MD3T -- A New Method
for
Safe, Secure, Accurate Tibial Tubercle Transfers

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Disclosures:
US Patents 7,794,466 & 8,828,010
Royalty: Kinamed, Inc., Camarillo, CA

MD3T System
-- A New Technique to Move the Tibial Tubercle

Discussion Topics

- Goals
- Background
- Concept
- Basic Technique
- Biomechanical Testing
- Advantages
- Clinical Use

MD3T Goals

- **Flexibility:** Medial & Anterior transfer distances are independent; not determined by slope of 1st cut. Distal or Proximal transfer as needed.
- **Precision:** Tubercle transferred to the desired position.
- **Safety:** Minimally invasive; minimize the risk of stress fracture. MD3T's cortical defect is about ½ that of the AMZ (15% vs. 26%).
- **Simplicity:** Cutting Guides to control precise cuts.
- **Quick Recovery:** Progressive Weight Bearing as tolerated in splint.
- **Construct Security:** Wedge shape + Bicortical screws enhances fixation.

Background & History: This was my original technique before the AMZ; it worked very well, so I did not switch.

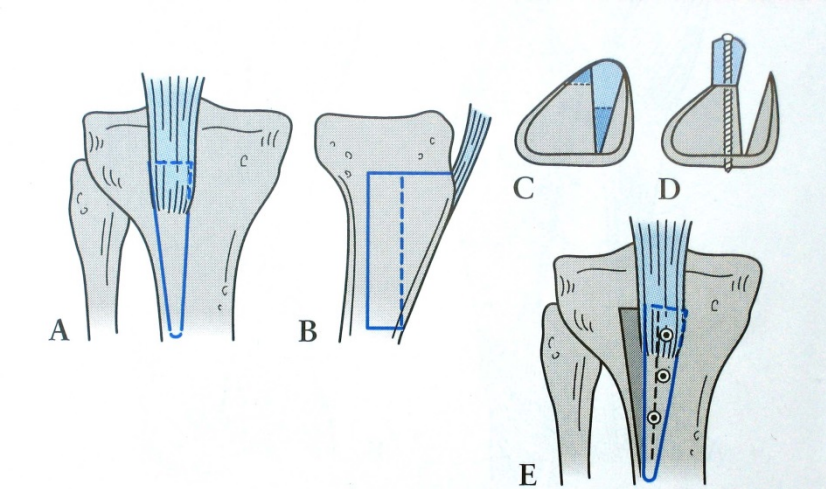


Figure 87.14. Anteromedial tibial tubercle plasty. **A:** Front view of initial cuts. **B:** Side view of initial and secondary (*dotted line*) cuts. **C:** Cross section of initial and secondary (*dotted lines*) cuts. **D:** Cross section after anteromedial transfer and fixation. **E:** Front view after anteromedial transfer and fixation.

Merchant AC (2001) Patellofemoral Joint Disorders. In: *Chapman's Orthopedic Surgery*, 3rd ed, pp. 2334-2335, edited by M.W. Chapman. Lippincott Williams & Wilkins, Philadelphia.

Advantages:

- Progressive WB as tolerated (in splint)
  - No Stress Fractures
  - No pull-offs.
- Less invasive
  - Less pain
- Quick return to work & school
- Colleagues thought it should be published, **but….**

Background & History: But, there were problems with my original technique.

Disadvantages:

- Too much free-hand sawing
- Too much free-hand carving
- Used hand-made, non-tapered, thin (± 1 mm) osteotomes to fit into the saw kerfs & to cut cancellous bone.

