MODERN CONCEPTS in IM NAILING of the PROXIMAL TIBIA

Roy Sanders
Tampa, Florida

ORTHOPAEDIC TRAUMA SERVICE
FLORIDA ORTHOPAEDIC INSTITUTE

FLORIDA ORTHOPAEDIC INSTITUTE

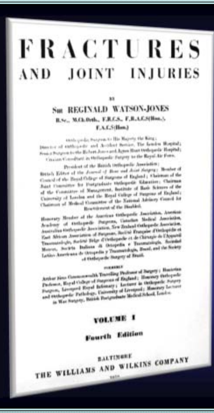
CURRENT PROBLEMS

- PROXIMAL FXS
- KNEE PAIN

FLORIDA ORTHOPAEDIC INSTITUTE

KŰNTSCHER
BEGAN
IM NAILING
IN THE
1930's

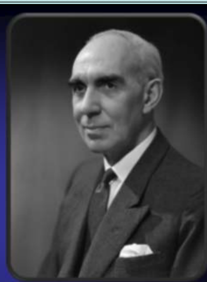
FLORIDA ORTHOPAEDIC INSTITUTE


FRACTURES
AND JOINT INJURIES

BY
Sir REGINALD WATSON-JONES
B.Sc., M.Ch.Orth., F.R.C.S., F.R.A.C.S.(Hon.),
F.A.C.S.(Hon.)

VOLUME I
Fourth Edition

BALTIMORE
THE WILLIAMS AND WILKINS COMPANY



REGINALD
WATSON-JONES

FLORIDA ORTHOPAEDIC INSTITUTE

Fixation of Tibial Fractures by an Intramedullary Nail. Intramedullary nail fixation which is so successful in fractures of the shaft of the femur, fractures of the upper shaft of the ulna, and fractures of the shaft of the humerus, where insertion of a straight nail is so easy, has also been advocated in fractures of the shaft of the tibia where the insertion of a curved nail through the upper tibial tuberosity down the shaft of the bone is far from easy. We are bound to say that despite all the advertising of manufacturers of nails who in their wanton publicity have tried to create medical journals of their own, it is not yet clear that there is real merit in the attempt to secure fixation of fractures of the shaft of the tibia by intramedullary nailing.

FLORIDA ORTHOPAEDIC INSTITUTE

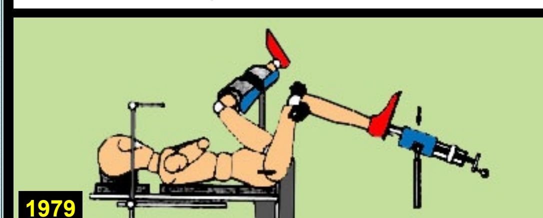
Number 138
January-February, 1979

Clinical Orthopaedics
and Related Research

Medullary Nailing

Medullary Nailing According to
Swiss Study Group Principles

S. WELLER, E. KUNER AND C. H. SCHWEIKERT



1979

FLORIDA ORTHOPAEDIC INSTITUTE

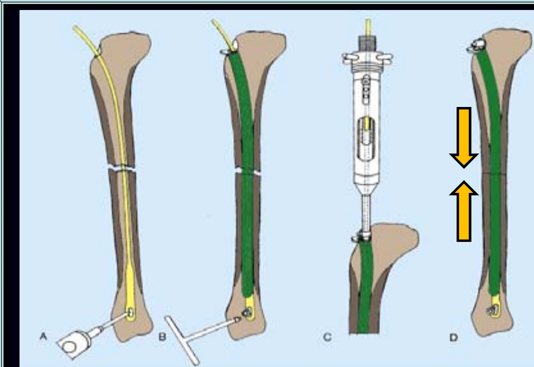


Fig. 1–15. Kaessmann compression nail. *A*, Locating the hole in the mandrel. *B*, Insertion of the transverse screw through the mandrel followed by insertion of the C-shaped nail. *C*, Compression is applied with a special calibrated compression device. The screw in the proximal locking cup is then tightened on the mandrel to hold the compression. *D*, Compressed fixed fracture with the implant in place.

FLORIDA ORTHOPAEDIC INSTITUTE

WITH LOCKS, SURGEONS NAILED PROXIMAL FX WITH SHAFT NAILS

AND GOT MALUNIONS

FLORIDA ORTHOPAEDIC INSTITUTE

Journal of Orthopaedic Trauma
Vol. 7, No. 4, pp. 311–319
© 1993 Raven Press, Ltd., New York

