


**AUTOLOGOUS
BONE GRAFT**

*IS THERE ANY LIFE
LEFT IN IT?*

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**DEDICATED
TO MY
MENTOR**

**HOWARD
ROSEN, M.D.**
(1925-2000)




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**WHY DO WE EVEN USE
A BONE GRAFT?**

- **NONUNIONS**
- **BONE DEFECTS**
- **ARTHRODESES**

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Flourens conclusively showed that periosteum was osteogenic and was the chief agent in the healing of bone defects

Flourens (1842)

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FIRST BONE GRAFT - 1858

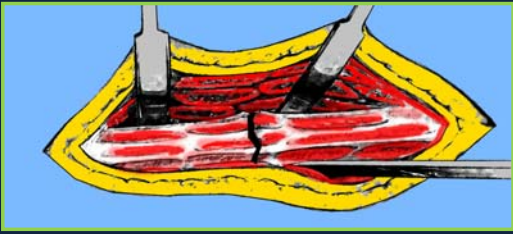
De la production artificielle des os au moyen de la transplantation de perioste et des greffes osseux.



*Ollier, L.X.
Comp Rend Soc de Biol 5: 145.
1858*

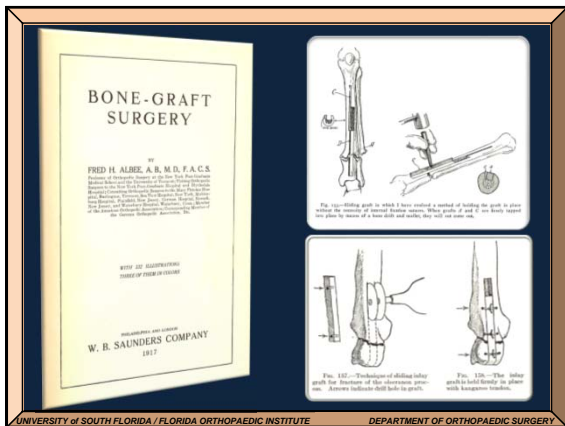
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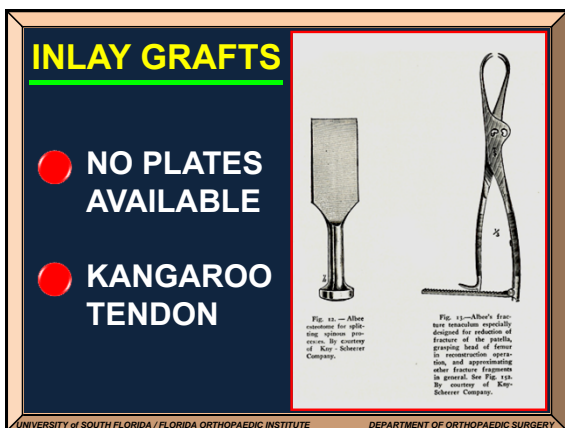
OSTEOPERIOSTEAL GRAFTS
(Delageniere = 1921)