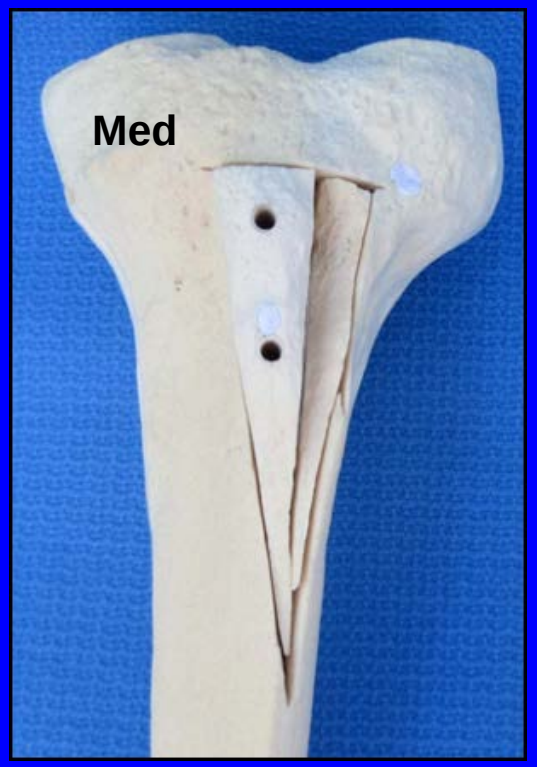
“Kitchen” Osteotomes

Concept: The Tubercle can be moved in many directions; therefore, we call it the Multi-Directional Tibial Tubercle Transfer (MD3T).

Create Two compound wedges: Primary Wedge with TT & Patellar Tendon + Secondary Wedge medial to it. Transposing the two wedges moves the Tubercle medially. Adding Bone Void Filler or Bone Graft laterally & posteriorly, lifts the TT anteriorly.

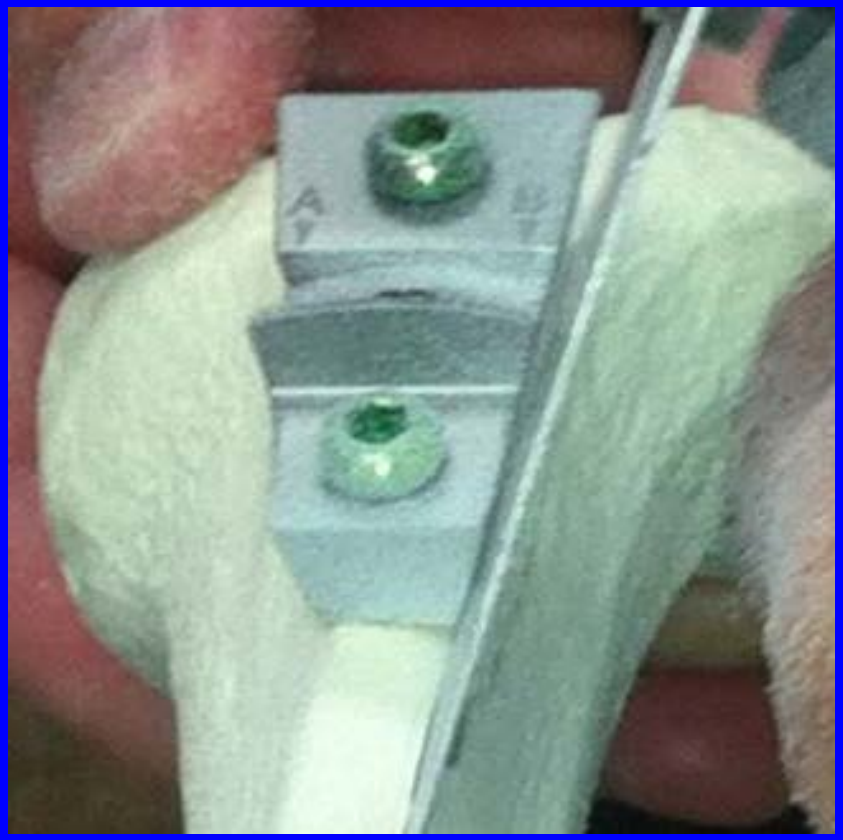
Before

After



MD3T Saw Guides

Primary Guide fixed to TT. **1st Cut** made along its Lateral surface. (Small Tibia shown. Use Outrigger Guide for larger tibias.)



2nd Cut made along its Medial surface.

