Veterinary Instrumentation

Surgery Guide

TTA
(Tibial Tuberosity Advancement)

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In the 1980s Barclay Slocum reasoned that changing the angle of the tibial plateau would modify the forces acting upon the cruciate deficient stifle, so that under load the stifle would be stable. Slobodan Tepic considered the Slocum model of stifle biomechanics too simplistic and factored in many other muscles and tendons acting on the stifle. He concluded that the relationship of the tibial plateau to the straight patella ligament was more significant than correcting the tibial plateau to an arbitrary angle. According to his mechanical engineering theories, by making the angle between the tibial plateau and the patellar ligament/tendon 90 degrees, the cranial thrust forces acting on the unstable stifle were effectively neutralised, when the stifle was loaded.

In the early 2000s, Tepic and Montavon adapted a human surgery called the Maquet Procedure, which advances the tibial tuberosity until the angle between the patella ligament and the tibial plateau is 90 degrees. This procedure is known as Tibial Tuberosity Advancement (TTA). Various modifications to the original technique including Modified Maquet Techniques and the TTA Rapid have been described.

Forked TTA plate
The main section of this surgery guide describes the original TTA technique using the forked plate.

Screwed TTA plate
The technique using the forkless (screwed) plate is described at the end of the surgery guide. This is arguably simpler, safer, and gives more flexibility for intra-operative adjustment.

Implants are manufactured from Titanium. Titanium offers better biocompatibility, fatigue strength, and higher resistance to infection.

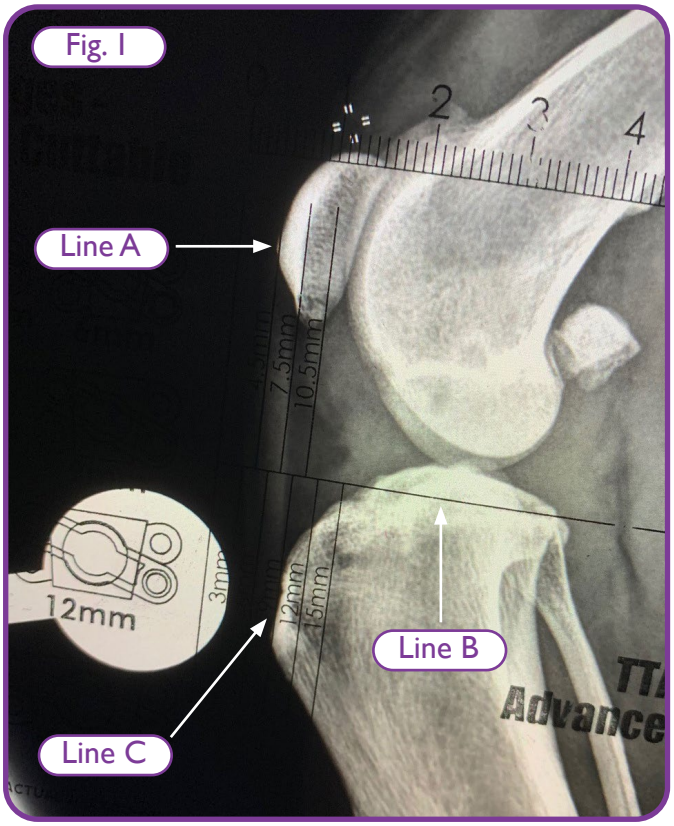
Contents

Pre-Operative Assessment and Planning

A well-positioned mediolateral view of the stifle at 135 degrees flexion is used to calculate the required tibial tuberosity advancement to bring the patellar tendon to a position of 90 degrees to the tibial plateau.

1. Tibial Advancement Calculation

The tibial plateau "traditional method" identifies the axis of the tibial plateau and then perpendiculars are run from this onto the tibial tuberosity and the cranial aspect of the patella (Fig.1).



- The tibial plateau is identified and line B on the acetate or digital guide placed to overlie it.
- A perpendicular line is extended from this line to intersect the cranial aspect of the patella (line A).
- Another perpendicular line is extended to intersect the cranial aspect of the tibial tuberosity at the point of insertion of the patellar tendon (line C).
- The linear distance between lines A and C are the amount of advancement required = cage size to be used.

Available cage sizes are from 3 to 15mm in 1.5mm increments. If in doubt, it is better to use a larger rather than smaller cage size.

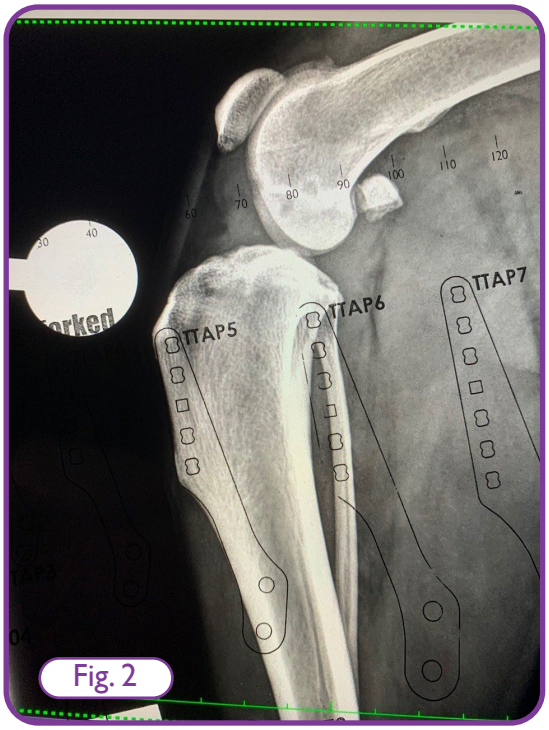
2. Osteotomy Position - Planning

- The osteotomy should extend in a straight line from just cranial to the tibial plateau to the distal aspect of the tibial tuberosity.
- At its most proximal aspect, the osteotomy should occupy about 30-33% the cranio-caudal width of the tibia.

3. Plate Size Templating

- Using acetate overlays or imaging planning software, an appropriate size TTA plate is selected (Fig. 2).
- The plate should comfortably fit the tibia; with the proximal fork holes overlying the cranial aspect of the tibial tuberosity, and the two distal screw holes overlying the central tibial diaphysis. Remember that the tibial tuberosity will be advanced, therefore the position of the distal plate holes will change relative to the tibial diaphysis.
- If in doubt between two sizes, it is better to use a smaller rather than larger plate.

Acetate overlays are available from Vi, and on digital templating software such as VPop and Orthoview.



TTA Surgical Technique – Forked Plate

Initial Approach and Preparation of the Tibia

1.

Start with the dog in dorsal recumbency. Make a skin incision on the medial aspect of the stifle and proximal tibia starting at about the level of the patella, extending distally parallel and medial to the straight patellar ligament, over the medial tibial tuberosity and curving caudally to extend over the proximal tibial diaphysis (Fig. 3).


Fig. 3

2.

Use diathermy and haemostats to control bleeding. First sharp and then blunt dissect through the subcutaneous fascia and fat to expose the medial retinaculum and patellar ligament, the proximal tibial tuberosity, the caudal sartorius muscle and its continuation distally as the pes anserinus (Fig. 4).

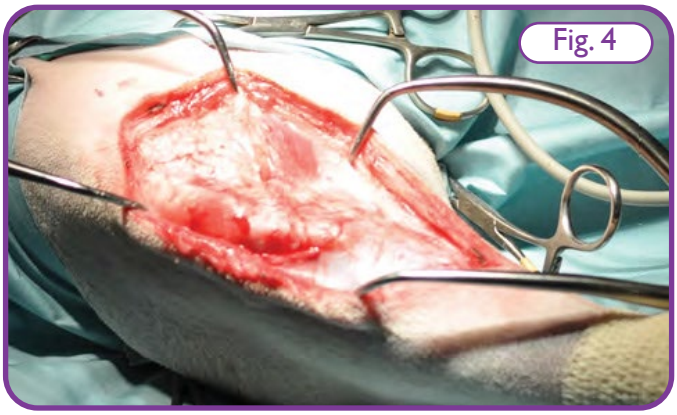


Fig. 4

3.