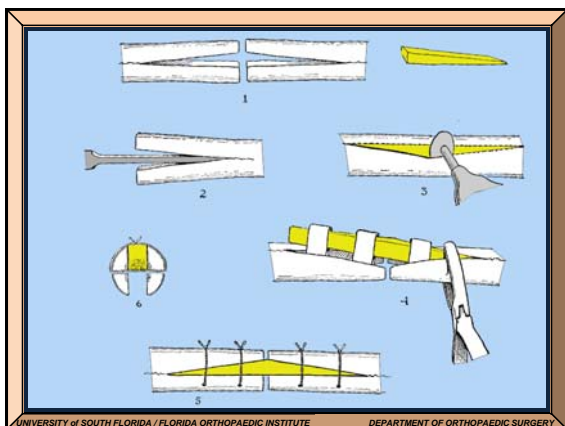


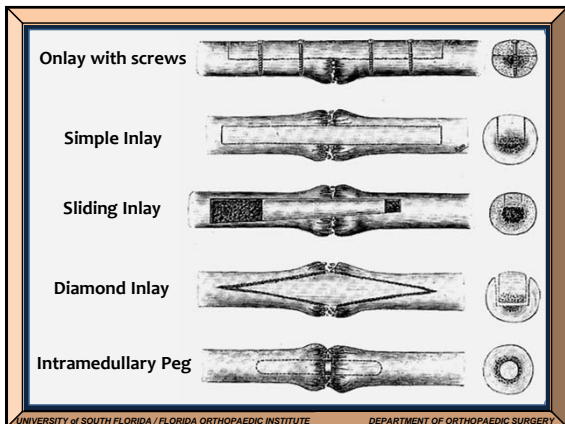
AKA "Judet Decortication"

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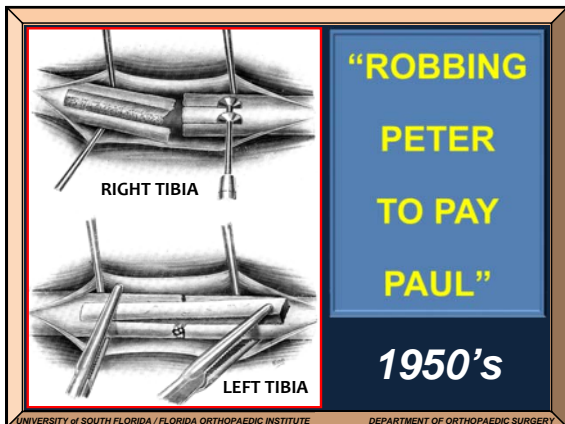


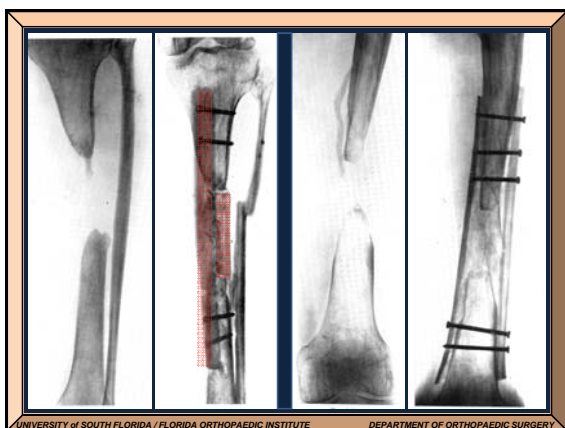


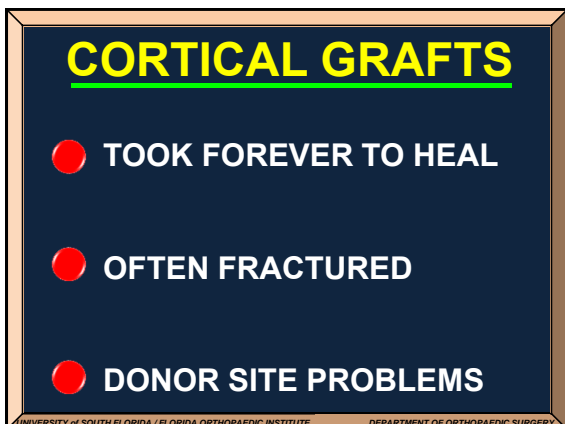




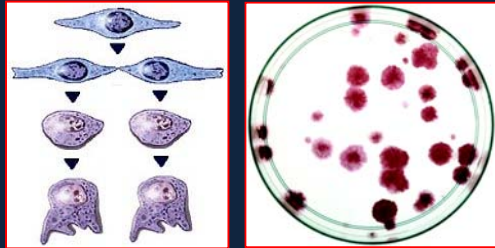








OSTEOGENIC = contains living cells that can differentiate into bone




The diagram on the left shows a sequence of cell differentiation from a single stem cell into two daughter cells, which then further differentiate into specialized osteogenic cells. The image on the right shows a petri dish containing a cell culture with several red-stained spots, likely representing osteogenic cells in culture.

