

Small Breed MMP TTA

Standard Operating Protocol

Including Tips for Avoiding Complications



Preoperative Planning



01 True mediolateral radiograph with calibrated marker near stifle

- femoral condyles superimposed
- fabellae superimposed



03 Estimate post osteotomy desired TT thickness

- proximal = 30% proximal craniocaudal tibial metaphyseal width = 30% x 25mm = 7.5mm
- distal = 30% mid-distal craniocaudal tibial metaphyseal width = 30% x 21mm = 6.3mm ≈ 6.5mm

Measure actual length of TT

- connecting vertical line from proximal articular surface coursing through caudal points of the post osteotomy desired proximal and mid-distal TT widths
- ideally TT = 24-31mm in length is suitable for SMALL breed MMP saw guide and implant



02 Measure proximal craniocaudal tibial metaphyseal width/thickness from the proximal tibial tuberosity (TT) protuberance.

Measure mid-distal craniocaudal tibial metaphyseal width/thickness at a point 10mm distal to the proximal tibial tuberosity (TT) protuberance.



04 Ideal positioning and peg sizes for SMALL breed MMP saw guide

- proximal = THINNEST in contact with cranioproximal articular surface
- distal = THICKEST in contact with distocranial TT neck region
- osteotomy channel of saw guide visually aligned parallel with cranial TT cortex

Intraoperative planning and execution



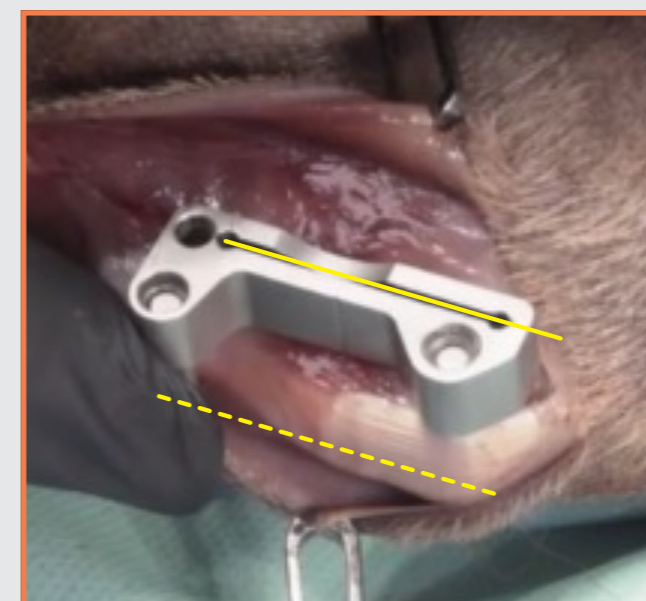
- 05** Desired osteotomy and insertion of SMALL breed MMP Orthofoam™ wedge within osteotomy gap
- estimate wedge size using formula 33% proximal craniocaudal tibial metaphyseal width = $33\% \times 25\text{mm} = 8.25\text{mm} \approx 8.0\text{mm}$
 - wedge inserted no further than 2mm distal to proximal articular surface and ideally distal end not inserted within the M-hole



- 01** Patient in lateral recumbency with affected side down
- lateral aspect of limb and hock in direct contact with table top

Medial parapatellar proximal crural surgical approach with minimal SQ dissection

- use scalpel blade with sharp edge facing proximal articular surface to walk off proximal aspect of cranial tibia with stab incision made immediately caudal to distal patellar tendon insertion on cranioproximal TT
- extend stab incision 1cm proximally with Metzenbaum scissor
- elevate infrapatellar fat pad to clearly visualise proximal articular surface
- perpendicularly puncture lateral joint capsule with Metzenbaum scissor



- 02** Arrange and order instrumentation
- SMALL breed saw guide with THINNEST peg proximally inserted caudal to patellar tendon insertion on proximal TT in contact with proximal articular surface
 - THICKEST peg distally in direct contact with distocranial TT cortical neck region
 - saw guide osteotomy channel visually aligned parallel with cranial TT cortex