Sharply dissect under the proximal cranial leading edge of the caudal sartorius muscle. Using a periosteal elevator, insert under the caudal sartorius and run distally against the medial tibia under the leading (insertion) edge of the pes anserinus (Fig. 5).

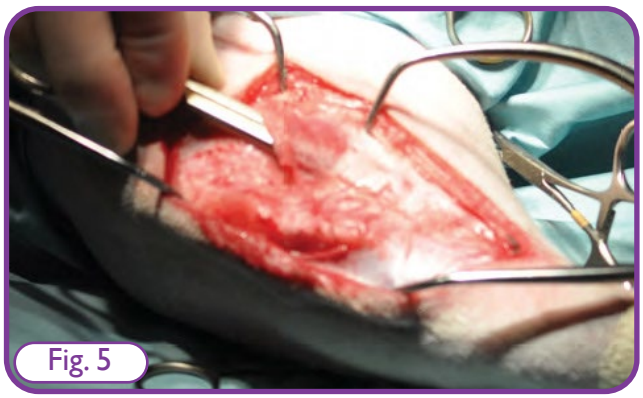


Fig. 5

4.

As close to the tibia as possible, cut the insertion of the pes anserinus from the tibia using cutting diathermy or a #11 blade. The popliteus muscle and the medial collateral ligament are visualised beneath (Fig. 6).

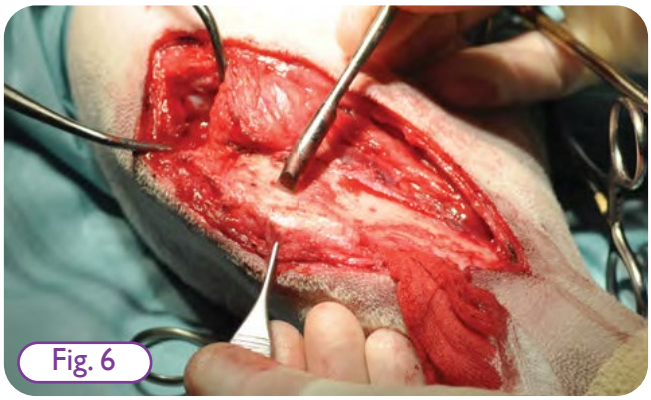


Fig. 6

5.

Prepare the tibial tuberosity on the medial aspect by reflecting and incising the periosteum cranially to expose the tibial tuberosity. This is best achieved by a combination of cutting diathermy, #11 blade and/or periosteal elevator. This soft tissue should be elevated and reflected sufficiently cranially until the following features are identified:

- the distal medial extent of the patellar ligament (highlighted in Fig. 7).
- the lateral curving surface of the cranial tibial tuberosity.
- the transversely oriented ligamentous tissue that is visualised at the distal aspect of the tibial tuberosity (highlighted in Fig. 8).

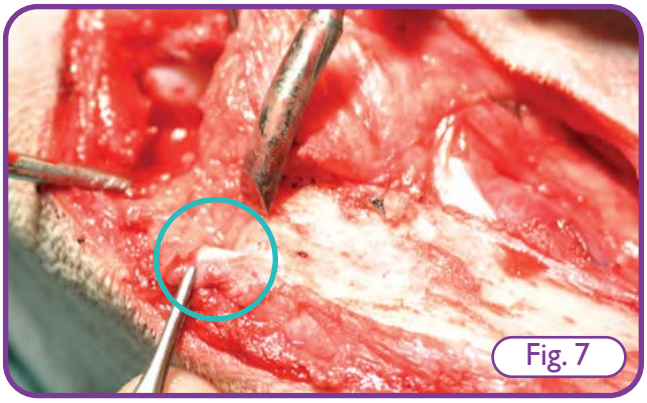


Fig. 7

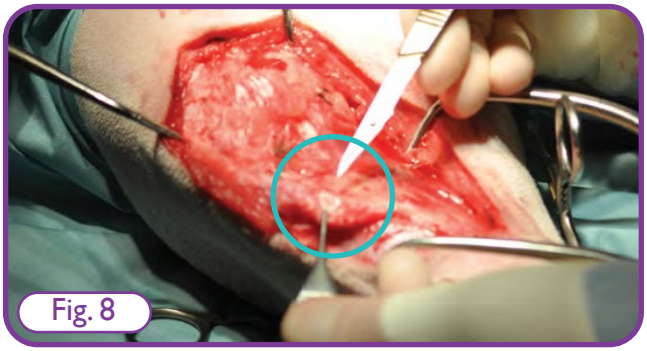


Fig. 8

6.

This elevation is continued just distal to the tibial tuberosity and a #11 blade is used to create a <2cm incision on the cranial aspect to allow elevation of the cranial tibial muscle (Fig. 9). Optional - a periosteal elevator is inserted into this hole and directed proximally – this is used to elevate the cranial tibial muscle from the lateral aspect of the proximal tibia.

On the medial aspect of the tibia, elevation is continued distally along the proximal tibial diaphysis to remove the periosteum from beneath the predicted position of the plate.

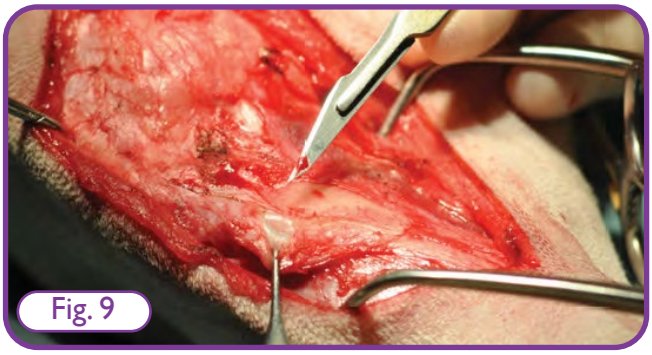


Fig. 9

Mini Medial Arthrotomy

It is important to know the meniscal anatomy.

