TPLO (Tibial Plateau Leveling Osteotomy) Based on Center of Rotation and Angulation (CORA): Description of Pre-Surgical Planning and Surgical Technique

Castaneda, K; Bruecker, KA

Veterinary Medical and Surgical Group, Ventura, CA

INTRODUCTION

Tibial Plateau Leveling Osteotomy (TPLO) has become a widely accepted technique to treat cranial cruciate ligament insufficiency/injury in canine patents.[1] However, some dogs may not be candidates for TPLO due to factors, such as unusual tibial anatomy, excessive tibial plateau slope, open physes in juvenile dogs, angular limb deformity due to physeal injury or failed prior surgery (TPLO, TTA, Extra-capsular Stabilization and other proximal tibial osteotomies).

Center of Roatation and Angulation (CORA) based osteotomies are used to correct angular limb deformities such that translation is not induced.[2] The CORA based osteotomy can be accomplished with closing wedge ostectomy or opening wedge osteotomy wherein the CORA is included in the osteotomy line or by domed osteotomy where the center of the osteotomy arc is the CORA.

An anatomic CORA (center of rotation and angulation) based TPLO (cbTPLO) has been described with some limitations on inherent implant stability due to the proximal nature of the CORA based osteotomy. [3] Since CORA describes a point/plane for correction of a deformity, an osteotomy that alters the anatomy to other than normal for purposes of addressing other problems, such as cruciate ligament insufficiency or abnormal joint wear is not a true CORA.

This poster describes the pre-surgical planning and surgical technique that centers a focal domed osteotomy on a CORA for the purposes of leveling the tibial plateau for the cranial cruciate ligament deficient stifle joint.

PRE-SURGICAL PLANING

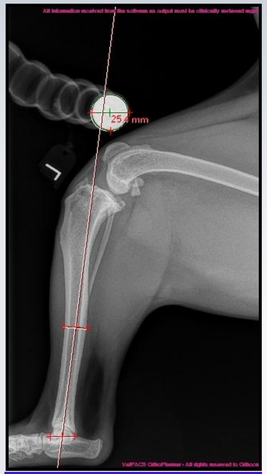

Figure 1.

Routine caudo-cranial (Cd-Cr) and medio-lateral (M-L) radiographs are obtained that include the entire tibia (stifle to tarsus). A distal tibial anatomic axis is made.

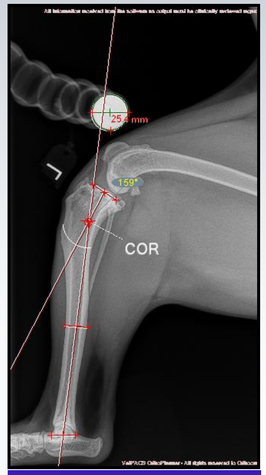

Figure 2.

A proximal tibial anatomic axis line is made based on the desired goal for the post-operative tibial plateau angle (TPA). Where these lines intersect in the proximal tibial corresponds to the CORA for the osteotomy.

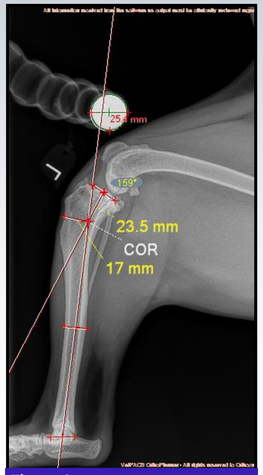

Figure 3.

Reference measurements can be made from any anatomic landmark.

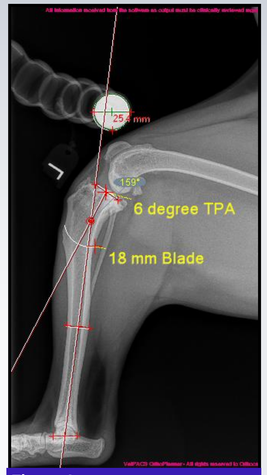

Figure 4.

A curved line is drawn utilizing a TPLO saw blade template that is of a diameter equal to or slightly larger than the diameter of the bone.

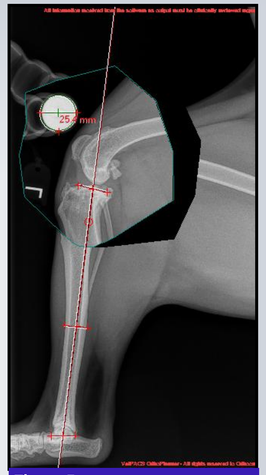

Figure 5.

The curved line is made distal to but centered on the CORA. The distance between the intersecting lines of the proximal tibial axis and the distal tibial axis on the line determines the degree of rotation required to achieve the planned TPA.