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! Helpful Tip

- translate preoperative radiographic measurements onto medial cortical bone surface
- use Castroviejo callipers to measure and mark bone surface at desired proximal and mid-distal TT thickness points
- insert 0.8mm K-wires perpendicularly and monocortically at these two points
- slide saw guide over K-wires ensuring passing through centre of osteotomy channel, with proximal and distal centre pegs in contact with their respective surfaces



- drill and 2.5mm drill bit
- 2.5mm drill sleeve
- steady saw guide with fingers of nondominant hand ensuring guide and drill bit are aligned perpendicular to table top
- ensures that osteotomy channel is also aligned perpendicular to medial tibial cortical bone surface



- with drill bit inserted into M-hole in saw guide and resting on bone surface, gently lift the distal end of the saw guide to assess the proposed position of the M-hole
- ensure that M-hole location is sufficiently caudal to the distocranial TT neck region (at least equal to cranial cortical thickness) and not passing through cranial cortex, or centrally within proximal tibial diaphysis



03 Insert M-drill bit and leave within the drill sleeve and saw guide

- pulse drilling to initiate insertion prevents accidental slippage of drill bit off the cranial aspect of the distal TT region
- if K-wires were used to assist with saw guide positioning precision, remove these once M-drill bit is inserted



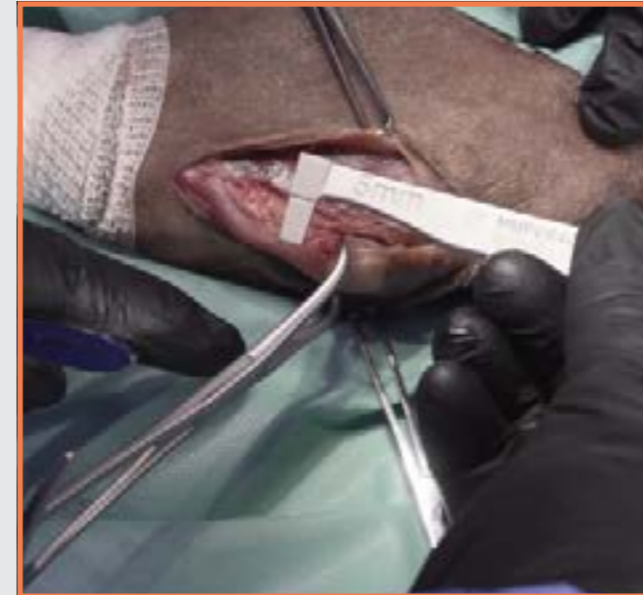
04 Steady saw guide with fingers of nondominant hand ensuring perpendicular alignment of saw blade with bone surface.

- Initiate osteotomy with saw blade in contact with bone surface, full speed sawing, painting slowly proximally to distally and gradually advancing medially to laterally along full length of the osteotomy channel
- avoid stopping and starting, and exiting and re-entering the osteotomy channel to prevent accidental creation of multiple osteotomy planes
 - saline irrigation is essential to prevent thermal tissue necrosis
 - avoid bending saw blade to prevent binding within osteotomy channel and accident creation of a curved osteotomy

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- 05** Once lateral cortex is penetrated along full length of osteotomy channel, remove M-drill bit and saw guide
- use scalpel blade to linearly incise the soft tissue just proximal to the M-hole
 - complete freehand osteotomy of isthmus of bone proximal to M-hole
 - insert saw blade obliquely into osteotomy channel angled distolaterally toward M-hole
 - begin full throttle sawing holding saw with two hands to steady blade



- 07** After osteotomy is completed, extend stifle and carefully attach small pointed reduction forceps to thickest portion of proximal aspect of TT
- gently traction the TT and, if not easily advancing,
 - carefully insert Metzenbaum scissor to blindly cut lateral soft tissues to free the TT for easier advancement
 - gradually perform TTA with sequential insertion of trial wedges beginning at least with the 5mm up to desired width
 - full stifle flexion and holding for 5-10 seconds between sizes assists with tissue fatigue to facilitate TTA