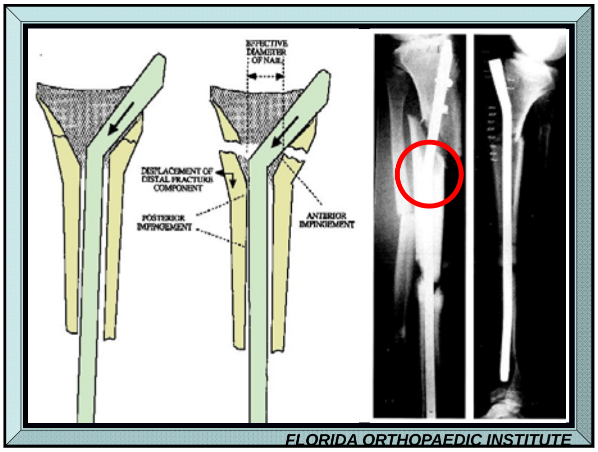
Influences of Some Design Parameters on the Biomechanics of the Unreamed Tibial Intramedullary Nail

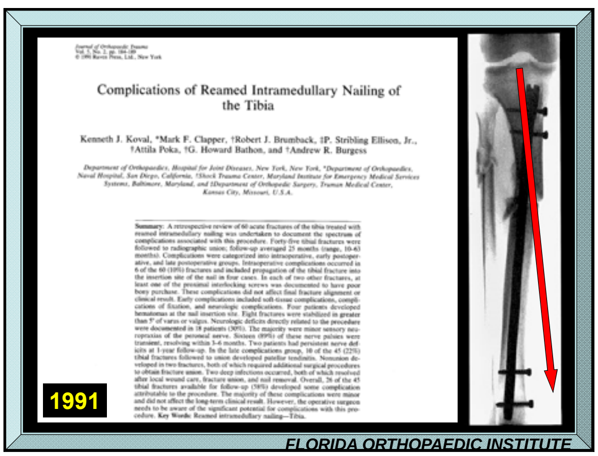
M. Bradford Henley, Mark Meier, and Allan F. Tencer

The Orthopedic Biomechanics Laboratory of the University of Washington at Harborview Medical Center, Seattle, Washington, U.S.A.

1993

FLORIDA ORTHOPAEDIC INSTITUTE





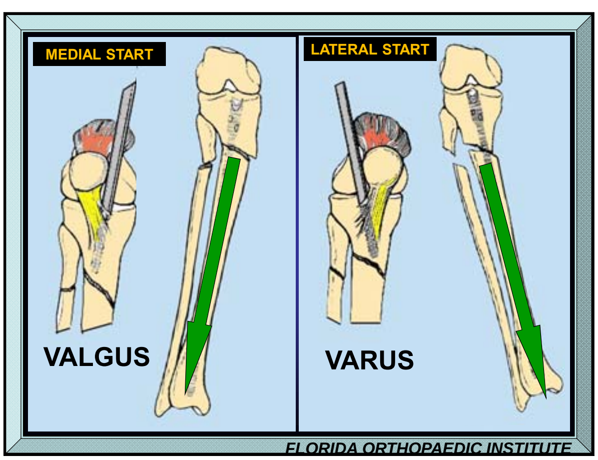
Journal of Orthopaedic Trauma
Vol. 5, No. 2, pp. 184-189
© 1991 Raven Press, Ltd., New York

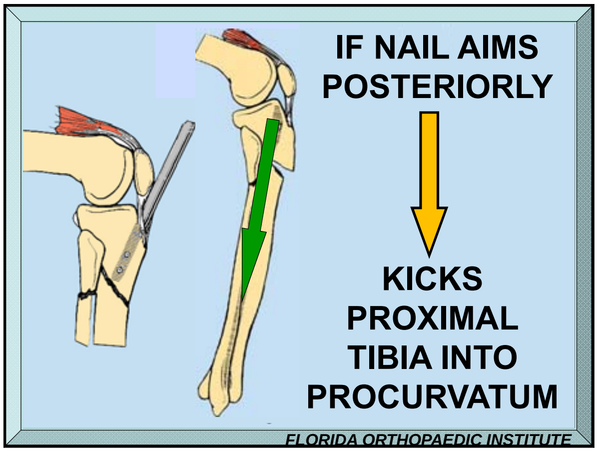
Complications of Reamed Intramedullary Nailing of the Tibia

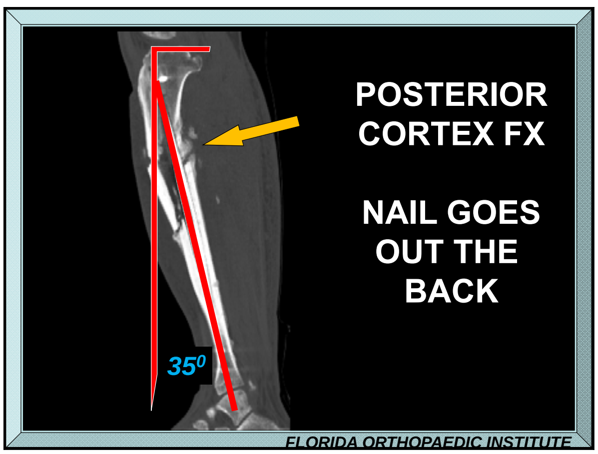
Kenneth J. Koval, *Mark F. Clapper, †Robert J. Brumback, ‡P. Stribling Ellison, Jr., †Attila Poka, †G. Howard Bathon, and †Andrew R. Burgess

