

Drawing by Leonardo da Vinci «The noblest pleasure is the joy of understanding»



uniklinik
EXPERTISE IN MOTION
balgrist



FAILED TIBIOTALOCALCANEAL FUSION: CAUSES AND SOLUTIONS

Managing Complications
& Ankle Surgery

UNIKLINIK BALGRIST
September 20th/21st 2012

Manuel Monteagudo

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SEQUELAE TRAUMA

OSTEOARTHRHOSIS

UNTREATED

CLUBFOOT

FAILED

ANKLE

FUSION

NEUROMUSCULAR DISEASE

AVASCULAR

NECROSIS

TALUS

FAILED TAR

CHARCOT

RHEUMATOID

ARTHRITIS

TTC ARTHRODESIS

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TTC ARTHRODESIS CONSIDERATIONS ON COMPLICATIONS

OVERALL COMPLICATION

RATE 55%

AMPUTATIONS 3%

BUT ...



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TTC ARTHRODESIS CONSIDERATIONS ON COMPLICATIONS

MAJORITY OF PATIENTS HAVE SIGNIFICANT
COMORBIDITIES

MOST COMMON DIABETES AND RHEUMATOID
ARTHRITIS

MOST MAJOR COMPLICATIONS IN DIABETIC PATIENTS



The success of tibiototalcalcaneal arthrodesis with intramedullary nailing – A systematic review of the literature

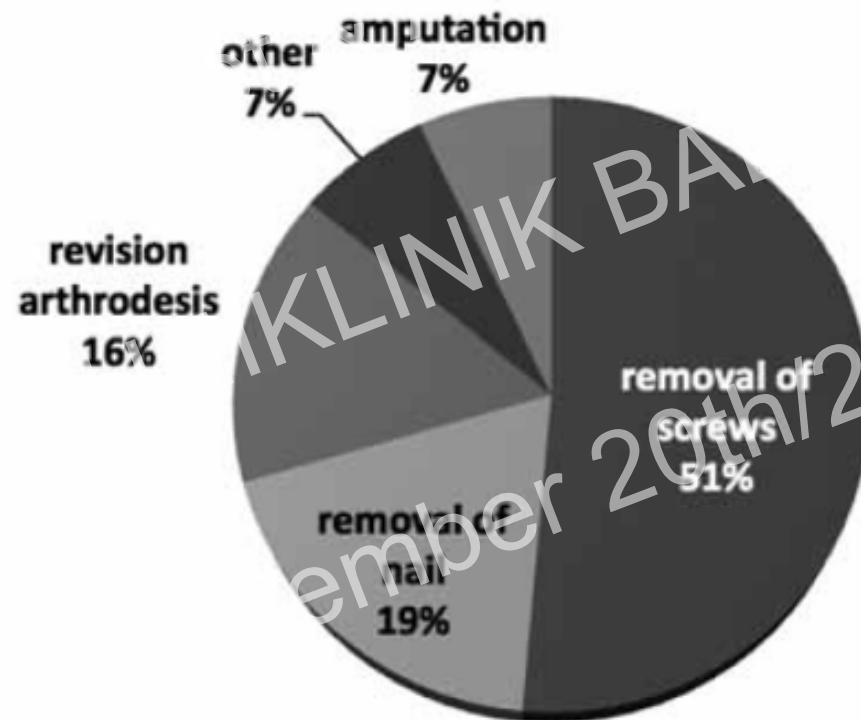
Shah JEHAN, Mohammad SHAKEEL, Andrew J. F. BING, Simon Owain HILL.

The Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry, UK

Complications	Number of cases	Percentage of all joints (641)	Percentage of all complications (357)
Metalwork related	107	16.8%	30.0%
Non-union	85	13.3%	23.8%
Infection	54	8.4%	15.1%
Delayed union	23	3.6%	6.4%
Non-infective wound problems	17	2.6%	4.8%
Neurovascular	16	2.5%	4.5%
Deformity	11	1.7%	3.1%
Mal-union	11	1.7%	3.1%
Amputations	10	1.5%	2.8%
Other	7	1.1%	2.0%
Thromboembolic	7	1.1%	2.0%
Plantar pain	5	0.8%	1.4%
Bleeding	4	0.6%	1.1%

Re-operation	Total number	Percentage of all procedures* (641)
Removal of screws	73	11.4%
Removal of nail	27	4.2%
Revision arthrodesis	22	3.4%
Other	10	1.6%
Amputation	10	1.5%

Proportion of re-operation procedures



AMPUTATION (3%)

