

# **Advanced Practitioner Cranial Cruciate Ligament Masterclass Mini Series**

## **Session Two: Tibial Tuberosity Advancement (TTA)**

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## 1. Introduction

2002 – Montavon & Tepic adapted human knee function to canine stifle. Conclusion – that cranial shear force on the stifle can be eliminated by making the patellar ligament perpendicular to the tibial plateau.

## 2. TTA evolution & evidence

- Vet Surg 2007: TTA 114 stifles. 12% minor post-op complications, 19% major (meniscal tear, tibial fracture). 81% good / satisfied outcome. 25% persistent lameness.
- JSAP 2008: TTA 70 stifles. 8.5% late meniscal tear rate. 12 months later, 17% persistent lameness. 65% excellent outcome.
- VCOT 2008: 40 TTAs. Dogs improve after TTA surgery but don't regain control dog levels. 25% dogs complications – lower PVF. Dogs improve with TTA but only 90% normal.
- VCOT 2008: TTA converts cranial to caudal shear force in the cruciate deficient stifle.
- Vet Surg 2009: literature review; TPLO and TTA are similar but unclear which is superior.
- JAAHA 2011: 193 TTAs, 11% complications, 5% late meniscal tear rate. Complications associated with increasing body weight & small TTA cage size. 92% owner satisfaction, 84% would choose procedure again.
- Vet Surg 2011: TTA osteotomy heals regardless of bone graft; makes little difference.
- JAVMA 2012: 501 TTAs. 95 (20% complication rate) including meniscal tear. Risk of complications higher with higher body weight & high patellar tendon angle.
- Vet Surg 2013: outcome for TTA worse than TPLO or TR. TTA – higher major complication rates and subsequent meniscal tear rates. TPLO – higher major complication rate & meniscal tear rates than TR.
- Vet Surg 2016: by 12 months postop, TPLO is similar to normal (walk and trot). For TTA walk is normal, but trot is not. For ECS, neither walk nor trot are normal

### TTA variants:

#### 1. Orthomed MMP

- OPNION ? high complication rate ? tibial fractures
- JAAHA 2016: 26 cases only. 2 major complications. 20/26 dogs (77%) returned to full clinical function at 6-11 months

#### 2. TTA Rapid - Leibinger / Vi

- OPINION – high minor complication rate – TT fractures – manage conservatively
- Vet Surg 2015: 50 dogs. 30% minor complication, 4% major. 95% dogs good to excellent outcome at 3 months

#### 3. KYON 2 – modification of the original KYON procedure

- No published evidence
- Anecdotal evidence – complication (fracture) rate relatively high – needs refining

#### 4. Fusion MMP – similar to the Orthomed MMP technique

- NO published evidence
- Anecdotal evidence – complication rate is very high - ? 50% ?

#### 5. Everost Xoprtion TTA cage – bioabsorbable

- Main advantage – no need for cage removal. relevant if surgical site infection
- Vet Surg 2016: 60 dogs; 30 absorbable cage, 30 non- absorbable. No differences in outcome other than healing scores higher in the bioabsorbable group.

### 3. Stifle stability after TTA + late meniscal tear?

- VCOT 2008: TTA causes a caudal shift in the cranial shear force i.e neutralizes CrCl rupture associated cranial thrust.
- T Prax 2014: Fluoroscopic kinematics. Most ECS, TTA and TPLO were unstable post-op = caudal slippage of the femur relative to the tibia.
- Vet Journal 2013: 30 stifles. 21/30 permanently cranially subluxated after TTA. PVF 65% BW and VI 9% BW. Conclusion – TTA does not normalise stability.
- JAVMA 2012: 501 TTAs. High rate of late meniscal tear if no release. Partial cruciate rupture was not protective. High body weight & patellar tendon angle associated with complications.
- KYON symposium / recommendation is to avoid meniscal release because of the deleterious affects & aim for higher / larger cage siz

### 4. TTA planning

- Measuring the TTA:
  - Vet Surg 2014: 4 different advancement planning methods produce very different results. Use of anatomic landmarks and imaging software simulating TTA less likely for error i.e. common tangent method results in more error.
  - VCOT 2015: compared 2 planning methods; only 53% had a PL-PTA of 90 degrees. Achieved advancement was 30% less than calculated.
- Calculating the osteotomy
  - VCOT 2014: tibial tuberosity fractures – incidental finding & clinically significant
  - VCOT 2015: TT fracture risk factors – osteotomy shape, plate position, cage position

## 5. TTA surgery – tips & tricks – minimizing complications

- The original forked TTA surgical technique in a step by step format is covered in pictures.
- OPINION – considering all the TTA variant techniques that are available, a simple screwed plate version of the original KYON version (i.e. 2 or 3 screws in the tibial tuberosity rather than many forks / tines) seems to be safer and more reliable.
  
- *Tips & tricks to make the procedure as safe as possible:*
  - *Measure the TPA carefully using anatomic landmarks*
    - *If in doubt use a large cage size*
  - *Template the implant placement carefully*
    - *If in doubt use a smaller plate*
    - *Line the plate with the cranial tibial tuberosity*
    - *Plan for change in bone position with advancement*
  - *Plan the osteotomy carefully*
    - *Proximal point – just cranial to tibial plateau*
      - *Use K-wire and Gerdy's tubercle to locate*
    - *Use 1/3 (tibial tuberosity) to 2/3 (tibial metaphysis) rule when measuring CrCd position. Measure pre-op and intra-op*
    - *Distal aspect – base of tibial tuberosity = between the distal tibial tuberosity hole and the proximal diaphyseal hole.*
    - *Subtly curve the distal osteotomy cranially*
  - *Use the screwed plate rather than the forked plate. This has the advantages of*
    - *Tibial tuberosity osteotomy made once rather than in 2 stages*
    - *Much greater freedom and safety in positioning the plate – have to predict less*
    - *Distal osteotomy can be made incomplete*
      - *Much more stable osteotomy intra-operatively making simpler surgery*
      - *Osteotomy more stable post-operatively*

## 6. Complications

1. **Septic arthritis** – treat as for any other joint. Aspirate the joint. Confirm high neutrophil count. Use broad spectrum antibiotics for minimum of 6 weeks, using Culture and Sensitivity result if it was positive. Repeat the synovial cytology at 6 weeks to confirm septic arthritis has resolved.
  
2. **Late meniscal tear** – eliminate septic arthritis as above. Then check menisci with arthrotomy or arthroscopy. To reduce the late meniscal tear rate, consider method of cage templating (as previously reported) and/or increasing cage size / advancement to avoid under-advancement.
  
3. **Tibial tuberosity fractures** major / minor – careful planning of the osteotomy & implant positioning including.
  
4. **Tibial diaphysis fracture:** very rare if osteotomy position correct.