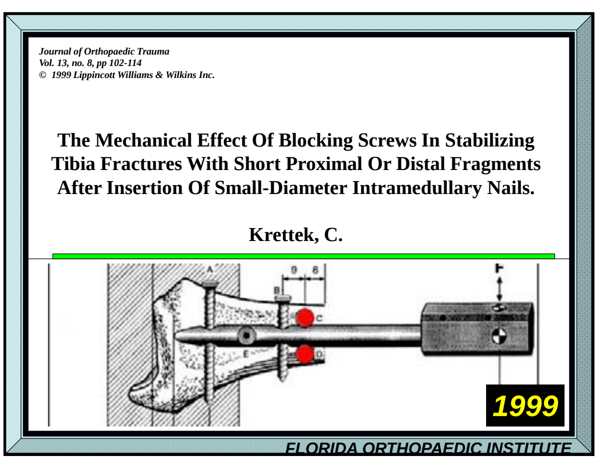
*Department of Orthopaedics, Hospital for Joint Diseases, New York, New York, *Department of Orthopaedics, Naval Hospital, San Diego, California, †Shock Trauma Center, Maryland Institute for Emergency Medical Services Systems, Baltimore, Maryland, and ‡Department of Orthopedic Surgery, Truman Medical Center, Kansas City, Missouri, U.S.A.*

Summary: A retrospective review of 60 acute fractures of the tibia treated with reamed intramedullary nailing was undertaken to document the spectrum of complications associated with this procedure. Forty-five tibial fractures were followed to radiographic union; follow-up averaged 25 months (range, 10-63 months). Complications were categorized into intraoperative, early postoperative, and late postoperative groups. Intraoperative complications occurred in 6 of the 60 (10%) fractures and included propagation of the tibial fracture into the insertion site of the nail in four cases. In each of two other fractures, at least one of the proximal interlocking screws was documented to have poor bony purchase. These complications did not affect final fracture alignment or clinical result. Early complications included soft-tissue complications, complications of fixation, and neurologic complications. Four patients developed hematomas at the nail insertion site. Eight fractures were stabilized in greater than 5° of varus or valgus. Neurologic deficits directly related to the procedure were documented in 18 patients (30%). The majority were minor sensory neuropraxias of the peroneal nerve. Sixteen (89%) of these nerve palsies were transient, resolving within 3-6 months. Two patients had persistent nerve deficits at 1-year follow-up. In the late complications group, 10 of the 45 (22%) tibial fractures followed to union developed patellar tendinitis. Nonunion developed in two fractures, both of which required additional surgical procedures to obtain fracture union. Two deep infections occurred, both of which resolved after local wound care, fracture union, and nail removal. Overall, 26 of the 45 tibial fractures available for follow-up (58%) developed some complication attributable to the procedure. The majority of these complications were minor and did not affect the long-term clinical result. However, the operative surgeon needs to be aware of the significant potential for complications with this procedure. **Key Words:** Reamed intramedullary nailing—Tibia.




IF NAIL AIMS
POSTERIORLY
KICKS
PROXIMAL
TIBIA INTO
PROCURVATUM
FLORIDA ORTHOPAEDIC INSTITUTE


POSTERIOR
CORTEX FX
NAIL GOES
OUT THE
BACK
35⁰
FLORIDA ORTHOPAEDIC INSTITUTE


Journal of Orthopaedic Trauma
Vol. 13, no. 8, pp 102-114
© 1999 Lippincott Williams & Wilkins Inc.
The Mechanical Effect Of Blocking Screws In Stabilizing Tibia Fractures With Short Proximal Or Distal Fragments After Insertion Of Small-Diameter Intramedullary Nails.
Krettek, C.
1999
FLORIDA ORTHOPAEDIC INSTITUTE

2001

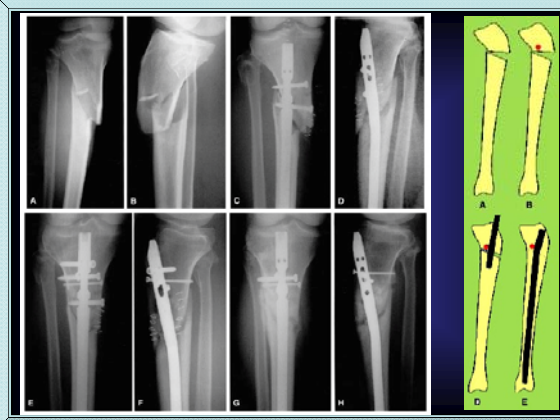
Journal of Orthopaedic Trauma
Vol. 15, No. 4, pp. 264–270

Fractures of the Proximal Third of the Tibial Shaft Treated With Intramedullary Nails and Blocking Screws

William M. Ricci, *Michael O'Boyle, Joseph Borrelli, †Carlo Bellabarba, and ‡Roy Sanders

