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The Reliability of the Symax Method of Measuring the Radiographic Femoral Varus Angle

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Conclusions & Perspectives

- **When measuring the canine femoral varus angle (FVA) the Symax method presents satisfactory reliability in terms of repeatability.**
- **Curved femoral osteotomy presents good practicability and is successful in reducing the FVA in small breed dogs displaying more than 6º varus.**
- **Curved femoral osteotomy is potentially easier to perform than the wedge ostectomy in small breed dogs, and presents some advantages such as increased stability and adjustability.**
- Next: 1) Comparison studies with other diagnostic modalities, such as CT and the influence of measuring method. 2) Further clinical evaluation of curved femoral osteotomies.

Abstract

Objective: To determine the practicability of curved osteotomy to correct femoral varus in small breed dogs, and to assess the reliability of the Symax method of measuring the radiographic femoral varus angle (FVA).
Methods: Eleven cadaveric femora plus one clinical case were included in this study. The FVA was measured using the Symax method on craniocaudal femoral radiographs. CORA principles were used to plan the curved osteotomy. Following osteotomy and planned correction of the FVA to 0º, the femur was stabilized with a 2.4 mm locking plate and screws (cadavers) or 2.0mm SOP plate (patient). FVA was reassessed from postoperative radiographs. All radiographs were blinded and randomized for statistical analysis. FVA measurement reliability was assessed using all radiographs (n=24), whereas surgical practicability was assessed from 8 femora with a preoperative FVA >6º.
Results: Femoral varus measurements were repeatable (intraobserver repeatability coefficients of 1.9º [95% CI: 1.5º; 2.2º] and 2.1º [95% CI: 1.6º; 2.5º]) and reproducible (interobserver repeatability coefficient of 3.2º [95% CI: 3.0º; 3.3º]). Preoperative FVA for all femora was 8.4º (SD 3.0º). Preoperative FVA of specimens included in practicability testing was 9.8º (SD 2.7º). Postoperative FVA was significantly (P<.001) lower than preoperatively at 1.4º (SD 2.3º). In the clinical case, all symptoms of patellar luxation resolved and normal limb function returned the day after surgery. Osteotomy healing was uneventful.
Conclusion: The Symax method for measuring FVA offers satisfactory repeatability and reproducibility. A curved osteotomy used according to CORA principles can practicably correct FVA in small breed dogs.
Clinical Relevance: Curved osteotomy is potentially easier to perform on especially small breed dogs and presents other advantages over femoral wedge closing ostectomy procedures in correction of FVA, such as increased stability and adjustability. The femoral curved osteotomy in this study produced results comparable to wedge ostectomy and warrants further clinical evaluation.

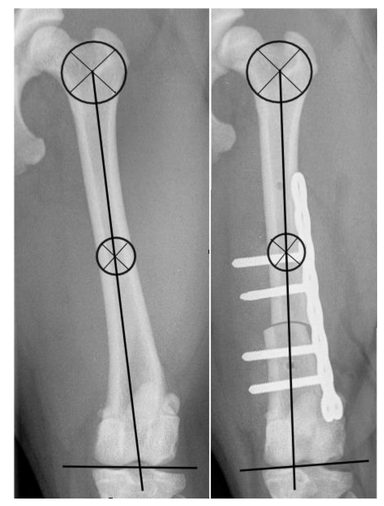
Introduction & Objectives

Distal femoral varus in the dog can predispose to medial patellar luxation. No gold-standard method has been established for measuring the canine FVA[1]. Differentiation between a normal FVA and pathologic varus is based on subjective recommendation rather than scientific fact. The Symax method of varus measurement has formerly been described in bone specimens[2].

Surgical correction of femoral varus in a limited number of dogs has been reported using a closing wedge ostectomy[3,4]. In humans, curved osteotomy methods have proved superior to the wedge procedure in some aspects[5].

Hypotheses in this study:

1. **The Symax method provides satisfactory reliability (intra- and interobserver) when measuring the FVA.**
2. **Curved femoral osteotomy performed according to the principles of center of rotation of angulation (CORA)[5] can significantly decrease a preoperative FVA of >6º in small breed dogs.**



Materials and Methods

A total of 12 femora (6 cadavers and one clinical case) from small breed dogs were included in this study.
The procedure was as follows:

- FVA measured from radiographs using the Symax method
- Osteotomy planned and performed according to the CORA principles
- FVA reduced according to pre-surgical planning
- Osteotomy reduced and stabilized with a 2.4mm locking plate (Synthes)
- Post-surgical radiographs obtained to repeat FVA measurement.

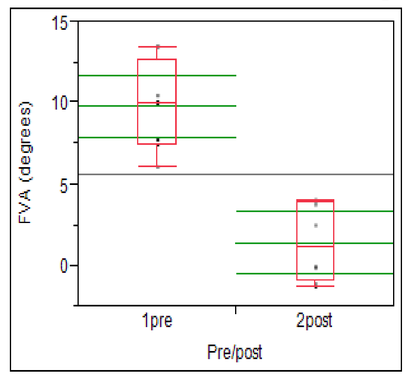
- In the clinical case, a 2mm 6-hole SOP plate (Orthomed) was applied.

Pre- and post-surgical radiographs (n = 24) were included in the reliability testing[6] of the Symax method, after randomising and anonymising. Two observers measured the FVA in three separate readings.

For the statistical assessment of the curved osteotomy an inclusion criterion of > 6º (n = 8) was established. Significance of the reduction in the FVA from pre- to post-surgery radiographs was assessed using Student's t-test.

Results

Reliability: Intra-observer within-subject standard deviation (wssd) was small (0.7º) indicating small variation between readings. Inter-observer wssd was also satisfactory (1.1º). Intra- and inter-observer repeatability coefficients were 1.9º -2.1º and 3.2º respectively.



Reduction in FVA: The FVA in dogs with initial FVA > 6º (n = 8) was significantly (*P*=.05) reduced from 9.8º (SD 2.7º) to 1.4º (SD 2.3º).

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