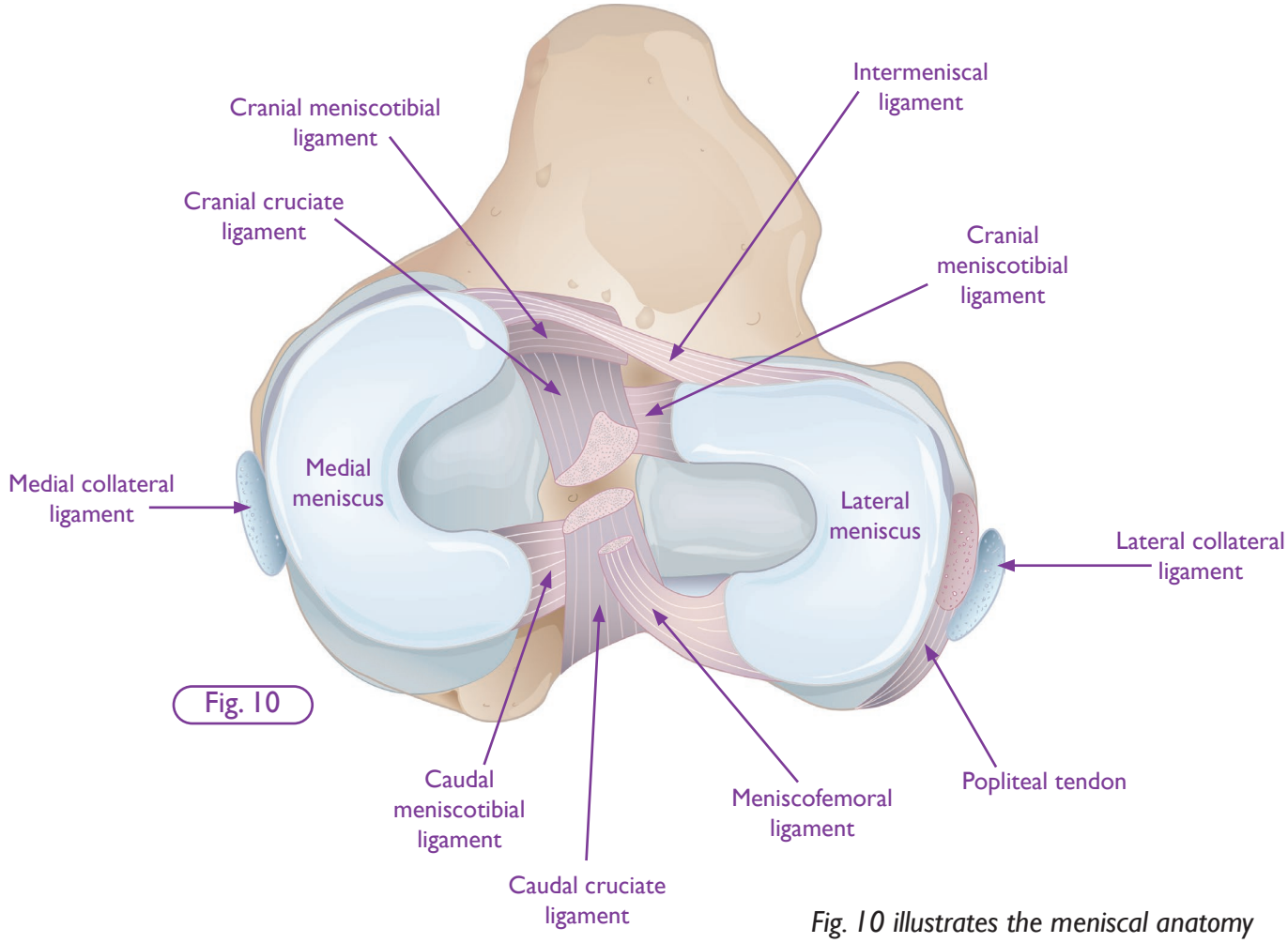


Fig. 10

Fig. 10 illustrates the meniscal anatomy

7.

Identify the patellar ligament between the distal patella and the tibial tuberosity; work medial to it. Use sharp dissection (#11 blade or cutting diathermy) to make a parapatellar incision through the medial retinaculum a few millimetres medial to the patellar ligament. This incision should extend from the distal pole of the patella down onto the proximal tibia (Fig. 11).

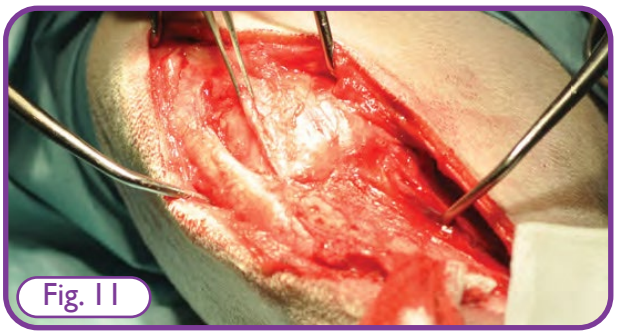


Fig. 11

8.

Blunt dissection is used to separate the cut edges of the medial retinaculum from the underlying exposed joint capsule (Fig. 12).

Fig. 12

9.

Starting proximally, at the level of the distal pole of the patella, sharp dissection (#11 blade or cutting diathermy) is used to incise into the joint capsule, initially entering the joint proximally; this releases a variable amount of fluid from the joint. The incision is continued distally as far as the proximal tibial tuberosity. The thick medial patellar fibrocartilage medial to the patella is **not** transected.

10.

Stifle distractors are carefully inserted into the joint (avoid damaging the menisci, articular cartilage or remaining cruciate ligament), rotated by 90 degrees and opened to distract the joint proximo-distally. Gelpi retractors are placed media-laterally to aid exposure. Flush/suction/swabs are used to clean the joint and maximise visualisation (Fig. 13).

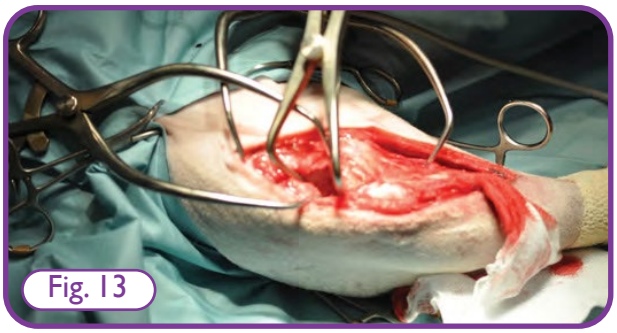


Fig. 13

11.

The joint is inspected methodically in order not to miss important lesions. Specifically check:

- Lateral and medial femoral condyle articular cartilage for erosion/osteochondrosis.
- Cranial cruciate ligament for integrity - debride mechanically incompetent portion; leave any mechanically component portions.
- Caudal cruciate ligament - probe to check integrity/damage.
- Lateral meniscus - visualise and probe for damage.
- Medial meniscus - visualise and probe for damage, use a Dandy Nerve Hook to probe above and below the meniscus to demonstrate tears. Resect damaged areas and tears using a small haemostat and no.11 blade or Beaver blade. Leave any undamaged areas alone.

12.

Flush joint thoroughly, remove retractors and leave arthrotomy open. Return the dog to lateral recumbency.

It is normal for the axial (medial) thin edge of the medial meniscus to have a folded undulating appearance; this is **not** a meniscal tear.

If the cranial cruciate ligament is mostly intact, it may be very difficult to inspect much of the medial meniscus as the cruciate ligament is directly in front of this; inspect as much of the meniscus as you safely can and if no damage is seen, it can be assumed that the meniscus is not torn/damaged given the cruciate ligament is present and competent.

Do not make a meniscal release or transection; this procedure is outdated and no longer performed by most surgeons. Releasing or cutting the meniscus means it loses its mechanical integrity and induces DJD in the stifle.

The lateral meniscus and caudal cruciate ligament are almost never affected other than some fibrillation of the visible portion caudal cruciate ligament.

Selecting The Correct Plate Size and Position

13.

Use the plate size originally predicted from templating. Palpate the distinct tip of the most cranial part of the tibial tuberosity, just under the insertion of the patellar ligament. Place the plate on the tibial tuberosity such that the most proximal fork hole of the plate is 5mm caudal to the tip of the tibial tuberosity. Align the cranial aspect of the plate with the cranial cortex of the tibial tuberosity. Check that this position ensures that good quality bone is present beneath the most distal fork hole. If this is not the case, consider a smaller plate (Fig. 14).

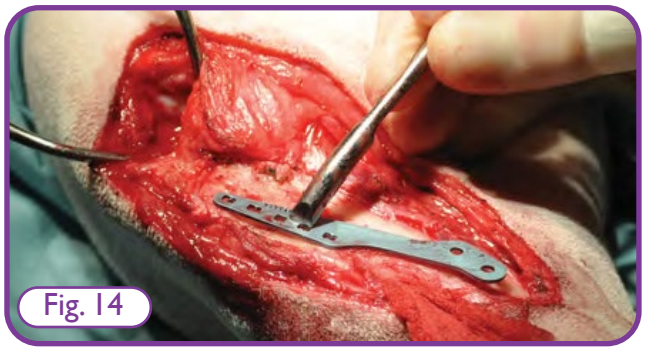


Fig. 14

14.

Check also that this plate position ensures that the plate screw holes are positioned over the mid to cranial tibial cortex. When the tibial tuberosity advancement is performed, these screw holes migrate caudally – if they start too caudal and subsequently migrate further caudally they may no longer be positioned over the tibial cortex. Small adjustments in plate position and/ or size may be necessary to ensure this. The plate should be as cranial as possible on the tibial tuberosity, only a few mm from the most cranial edge, with the intended fork position pointing slightly caudally.