CONSIDER AS FIRST STAGE TREATMENT vs TTC FUSION



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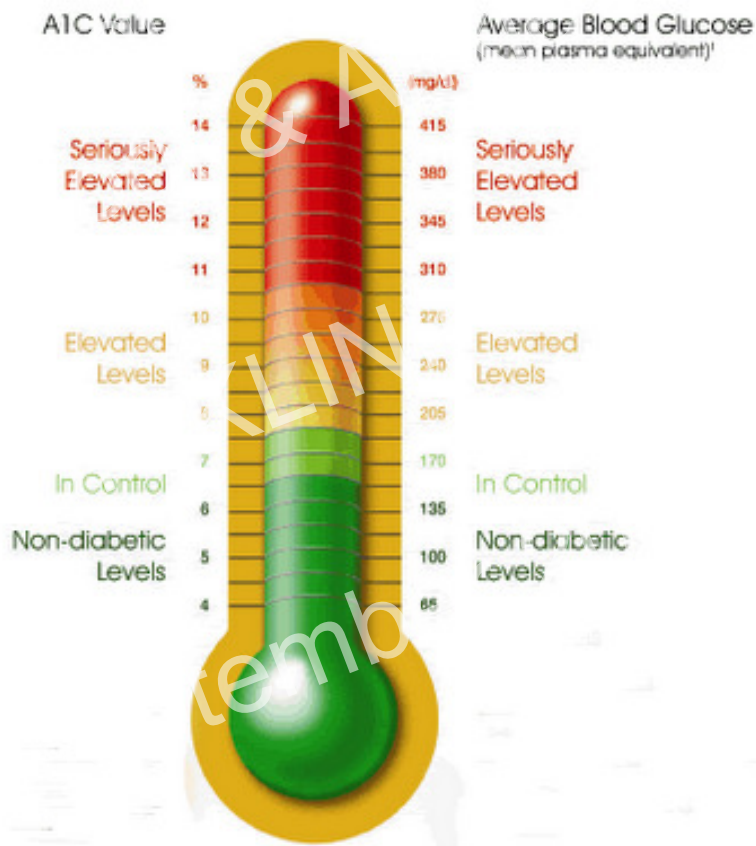
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AMPUTATION (3%) CAUSES

SOMETIMES INEVITABLE
MEDICOLEGAL PROTECTION

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Complications
Surgery



BRISTOL
2012

AMPUTATION (3%) SOLUTIONS

FIND A GOOD ORTHOPAEDIC TECHNICIAN
BE REALISTIC WITH PATIENT EXPECTATIONS
UPGRADE IS ALWAYS A POSSIBILITY



NEUROVASCULAR (4.5%)



NEUROVASCULAR (4.5%)

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BIPEDESTACION

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NEUROVASCULAR (4.5%) CAUSES and SOLUTIONS

NAIL ENTRY AND PLANTAR NERVES

NAIL DESIGN

SURAL NERVE IF LATERAL APPROACH

TIBIALIS POSTERIOR NERVE IF PREOP EQUINOVARUS

DEFORMITY

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NON-INFECTIVE WOUND PROBLEMS (5%)



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4th

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NON-INFECTIVE WOUND PROBLEMS (5%) CAUSES



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NON-INFECTIVE WOUND PROBLEMS (5%) SOLUTIONS

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NEW DRESSING

BE PATIENT .. IT MAY TAKE MONTHS

TALK TO PLASTIC SURGEONS IF DOUBTS



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MALUNION (6%)

SAGITAL PLANE

RESULT FROM INADECUATE OPERATIVE TECHNIQUE

BEWARE OF NEW "DOUBLE CURVED" NAIL DESIGNS

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MALUNION (6%)

TRANSVERSE PLANE

VARUS OR VALGUS

THERE IS NEVER TOO MUCH VALGUS IN A TTC
ARTHRODESIS ...

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CHANGE NAIL LATERALITY IF IN TROUBLE...

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INFECTION (15%)