*Department of Orthopaedic Surgery, Washington University School of Medicine, St. Louis, Missouri; *Carolina Orthopaedic Center, Greenville, South Carolina; †Department of Orthopaedics, University of Washington, Seattle, Washington; and ‡Florida Orthopaedic Institute, Tampa, Florida, U.S.A.*

FLORIDA ORTHOPAEDIC INSTITUTE



FLORIDA ORTHOPAEDIC INSTITUTE

STREET NAIL – 1947

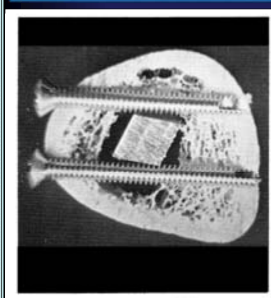


Fig. 12–3. Supplementary screw stabilization to prevent nail rotation in enlarged portion of medullary canal.

SCREWS

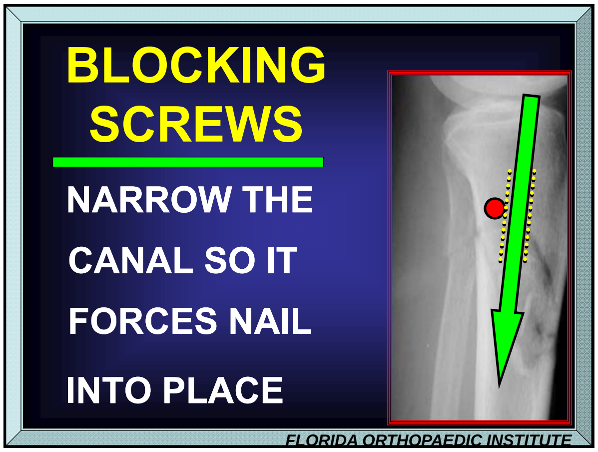
AROUND

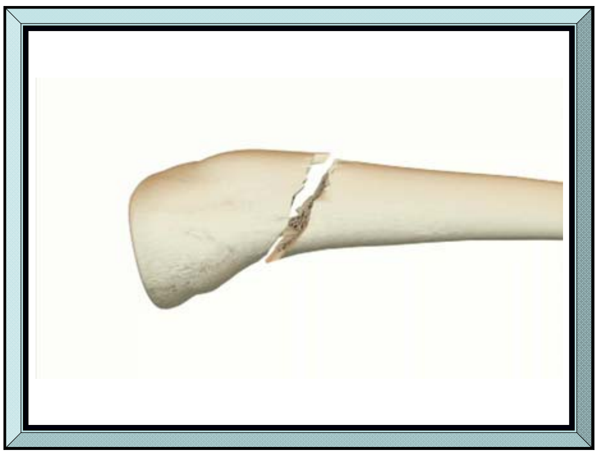
DIAMOND NAIL

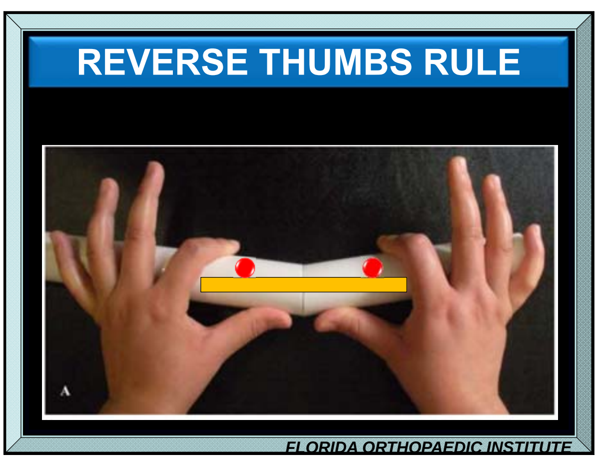
TO STOP

ROTATION

FLORIDA ORTHOPAEDIC INSTITUTE


BLOCKING SCREWS
NARROW THE CANAL SO IT FORCES NAIL INTO PLACE
FLORIDA ORTHOPAEDIC INSTITUTE




REVERSE THUMBS RULE
A
FLORIDA ORTHOPAEDIC INSTITUTE


Originalien

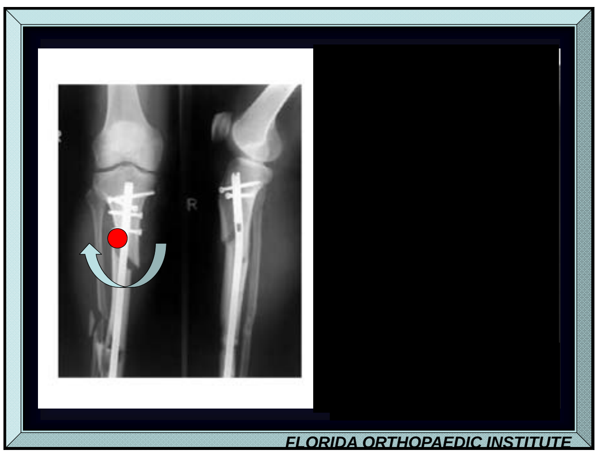
C. Josten · B. Marquass · C. Schwarz · A. Verheyden
Klinik für Unfall-, Wiederherstellungs- und Plastische Chirurgie, Universität Leipzig