MD3T Saw Guides

3rd Cut: Adjust Outrigger Guide to desired width using Indicator Guide (next slide) of Secondary Wedge, lock it tight, and use its medial surface to make the 3rd Cut.

Completing the Transfer

- **4th Cut** made transversely and proximally under the patellar tendon with non-tapered osteotomes.
- Free the two wedges with saw & osteotomes (Non-tapered osteotomes cut cancellous bone and fit into the cortical saw kerfs without jamming.)
- Transpose the two wedges.

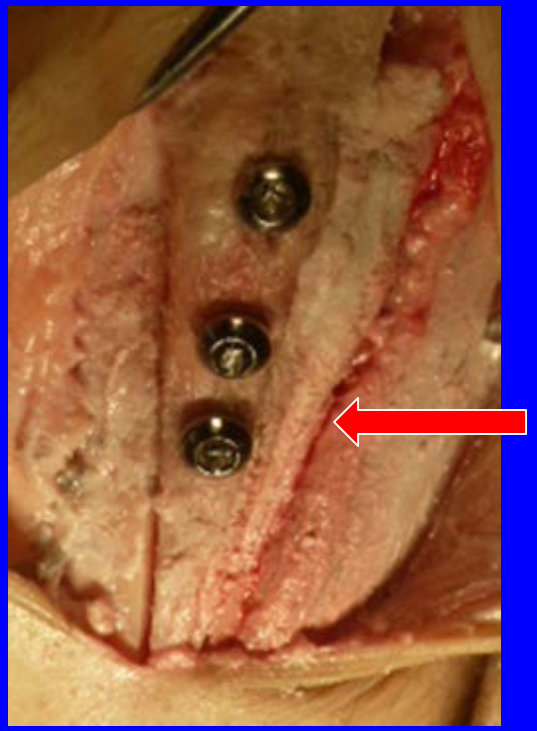
(Guide removed for demonstration)

Securing the Fixation

- Mix & apply fast-setting bone void filler. Fill the saw kerfs laterally for Medial transfer, or use more laterally & posteriorly to lift Tubercle anteriorly for Anteromedial transfer.
- After it has set, secure the fixation with Bicortical stainless steel bone screws.

Epoxy putty & wood screws used for Sawbones.

Bone void filler & 4.5 mm cortical bone screws used in the cadaver lab.



Testing Initial MD3T Construct Strength

Sawbones® Lab (cortical model)
Simulated post-op use for 6 weeks
w/ cyclical walking & cyclical
chair-rise tests:
Construct showed no signs of failure.

Load-to-Failure test:
Cracks appeared at 2,000 N,
but did not fail at 2,500 N
(the test rig's limit).