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INFECTION (15%): CAUSES



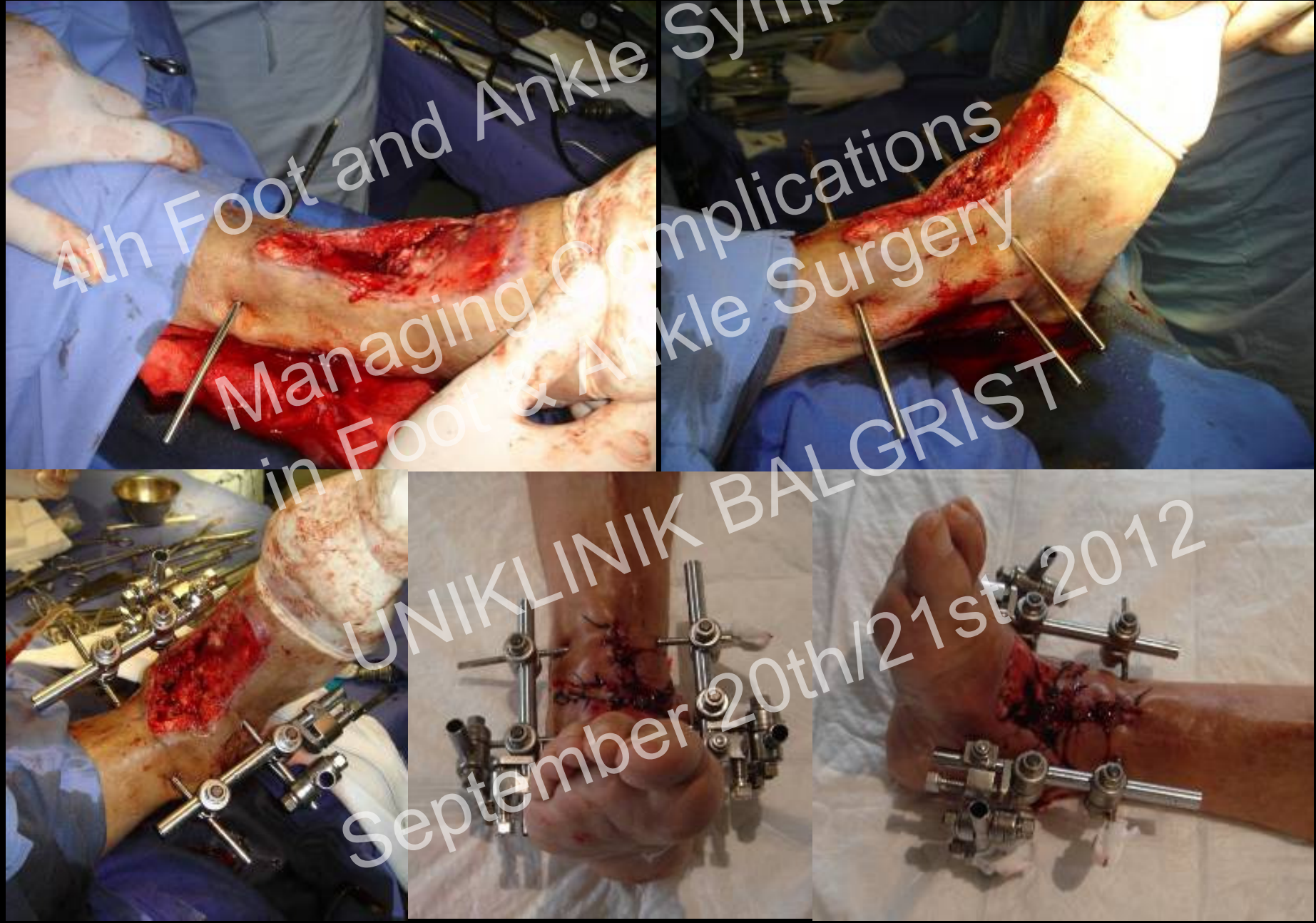
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INFECTION (15%): SOLUTIONS



NON-UNION (24%): TIBIOTALAR AND SUBTALAR



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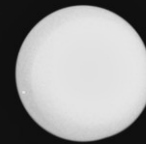
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NON-UNION (24%): TIBIOTALAR AND SUBTALAR

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NON-UNION (24%): SUBTALAR

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NON-UNION (24%): MAY BE ASYMPTOMATIC ... WITH A NAIL



NON-UNION (24%): CAUSES

PATIENT

OPTIMIZE VASCULAR STATUS + MEDICATION
DIABETES AND RHEUMATOID

SURGEON

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NON-UNION (24%): CAUSES

SURGEON

METICULOUS SURGICAL TECHNIQUE

IMPLANT SELECTION

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IMPLANT FACTOR...

IM FIBULAR ALLOGRAFT

SCREWS

BLADE-PLATE

EXTERNAL FIXATOR

RETROGRADE NAIL



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IMPLANT CHOICE...

IM FIBULAR ALLOGRAFT

SCREWS

BLADE-PLATE

EXTERNAL FIXATOR

RETROGRADE NAIL



IMPLANT CHOICE ... THE FACTS

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Tibiototalcaneal Arthrodesis: A Biomechanical Analysis of the Rotational Stability of the Biomet Ankle Arthrodesis Nail

Michael R. Mann, M.D.; Brent G. Parks, MSc; Shane S. Pak, M.D.; Stuart D. Miller, M.D.
Baltimore, MD

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Evaluation of Compression in Intramedullary Hindfoot Arthrodesis

Lawrence Berson, M.D.*; William C. McGarvey, M.D.**; Thomas O. Clanton, M.D.**
Houston, TX

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Tibiototalcaneal Arthrodesis: A Biomechanical Assessment of Stability

Gordon L. Bennett, M.D.¹; Brian Cameron, M.D.²; Glen Njus, Ph.D.³; Mamie Saunders, M.S., Ph.D.³; David B. Kay, M.D.¹
Akron, OH

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Biomechanical Evaluation of Primary Stiffness of Tibiotalar Arthrodesis with an Intramedullary Compression Nail and Four Other Fixation Devices