15.

When appropriate plate sizing and positioning has been achieved, the plate must then be contoured. The T-handle is used to hold the proximal portion of the plate, and the oval plate bender is used for the distal portion of the plate. Most plates require a gentle bend and twist to match the shape of the tibia. It is better to use small increments rather than over-contouring and then having to correct – this is because titanium is easily fatigued by repeated bending (Fig. 15).

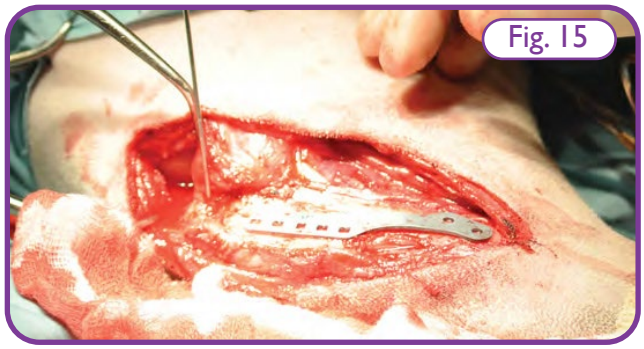


Fig. 15

16.

Place the TTA drill guide, with the holes pointing distally, over the tibial tuberosity in the same position as the plate was when confirming plate positioning. Use a finger tip to feel the cranial cortex of the tibial tuberosity; the feet of the jig should be at the same level. Use a small or medium sized pointed bone holding forceps to immobilise the drill guide onto the tibial tuberosity. Before drilling, double check that the position of the drill guide is correct - put the plate on top and assess its position (Fig. 16).

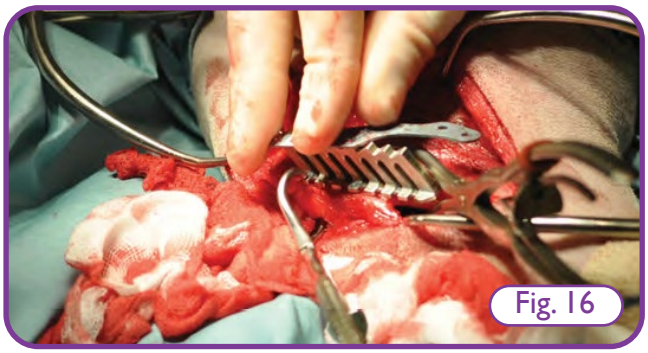


Fig. 16

17.

Using a 2mm drill bit with flush and suction, drill the most proximal plate hole. Once drilled, place the anchor peg to secure the drill guide. Then drill the most distal hole, and place the second anchor peg (Fig. 17). Drill the remaining holes, then remove the pegs, the drill guide and the bone holding forceps.

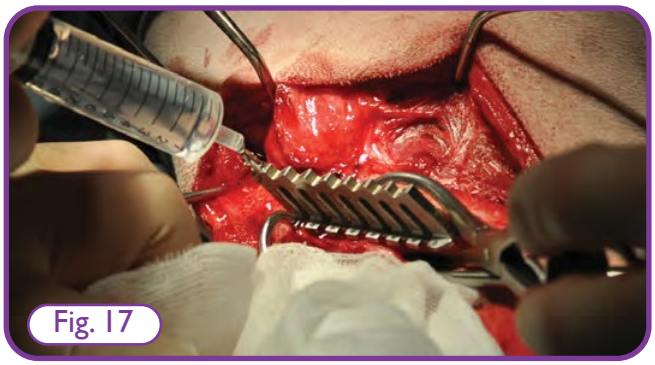


Fig. 17

Templating and Making the Tibial Osteotomy

18.

Palpate and identify Gerdy's tubercle on the proximolateral aspect of the tibial tuberosity - this is the protrusion at the cranial aspect of the fossa in which the long digital extensor tendon runs. Place a K-wire (1.6mm for medium breed dog) vertically from medial to lateral at the most proximal aspect of the tibia/distal aspect of the stifle arthrotomy so that it exits laterally over Gerdy's tubercle. Adjust if not correct. On the medial aspect the position of the K-wire now identifies the location of the proximal tibial tuberosity osteotomy (Fig. 18).


Fig. 18

19.

Place the plate on the tibia overlying the holes that have been drilled. Using cutting diathermy or a bone scribe, mark on the cranial tibial cortex a point halfway between the most distal fork hole and most proximal screw hole. This marks the distal aspect of the tibial tuberosity osteotomy (Fig. 19).

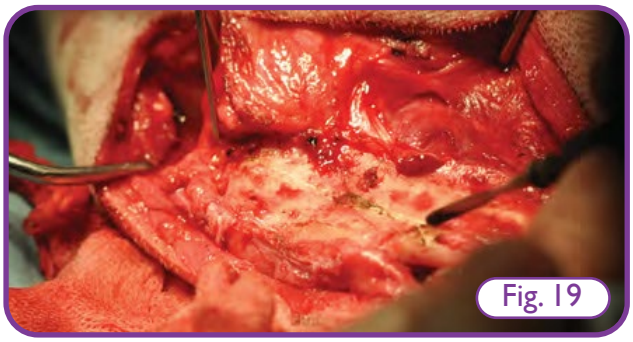


Fig. 19

20.

Using cutting diathermy or a bone scribe, mark on the medial tibia in a straight line from the K-wire proximally directing distally towards the mark on the cranial tibial cortex. As you approach the distal mark, make a gentle curve so that the cortical exit point is a few millimetres proximal to the mark on the cranial tibial cortex. This is to ensure that the osteotomy exits the cranial tibial cortex more proximally than the final position of the distal plate screw holes. This is to minimise the effect of having 2 stress risers in too close proximity (Fig. 20).

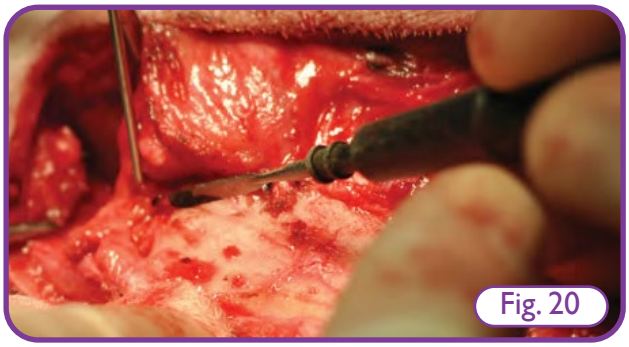


Fig. 20

Check the osteotomy position against the pre-operative plan. At the level of the cranial tip of the tibial tuberosity/insertion point of the patellar tendon, the osteotomy should divide the tibia approximately 30% tibial tuberosity, 70% tibial diaphysis.

21.

Remove the K-wire. Ensure that the tibia is parallel to the table, to ensure that the osteotomy cut is straight. This can be achieved by placing lap sponges or swabs under the hock and/or asking an assistant to hold the foot.

22.

Place Gelpi retractors in the stifle joint - to reflect the patellar ligament cranially away from the blade (Fig. 21).

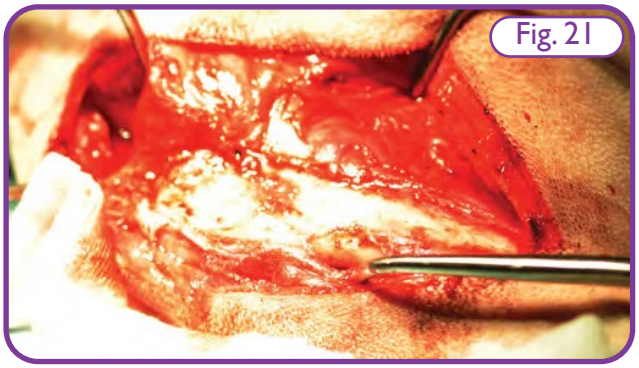


Fig. 21

23.

