

A Trans-Orbital Projection for Radiological Evaluation of the Maxillary First Molar Tooth in Dogs

Jens Ruhnau, DVM, DEVDC¹ 

Abstract

A new extraoral radiology technique is described. The trans-orbital projection provides valuable information to assist in diagnosis of attachment loss and periapical pathology adjacent to the maxillary first molar tooth in dogs. It is an easy and quick supplement to the full mouth radiographic evaluation of the canine patient.

Keywords

radiography, molar, dog, projections, transorbital

Introduction

In veterinary dentistry, dental radiography is one of the best tools to diagnose disease. Even though there has been a huge development in veterinary imaging in the field of computed tomography and magnetic resonance imaging, dental radiology is often utilized to obtain diagnoses during dental/oral surgical procedures. Historically, the bisecting angle, parallel and other projection techniques have been used to image all teeth in the dog's oral cavity.¹⁻³ For the single-rooted and two-rooted teeth it is possible to obtain diagnostic radiographs using these techniques that in 2 dimensions give a reliable image of the status of the target tooth. In contrast, the three-rooted teeth in the distal maxilla have a 3-dimensional structure that makes it difficult to obtain diagnostic images. This is especially true of the maxillary fourth premolar and first molar teeth, where the periodontal tissues, periapical area, and endodontic structures can be masked by superimposed adjacent structures. For the maxillary fourth premolar teeth (108 / 208) the standard lateral bisecting angle projection has been supported by additional projections to avoid the superimposition of the mesiobuccal and mesiolateral roots. Mesiolateral or distolateral bisecting angle projections have been recommended to overcome this challenge.¹

The maxillary fourth premolar and first molar teeth accumulate plaque and calculus and therefore they are prone to the development of periodontal disease. In the lateral bisecting angle projection, it can be very difficult to evaluate the attachment loss and any periapical pathology around the mesiobuccal and distobuccal roots of the maxillary first molar teeth (109 / 209) due to superimposition of the crown and the palatal root.

The distolateral bisecting angle projection in many cases will provide a good image of the level of the alveolar crest between

the distal root of the fourth premolar and the mesiobuccal root of the first molar teeth. However, the furcation area, the attachment loss, and periapical pathology around the distobuccal root are still difficult to evaluate.

In 2019, the transorbital projection (TO) was introduced. As the name implies, the x-ray beam passes through the orbit to provide an extra-oral image of the maxillary fourth premolar, first molar, and second molar teeth.

In previous extraoral lateral projections of the maxillary molar teeth,¹ the palatal root and crown will superimpose the mesiobuccal and distobuccal roots (Figure 1). The TO projection (Figure 2) in contrast to the lateral projection provides a clearer view of the attachment and periapical areas of the mesiobuccal and distobuccal roots.

Materials and Methods

Forty-seven dogs that were undergoing dental treatment, between November 2019 and February 2020, had additional projections of the dentition in the distal maxilla obtained. Five different projections were used: Lateral (LL), Mesiolateral (ML), Distolateral (DL), Occlusal (O), and Transorbital (TO). The extraoral oblique projection is not included in this study since the superimposition of the palatal root is a hindrance to quality.

The TO projection is obtained by placing the film intra-orally parallel to the palate, and as distal and extending as far lateral as possible towards the buccal tissue (Figure 3). The x-ray tube is

¹TandDyrekllinikken, Maaloev, Denmark

Corresponding Author:

Jens Ruhnau, TandDyrekllinikken, Maaloev, Denmark.
Email: jensruhnau@tanddyreklinikken.dk



Figure 1. Radiograph of the maxillary fourth premolar, first and second molar teeth using the normal bisecting angle lateral projection.



Figure 2. Radiograph of the maxillary first and second molar teeth using transorbital projection. Note the mesiobuccal and distobuccal roots are visible without superimposition (Picture is mirrored to allow comparison with lateral intraoral projection).



Figure 3. Photograph showing position of the x-ray film, parallel to the palate extending to the buccal tissue, for the transorbital projection.

