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Radiographic protocol to quantify cranial tibial translation in dogs

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We use this protocol and it's working

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Abstract

This protocol describes a radiographic procedure to objectively quantify *in vivo* the cranial tibial translation using a simple device in dogs.

This protocol was used in the following publication:
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Tambella AM, Omini L, Attili AR, Vullo C, Martin S (2020) Evaluation of cranial tibial translation in dogs: Diagnostic accuracy of radiographic method using a simple device. PLoS ONE 15(2): e0228621. (ISSN: 1932-6203) (DOI: 10.1371/journal.pone.0228621)

Troubleshooting

1 BACKGROUND

Canine cranial cruciate ligament (CrCL), in addition to other biomechanical functions, prevents cranial tibial translation [1-4]. The detection of tibial translation can aid revealing stifle joint instability as a result of CrCL injury. However, clinical diagnosis of CrCL insufficiency is subjective and difficult to quantify accurately [5,6]. In order to thoroughly assess the joint stability as well as joint stabilization after surgery, it is imperative to quantify and compare joint stability between and within subjects over time. Several studies described radiographic techniques to assess translational stifle stability and CrCL integrity [6-12], but they may have some limitations: tricky execution; need for complex devices; absence of validation; failure to include a specific angle or a controlled force; tested only on experimental lesion or only ex vivo; poor applicability in vivo. This protocol aims to assess the integrity of CrCL and objectively quantifying the in vivo cranial canine stifle translation using a simple, radiolucent translator device keeping fixed the joint angle during the thrust.

This protocol was validated in the following article:

Tambella AM, Omini L, Attili AR, Vullo C, Martin S (2020) Evaluation of cranial tibial translation in dogs: Diagnostic accuracy of radiographic method using a simple device. PLoS ONE 15(2): e0228621. (ISSN: 1932-6203) (DOI: 10.1371/journal.pone.0228621)

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2 DEVICE

Radiolucent, custom-designed device having a mobile platform and a non-mobile platform, keeping 135° of joint angle.

3 DOG POSITIONING

Place the dog under general anaesthesia in lateral recumbence with the hind limb on the translator device: allocate the femur on the immobile platform while secure the tibia to the mobile platform with polystyrene blocks in the respective housings. Apply a manual force in caudal direction obtaining a zero point for the translation measurement.

4 RADIOGRAPHIC PROJECTION BEFORE FORCE PPLICATION

Take a mediolateral radiographic projection of the stifle to be evaluated. The central radiographic beam is consistently centered on each stifle.

5 FORCE APPLICATION

Apply a standard force (49 N) to the mobile tibial platform on the horizontal plane and cranial direction. The force can be measured using a digital dynamometer. Maintain the force application during the execution of the radiograph in phase 6.

6 RADIOGRAPHIC PROJECTION DURING FORCE APPLICATION

Take a mediolateral radiographic projection of the stifle during the force application (phase 5).

7 DIGITAL MEASUREMENT OF ABSOLUTE CRANIAL TIBIAL TRANSLATION

Draw on each radiographic image two vertical, parallel lines, perpendicularly to the vector force and tangent to the apex of tibial crest or the caudal edge of femoral condyles respectively. Measure in mm the distance between these two lines on both radiographic images.

The absolute tibial translation (ΔS) is obtained with the following formula:

$$\Delta S = D2 - D1$$

D1: distance between the two lines on the radiographic image obtained before force application (phase 4);

D2: distance between the two lines on the radiographic image obtained during force application (phase 6).

8 NORMALIZATION OF TIBIAL TRANSLATION

Measure the tibial width (TW) in mm in a mediolateral projection on the distal portion of the tibial crest, perpendicularly to the long axis of the tibia.

The normalized tibial translation (ΔN) is obtained with the following formula:

$$\Delta N = \Delta S / TW \times 100$$

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