Place the plate over the tibia and mark the point at which the plate no longer covers the osteotomy scribe line (Fig. 22).

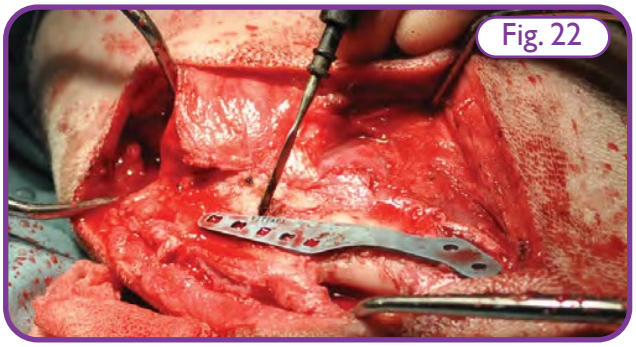


Fig. 22

24.

With plenty of flush and suction, use an oscillating saw to make the osteotomy along the pre-scribed line (Fig. 23). The osteotomy should be monocortical proximally and bicortical distally for the section that will be covered by the plate. A narrower blade should be used to make the gentle curve of the osteotomy distally. Once the osteotomy is completed bicortical distally and monocortical proximally, you are ready to place the plate.


Fig. 23

Placing the Plate and Fork

25.

Insert the forks into the plate – a subtle click should be appreciated (Fig. 24).

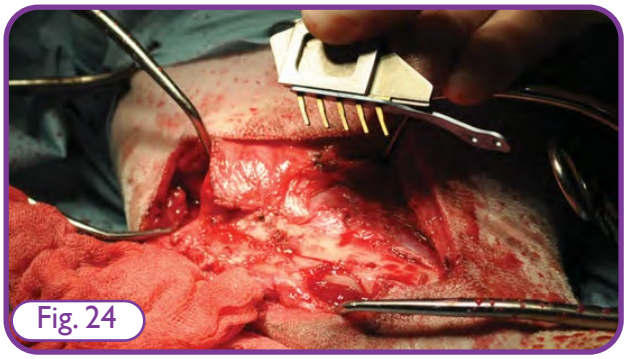


Fig. 24

Manually insert the forks into the prepared holes in the tibial tuberosity – the forks should go in about halfway. Ensure that all periosteum is cleared from the distal tibia in the region underlying the distal plate.

26.

Supporting the lateral aspect of the tibial tuberosity with fingers or some swabs, use the mallet and impacting tool to drive home the forks and plate onto the tibial tuberosity. The plate and fork should fit snugly and ideally with no residual movement. If slight movement is still present, strike again with the mallet and impacting tool. If there is still mild instability, remove the impacting tool, place a swab over the exposed fork and strike directly with a mallet (Fig. 25).

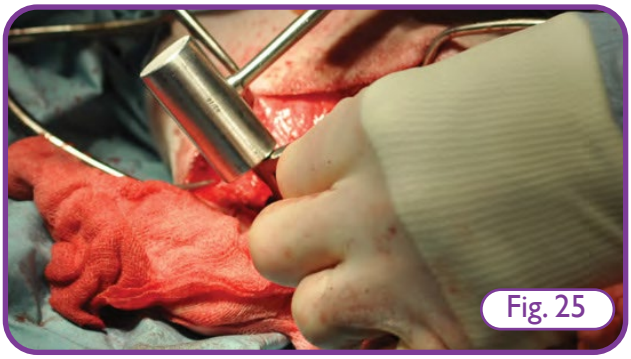


Fig. 25

27.

When the plate and fork are secure, complete the osteotomy by making the cut bicortical proximally. The tibial tuberosity will now be free and unstable. Remove the Gelpi retractors at this point.

28.

Place the appropriate sized (previously calculated advancement) spreader in the osteotomy – frequently the tuberosity will rotate laterally along its long axis. Using suction and swab, use straight Mayo scissors to cut the fibrous tissue at the proximal lateral aspect of the osteotomy – do not do this blind as there is the risk of cutting the long digital extensor tendon. Once this soft tissue is released, the tibial tuberosity should advance easily without rotating laterally along its long axis. Check (visualise or palpate with periosteal elevator) that the forks exit the lateral cortex of the tibial tuberosity.

Cage Assessment and Placement

29.

Use the spreader to distract the osteotomy (Fig. 26) then use a depth gauge (Fig. 27) to measure the depth of the caudal cut surface of the tibia near to its most proximal aspect – this equates to the length of cage you need to the closest 3mm. If in doubt, use a shorter rather than a longer cage as the cage can become particularly prominent on the lateral aspect.

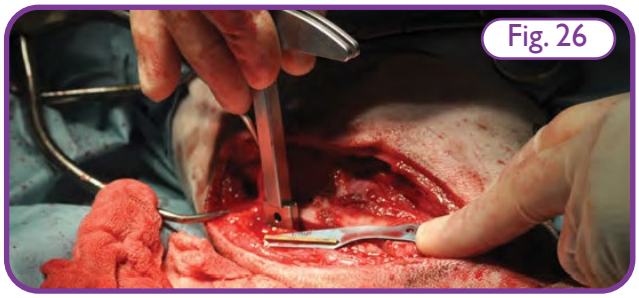


Fig. 26

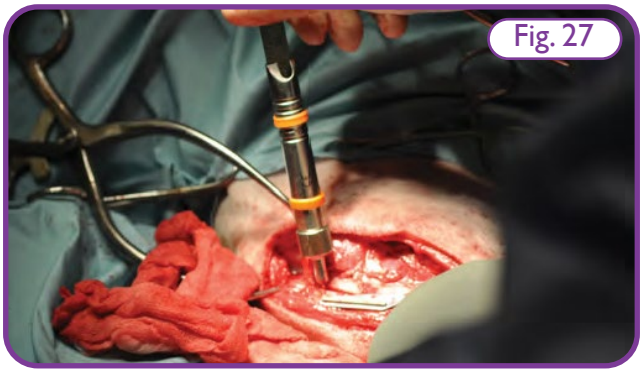


Fig. 27

30.

Having selected the cage, insert it into the proximal aspect of the osteotomy for a trial fit (Fig. 28).

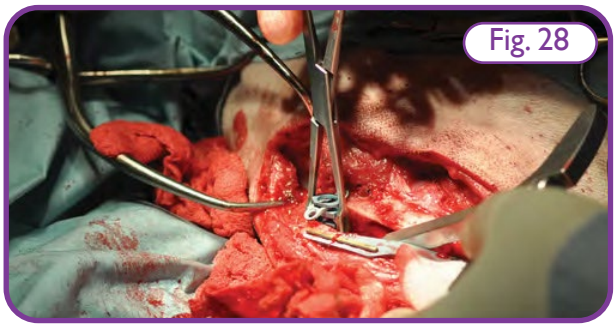


Fig. 28

31.

Remove the cage and using the oval plate bender, bend the caudal ear of the cage medially (outwards) and bend the cranial ear laterally (inwards) (Fig. 29).


Fig. 29

32.

Re-place the cage into the osteotomy, about 3mm distal to the most proximal aspect of caudal cut surface of the tibia.

33.

If intending to harvest a bone graft, mark the level of the most distal aspect of the cage against the caudal cut surface of the tibia using diathermy or a bone scribe (Fig. 30) . Remove the cage. Using a Volkmann's curette and via the caudal cut surface of the tibia for access, harvest cancellous bone from the tibia. Only harvest from a location below the intended position of the cage – hence the need to mark the cage position above.

