BIOLOGICAL BENEFITS:
• Sound biomechanical rationale
• Simplified surgical procedure
• Unique implants designed specifically for TTA
• Superb biocompatibility of titanium
• Broad range of sizes available

TECHNICAL FEATURES:
• TTA neutralizes cranial tibial thrust in cranial cruciate deficient stifles
• Stability is achieved without compromising joint congruency
• TTA decreases internal joint reactions including retro-patellar pressure
• TTA is less invasive than other geometry modifying techniques
• TTA reduces morbidity and post-surgical complications while accelerating recovery
CLINICAL DEVELOPMENT
Surgical repair of cranial cruciate deficiency is one of the most common small animal orthopedic procedures, due not only to the high incidence of the problem, but also to the clinical success of recent surgical techniques.

KYON launched TTA for cranial cruciate deficiency in dogs in early 2004, following three years of clinical testing. Slobodan Tepic, Dr. Sci., Dipl. Ing., and Prof. Pierre M. Montavon, Head of Small Animal Surgery at the School of Veterinary Medicine, University of Zurich, developed TTA to allow neutralization of cranial tibial thrust without compromising joint congruency. This technique was a major departure from conventional practice. Since 2004, KYON’s TTA procedure has become an important addition to the canine cranial cruciate repair armamentarium.

OVERVIEW
TTA restores stability in stifles with ruptured cranial cruciate ligaments using a rationally based surgical intervention reducing morbidity in comparison to other geometry changing approaches.

• Stability of the stifle is restored by adjusting the joint force vector to make it perpendicular to the condyles of the tibia with the stifle extended
• TTA achieves stability without effecting congruency of the joint and allows for an unimpeded full range of motion
• TTA does not disrupt the primary loading axis of the tibia
• TTA increases the lever arm of the quadriceps force thus reducing all internal joint reactions

TECHNICAL FEATURES:
• TTA neutralizes cranial tibial thrust in cranial cruciate deficient stifles
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BIOLOGICAL BENEFITS:
• Sound biomechanical rationale
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• Unique implants designed specifically for TTA
• Superb biocompatibility of titanium
• Broad range of sizes available

The rapid acceptance of TTA has motivated several other companies to offer similar implants. KYON has neither collaborated with nor endorsed any of the competitors in the manufacture, promotion or sale of their TTA systems. KYON Pharma, Inc. is the only authorized distributor of KYON products in the United States.
BIOMECHANICAL RATIONALE
The TTA technique was developed on the basis of several observations and simple biomechanical analysis of the canine knee joint:

- Total joint force in the stifle is approximately parallel to the patellar ligament (a point of departure from Slocum, who maintained that it was parallel to the functional axis of the tibia)
- If the angle between the patellar ligament and the common-tangent at the tibio-femoral point of contact, call it alpha, is 90 deg, neither of the cruciates is loaded
- In the canine stifle, alpha is 90 deg at 110 deg of flexion – call this a cross-over flexion point; in full extension (~135° stifle angle) alpha is approx. 105 deg; in full flexion it is approx. 80 deg
- With the stifle in extension with respect to the cross-over point, the load is on the cranial cruciate ligament; with the stifle flexed past the cross-over point, the load is on the caudal cruciate ligament
- With the cranial cruciate ligament gone, the stifle can be stabilized by shifting the cross-over point to the full extension
- This can be done by either TPLO (turning the plateau), or by TTA (advancing the patellar ligament)

EXECUTION
The TTA involves an osteotomy of the non-weight bearing portion of the tibia. The patellar ligament is aligned perpendicularly to the common tangent of the femorotibial joint, eliminating cranial tibial thrust. This new alignment takes the load off the CrCL even in full extension and results in a stable joint.

- The required advancement of the patellar ligament insertion at the tibial tuberosity is measured from a radiograph of the stifle in extension
- With a frontal plane osteotomy, the tibial tuberosity is advanced and held in position by:
  1. A cage transferring the compression component of the patellar ligament force from the tuberosity to the proximal tibia
  2. A tension band plate transferring the patellar ligament force to the proximal diaphysis of the tibia
- The open osteotomy, distal to the cage, is usually grafted with autologous cancellous bone or other graft material such as allograft to accelerate healing

View relevant publications online @ www.kyon.ch.

KYON TTA Pre-Op Planning
Since the first KYON TTA procedure in 2001, TTA materials and technique have undergone numerous changes. Even an implant as seemingly simple as the TTA cage has seen numerous iterations, each one improving the procedure and reducing complications. KYON continually optimizes manufacturing techniques and processes, and expands implant and instrument selection to better suit the latest understanding of the biomechanics and anatomy.