Thomas Martin Mueckley, M.D.¹; Stefan Eichorn, Dip.-Ing.²; Geert von Oldenburg, Dipl.-Ing.³; Andreas Speitling, Dr.-Ing.³; Joseph D. DiCiccio III, D.O.¹; Gunther O. Hoffmann, M.D.¹; Volker Bühren, M.D.²
Manick, Germany

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Intramedullary Nail Fixation with Posterior-to-Anterior Compared to Transverse Distal Screw Placement for Tibiototalcaneal Arthrodesis: A Biomechanical Investigation

Kenneth R. Means, M.D.; Brent G. Parks, M.D., M.Sc.; Augustine Nguyen, B.S.; Lew C. Schon, M.D.
Baltimore, MD

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DOI: 10.3113/FAI.2007.0234

Biomechanical Evaluation of Primary Stiffness of Tibiototalcaneal Fusion with Intramedullary Nails

Thomas Mueckley, M.D.¹; Stephan Eichorn, Dipl.-Ing.²; Konrad Hoffmeier, Dipl.-Ing.¹; Geert von Oldenburg, Dipl.-Ing.³; Andreas Speitling, Dipl.-Ing.³; Gunther O. Hoffmann, M.D.¹; Volker Bühren, M.D.²
Jena, Germany

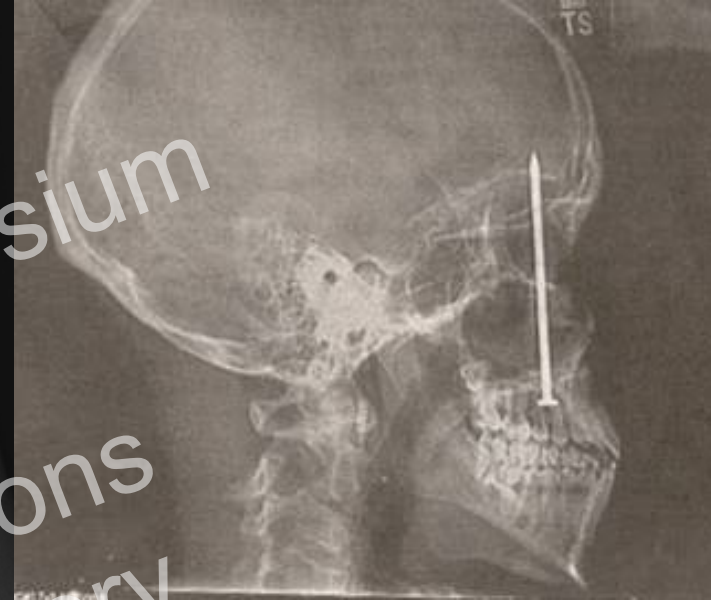
COMPRESSION & MECHANICAL STABILITY

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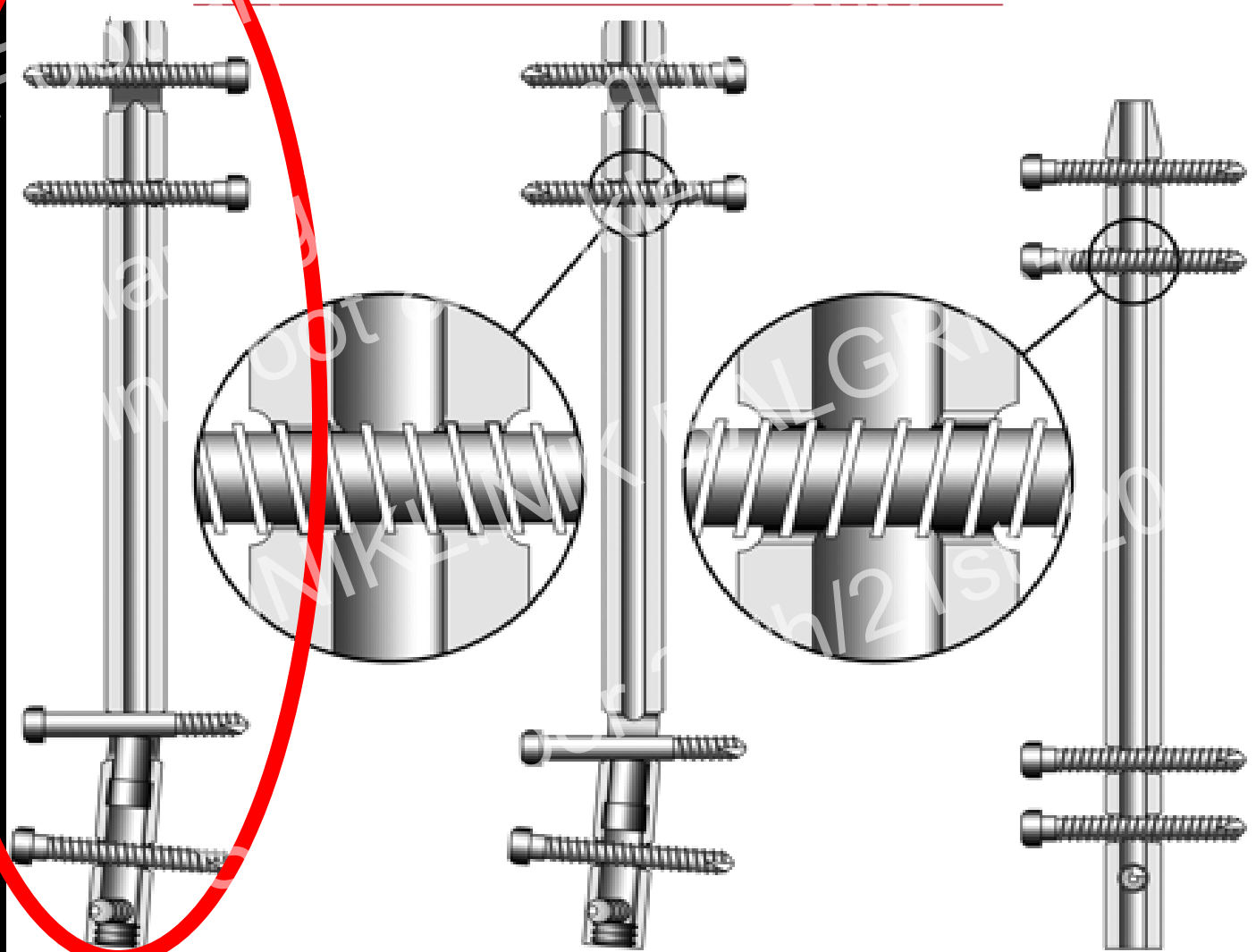
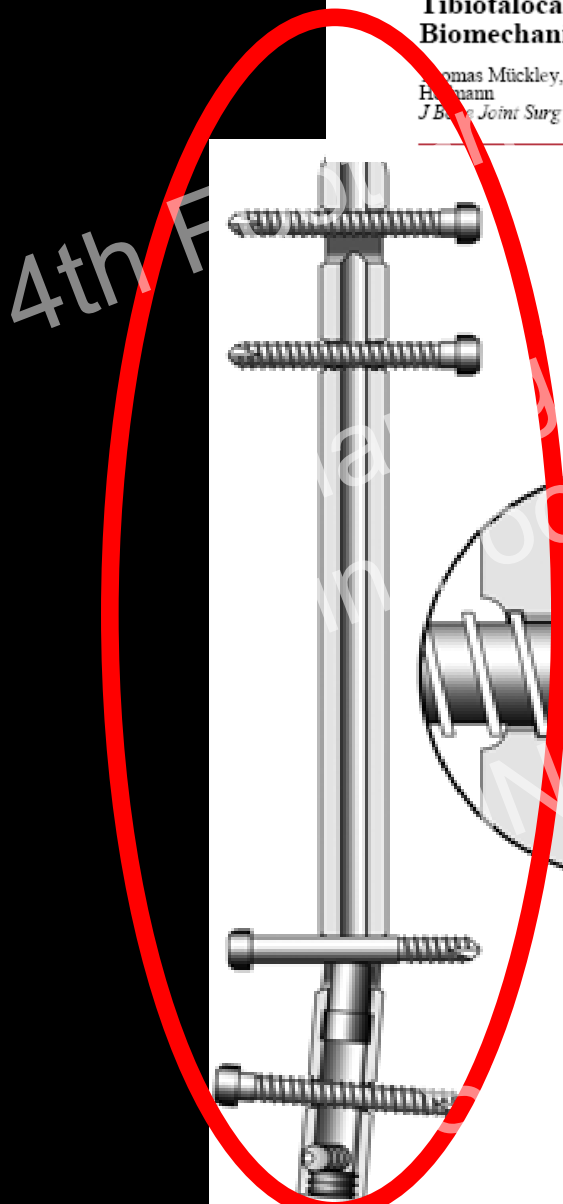
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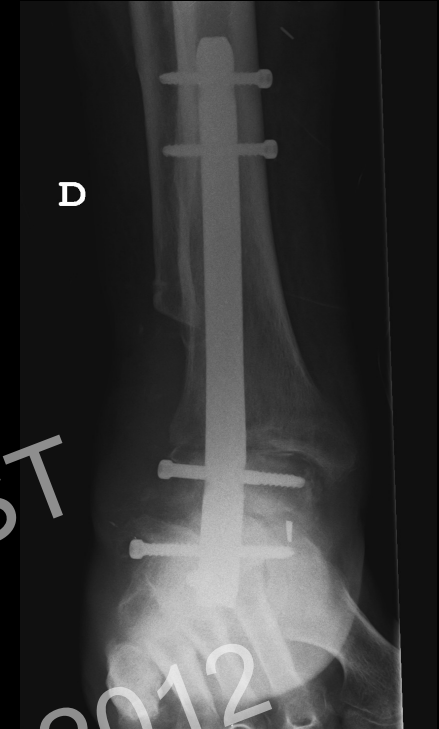
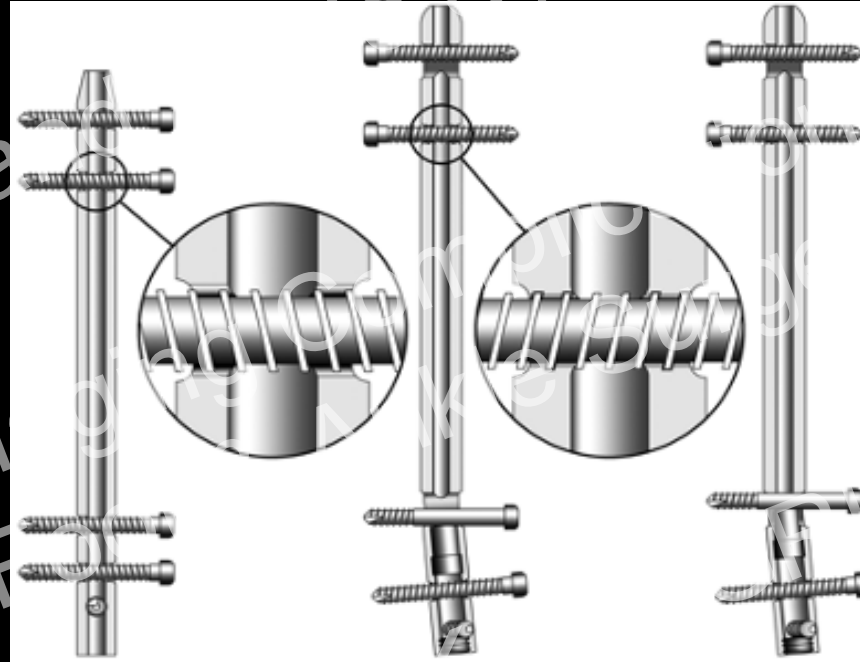
Angle-Stable and Compressed Angle-Stable Locking for Tibiotalocalcaneal Arthrodesis with Retrograde Intramedullary Nails. Biomechanical Evaluation