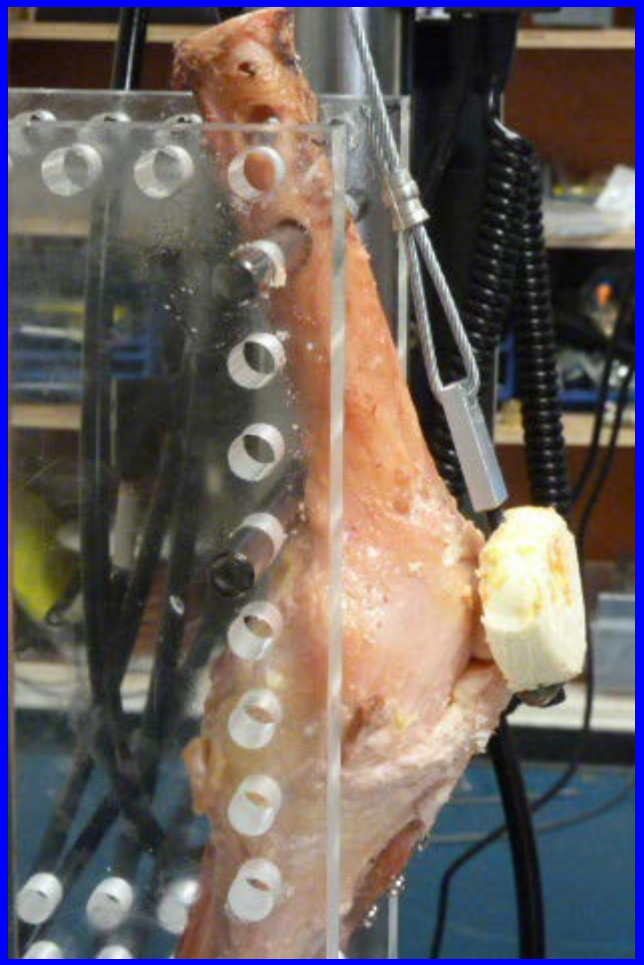
Testing Initial MD3T Construct Strength

Cadaver Lab:

Specimen #1: 39 yo M, (160 lbs., medium tibia)
Secure Fixation: Simulated 6 wks.
cyclical walking & sit-rise tests:
No sign of Failure.
Load-to-Failure: Screws pulled out
at 1450 N.

Specimen #2: 36 yo F, (190 lbs., small tibia)
Insecure Fixation due to technical problems w/ lab equipment & specimen; results were as predicted:
Failed in cyclical walking test.
Lessons: Same for any reconstruction:

1. Don't leave insecure fixation; reinforce it (cerclage wire, etc).
2. Don't allow FWB w/o splint.
3. Expect more complications in obese patients.



Rationale & Test Results Published

Journal of Surgical Orthopaedic Advances 25(3):157-64, Fall 2016

Journal of Surgical Orthopaedic Advances

PRIMARY ARTICLES

Multidirectional Tibial Tubercle Transfer Technique: Rationale and Biomechanical Investigation

Vineet K. Sarin, PhD[1]; William Camisa, MS[2]; Jeremi M. Leasure, MS[2]; and Alan C. Merchant, MD[3]

This study describes a new surgical technique to transfer the tibial tubercle, explains the rationale for its development, and reports the results of initial biomechanical testing. The design goals were to create a tibial tubercle osteotomy that would provide equivalent or better initial fixation compared with traditional techniques, yet would be more flexible, reproducible, accurate, less invasive, and safer. The results of the biomechanical analysis suggest that initial fixation with this novel tubercle transfer technique is as strong as traditional Elmslie–Trillat and anteromedialization procedures. (Journal of Surgical Orthopaedic Advances 25(3):157–164, 2016)

Key words: anteromedialization, osteotomy, patella tracking, Q angle, tibial tubercle, trochlear groove