In addition to being an inventor, designer and manufacturer, KYON is also an educator and steward of these procedures. KYON has held hundreds of TTA courses worldwide, refining the educational materials, presentations and technique with the help of numerous surgeons from universities and private practice. Recently, KYON created the TTA Pre-Op Planning Guide. The Guide was made possible thanks to the contributions of numerous KYON TTA surgeons, whose presentations, course instruction, feedback, and counsel drive the evolution of all KYON procedures. Special thanks go to Dr. Robert Botte, DVM, DACVS, Veterinary Surgical Service, San Diego, CA. We feel that this guide will help to codify the TTA technique and improve clinical outcomes through more precise planning and increased implant selection.
TTA IMPLANTS & INSTRUMENTS

The Tibial Tuberosity Advancement (TTA) procedure was invented and developed by KYON, through iteration during clinical testing, to best meet the exacting demands of the procedure and surgical convenience, with optimal selection of materials and manufacturing techniques for precision, durability, and maintenance. KYON products are manufactured in Switzerland with proprietary processes that produce superior products to those made by conventional manufacturing.

CAGES  

c.p. titanium

ORIGINAL IMPLANT SELECTION

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EXPANDED IMPLANT SELECTION

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TECHNICAL FEATURES:

c.p. titanium →
pickled & anodized →
cage ears turn →
tumbled edges →
wide selection of cage widths and lengths →

BIOLOGICAL BENEFITS:

• supreme biocompatibility
• thorough cleaning for biocompatibility creates inert titanium oxide surface
• greater intraoperative flexibility for avoiding interference between the cranial cage screw and proximal fork prong
• eliminates sticking during cage placement
• provides most preferable advancement of the tuberosity, reducing risk of subsequent meniscal injury

SPACERS  

c.p. titanium (ideal for performing simultaneous medial or lateral patellar correction)

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<td>03.11.06</td>
<td>6mm</td>
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</table>

TECHNICAL FEATURES:

c.p. titanium, grade 4 →
pickled & anodized →
concave exit hole →

BIOLOGICAL BENEFITS:

• supreme biocompatibility
• thorough cleaning for biocompatibility creates inert titanium oxide surface
• allows for angulation of cage screws
PLATES  
c.p. titanium  

ORIGINAL IMPLANT SELECTION  

03.20.03  3-hole  
03.20.04  4-hole  
03.20.05  5-hole  
03.20.06  6-hole  
03.20.07  7-hole  
03.20.08  8-hole  

EXPANDED IMPLANT SELECTION  

03.20.02  2-hole, cat  
03.21.03  3-hole - LONG  
03.21.04  4-hole - LONG  
03.21.05  5-hole - LONG  
03.21.06  6-hole - LONG  
03.21.07  7-hole - LONG  
03.21.08  8-hole - LONG  

TECHNICAL FEATURES:  
c.p. titanium, grade 4  
pickled & anodized  
rounded edges  
optimized geometry  
micro-water jet cutting  
new LONG shape  

BIOLOGICAL BENEFITS:  
• supreme biocompatibility  
• thorough cleaning for biocompatibility creates inert titanium oxide surface  
• smooth contours reduce stress concentration  
• reduces stress concentration at transitions  
• creates tight tolerances for fork to plate load transfer  
• eliminates heat induced damage  
• provides a better fit and easier (straight) cut  
• longer cut accommodates larger cage sizes  
• ideal for ‘skinny tibia’ breeds  
• provides additional space for caudal swing of the plate  

FORKS  
c.p. titanium  

03.30.02  2-prong, cat  
03.30.03  3-prong  
03.30.04  4-prong  
03.30.05  5-prong  
03.30.06  6-prong  
03.30.07  7-prong  
03.30.08  8-prong  

TECHNICAL FEATURES:  
c.p. titanium, grade 4  
pickled & anodized  
wire erosion  
optimized geometry prong-by-prong  

BIOLOGICAL BENEFITS:  
• supreme biocompatibility  
• thorough cleaning for biocompatibility creates inert titanium oxide surface  
• control tolerances batch-to-batch  
• very high precision and fine detail for fork teeth creates tight-fit plate and fork locking  
• increases strength
**TECHNICAL FEATURES:**
- titanium alloy, self tapping, cross-head
  - pickled & anodized
  - thread continues to screw head
  - self-tapping
  - cruciform head

**BIOLOGICAL BENEFITS:**
- supreme biocompatibility
- thorough cleaning for biocompatibility creates inert titanium oxide surface
- faster insertion and improved grip
- low profile
- eliminates damage to near cortex, in contrast to standard screws

