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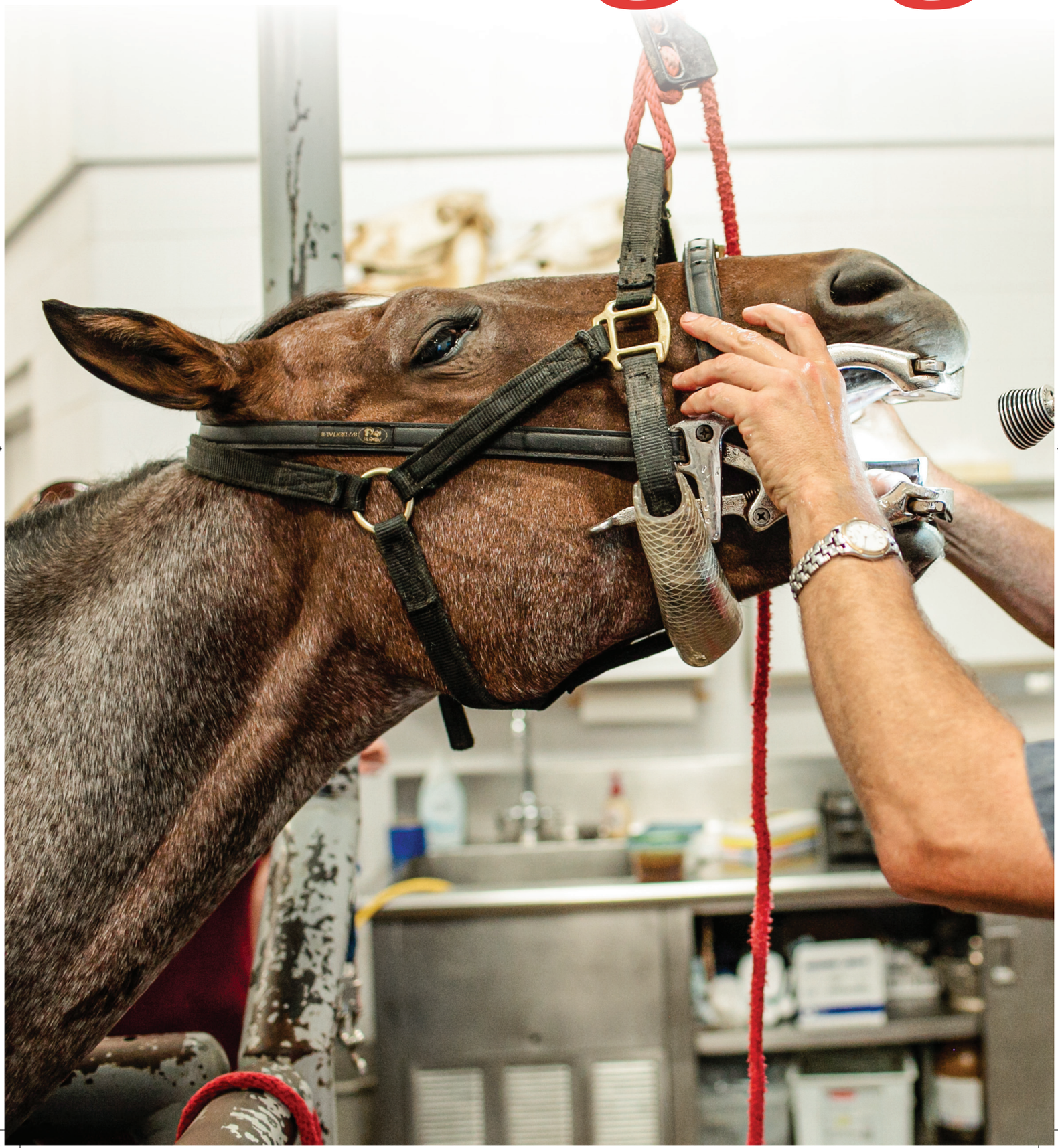

the Gap

SHELLEY PAULSON

LUCILE VIGOUROUX, MSC

Emerging technologies are giving veterinarians the tools they need to best address dental disease in horses

Adult horses possess 36 to 42 teeth in those large, cavernous mouths. Teeth are made of enamel (the outer covering of the tooth) and dentin (mineralized connective tissue)—a unique composition that makes them the strongest substance in the equine body. This toughness, however, doesn't spare the teeth from fractures, infections, or disorders associated with the periodontal ligament that anchors them into the underlying jaws.