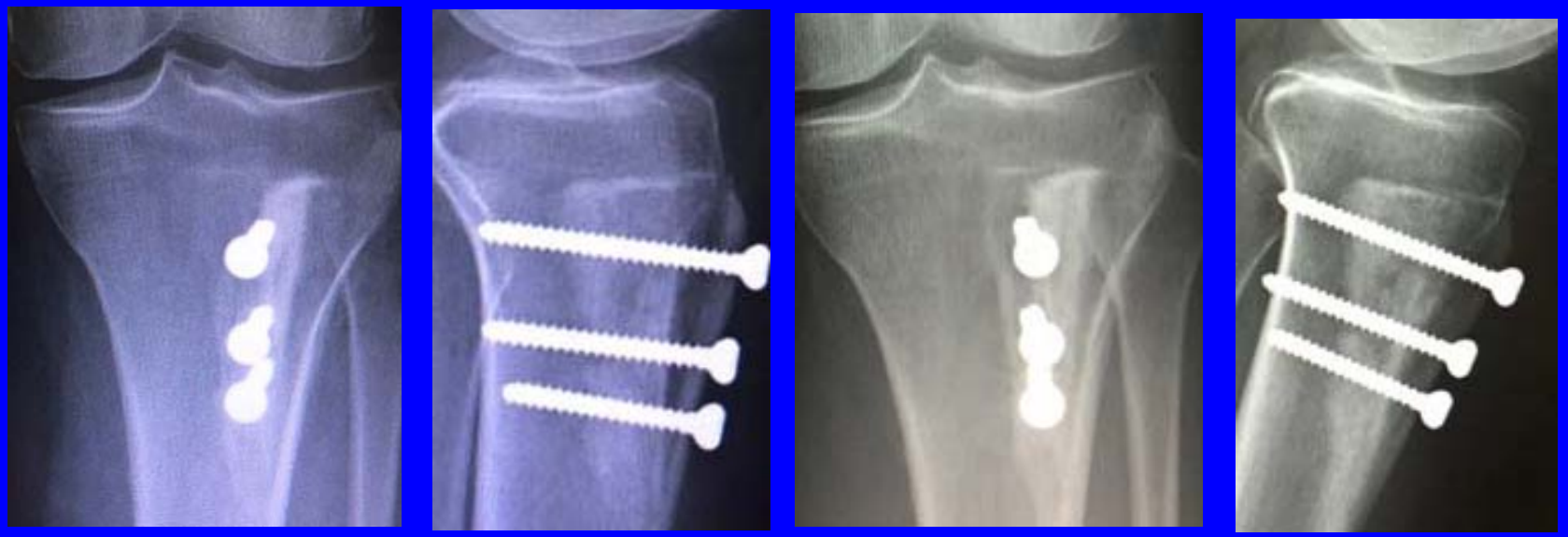
Clinical Use

- No other tubercle transfer technique has had such rigorous:
  - Proof of concept analysis, and
  - Pre-clinical biomechanical testing.

- Clinical use began 2016.

Case 1

RA, 46 yo F, Anteromedial TTT + Chondroplasty



1 Week Post-op

5 Months Post-op

1 Year Post-op, Patient (& Surgeon) are both pleased.

(3rd fixation screw added for additional security)

Case 2

SS, 45 yo M, Anteromedial TTT + Chondroplasty




1 Week Post-op

4 Months Post-op

11 Months Post-op: Patient (& Surgeon) are both pleased.

Goals Achieved / Advantages

- **Flexibility:** The Medial & Anterior distances transferred are independent of one another. Controlled Distalization prn.

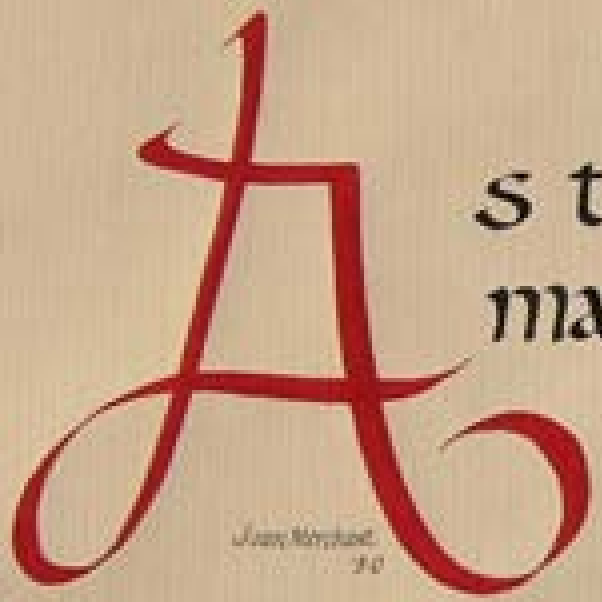
- **Precision:** Saw & Indicator Guides allow transfer to the desired location; not pre-determined by slope of initial cut.

- **Safety:** Less invasive; NO stress fractures or pull-offs with original 'freehand' method (MD3T cortical defect is about ½ (15%) of AMZ defect (26%).

- **Simplicity:** Saw Guides allow controlled, precise cuts.

- **Fast Recovery:** Progressive weight bearing as tolerated in splint.

- **Security:** Wedge shape + Bicortical screws = very secure fixation. No failure in simulated 6-week cyclical fatigue tests. Possibly stronger than either Elmslie-Trillat or AMZ.



As to diseases;
make a habit of two things;
to help,
or at least not to harm.

« Hippocrates »


Thank you
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