- 06**
- advance slowly along isthmus of bone and slowly rotate saw blade perpendicularly to bone surface so blunt side of blade will abut distal end of M-hole



- 08** Carefully and gently apply mild cranial traction with the small pointed reduction forceps whilst utilising the tapered shape (inserted distal end to proximal end from proximal aspect of the osteotomy) of the trial wedges to fully accomplish the gradual TTA
- insert trial wedges such that the final positioning within osteotomy gap is level with or ever so slightly proud of the medial tibial cortical surface AND the proximal aspect of the trial wedge is visualised at a point no further than 2mm distal to proximal aspect of osteotomy/articular surface



- 09** Load implant and align symmetrically with the wedge introducer and insert Orthofoam™ wedge within osteotomy gap until the its final positioning within osteotomy gap is level with or ever so slightly proud of the medial tibial cortical surface AND proximal aspect of the wedge is visualised at a point no further than 2mm distal to the proximal aspect of osteotomy/articular surface



- 11**
- ensure pointed reduction forceps are applied across “TT-wedge-tibial metaphysis” and not distal to the distal aspect of the wedge across “TT-osteotomy gap-tibial metaphysis” to prevent accidental fracture of the distal TT and M-hole bone hinge
 - ensure the arms of the reduction forceps are upside down (angled below the bone surface) to avoid interference of placement of the butterfly drill guide and obstruction of elected distal TT stabilisation method



- 10** Flex the stifle to apply natural mechanical compression ensuring the implant remains stable as was initially positioned; extend and reposition as necessary, then reapply stifle flexion compression
- apply pointed reduction forceps craniocaudally across the TT-wedge-tibial metaphyseal wedge-bone interfaces, ensuring to tighten only to first or second ratchet click, sufficient to hold the wedge and introducer in place within lightly compressed osteotomy gap

Note: over-tightening the reduction forceps may cause inadvertent fracture of the distal TT and M-hole bone hinge



- 12** The SMALL breed butterfly drill guide fits in only one direction for each of the L or R stifles
- ensure legs of the drill guide slide cleanly and fully through the respective wedge introducer holes and that it makes contact with the cranial TT cortical surface
 - load K-wire into drill and perform cranial to caudal overlay length sizing technique to ensure only trocar tippenetration of the caudal tibial cortex is achieved on insertion
 - for wedge sizes $\leq 6\text{mm}$, use 1.2mm K-wire
 - for wedge sizes $\geq 7\text{mm}$, use 1.4mm K-wire



- 13** Secure the butterfly guide and wedge introducer with fingers of nondominant hand
- ensure entry point of K-wire is centred or as close to centred on the cranial TT cortex to avoid accidental medial cortical splicing; adjust wedge mediolateralisation as necessary
 - pulse drilling at point of entry helps to prevent the trocar tip from sliding off the cranial TT cortex and changing the angle of penetration which may then miss the central K-wire hole in the wedge
 - saline irrigation may assist with preventing tissue thermal necrosis
 - penetration of the caudal cortex is not always noticed, but whenever possible, it helps to appreciate when the harder cortices are reached and then penetrated to avoid inadvertent over drilling and over insertion of the K-wire



- 15** Staple placement requires a minimum of 4-5mm distal one-third TT thickness to safely accommodate the cranial staple leg drilled hole
- cranial staple leg drill hole should be positioned within the distal 1/3 TT thickness at a point that is a minimum of 2.5-3mm measured from the osteotomy/cranial wedge-bone interface
 - caudal staple leg drill hole should be positioned within the caudal tibial metaphysis at a point that is a minimum of 2.5-3mm measured from the caudal border of the medial tibial cortex
 - staples should be orientated perpendicular to the tibial long axis at a point that is 60-70% the linear distance between the K-wire and M-hole
 - wedge sizes $\leq 6\text{mm}$, use 5mm MINI staple (1.5mm drill bit)
 - wedge sizes $\geq 7\text{mm}$, use 6mm SMALL staple (2.0mm drill bit)



