Antibiotics during dental extraction

Author: Tim Barnett

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Periapical and advanced periodontal disease will often cause irreversible changes to the periapical tissues, which, in many cases, will become infected with bacteria.

Figure 1. Mucopurulent nasal discharge as a result of dental sinusitis secondary to a periapical infection.

Such infections will both perpetuate the periodontal and periapical diseases, and, in some cases, result in secondary diseases, such as osteomyelitis and sinusitis (Figure 1).

Meanwhile, acute fractures of teeth – such as sagittal fractures of the maxillary teeth (Figure 2) – may necessitate extraction due to oral pain from periodontal inflammation and soft tissue trauma. In some cases, such teeth will often be extracted before significant bacterial invasion.

Oral bacteria

Primary apical infections cause gross contamination of the dental pulps and periapical periodontal ligaments with commensal and opportunistic bacteria.
However, routine culture and sensitivity from oral and dental swabs is renowned for being particularly unrewarding in identifying the pathological bacteria.

On the other hand, swab cultures of the pulp labyrinths of extracted periapically infected teeth offer a diverse and varied population of microflora\(^1\). Within these cultures, reports exist of a high population of Gram-negative obligatory anaerobes from within the pulp cavities and chambers, with *Prevotella* species and *Fusobacterium* species predominating.

More recent work, analysing the 16S ribosomal RNA sequences from gingival swabs in horses with signs of periodontitis, revealed the oral microflora to be particularly diverse. Elevated quantities of *Prevotella* species and *Veillonella* species were predominantly found in the oral cavities of horses showing signs of periodontitis\(^2\).

As with most species, the oral cavity must be considered as being heavily contaminated\(^3\) and any attempt to render it a sterile surgical field would be futile. Performing surgeries classified as dirty, with infected surgical wounds, would typically suggest preoperative and postoperative antibiotics are necessary\(^3\).

In other surgical procedures, adhering to Halsted’s surgical principles has been suggested as one method of reducing the microbial burden at a surgical site and, in turn, the requirement for antibiotic therapy. However, equine dental extractions do not usually permit conformation with such guidelines, and certainly not all of them.

In a study of the 16S ribosomal RNA sequences from gingival swabs, Kennedy et al\(^2\) found the oral cavities of horses considered free of dental disease to have a consistent, but much less diverse, population of bacteria. The most common bacterial species identified in such cases were *Gemella* species and *Actinobacillus* species.

Therefore, even in acutely fractured teeth necessitating extraction, without the development of established apical infection, the inflamed dental and periodontal tissues could be contaminated with commensal oral bacteria.
Figure 2. A CT image of a fractured cheek tooth, showing the extent of the contamination and inflammation changes of the apical and periodontal tissues (click to zoom).

Along with other ingested bacteria, such colonies may opportunistically cause an infection as a result of the surgical trauma. Additionally, the resulting periodontitis may cause a gradual shift in the dominant bacterial species in the oral cavities.

It should be assumed, when extracting periapically infected teeth, contamination of the surgical site and surrounding tissues, with a number of potentially pathogenic bacterial species, will be inevitable.

Bacteraemia and septicaemia after extraction has also been reported in the horse, with Kern et al\textsuperscript{4} showing high levels of potential pathogens in equine blood postoperatively. Further post-extraction complications, such as meningitis, laminitis and pneumonia, are all, therefore, a possibility.

This may be particularly important to consider in individuals with concurrent morbidity and those more susceptible to diseases, such as those immunocompromised by conditions or medications.
Modern methods

Equine dental extraction procedures have evolved greatly over the years, with a multitude of techniques at the disposal of the veterinary surgeon (Figure 3).

Oral extraction – often using a combination of gingival elevation, spreading and separating the periodontal attachments, and careful mobilisation by accurately placed extraction forceps – is associated with the fewest postoperative complications\(^5\).

It is thought the inevitable postoperative infection will usually remain localised, affecting only the adjacent tissues (including the alveolar bone), with a low risk of wider infection. On the other hand, other techniques, such as repulsion, even if performed minimally invasively, will mandate surgical access and contamination of other tissues and anatomical spaces.

Repulsion of a tooth or dental fragments through the maxillary sinus could contaminate the sinus with pathogenic bacteria, causing iatrogenic bacterial sinusitis\(^5\). Osteomyelitis from repulsion through a mandibular or maxillary bone is also possible in a similar way\(^5\).

Lateral buccotomy requires a surgical approach with a more extensive incision and dissection. This may result in the subsequent contamination of a number of tissues and structures with pathogenic and commensal bacteria.

Complications

A localised osteomyelitis of the supporting alveolar bones will inevitably accompany cases of periapical infection\(^5\).

By removing the infected tooth, the source of infection will usually be removed or allowed to drain easier. In addition, adjacent infected periodontal tissues will often be removed or debrided during the procedure.

Osteomyelitis of the supporting alveolar bone may persist in some cases, possibly resulting in an alveolar sequestrum necessitating further surgery and antibiotic therapy\(^5\). Damage to adjacent teeth, especially when using repulsion techniques, may lead to inadvertent inflammation and infection of adjacent tissues\(^5\). These instances would mandate using precautionary antibiotic therapy and, possibly, remedial procedures.

Heavily contaminated skin and soft tissue wounds and tracts may also show signs of a persistent infection, also requiring local debridement and antibiotic therapy.

Which antibiotics?
Figure 3. Minimally invasive transbuccal extraction technique, which provides a method of extracting teeth not amenable to routine oral extraction. Providing oral access through the use of a buccal cannula minimises contamination of other oral tissue.

In most instances, empirical broad-spectrum antibiotics are initially chosen in surgical cases and then modified, if needed, based on culture and sensitivity from tissue samples or swabs of infected tissues\(^3\).

Unfortunately, it has been shown at least 50% of oral bacteria cannot be cultured by conventional approaches\(^6\), hence the recent study using 16S ribosomal RNA gene sequencing to determine the microflora population in the equine oral cavity\(^2\).

Therefore, in many cases, the choice of antibiotics will remain from the available broad-spectrum agents.

With osteomyelitis a risk following dental extraction\(^5\), it would be wise to choose a medication with proven bone penetration.

Based on the two studies that have determined a high proportion of Gram-negative obligatory
anaerobic bacteria in cases of periodontitis and periapical infection, it would be sensible to select a drug effective against anaerobes.

An antibiotic-infused packing material may provide additional high local levels of antibiotics.

**Conclusion**

In many cases, removal of the diseased dental tissue is likely to be the most important step in eradicating the infection and, in some cases, may be all that is required.

However, infection of surrounding tissues is a real concern in most cases and secondary complications can cause severe morbidity and, potentially, mortality.

Perioperative antibiotics would, therefore, be advisable in most cases; the choice of postoperative antibiotics depends on the individual case and the presence of any secondary or associated disease.

**References**