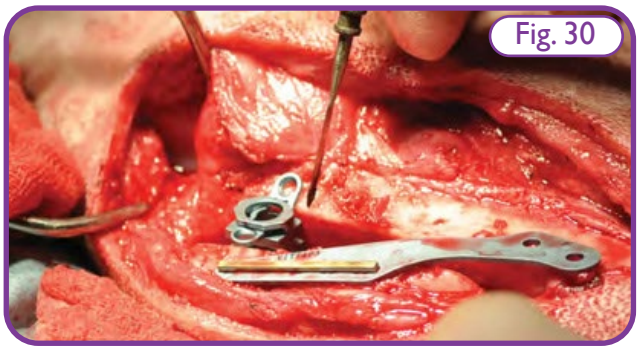


Fig. 30

Collect the bone graft in a blood soaked swab or a 5ml syringe or similar.

Stabilising the Osteotomy

34.

Place the cage in the correct position:

- (wide aspect proximal, narrow aspect distal).
- perpendicular to the cut surface of the tibia.
- most proximal aspect approx 3mm distal to the most proximal aspect of the cut surface of the caudal tibia.

35.

Using a large pair of single point reduction forceps between the cranial aspect of the mid tibial tuberosity and an adjacent point on the caudal tibial, reduce and compress the advanced tibial tuberosity (Fig. 31). This can be a little fiddly and will take practice. The tibial tuberosity has a tendency to migrate proximally but this can be controlled by applying a combination of digital pressure and application of the bone holding forceps. The end result should be:

- The distal aspect of the osteotomy should be snugly compressed.
- The distal screw holes should be over the mid to caudal tibial cortex.
- The cage should be proximal to the most proximal fork hole.
- The ears of the cage can be rotated to move its cranial screw hole as far as possible away from the proximal fork hole.

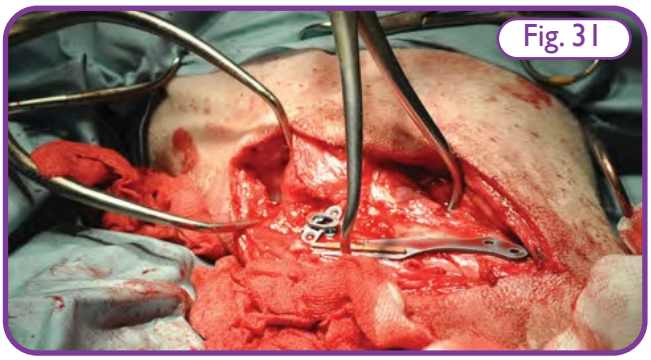


Fig. 31

36.

Using a 1.8mm drill bit, drill guide and depth gauge, drill and place the screw in the caudal cage hole. Aim at a reasonable angle caudo-distal to the fibular head. This will be a relatively long screw; approx 28mm in a Labrador. Place a self-tapping 2.4mm screw. Ensure that the screw is driven sufficiently far that rides over the edge of cage and engages the ear correctly (Fig. 32).

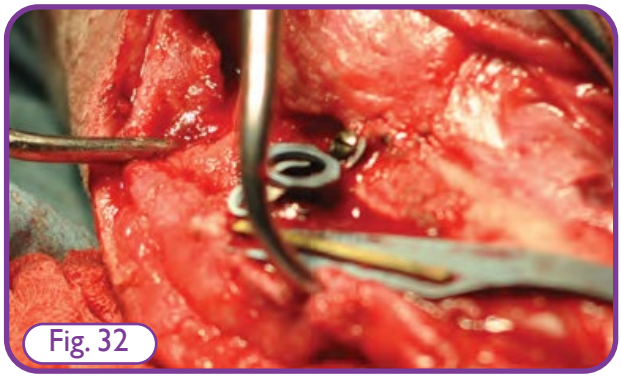


Fig. 32

37.

Drill the most proximal or distal plate hole; 2.0mm drill bit for 5 hole plates and smaller, 2.5mm for 6 hole plates and larger. Measure and place 2.7mm or 3.5mm self tapping screw as appropriate. Do not angle this screw excessively as doing so will not engage the plate hole correctly (Fig. 33).

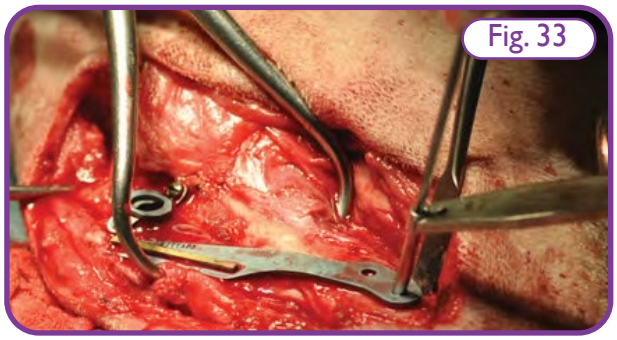


Fig. 33

38.

Using a 1.8mm drill bit and drill guide, place the cranial cage screw – aim as proximally and cranially as bone stock will allow. As the depth gauge may not sit on the cage ear correctly, this screw may end up being too long. It is therefore advised not to add to the measured length when selecting this screw. Place a 2.4mm self tapping screw (Fig. 34).

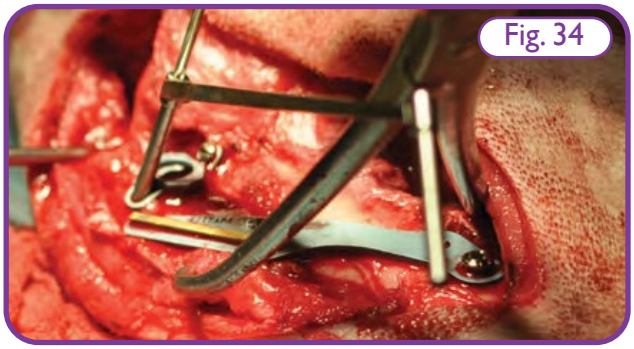


Fig. 34

39.

Place the other distal plate screw (2.7mm or 3.5mm as appropriate). Do not angle this screw excessively as doing so will not engage the plate hole correctly (Fig. 35). Flush the entire surgical site thoroughly. Optional according to surgeon preference - place harvested cancellous autograft (or allograft) at the osteotomy site proximal and distal to the cage and in the cage itself Alternatively, a synthetic bone graft product may be used, or the use of no bone graft product is also acceptable.

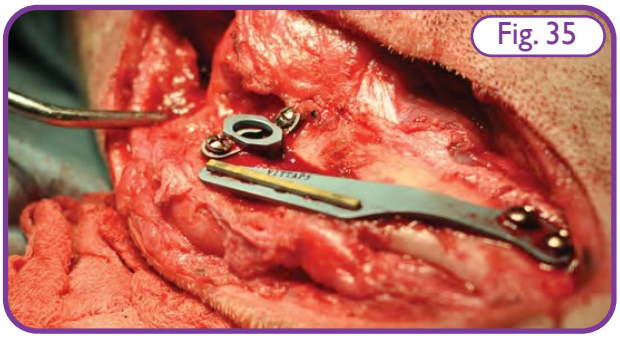


Fig. 35

Finish and Close

40.

Close the joint capsule (3m PDS, simple continuous). Close the medial retinaculum (3.5m PDS, simple continuous). Starting distally, re-attach the pes anserinus to the elevated periosteum/soft tissue on the cranial aspect of the tibial tuberosity (Fig. 36). This should be possible all the way proximally to include the caudal Sartorius muscle, and covering the implants most of the way (3.5m PDS, simple continuous). Occasionally it is not possible to close over the proximal plate and cage.

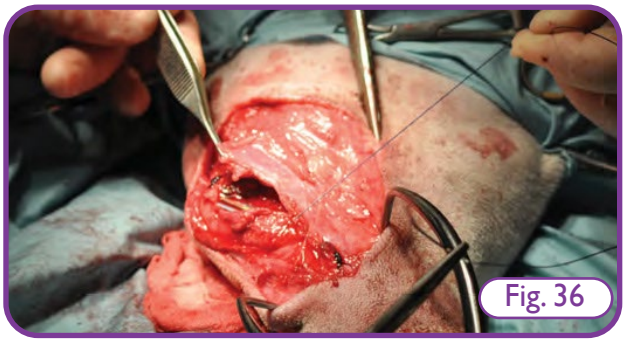


Fig. 36

41.

