view of the left rostral mandible of the same patient in a) showing thre permanent tooth follicles very closely associated with the root of the deciduous canine. c) An occlusal view of the rostral mandibles of a 10-month-old German Shepherd. The arrow highlights advanced root resorption of the left deciduous mandibular canine allowing a closed extraction. d) A lateral view of the rostral right maxilla in a 10-month-old Jack Russel Terrier. The arrow highlights focal tooth resorption because of pressure from the permanent crown.

Linguoverted mandibular canines (with normal jaw relationship)

In this malocclusion, the mandibular canines have failed to move labial enough for their cusps to occupy the diastema. Although recessive genes have been implicated for some of these cases, there is also a school of thought that certain cross breeds are more prone to this malocclusion because of the face shapes of the original breeds. It is the author's experience that poodle crosses are very much over represented when it comes to linguoverted mandibular canines (*Figure 12*). Often, the narrow-faced poodles have been crossed with dogs who have broader muzzles (such as Labradors and Cocker Spaniels).

Most of the information provided on skeletal malocclusions applies to these cases too. The same traumatic contact from the

cusps of the mandibular canines is seen (*Figure 12*), and there is also an inappropriate canine interlock preventing independent growth of the jaws. For this reason, prompt extraction of the deciduous mandibular canines is advised. The only significant difference with these cases versus the skeletal malocclusions is the idea that these extractions may not just alleviate the interlock, but also allow earlier labial movement of the permanent canines. Up until exfoliation, the deciduous mandibular canines will act like retaining walls keeping the permanent teeth lingual, so it is logical that their early extraction will help; however, this is not yet proven and conjecture at the time of writing. For this reason, the author will always extract both deciduous mandibular canines even if only one side appears problematic. A bilateral approach should help to maximise the distance between the cusps of the permanent canines and its best to think in terms of increasing this distance rather than thinking of a good side and a bad side.

How to extract deciduous teeth

Complete extraction of the whole tooth is essential, and veterinarians should not expect root fragments to resorb just because they are deciduous roots. The author regularly finds retained deciduous roots causing clinical disease in much older animals (*Figure 13*). Whether extracting persistent deciduous teeth in young adults or fractured or malpositioned teeth in younger puppies, the author is very much of the opinion that the best way to achieve complete extraction is with a careful, open approach.

When the permanent teeth are yet to erupt, veterinarians should be very mindful of how close the permanent dental follicles are to the deciduous roots (*Figure 14a; 14b*). Iatrogenic damage is possible even with a careful approach by an experienced surgeon.

When extracting persistent deciduous teeth, the adult counterparts are much less vulnerable to iatrogenic damage since they have erupted, but they tend to hinder the approach to the deciduous teeth. They may have also triggered partial focal resorption making the deciduous root weaker and more prone to fracture at this point (*Figure 14d*).

Extraction of deciduous canines

Step 1: radiography

Informed clinical decisions cannot be made in dentistry without diagnostic imaging. Veterinarians must use radiographs to increase familiarisation with the local anatomy, assess the deciduous tooth's morphology and check for resorption. If tooth resorption is advanced (*Figure 14c*) a closed extraction with a sharp luxator or scalpel is acceptable.

Step 2: raising a flap

When extracting a maxillary deciduous canine, raising a triangle flap is achieved by using a scalpel to cut the gingival attachment from the deciduous tooth. This needs to be circumferential. At the distal aspect of the tooth, extend the incision in a caudodorsal direction in a slightly arcing path as shown with the bold red line in *Figure 15*. Firm pressure is required to cut through the periosteum.

Starting at the angle marked by the blue arrow (*Figure 15*), take a small dental periosteal elevator (the author favours a feline size for smaller puppies) and elevate the small flap. The periosteum

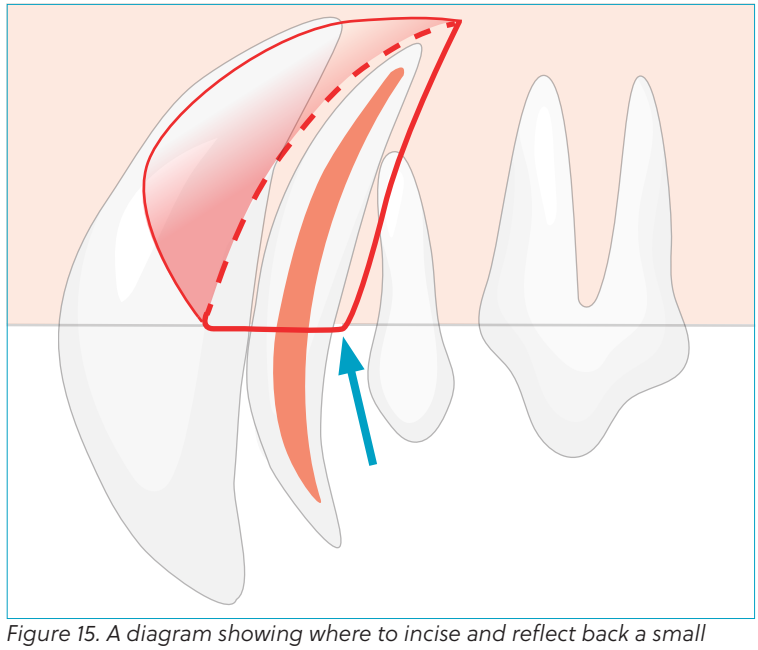

Figure 15. A diagram showing where to incise and reflect back a small two-sided triangular flap for the extraction of a retained deciduous maxillary canine.