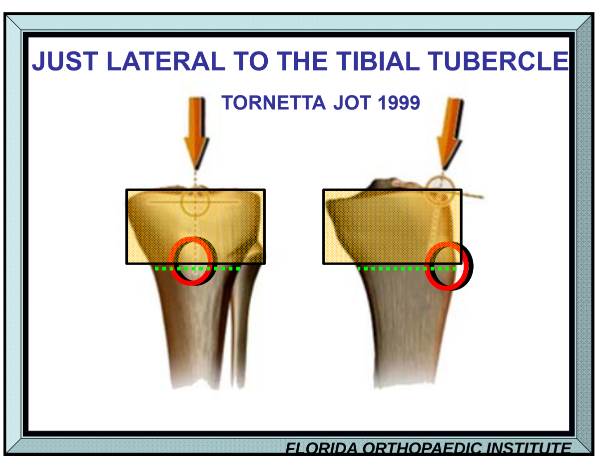
Marknagelosteosynthese proximaler Tibiafrakturen

Komplikationen und Risikofaktoren

2009

FLORIDA ORTHOPAEDIC INSTITUTE



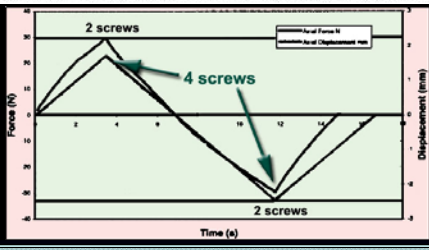


Journal of Orthopaedic Trauma
Vol. 17, No. 7, pp. 496–502

Proximal Tibial Fracture Stability With Intramedullary Nail Fixation Using Oblique Interlocking Screws

*G. Y. Laflamme, †D. Heimlich, †D. Stephen, †H. J. Kreder, and †C. M. Whyne

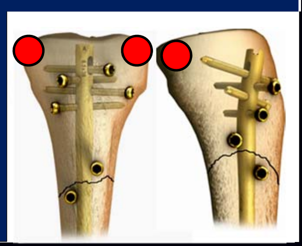
*Hôpital du Sacré-Coeur, Université de Montréal, Montreal, Quebec and †Orthopaedic Biomechanics Laboratory, U-B Sunnybrook and Women's College Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada



FLORIDA ORTHOPAEDIC INSTITUTE

- SHALLOW BEND
- COMPRESSION

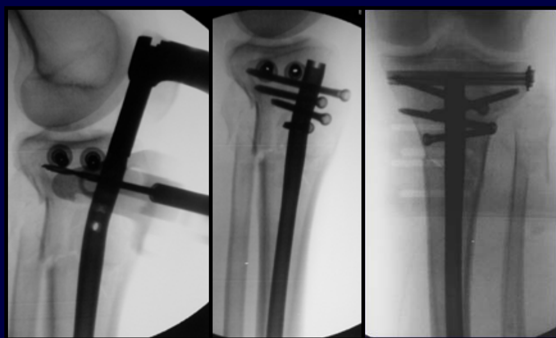
4 PROX LOCKS
WIDE SPREAD



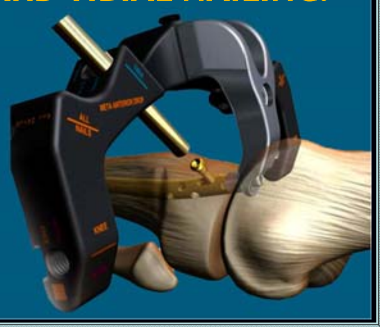
FLORIDA ORTHOPAEDIC INSTITUTE

PROXIMAL TIBIA FX
WITH METAPHYSEAL
COMMINUTION

ANATOMIC RECONSTRUCTION



SO WHATS WRONG WITH STANDARD TIBIAL NAILING?



ANTERIOR KNEE PAIN

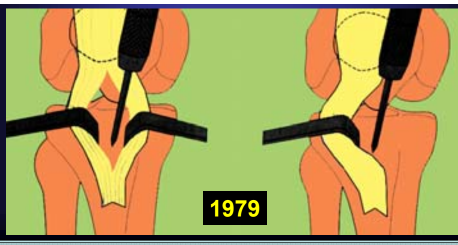
25%

Number 138
January-February, 1979

Medullary Nailing

Medullary Nailing According to Swiss Study Group Principles

S. Weller, E. Kuner and C. H. Schweikert



FLORIDA ORTHOPAEDIC INSTITUTE

Conclusion: Compared with a transpatellar tendon approach, a paratendinous approach for nail insertion does not reduce the prevalence of chronic anterior knee pain or functional impairment after intramedullary nailing of a tibial shaft fracture.