Thomas Mückley, Konrad Hoffmeier, Kajetan Klos, Alexander Petrovitch, Geert von Oldenburg and Gunther O. Hoffmann
J Bone Joint Surg Am. 2008;90:620-627. doi:10.2106/JBJS.G.00010



1st GENERATION

2nd GENERATION



STRAIGHT
NO POSTERIOR TO
ANTERIOR
CALCANEAL SCREW
NO COMPRESSION

FIXED ANGLED
POSTERIOR TO
ANTERIOR CALCANEAL
SCREW
DOUBLE COMPRESSION

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TTC BY RETROGRADE IM NAIL: OUR EXPERIENCE

2002-2004 – First 12 cases not recorded in present study (learning curve)

2004-2008 – 6 cases lost for follow-up.

Rest 26 cases included: 13 1st Gen vs 13 2nd Gen

One single surgeon

EPIDEMIOLOGY

Mean age – 60y

19 female – 7 male

18 left – 8 right

20 patients with previous
surgeries (5 pts > 3)

Mean follow-up 39
months (min 18 m)

One single surgeon



INDICATIONS MATCHED IN BOTH GROUPS

POSTRAUMATIC OSTEOARTHRITIS (10 – 4+6)
STAGE IV TIBIALIS POST DYSFUNCTION (6 – 4+2)
FAILED ANKLE REPLACEMENT (4 – 1+3)
REUMATHOID ARTHRITIS (4 – 3+1)
CHARCOT (2 – 1+1)

RESULTS

1st GENERATION

FUSION – 14 WEEKS

AOFAS A-HINDFOOT

Preop: 40

Postop 1y: 67

1y ROCKER-BOTTOM: 71

VAS (visual analogue scale)

From 9.5 to 2

2nd GENERATION

FUSION – 10 WEEKS?

AOFAS A-HINDFOOT

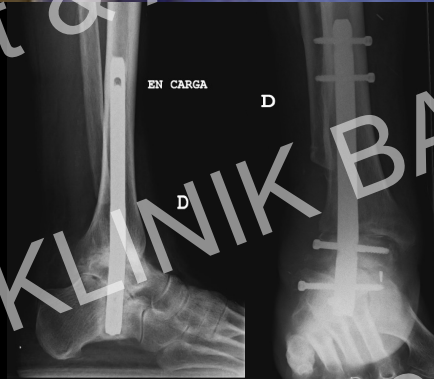
Preop: 39

Postop 1y: 68

1y ROCKER-BOTTOM: 73

VAS (visual analogue scale)

From 9.2 to 1.6



Both groups:

200 x 11 mm nail in 20 cases

Mean tourniquet time 85 minutes

RESULTS

1st GENERATION

2nd GENERATION

PATIENT
SATISFACTION

Excellent – 3
Good – 8
Satisfactory – 1
Poor – 1

Yes – 10
No – 3

PATIENT
SATISFACTION

Excellent – 5
Good – 4
Satisfactory – 3
Poor – 1

Yes – 12
No – 1

WOULD HAVE SURGERY AGAIN?