- 14** Loosen the wedge introducer and remove the butterfly drill guide and introducer, in turn, leaving the wedge and K-wire fully seated within the osteotomy gap
- if needed, the pointed reduction forceps may be carefully tightened another 1 or 2 ratchet clicks to achieve required wedge-bone interface precompression in preparation for final distal TT stabilisation with either a staple or tension band wire (TBW) fixation



- 16** Insertion of the MINI staple
- ensure drilling with 1.5mm drill bit using the appropriate MINI staple leg drill holes in staple drill guide
 - inserting cranial leg in TT hole may be challenging at times
 - tapping with the drill guide may result in fracture of a thin distocranial TT bone hinge
 - the jaws of a pair of wire twister forceps to gently apply mediolateral squeezing pressure may be used instead to guide the legs into their respective holes



- 17** Tension Band Wire (TBW) distal TT stabilisation
- anchored around K-wire proximally
 - distal transverse drill hole positioned at a point that is 7.0-10mm distal to M-hole AND 4.0mm caudal to cranioproximal tibial diaphyseal cortex
 - pulse drill with 1.5mm drill bit perpendicular to medial cortical surface then angle craniolaterally to exit craniolateral aspect of cranial tibialis fossa and avoid damage to cranial tibialis muscle during wire passage



- 18**
- 1.2-1.4mm orthopaedic spool wire cut into 2 lengths
 - distal length is passed through distal drill hole and formed into figure-of-8 crossing at the level of the M-hole



- 19**
- proximal length formed into an inverted U bent over K-wire
 - free ends of 2 wires are twisted together around each other on medial and lateral sides of the TT ensuring that traction is applied while twisting evenly tensioning each side, respectively
 - when secured, cut ends leaving 2.5-3 twists on each side and twist and tuck against the medial and lateral sides of the TT; especially medially so it does not protrude excessively subcutaneously after wound closure





Orthomed (UK) Ltd

Majestic House
29 Green Street, Huddersfield
West Yorkshire, HD1 5DQ
United Kingdom

Tel: +44 (0) 845 045 0259

Fax: +44 (0) 845 603 2456

Email: info@orthomed.co.uk



Orthomed (SA) Pty Ltd

90 Henry Rd
Shere
Pretoria, 0084
South Africa

Tel: +27 (0) 83 227 8181

Fax: +27 (0) 86 683 2511

Email: info@orthomedsa.co.za



Orthomed North America Inc.

13822 W Boulton Blvd
Mettawa
Illinois 60045
USA

Tel: +1 772-562-6044

Fax: +1 772-562-6046

Email: info@orthomedusa.com



Orthomed Australasia Pty Ltd

PO Box 881
Mandurah
WA, 6210
Australia

Tel: +61 (0) 8 9590 8850

Fax: +61 (0) 8 9510 9001

Email: info@orthomed.com.au



Authorised distributor for Germany, Austria and Switzerland

STK-VET GmbH

Neusser Str. 1
52428 Jülich
Germany

Tel: +49 (0) 2461 70 39 778

Fax: +49 (0) 2461 70 39 979

Email: info@stk-vet.de



Authorised distributor for Taiwan

VETSEN Medical Company Limited

5F-6, No. 79-1, Sec. 2, Roosevelt Rd,
Da'an Dist, Taipei City, 106012
Taiwan

Tel: +886 978-273-013

Email: sales@vetsen-medical.com



Authorised distributor for Spain and Portugal

B Braun VetCare S.A.

Carretera de Terrassa, 121
08191, Rubi
Barcelona
Spain

Tel: +34 902 47 47 01

Fax: +34 902 48 48 01

Email: vet.es@bbraun.com



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