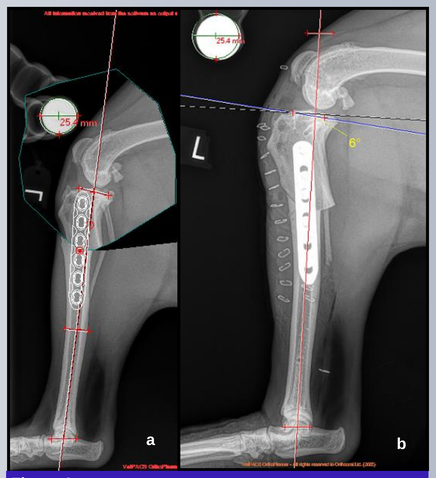

Figure 6.

Use appropriately sized implant template for stabilization of osteotomy (a). Corresponding post-operative radiographs (b).

CONCLUSION

This technique provides an alternative to TPLO, cbTPLO, TTA, TWO or other osteotomies where anatomic consideration may preclude these options, in cases where previous surgical attempts have failed and require revision, or re-operation at the failure site would be deemed inappropriate by the surgeon. Osteotomy centered on the CORA, but distal to the CORA in the diaphyseal bone, permits stable implant fixation and thus less potential complications associated with limited implant fixation associated with more proximal metaphyseal osteotomies.

In our cases, we plan for a post-surgical TPA between 6 degrees (as recommended for TPLO) and 10 degrees (as recommended for cbTPLO).[1, 3] In all patients, cranial tibial thrust was eliminated. However, without biomechanical testing to verify the proper post-surgical TPA to reduce cranial tibial thrust, the range for post-surgical TPA must be considered subjective and requires further investigation.

REFERENCES

1. Slocum B, Devine T: Tibial plateau leveling osteotomy for repair of cranial cruciate ligament rupture in the canine. *Vet Clin N Am Sm Anim Pract* 1993; 23: 777-795
2. Paley, D. (2002). *Principles of Deformity Correction.* New York: Springer-Verlag Berlin Heidelberg.
3. Raske M, Hulse D, et al: Stabilization of the CORA Based Leveling Osteotomy for Treatment of Cranial Cruciate Ligament Injury Using a Bone Plate Augmented with a Headless Compression Screw. *Vet Surg* 2013; 42: 759-764

SURGICAL TECHNIQUE

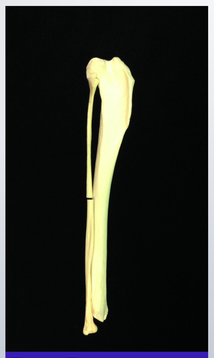

Figure 7.

A small lateral approach is made to the fibula just proximal to the tibial-fibular synostosis. An osteotomy is made in the fibula at this location to permit rotation of the tibia about the CORA to prevent inducing angular or torsional deformity.

Figure 8.

A medial approach is made to the proximal tibia. Using the recognizable anatomic landmarks from the pre-surgical planning, the planned CORA is identified and marked with an indentation.

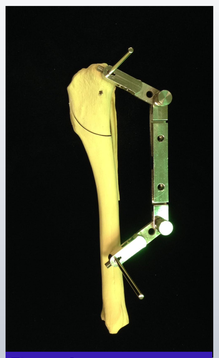

Figure 9.

A TPLO jig is placed as it would be for standard TPLO. The TPLO saw blade is then used to create the focal domed osteotomy centered properly on the CORA.

Figure 10.

Before completion of the osteotomy, two marks are made along the osteotomy at a distant equal to the calculated distance of planned rotation as would be done in TPLO.

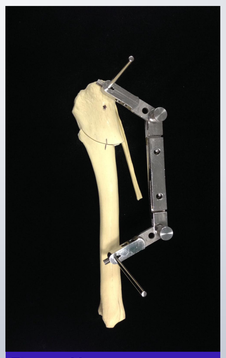

Figure 11.

The osteotomy is then completed and the proximal segment rotated the measured distance such that the marks align

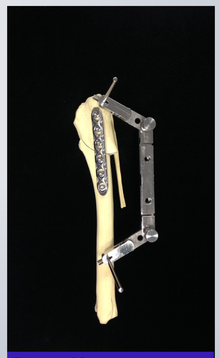

Figure 12.

An appropriate sized bone plate and screws are placed in standard fashion for the implant design.

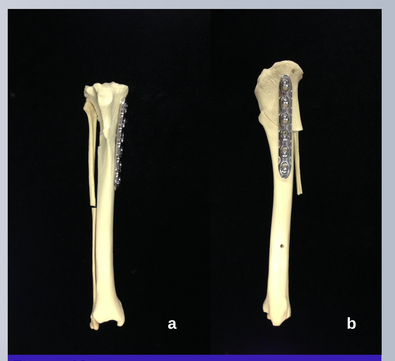

Figure 13.

Cranial (a) and lateral (b) views.

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