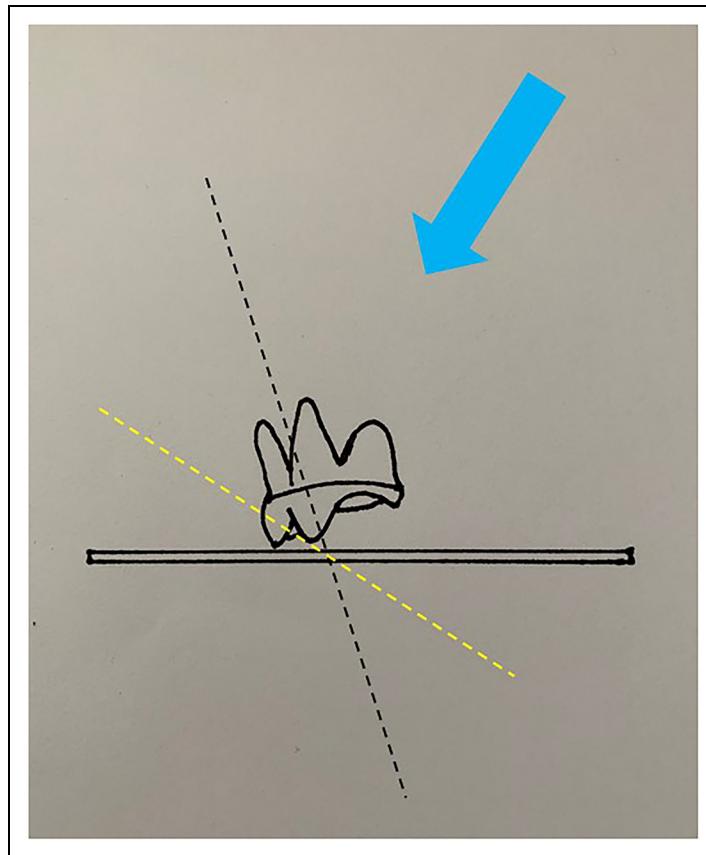


Figure 4. Diagram showing the maxillary first molar tooth and film position. The long axis of the mesiobuccal and distobuccal roots (black dotted line) and the bisecting angle (yellow dotted line). The x-ray beam (blue arrow) angled perpendicular to the bisecting angle is almost parallel to the long axis of the palatal root, preventing it from superimposing the mesiobuccal and distobuccal roots on the image.



Figure 5. The patient positioned in lateral recumbency for the transorbital projection.

Table 1. The Average Score in the Distolateral Projection.

Feature / Root	108/208 Mesiobuccal	108/208 Palatal	108/208 Distobuccal	109/209 Mesiobuccal	109/209 Palatal	109/209 Distobuccal
Attachment loss	1.73	1.70	1.77	1.46	1.83	0.82
Periapical pathology	1.43	1.53	1.43	1.18	1.82	0.54
Pulp-Dentine complex	1.24	1.14	1.64	1.12	0.92	0.29
Periodontal ligament	1.54	1.55	1.61	1.30	1.75	0.69
Overall quality of image	1.49	1.55	1.75	1.69	1.75	1.58

Table 2. The Average Score in the Lateral Projection.

Feature / Root	108/208 Mesiobuccal	108/208 Palatal	108/208 Distobuccal	109/209 Mesiobuccal	109/209 Palatal	109/209 Distobuccal
Attachment loss	1.82	1.74	1.98	1.38	1.81	1.00
Periapical pathology	1.55	1.42	1.77	0.90	1.83	0.49
Pulp-Dentine complex	1.19	0.71	1.85	0.89	0.92	0.36
Periodontal ligament	1.65	1.25	1.85	1.17	1.77	0.62
Overall quality of image	1.75	1.68	1.88	1.69	1.76	1.65

pointed towards the film from the contralateral orbit, through the frontal bone, giving an extraoral bisecting angle image of the upper first molar tooth (Figures 4 and 5).

All radiographs had each root separately scored for 5 different features: Attachment loss (AL), Periapical pathology (PA), Pulp-Dentine-Complex (PDC), Periodontal Ligament (PDL) and overall picture quality (Q). A score of 0 was assigned when a diagnosis was not possible due to poor image quality; a score of 1 when a diagnosis was possible, but uncertain;

and a score of 2 when a precise diagnosis was possible and certain.

Results

The average scores for each root in the 5 different projections are given in Tables 1 to 5. Evaluation of the AL (Figure 6) and PA (Figure 7) for the 109/209 mesiobuccal root and 109/209 distobuccal root showed the TO is significantly better



Figure 8. Gingival recession and loss of the interdental papilla between maxillary fourth premolar and first molar teeth.