Close the subcutaneous fascia (3m PDS, simple continuous). Close the subcutis (2m or 3m Monocryl, simple continuous. Close the skin (staples, skin sutures etc.) (Fig. 37).


Fig. 37

42.

Take well positioned radiographs and check osteotomy position and reduction and implant position (Fig. 38).

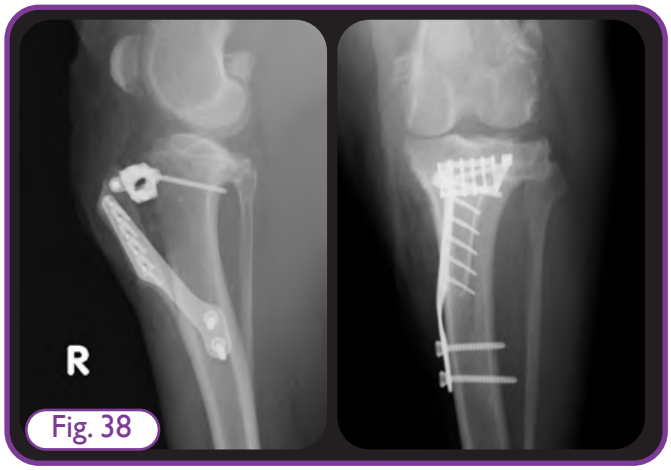


Fig. 38

Post-Operative Care

Post-operative care of the TTA patient is critical. Until the osteotomy has filled and consolidated the tibia is vulnerable to fracture, and the implants vulnerable to failure.

- The patient is kept in hospital overnight on appropriate analgesia and is normally ready to be discharged the day after surgery.
- NSAIDs are typically given for 10-20 days.
- There is no indication for post-operative antibiotics.
- Strict cage rest with gradually increasing duration of strict lead walks only for toileting purposes is indicated.
- Physiotherapy should start immediately.
- The patient is checked at 10 days and the skin
- staples/ sutures removed.
- Hydrotherapy should start once the skin wound has healed ie at 10 days post-op.
- The patient is checked at 6-8 weeks and progress radiographs are taken.

If the 6-8 week radiographs show good progression of bone healing, exercise is gradually returned back to normal over the subsequent 6 weeks.

TTA Surgery with Forkless/ Screwed Plate

An evolution of the original TTA plate and technique is the development of the plate that uses screws rather than forks in the tibial tuberosity (Fig. 39).

Fig. 39

The screwed TTA plate has a number of advantages over the original forked plate including:

- The osteotomy is made in one simple step rather than two stages.
- Making an incomplete osteotomy distally creates a much more stable osteotomy construct for stabilisation. This is makes reduction and placements of implants quicker and easier.
- There is more freedom of plate positioning. This is because the screwed plate is placed after the osteotomy is complete and after the cage is placed, as compared to the forked plate which is placed even before the osteotomy is complete.
- Screw direction can be adjusted by the surgeon whereas fork direction cannot.
- Screw length is selected as determined by the depth gauge but fork tine length cannot be altered.

Forkless TTA - Surgical Technique

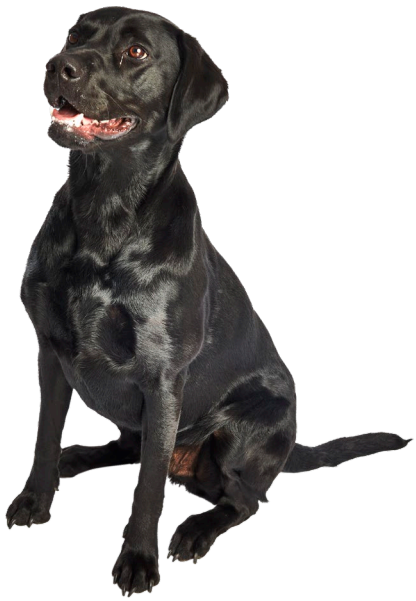
Follow a similar procedure to the forked TTA but with differences as outlined below:

- Mark intended osteotomy position on the proximal medial tibia.
- Plate size and position – check relative to osteotomy position and tibial tuberosity.
- Make the osteotomy – leave distal tibia cortex and periosteum intact.
- At the proximal osteotomy, gradually and gently advance the tibial tuberosity.
- Measure the depth of the proximal tibia using depth gauge.
- Place cage of the appropriate size and depth; contour ears as appropriate.
- Place pointed reduction forceps just under the insertion point of the patellar ligament from cranial to caudal. This is to immobilise the tibial tuberosity and compress the osteotomy (onto the cage).
- Place the cranial and caudal cage ear screws (2.4mm).
- Place the plate in a good position, ensuring screws as far away from other screws/ edge of bone/edge of osteotomy as possible.
- Place screws in the tibial tuberosity and tibial diaphysis.
- Flush and close.

Procedure steps which are unchanged:

- Pre-operative radiographs including templating.
- Preparation for surgery.
- Surgical approach and proximal tibial exposure
- Arthrotomy, cruciate and meniscal inspection +/- debridement.
- Closure.
- Post-operative radiographs.
- Post-operative care and recovery.

With thanks to Gareth Arthurs PGCertMedEd MA VetMB CertVR CertSAS DSAS(Orth) FHEA FRCVS RCVS Recognised Specialist in Small Animal Surgery (Orthopaedics) for his invaluable assistance with the revised version (2023) of this Surgery Guide.



Featured Products

Please note, the following featured products are only a selection of those available in the range.

TTA Starter Kit

TTAPREM TTA Starter Kit In A Premium Aluminium Box

TTA Instrumentation

TTA554 TTA Drill Guide (4 Hole)
TTA555 TTA Drill Guide (8 Hole)
TTA666 TTA Fork Holder
TTA444 TTA Spreader & 3mm, 6mm, 9mm, 12mm & 15mm Inserts
TTA445 4.5mm, 7.5mm & 10.5mm Insert Set
TTA333 TTA Plate Bender
TTA777 1.9mm Pins (Set of Two)
TTAPFO TTA Plate & Fork Overlay
TTATAN Common Tangent TTA/MMT Advancement Overlay
001323 TTA Mallet (140g)
TTAFCP TTA Cage Forceps
SDHS35POM-C 2.5mm Hex Screwdriver & Sleeve
H090208 1.8mm Drill Bit Hard
H090102 2.0mm Drill Bit Hard
H090112 2.5mm Drill Bit Hard
DG242735 Depth Gauge For 2.4mm, 2.7mm & 3.5mm Screws

TTA Cage Forceps

TTAFCP TTA Cage Forceps

TTA Mallet

001323 TTA Mallet 140g 155mm

TTA Spinlock Reduction Forceps

001245SL TTA Spinlock Reduction Forceps 180mm

TTA Saw Guide

TTA999 TTA Saw Guide

TTA Plates

TTAP2 Plate 2 Hole Titanium Screw 2.4mm
TTAP3 Plate 3 Hole Titanium Screw 2.4mm + 2.7mm
TTAP4 Plate 4 Hole Titanium Screw 2.4mm + 2.7mm
TTAP5 Plate 5 Hole Titanium Screw 2.7mm
TTAP6 Plate 6 Hole Titanium Screw 2.7mm + 3.5mm
TTAP7 Plate 7 Hole Titanium Screw 3.5mm
TTAP8 Plate 8 Hole Titanium Screw 3.5mm