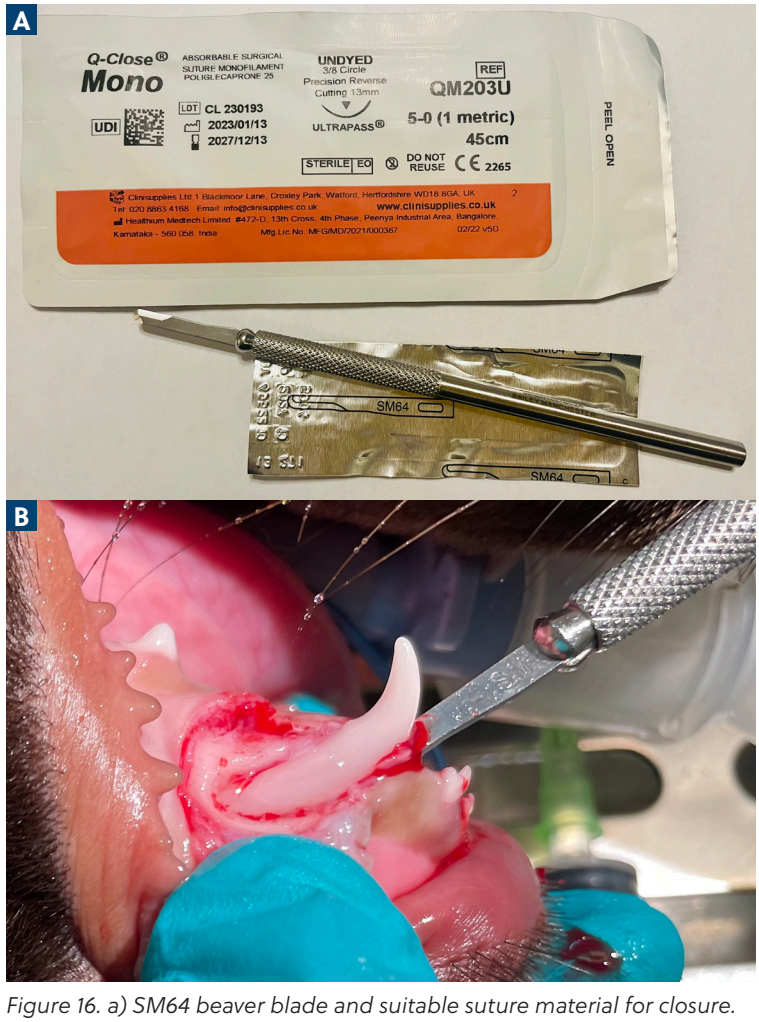

Figure 16. a) SM64 beaver blade and suitable suture material for closure. b) An SM64 beaver blade being used as a luxator in the extraction of a deciduous mandibular canine after removal of the alveolar bone.

KEY POINTS

- Deciduous teeth will need extracting if they are considered persistent, if they are fractured and for the treatment of certain malocclusions.
- The extraction of fractured deciduous teeth should be considered urgent.
- Unless there is advanced root resorption, an open approach is needed to ensure complete and safe extraction.
- Intraoral radiography should be considered mandatory.

should lift easily from the alveolar bone in a young patient, and should reflect back on itself along the dashed red line.

For a deciduous mandibular canine, the process is very similar but a releasing incision would be made in a caudoventral direction caudal to the labial frenulum. Care must be taken to avoid damaging neurovacular structures as they leave the middle mental foramen at the caudoventral aspect of this flap.

Step 3: remove the buccal alveolar bone

The young bone is soft, and it is possible to remove this with a scalpel blade or a sharp luxator, but the author favours a 19 mm size 2 round headed diamond bur in a high-speed hand piece. Veterinarians need to be very careful not to bur too deep and into the thin dentine walls because this will promote tooth fracture when luxating. With good light and magnification, veterinarians can appreciate a pink more vascular layer when the periodontal ligament is reached. This is the point at which the veterinarian should cease using the high-speed hand piece. If in doubt, it is best to stop a little too superficially than go too deep. A scalpel blade can be used to shave off a small amount of bone that the bur did not remove. An SM64 beaver blade (*Figure 16*) is ideal for this and the next step.

Step 4: luxation

The use of elevators should be avoided, as they increase the tipping type forces. This is a scenario where luxation comes into its own. There should be a wide periodontal ligament space and apical advancement of a sharp well maintained luxator should be possible. Alternatively, a scalpel can be used for this and the SM64 beaver blade works very nicely (*Figure 16*). Start by sectioning the ligament in the 'gutters' (down the mesial and distal aspects of the tooth root), and finally luxate delicately on the palatal or lingual aspect of the root. The tooth should quickly mobilise – if it does not, it is often because the initial removal of the buccal bone did not go apically enough.

Step 5: closure

After radiographs have confirmed the complete extraction, the flap can be closed. The author's preference is to use poliglecaprone 25 on a reverse cutting needle. Simple interrupted sutures are placed 3mm apart and tension free closure should be achievable without a periosteal releasing incision.

Conclusions

The indications given for the extraction of deciduous teeth are all common findings in small animal practice. For the immediate benefit of improved comfort and also for the long-term benefits of better occlusion and periodontal health, veterinary professionals need to identify problems early and act promptly. Inaction based on the idea that 'deciduous teeth will soon exfoliate anyway' will fail patients. A careful open approach with a good understanding of local anatomy will minimise the risk of iatrogenic damage to permanent teeth and incomplete extraction. These operations should not be performed without radiography, and if the practitioner is not comfortable with open extractions then referral is always an option. CA

Conflicts of interest

The author declares that there are no conflicts of interest.

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