FLORIDA ORTHOPAEDIC INSTITUTE

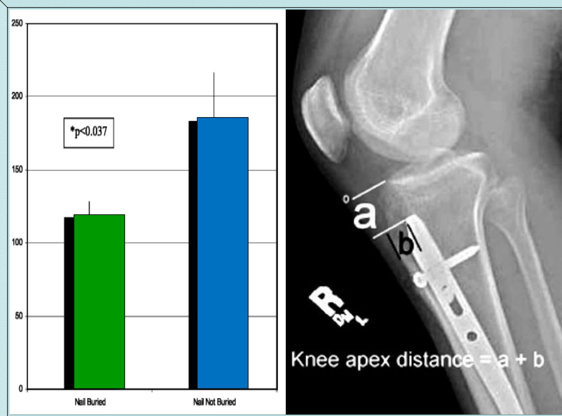
CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 449, pp. 303–307

Knee Pain after Tibial Nailing

The Role of Nail Prominence

Timothy Bhattacharyya, MD; Khemarin Seng, MD; Nader A. Nassif, MD; Ilan Freedman, MBBS

FLORIDA ORTHOPAEDIC INSTITUTE



FLORIDA ORTHOPAEDIC INSTITUTE

Journal of Orthopaedic Trauma:
January 1997 - Volume 11 - Issue 1 - pp 10-13

Knee Pain After Tibial Nailing

Keating, J. F.; Orfaly, R.; O'Brien, P. J.

Department of Orthopaedic Trauma, Royal Infirmary, Edinburgh, Scotland, and *Division of Orthopaedic Trauma, Vancouver General Hospital, Vancouver, British Columbia, Canada.

Time to onset of knee pain postoperatively (months)	No. of patients affected
<2	29
2–6	22
6–12	7
>12	3
	61

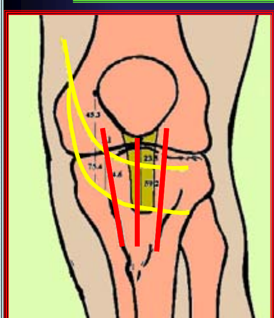
FLORIDA ORTHOPAEDIC INSTITUTE

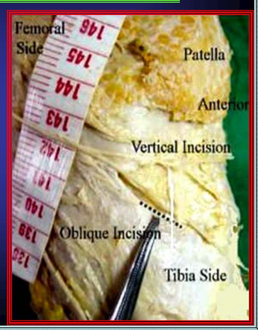
At a mean follow-up period of thirty-two months (12-58 months), sixty-one (57%) patients (63 of 110 knees) had developed anterior knee pain. There was no correlation between nail protrusion and knee pain. Insertion of the nail through the patella tendon was associated with a higher incidence of knee pain compared to the paratendon site of nail insertion (77% and 50% respectively). Of patients with knee pain, 80% (49/61) required nail removal. At a mean duration of 16 months following nail removal, pain was completely relieved in 22 patients and partially relieved in 17. In the remaining 10 patients, there was no improvement.

FLORIDA ORTHOPAEDIC INSTITUTE

At a mean follow-up period of thirty-two months (12–58 months), sixty-one (57%) patients (63 of 110 knees) had developed anterior knee pain. There was no correlation between nail protrusion and knee pain. Insertion of the nail through the patella tendon was associated with a higher incidence of knee pain compared to the paratendon site of nail insertion (77% and 50% respectively). Of patients with knee pain, 80% (49/61) required nail removal. At a mean duration of 16 months following nail removal, pain was completely relieved in 22 patients and partially relieved in 17. In the remaining 10 patients, there was no improvement.

INFRA-PATELLAR BRANCH SAPHENOUS NERVE





INFRAPATELLA FAT PAD

IRRITATION FROM INSERTION OR PROTRUSION OF NAIL

FIBROSIS

PATELLA SUBLUXATION

COMMON
WITH
STANDARD
TECHNIQUE

FLORIDA ORTHOPAEDIC INSTITUTE

STANDARD NAILING

- DIFFICULT TO GET CORRECT STARTING POINT & PRESERVE ANTERIOR CORTEX
- DEFORMING FORCE OF EXTENSOR MX IS AMPLIFIED WITH KNEE FLEXION
- EARLY EXIT OF NAIL POSTERIORLY WITH SHORT PROXIMAL SEGMENTS

FLORIDA ORTHOPAEDIC INSTITUTE

FLORIDA ORTHOPAEDIC INSTITUTE

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 328, pp 185–189

Semiextended Position for Intramedullary Nailing of the Proximal Tibia

Paul Tornetta, III, MD; and Evan Collins, MD

1995

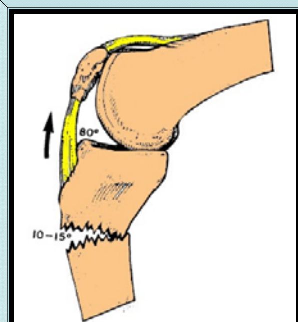
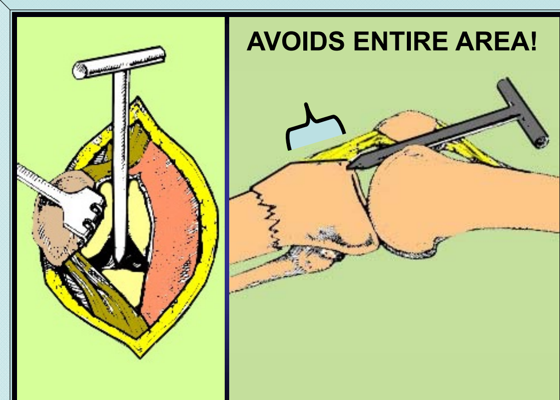