If your horse shows signs of dental pain or difficulty chewing his food, it's time to ring your veterinarian for an exam. Practitioners often use radiography to diagnose ailments affecting other parts of your horse's skeletal system (the bones and joints in the legs, for instance), and, likewise, X rays are a popular first step in addressing dental issues. But these days veterinarians have various imaging modalities beyond radiography at their fingertips. Let's look at the progress they've made.

The Evolution of Diagnostic Imaging in Dentistry

Over the course of his 40-year career in equine dentistry, Robert Baratt, DVM, MS, FAVD, Dipl. AVDC, AVDC/EQ,

A COMPARISON OF DIAGNOSTIC MODALITIES IN EQUINE DENTISTRY

DIAGNOSTIC MODALITY	BENEFITS	LIMITATIONS
Radiography (X rays)	■ Readily available, quick and easy to use on the farm. ■ Provides basic yet essential information about the health of the teeth and jaws.	■ Practitioners' potential lack of training in obtaining diagnostic dental radiographs. ■ Diagnostic limitations: Sometimes two-dimensional radiographic images are not enough to make accurate diagnoses, requiring a three-dimensional CT or MRI scan.
Computed tomography (CT scan)	■ These three-dimensional images are more precise, detailed, and sensitive than radiographs for diagnosing dental and orofacial disease. ■ Particularly useful for diagnosing apical infection of maxillary cheek teeth, temporomandibular joint disease, and sinus disease.	■ Lack of availability in most practices. ■ Requires general anesthesia in many cases. ■ Cost.
Nuclear scintigraphy (bone scan)	■ Provides valuable information about particular areas of inflammation.	■ Not sufficient on its own—additional imaging (visual examination, radiograph, or CT) is needed to gain detailed information about the teeth involved.
Magnetic resonance imaging (MRI)	■ Best suited for imaging soft tissues, primarily oral tumors, tooth roots, and ligaments.	■ MRI is most useful for soft tissue abnormalities. However, dental disease often involves hard tissue (tooth and bone). For this reason MRI is not typically used in dental cases.
Oral endoscopy	■ Provides excellent images of the entire oral cavity, including the crown and occlusal surface of each tooth, plus gums and soft tissues.	■ Does not allow practitioners to examine tooth roots. Radiography is still necessary to look for problems below the gumline.

founder of Salem Valley Veterinary Clinic, in Connecticut, has seen and embraced groundbreaking advancements in diagnostic imaging. Today, the modalities and technologies Baratt and his colleagues use are infinitely more elaborate, precise, and user-friendly than those available in the '80s. It's literally a black-and-white difference.

"When I graduated veterinary school in 1981, the tools we used to assess the horse's mouth were limited to a speculum and a penlight," he says. "Radiographic examination was essentially impossible."

"And for practitioners who did have access to radiography before its digital form was widely available, the image quality was minimally diagnostic," adds Leah Limone, DVM, Dipl. AVDC, owner of Northeast Equine Veterinary Dental Services, in Topsfield, Massachusetts.

The first significant evolution in equine dentistry diagnostics was the development of portable digital radiography systems by Fuji in 1981. "Nowadays, using digital radiography, we can capture diagnostic images with great detail, which is critical for the successful diagnosis of a wide range of dental conditions," explains Limone.

While the cost of such equipment back then was considerable for the average solo equine practitioner, it nonetheless quickly became the standard of care for both dentistry and lameness evaluations, says Baratt. Veterinarians still use digital radiography in just about any case involving the skeleton, teeth included. A digital radiographic image provides a relatively easy, quick, and cost-effective first glance into the bony structures inside the horse.

New Standards of Care

Times have surely changed: Once revolutionary, digital radiography is now considered "basic" and, in many cases, limiting compared to newer, more high-tech three-dimensional imaging modalities. "The increasing availability of computed tomography (CT) scans, for instance, has greatly enhanced our ability to diagnose dental and sinus pathology (disease or damage)," says Baratt. "In the future we will continue to see increased access to standing CT for horses, eliminating the risk of general anesthesia associated with obtaining a CT scan of a 1,200-pound animal."