RADIOLOGY AND FUSION

Fusion = Resume activities = Success if right alignment

Independent observer – orthopaedic surgeon

Time from surgery to radiological fusion

Difficulties in evaluating fusion with 2nd generation
nails

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DOI: 10.3113/FAI.2007.0605

Comparison of Two Intramedullary Nails for Tibiototalcaneal Fusion: Anatomic and Radiographic Considerations

Thomas Mückley, M.D.; Sebastian Ullm, M.D.; Alexander Petrovitch, M.D.; Kajetan Klos, M.D.; Claudia Beimel, M.Sc.;
Rosemarie Fröber, M.D.; Gunther O. Hofmann, M.D.
Jena, Germany

RADIOLOGY AND FUSION

IS THIS RA

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COMPLICATIONS

1st GENERATION

2 NON UNIONS

(one needed revision,
one asymptomatic
Charcot case)

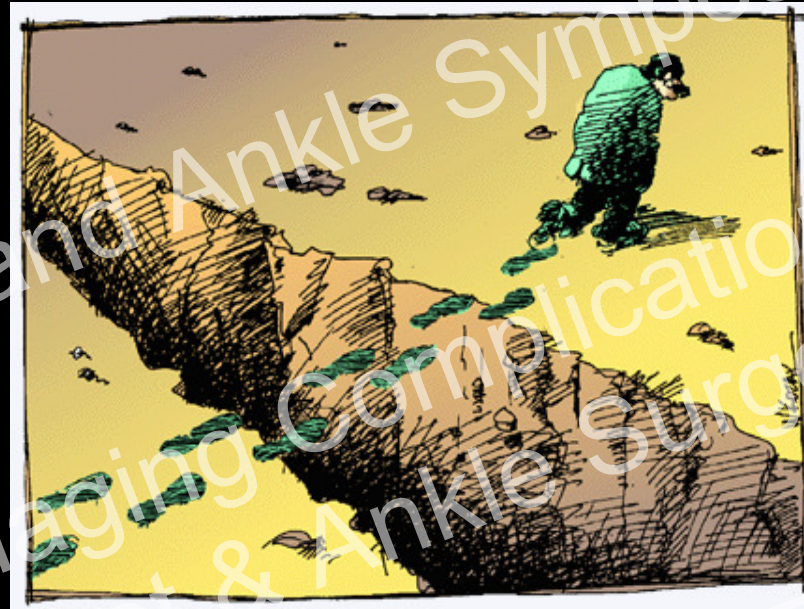
1 WOUND DEHISCENCE

1 NEUROAPRAXIA

1 INTRAOP TIBIAL FRACTURE

2 MILD HINDFOOT VARUS

2 MILD EQUINUS



2nd GENERATION

1 POSTOP TIBIAL
STRESS FRACTURE

1 PROMINENT
SCREW

(needed removal)

1 MILD EQUINUS
DEFORMITY

1 SUPERFICIAL WOUND
INFECTION



COMPLICATIONS

1st GENERATION

2 NON UNIONS (one needed revision, one asymptomatic Charcot case)



SURGICAL TECHNIQUE

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NON-UNION (24%): SOLUTIONS

SURGICAL TECHNIQUE

ALLOGRAFTS AND OTHERS

IMPLANT SELECTION

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TECHNICAL TIPS ...