Fig 1. As the knee is flexed for standard nailing, proximal fractures become angulated due to the pull of the patellar tendon (arrow). In the authors' experience, 10° to 15° angulation results from the 80° to 90° knee flexion needed for standard portal placement.



Arch Orthop Trauma Surg (2009) 129:773–777
DOI 10.1007/s00402-008-0678-7

ORTHOPAEDIC SURGERY

Anterior knee pain following the lateral parapatellar approach for tibial nailing

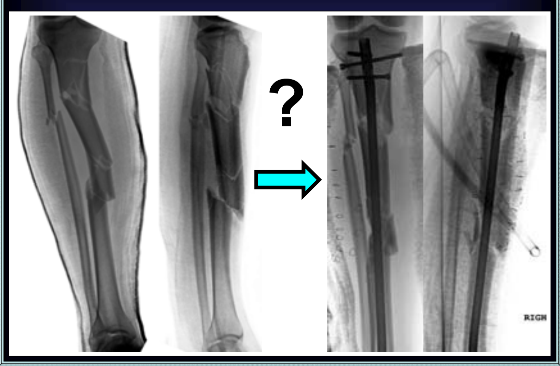
Yoram A. Weil · Michael J. Gardner · Sreevathsa Boraiah · David L. Helfet · Dean G. Lorich

LESS KNEE PAIN

- LESS DAMAGE TO N. SAPHENOUS ?
- LESS DAMAGE TO FAT PAD ?