Modalities such as radiography and CT generate images that provide valuable information to the practitioner, but sometimes getting answers straight from the horse's mouth is the way to go. That's where oral endoscopy comes in. Put simply, oral endoscopy involves guiding a rigid laparoscope and camera into the depths of the horse's oral cavity to record real-time video and capture still images. "This is a diagnostic tool that all practitioners should invest in," says Baratt, who's been a pioneer of oral endoscopy research in horses. "The ability to closely examine each tooth and point out the pathology in real time to the owner is invaluable."

Advanced Imaging Makes Procedures Safer

Imaging is about more than just diagnosing problems—it also helps practitioners treat said problems safely and effectively. "Digital dental radiographs and, in complex cases, CT imaging are imperative in planning for tooth extractions," says Limone. "We need to know the often abnormal anatomy and pathology of the specific tooth we are extracting and also determine how best to extract in the least invasive way to avoid complications." Taking a detailed look at the mouth ahead of an invasive procedure reduces the risk and potential cost associated with a blind approach.

In the same vein, horses undergoing extractions and surgeries have benefited from the precision and safety that come with more sophisticated tools. "Let's circle back to the endoscope, which over the last 10 years has become widely recognized

(Continued on page 22)

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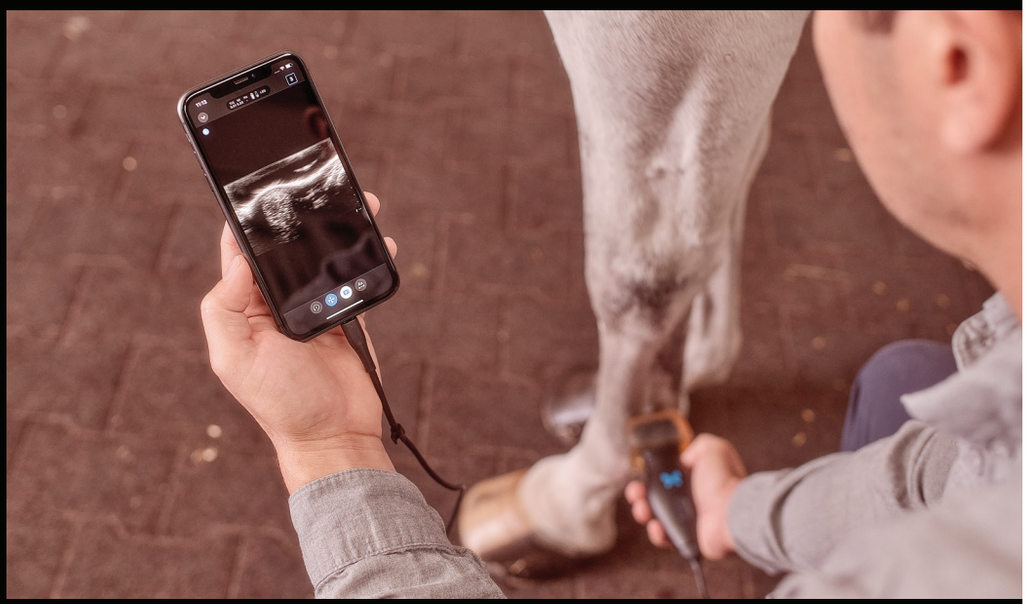

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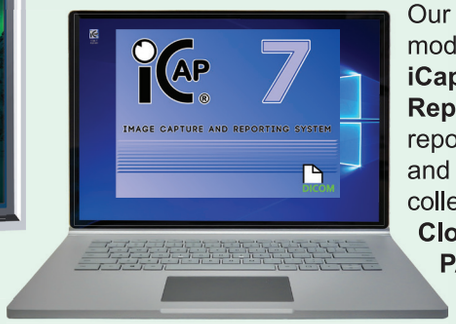