TTA Forks

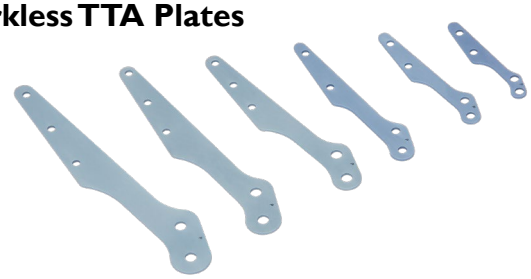
TTAF2 Fork 2 Prong Titanium
TTAF3 Fork 3 Prong Titanium
TTAF4 Fork 4 Prong Titanium
TTAF5 Fork 5 Prong Titanium
TTAF6 Fork 6 Prong Titanium
TTAF7 Fork 7 Prong Titanium
TTAF8 Fork 8 Prong Titanium

TTA Implants

TTA Cages

TTAC310	Cage 3 x 10mm Titanium Screw 2.4mm
TTAC313	Cage 3 x 13mm Titanium Screw 2.4mm
TTAC316	Cage 3 x 16mm Titanium Screw 2.4mm
TTAC4512	Cage 4.5 x 12mm Titanium Screw 2.4mm
TTAC4515	Cage 4.5 x 15mm Titanium Screw 2.4mm
TTAC4518	Cage 4.5 x 18mm Titanium Screw 2.4mm
TTAC616	Cage 6 x 16mm Titanium Screw 2.4mm
TTAC619	Cage 6 x 19mm Titanium Screw 2.4mm
TTAC622	Cage 6 x 22mm Titanium Screw 2.4mm
TTAC7513	Cage 7.5 x 13mm Titanium Screw 2.4mm
TTAC7516	Cage 7.5 x 16mm Titanium Screw 2.4mm
TTAC7519	Cage 7.5 x 19mm Titanium Screw 2.4mm
TTAC919	Cage 9 x 19mm Titanium Screw 2.4mm
TTAC922	Cage 9 x 22mm Titanium Screw 2.4mm
TTAC925	Cage 9 x 25mm Titanium Screw 2.4mm
TTAC10519	Cage 10.5 x 19mm Titanium Screw 2.4mm
TTAC10522	Cage 10.5 x 22mm Titanium Screw 2.4mm
TTAC10525	Cage 10.5 x 25mm Titanium Screw 2.4mm
TTAC1222	Cage 12 x 22mm Titanium Screw 2.4mm
TTAC1225	Cage 12 x 25mm Titanium Screw 2.4mm
TTAC1228	Cage 12 x 28mm Titanium Screw 2.4mm
TTAC13522	Cage 13.5 x 22mm Titanium Screw 2.4mm
TTAC13525	Cage 13.5 x 25mm Titanium Screw 2.4mm
TTAC13528	Cage 13.5 x 28mm Titanium Screw 2.4mm
TTAC1522	Cage 15 x 22mm Titanium Screw 2.4mm
TTAC1525	Cage 15 x 25mm Titanium Screw 2.4mm
TTAC1528	Cage 15 x 28mm Titanium Screw 2.4mm
TTAC1531	Cage 15 x 31mm Titanium Screw 2.4mm

Forkless TTA Plates



TTAX42	Forkless TTA Plate (Same Length As TTAP3) 2.4+2.7 Screw
TTAX52	Forkless TTA Plate (Same Length As TTAP4) 2.4+2.7 Screw
TTAX65	Forkless TTA Plate (Same Length As TTAP5) 2.7 Screw
TTAX78	Forkless TTA Plate (Same Length As TTAP6) 2.7+3.5 Screw
TTAX91	Forkless TTA Plate (Same Length As TTAP7) 3.5 Screw
TTAX104	Forkless TTA Plate (Same Length As TTAP8) 3.5 Screw
TTAXSET	Forkless TTA Plate Set - One of Each Size

Forkless Plate Forceps

TTAXFCP	Forkless TTA Plate Forceps (145mm)

2.4mm Titanium Screws - Cruciate Head

TICS2408	Titanium 2.4mm Self Tapping Cortical Screw 8mm
TICS2410	Titanium 2.4mm Self Tapping Cortical Screw 10mm
TICS2412	Titanium 2.4mm Self Tapping Cortical Screw 12mm
TICS2414	Titanium 2.4mm Self Tapping Cortical Screw 14mm
TICS2416	Titanium 2.4mm Self Tapping Cortical Screw 16mm
TICS2418	Titanium 2.4mm Self Tapping Cortical Screw 18mm
TICS2420	Titanium 2.4mm Self Tapping Cortical Screw 20mm
TICS2422	Titanium 2.4mm Self Tapping Cortical Screw 22mm
TICS2424	Titanium 2.4mm Self Tapping Cortical Screw 24mm
TICS2426	Titanium 2.4mm Self Tapping Cortical Screw 26mm
TICS2428	Titanium 2.4mm Self Tapping Cortical Screw 28mm
TICS2430	Titanium 2.4mm Self Tapping Cortical Screw 30mm
TICS2432	Titanium 2.4mm Self Tapping Cortical Screw 32mm
TICS2434	Titanium 2.4mm Self Tapping Cortical Screw 34mm
TICS2436	Titanium 2.4mm Self Tapping Cortical Screw 36mm
TICS2438	Titanium 2.4mm Self Tapping Cortical Screw 38mm
TICS2440	Titanium 2.4mm Self Tapping Cortical Screw 40mm

2.7mm Titanium Screws - Hexagonal Head

TICS2706	Titanium 2.7mm Self Tapping Cortical Screw 6mm
TICS2708	Titanium 2.7mm Self Tapping Cortical Screw 8mm
TICS2710	Titanium 2.7mm Self Tapping Cortical Screw 10mm
TICS2712	Titanium 2.7mm Self Tapping Cortical Screw 12mm
TICS2714	Titanium 2.7mm Self Tapping Cortical Screw 14mm
TICS2716	Titanium 2.7mm Self Tapping Cortical Screw 16mm
TICS2718	Titanium 2.7mm Self Tapping Cortical Screw 18mm
TICS2720	Titanium 2.7mm Self Tapping Cortical Screw 20mm
TICS2722	Titanium 2.7mm Self Tapping Cortical Screw 22mm
TICS2724	Titanium 2.7mm Self Tapping Cortical Screw 24mm
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TICS2734	Titanium 2.7mm Self Tapping Cortical Screw 34mm
TICS2736	Titanium 2.7mm Self Tapping Cortical Screw 36mm
TICS2738	Titanium 2.7mm Self Tapping Cortical Screw 38mm
TICS2740	Titanium 2.7mm Self Tapping Cortical Screw 40mm

3.5mm Titanium Screws - Hexagonal Head

TICS3514	Titanium 3.5mm Self Tapping Cortical Screw 14mm
TICS3516	Titanium 3.5mm Self Tapping Cortical Screw 16mm
TICS3518	Titanium 3.5mm Self Tapping Cortical Screw 18mm
TICS3520	Titanium 3.5mm Self Tapping Cortical Screw 20mm
TICS3522	Titanium 3.5mm Self Tapping Cortical Screw 22mm
TICS3524	Titanium 3.5mm Self Tapping Cortical Screw 24mm
TICS3526	Titanium 3.5mm Self Tapping Cortical Screw 26mm
TICS3528	Titanium 3.5mm Self Tapping Cortical Screw 28mm
TICS3530	Titanium 3.5mm Self Tapping Cortical Screw 30mm
TICS3532	Titanium 3.5mm Self Tapping Cortical Screw 32mm
TICS3534	Titanium 3.5mm Self Tapping Cortical Screw 34mm
TICS3536	Titanium 3.5mm Self Tapping Cortical Screw 36mm
TICS3538	Titanium 3.5mm Self Tapping Cortical Screw 38mm
TICS3540	Titanium 3.5mm Self Tapping Cortical Screw 40mm

Drill Bits - Standard Length - Round Shank

	Diameter	Overall length	Flute length
H090208	1.8mm	110mm	25mm
H090102	2.0mm	110mm	30mm
H090112	2.5mm	120mm	30mm

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