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Doctor Name

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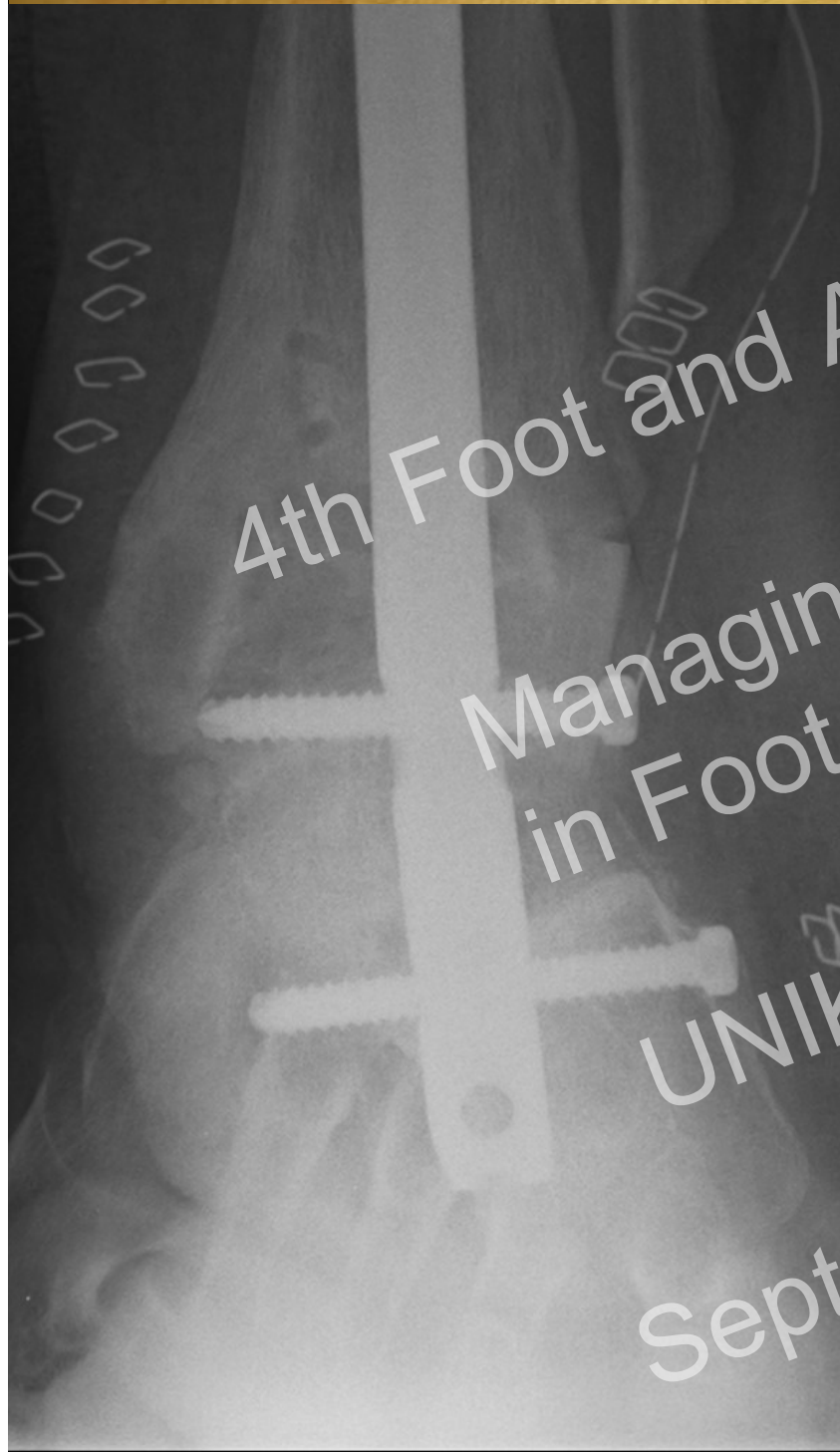


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IMPLANT RELATED (30%)



IMPLANT RELATED (30%)

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IMPLANT RELATED (30%) TIBIAL PAIN / STRESS REACTION

Researcher's Name:
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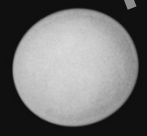
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IMPLANT RELATED (30%): CAUSES

SURGICAL TECHNIQUE

KNOW YOUR IMPLANTS

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IMPLANT RELATED (30%)



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IMPLANT RELATED (30%)



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IMPLANT RELATED (30%): SOLUTIONS

SURGICAL TECHNIQUE



LEARN FROM LEARNING CURVE

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TAKE HOME

Complications on complex cases
Optimize patient condition whenever possible
Know your implants
Improve your surgical technique



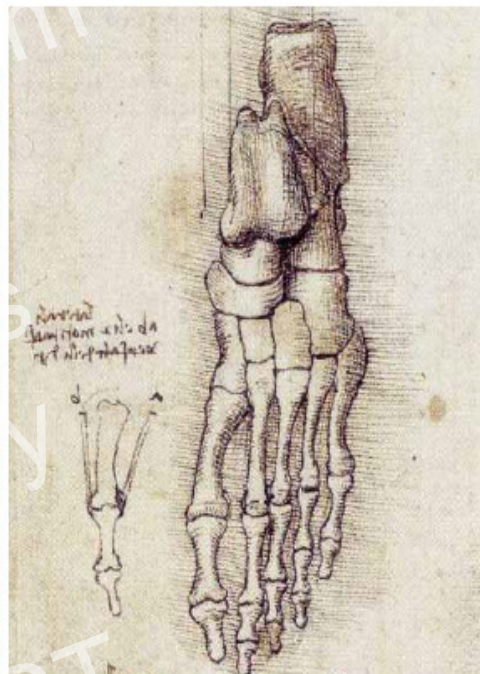


Fixed angle nails + posterior-to-anterior screw provide biomechanical support for increased primary stability in 2nd generation nails





Drawing by Leonardo da Vinci of the noblest pleasure is the joy of understanding.



**THANK YOU
FOR
YOUR
ATTENTION**