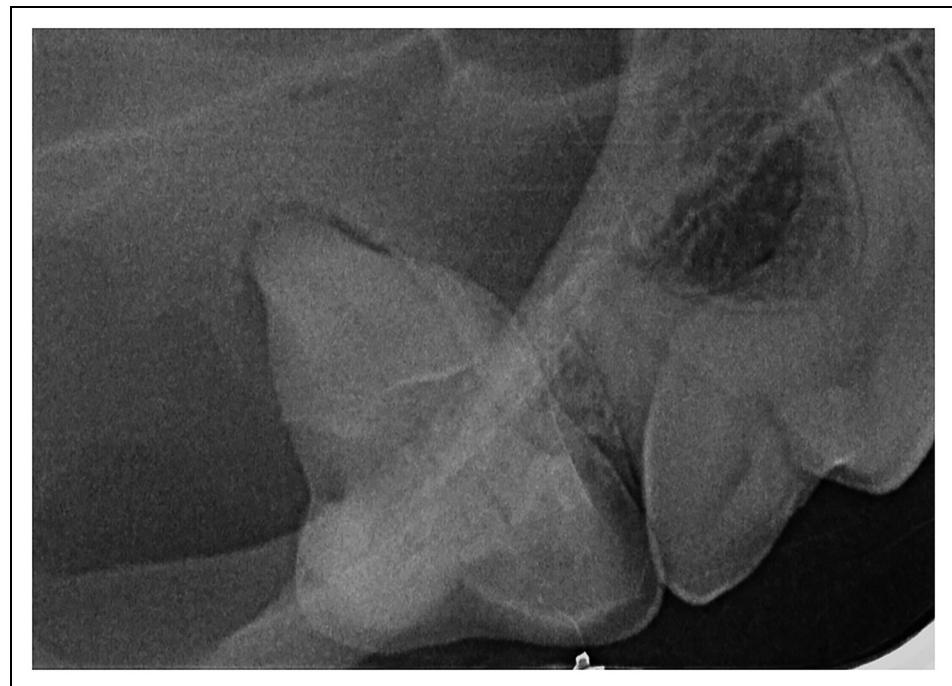


Figure 9. Radiograph of the maxillary first molar tooth using the lateral bisecting angle projection. Note the mesiobuccal and distobuccal roots are superimposed by the crown obscuring the ability to evaluate periodontal disease.



Figure 10. Radiograph using the transorbital projection of the same patient in Figure 9. Note the 40% attachment loss on the mesiobuccal root and 100% attachment loss on the distobuccal root.

than all other projections. The DL projection is also significantly better than the LL projection. The TO projection is even significantly better than the DL projection (using unpaired Student's *t*-test) (Tables 6 to 9).

Discussion

This study radiographed the maxillary first molar tooth's mesiobuccal and distobuccal roots. AL and PA were evaluated because clinically they are very important parameters used to decide on potential and necessary treatment of the mesiobuccal and distobuccal roots of the maxillary first molar teeth. The results showed that the TO projection is a valid supplement to the previously used LL and DL projections.

The TO projection can be used in cases that clinically have visible periodontal disease around the maxillary first molar tooth with loss of the interdental papilla between the fourth premolar and first molar teeth (Figure 8) where the standard LL and DL projections do not yield a conclusive image (Figure 9). In these cases, the authors found the TO projection to be very helpful in diagnosis of disease (Figure 10).

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Jens Ruhnau <https://orcid.org/0000-0001-6246-5418>

References

1. Mulligan TW, Aller MS, Williams CA. Intraoral imaging techniques. In: Aller MS, ed. *Atlas of canine & feline dental radiography*. Veterinary Learning Systems; 1998:33-35.
2. DuPont GA, DeBowes LJ. Obtaining diagnostic dental radiographs. In: DuPont GA, DeBowes LJ, eds. *Atlas of dental radiography in dogs and cats*. Saunders Elsevier; 2014: 232-238.
3. DeForge DH, Colmery III BH. Introduction. In: DeForge DH, Colmery III BH, eds. *An atlas in veterinary dental radiology*. Iowa State University Press; 2000:xxi–xxv.