FLORIDA ORTHOPAEDIC INSTITUTE

HOW TO GET FROM HERE TO THERE



FLORIDA ORTHOPAEDIC INSTITUTE

EXTENSION NAILING OF THE TIBIA

THE NEW *NEW* WAY

FLORIDA ORTHOPAEDIC INSTITUTE

EXTENSION NAILING

ADVANTAGES

- EXTENSION
- PROX SEGMENTS
- NO GRAVITY
- SIMPLE PLATEAU FXS

SEMI-EXTENDED APPROACH

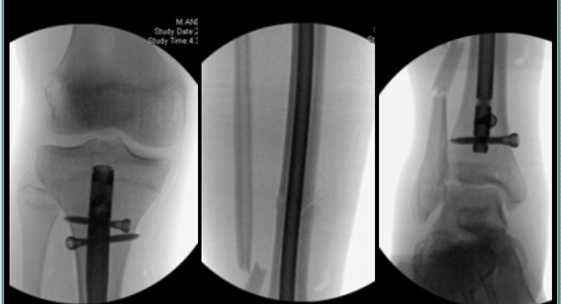
TROCAR & SLEEVE

REALLY LONG INSERTER

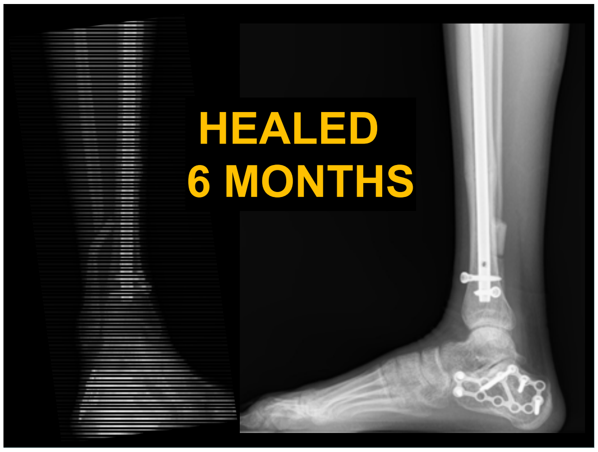
FLORIDA ORTHOPAEDIC INSTITUTE

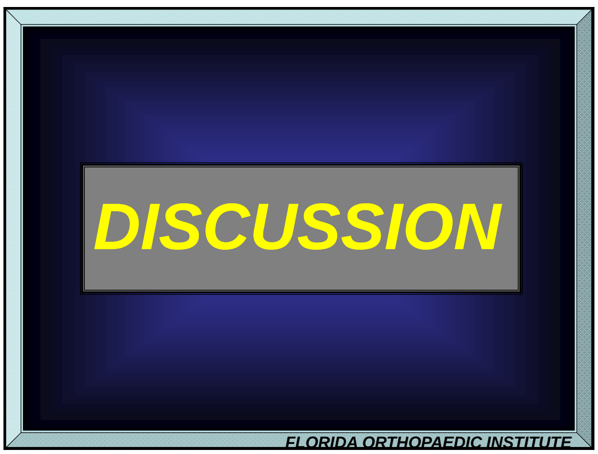
FLORIDA ORTHOPAEDIC INSTITUTE

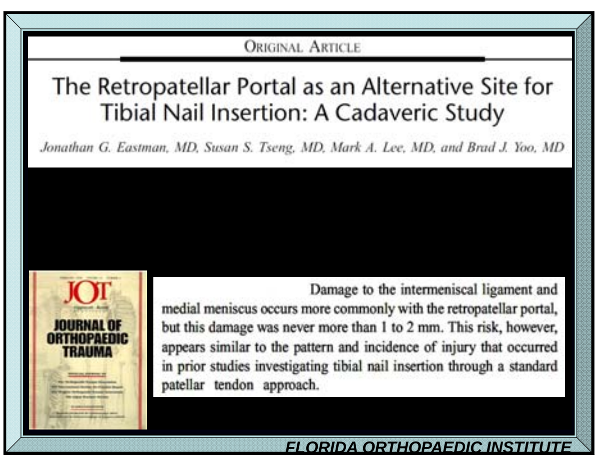
FINAL XRAYS



FLORIDA ORTHOPAEDIC INSTITUTE






ORIGINAL ARTICLE

The Retropatellar Portal as an Alternative Site for Tibial Nail Insertion: A Cadaveric Study

Jonathan G. Eastman, MD, Susan S. Tseng, MD, Mark A. Lee, MD, and Brad J. Yoo, MD

JOT JOURNAL OF ORTHOPAEDIC TRAUMA

Damage to the intermeniscal ligament and medial meniscus occurs more commonly with the retropatellar portal, but this damage was never more than 1 to 2 mm. This risk, however, appears similar to the pattern and incidence of injury that occurred in prior studies investigating tibial nail insertion through a standard patellar tendon approach.

FLORIDA ORTHOPAEDIC INSTITUTE

ORIGINAL ARTICLE

Suprapatellar versus Infra-Patellar Intramedullary Nail Insertion of the Tibia: A Cadaveric Model for Comparison of Patellofemoral Contact Pressures and Forces

Martin K. Gelbke, MD, Dana Coombs, MS,† Sean Powell, BS,† and Thomas G. DiPasquale, DO†*

PATELLO-FEMORAL CONTACT PRESSURES REMAINED BELOW LEVELS ASSOCIATED WITH CARTILAGE DAMAGE

FLORIDA ORTHOPAEDIC INSTITUTE

ORIGINAL ARTICLE

Semiextended Intramedullary Nailing of the Tibia Using a Suprapatellar Approach: Radiographic Results and Clinical Outcomes at a Minimum of 12 Months Follow-up

Roy W. Sanders, MD, Thomas G. DiPasquale, DO,† Charles J. Jordan, MD,‡ John A. Arrington, MD,§ and H. Claude Sagi, MD**

Conclusions: This is the first paper to critically document clinical and radiographic results using the percutaneous SP portal with the semiextended approach for IMN of the tibia. Our 1 year results indicate that the procedure resulted in excellent tibial alignment, union, and knee range of motion, with rare sequelae in the PF joint based on immediate arthroscopy and 1-year MRI scans and clinical examinations. Even more interesting was the absence of anterior tibial pain often found when a tibial nail is inserted in a standard fashion.

FLORIDA ORTHOPAEDIC INSTITUTE

ORIGINAL ARTICLE

Semi-Extended Nailing of Metaphyseal Tibia Fractures: Alignment and Incidence of Postoperative Knee Pain

Scott P. Ryan, MD, Brandon Steen, MD,† and Paul Tornetta, III, MD†*

Results: There was no statistical difference in the number of patients without knee pain at union ($P = 0.7$). Radiographic angulation at the fracture was <5 degrees in all patients immediately postoperative, and no patient lost reduction. The average follow-up was 2.3 years.

Conclusions: Knee pain after semi-extended tibial nailing was similar in frequency compared with standard nailing. There were no significant angulatory deformities, and no losses of reduction for both proximal and distal metaphyseal fractures nailed with the semi-extended technique.

FLORIDA ORTHOPAEDIC INSTITUTE

CONCLUSIONS

SUPRA-PATELLAR APPROACH IS

SAFE

EASIER

when using sleeves

FLORIDA ORTHOPAEDIC INSTITUTE

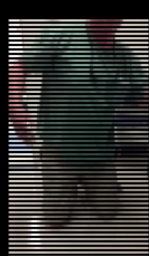
CONCLUSIONS

NO VISIBLE PATELLO - FEMORAL FINDINGS ON MRI AT 1 YEAR

FLORIDA ORTHOPAEDIC INSTITUTE

CONCLUSIONS

LOWER PAIN RATES



FLORIDA ORTHOPAEDIC INSTITUTE

FLORIDA ORTHOPAEDIC INSTITUTE