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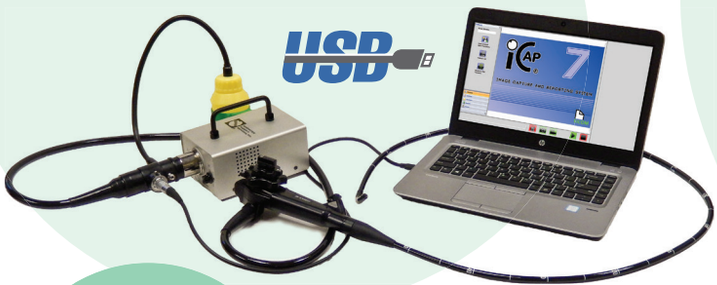

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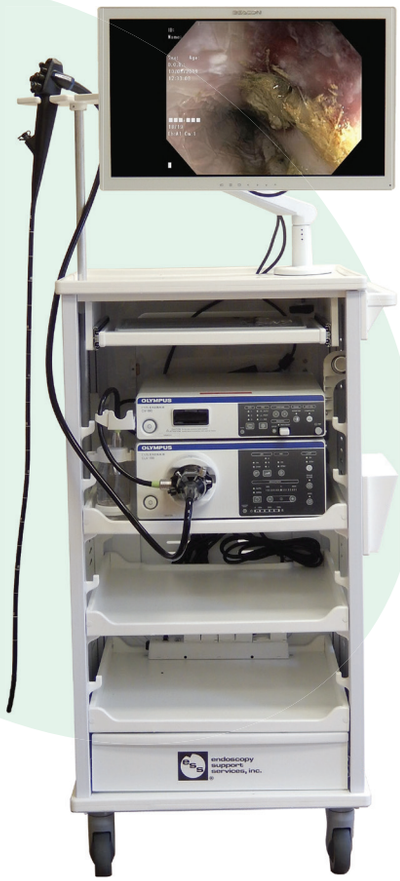

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(Continued from page 18)

not only as an invaluable examination instrument but also as a guiding tool in oral and sinus surgery," says Baratt. Endoscopes essentially act as an extension of surgeons' eyesight, allowing them to precisely see their instruments' positioning relative to lesions of interest.

"Beyond the endoscope, the development of new surgical instruments and techniques now allows equine dentists to perform more oral extractions and fewer repulsions (the latter involving pushing the tooth out via the sinuses using a mallet/dental punch), thereby reducing the incidence of post-extraction complications," Baratt adds. "Last but not least, the improvements of techniques used in standing sedation, notably constant rate infusions (CRI) of sedatives and regional anesthesia, now allow almost all equine dentistry and sinus surgery procedures to be performed standing, without the need for general anesthesia. This is both safer for the horse and more cost-effective for the client."

Diagnostic Imaging's Role in EOTRH

Neither veterinarians nor scientists can confidently identify the root cause of the intricate condition termed equine odontoclastic tooth resorption and hypercementosis (EOTRH). Horses affected by this unique periodontal disease—usually geldings over the age of 15—spontaneously reabsorb their incisor teeth, which is an extremely painful process.

Secondary bacterial infections are common, likewise resulting in painful periodontal disease. Hypercementosis—excessive deposition of cementum (another mineralized connective tissue similar to bone) on the tooth roots—might or might not accompany tooth resorption and occasionally occurs alone. "Hypercementosis can result in significant gingival (gum) recession and tooth extrusion (displacement out of its socket), but I do not believe it is a significant contributor to oral pain in the absence of secondary bacterial infection," says Baratt. There is currently no treatment for EOTRH, which is a progressive disease; extraction of the incisors is the only permanent solution.

With EOTRH, diagnostic imaging is especially invaluable. "The earliest manifestation of this disease is usually radiographic evidence of replacement resorption of the roots," says Baratt. "At that stage the disease is not yet accompanied by clinical signs of periodontal disease or

(Continued on page 25)

Take-Home Message for Veterinarians

Due to the oral cavity's proximity to the sinuses, certain cases of dental disease evolve into sinusitis. In a paper published this year, researchers examined data from four studies to determine whether computed tomography (CT) is more accurate than radiography for identifying apical dental pathology in these cases (Gill-Parsons et al., 2022).

In all four studies reviewed, the authors found weak yet statistically significant evidence that CT did indeed identify teeth with apical pathology that radiography had failed to detect. Specifically, the authors concluded that CT is more accurate than radiography for diagnosing equine maxillary apical dental pathology.