### ø2.4mm CORTICAL SCREWS
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### ø2.7mm CORTICAL SCREWS
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### ø3.5mm CORTICAL SCREWS
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**Tibial Tuberosity Advancement (TTA)**
- ø2.4mm cortical screws are used for TTA cage ears as well as the 2 hole plate.
- ø2.7mm cortical screws are used for 3 hole - 5 hole TTA plates.
- ø3.5mm cortical screws are used for 6 hole - 8 hole TTA plates.
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<tr>
<th>Item Code</th>
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<tbody>
<tr>
<td>04.10.01</td>
<td>fork drill guide; 8 holes</td>
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<tr>
<td>04.10.02</td>
<td>fork inserter</td>
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<tr>
<td>04.10.03</td>
<td>plate bender</td>
</tr>
<tr>
<td>04.10.04</td>
<td>T-handle/plate bender; w/ spreaders 6, 9, 12 and 15mm</td>
</tr>
<tr>
<td>04.10.05</td>
<td>ø1.9mm pins (set of two)</td>
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<tr>
<td>04.10.06</td>
<td>fork drill guide; 4 holes</td>
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<tr>
<td>04.10.14</td>
<td>T-handle/plate bender; w/o spreaders</td>
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<tr>
<td>04.10.24</td>
<td>6mm spreader</td>
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<td>04.10.34</td>
<td>9mm spreader</td>
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<td>04.10.44</td>
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<td>04.10.54</td>
<td>15mm spreader</td>
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<th>Item Code</th>
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<td>ø2.0mm drill bit; quick coupling, L 102/75 mm</td>
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<td>04.20.04</td>
<td>ø2.5mm drill bit; quick coupling, L 145/120 mm</td>
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<td>04.20.11</td>
<td>ø1.8mm drill bit; quick coupling, L 125/100mm</td>
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<td>depth gauge; f/ screws 2.7 to 4.0mm - measuring depth up to 60mm</td>
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<tr>
<td>04.20.12</td>
<td>ø2.0mm/ø2.5mm drill sleeve</td>
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<tr>
<td>04.20.07</td>
<td>2.5mm hex screwdriver insert; quick coupling - for 2.7 and 3.5mm screws</td>
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<tr>
<td>04.20.08</td>
<td>2.4mm cross-head screwdriver insert; quick coupling - for 2.4mm screws</td>
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<tr>
<td>04.20.01</td>
<td>screwdriver handle; quick coupling, L 110 mm PEEK</td>
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<td>04.30.01</td>
<td>hammer; 100g</td>
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<td>04.31.03</td>
<td>reduction forceps; L 130mm</td>
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<td>04.31.04</td>
<td>reduction forceps; L 200mm</td>
</tr>
</tbody>
</table>

INVENT • DESIGN • CLINICALLY TEST • MANUFACTURE TO PERFECTION • EDUCATE • SUPPORT
TTA IMPLANT TRAY 1, 2 & ORGANIZATION

04.40.02  implant tray 1.0; aluminum (ideal for TTA implant inventory)

04.41.02  implant tray 2.0; aluminum (accommodates new TTA implant sizes)

80.00.01  sterile container lid, blue (implants); aluminum, w/o permanent filter

80.00.02  sterile container lid, silver (instruments); aluminum, w/o permanent filter

80.01.01  sterile container body; aluminum, 30mm high (fits 1 tray)

80.01.02  sterile container body; aluminum, 57mm high (fits 2 trays)

80.02.01  permanent filter for 80.00.--

80.02.02  silicone pad insert for 80.01.--

80.02.03  sterile container locks, blue; (100pcs)

80.02.04  tray separators (set of two) - required for proper sterilization

TTA TRAINING
TTA is a technically demanding procedure. We strongly recommend instructional training. KYON sponsors instructional courses to facilitate the introduction of the TTA technique into clinical practice. KYON TTA training and educational opportunities can be found on our website @ www.kyon.ch.

THE KYON SYMPOSIUM
Every spring, KYON hosts a Symposium, primarily for clients, but the event is open to all veterinary professionals. Our goal is to provide a forum for addressing advancements, adaptations, issues and complications in veterinary orthopedic surgery. We also hope to foster some spirited dialogue and exchange of ideas. In addition to a dynamic international faculty of human and veterinary orthopedic opinion leaders who present, each KYON Symposium gives a glimpse into our ongoing research and development in the area of veterinary orthopedic surgery. View past Symposia and register for the next Symposium @ www.kyon.ch.

PARTICIPATING SURGEONS
Find a surgeon performing KYON procedures and using KYON materials near you. Search the Participating Surgeons Database @ www.kyon.ch.

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www.kyon.us

Thank you for your interest in furthering the art and practice of veterinary orthopedic and trauma surgery.