That's a start. Going forward, veterinarians must establish clear guidelines on the CT changes associated with apical dental pathology to ensure the accuracy and repeatability of CT-assisted diagnoses. "Loss of the lamina dura, infundibular changes, or pulpal gas as singular findings on CT imaging can be seen in teeth with no underlying histopathological evidence of apical disease and in maxillary teeth imaged in horses without clinical signs of maxillary cheek tooth pathology," the authors wrote. These findings might be useful in furthering earlier and more accurate diagnoses of sinusitis secondary to dental disease.

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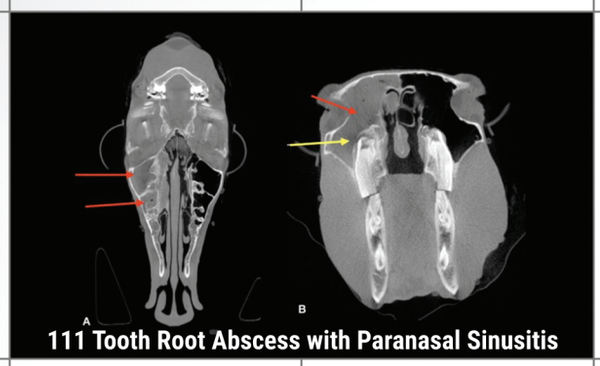
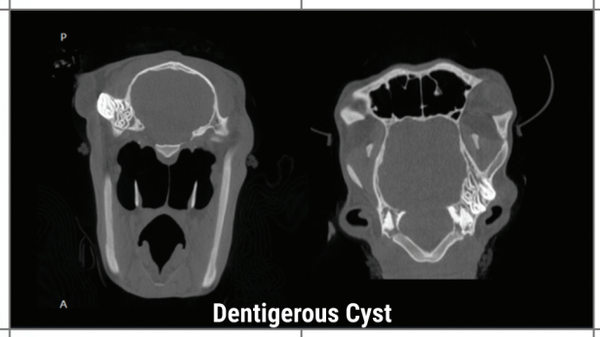
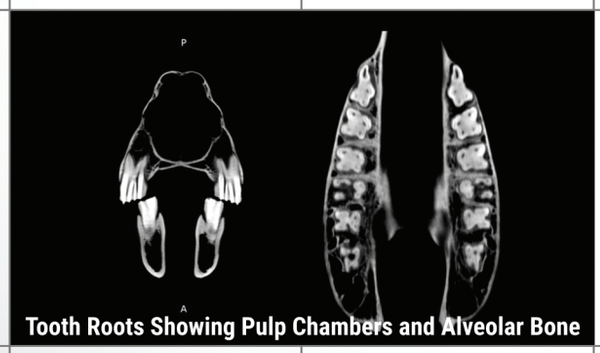


111 Tooth Root Abscess with Paranasal Sinusitis



Dentigerous Cyst



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(Continued from page 22)

oral pain. Frequently, the lateral (third) incisors are the first teeth affected."

Equine odontoclastic tooth resorption and hypercementosis can compromise the oral cavity in several ways. Those secondary bacterial infections can result in the aforementioned inflammatory tooth resorption, alveolar bone infection, and typical clinical signs of periodontal disease: gingivitis, gingival recession, tooth extrusion, and gingival and/or mucosal fistulation (formation of an abnormal pathway between the alveolar bone and the oral cavity). "This stage of the disease results in oral pain," Baratt says. Therefore, the goal is to intervene before that pain develops.

The painful progressive course of this disease and an increase in its incidence create the need for improved early diagnosis. "Unfortunately, early radiographic diagnosis of EOTRH does not affect our ability to prevent the inevitable," Baratt says. "There is no known treatment (aside from tooth extraction) at this time."

Take-Home Message

Now more than ever, vets have the tools to make prompt, precise decisions about your horse's oral health and provide the safest and most effective care possible. The days of peering into the dark oral cavity with a mere flashlight have been replaced by well-lit oral endoscopy exams. Crisp, high-resolution digital radiographic images have kicked fuzzy early computed radiography to the curb. "We can now make accurate diagnoses utilizing oral examinations in combination with advanced imaging modalities," says Limone. "Most conditions can be diagnosed on the farm, which is both efficient and cost-effective, and then a plan can be made for treatment and long-term management."