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OSTEOGENIC

ASPIRATE **TRICORTICAL GRAFT**

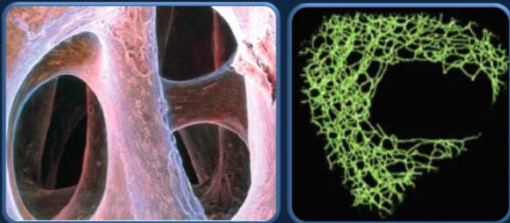


The image on the left shows a surgical aspirate procedure where a hand is using a suction device to collect bone marrow. The image on the right shows a tricortical bone graft, which is a section of bone with three cortical layers and a cancellous core.

(BOTH CONTAIN OSTEOPROGENITOR CELLS)

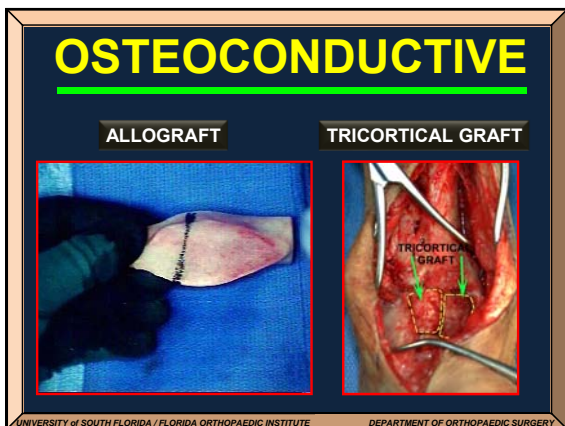
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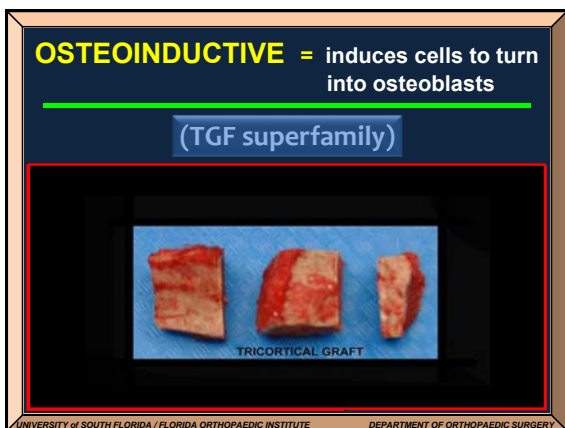
OSTEOCONDUCTIVE = promotes bone apposition to act as a scaffolding to allow bone formation

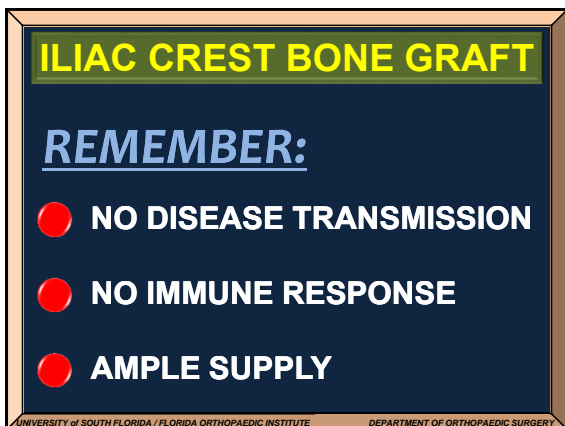


The image on the left shows a porous, lattice-like structure, likely a scaffold used in bone regeneration. The image on the right shows a similar porous structure, possibly a natural bone structure or a synthetic scaffold.

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ILIAC CREST BONE GRAFT

SIMPLY IS

THE GOLD STANDARD




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ILIAC CREST BONE GRAFT

COMPLICATIONS

MAJOR	2.5 – 10%
MINOR	~ 40%
PAIN	20%




Hill et al Aust J Surg 1999 (10):726-8
Goulet et al CORR 1997 (339): 76-81
Arrington et al CORR 1996 (329):300-309
Banwart et al Spine 1995 (9):1055-1060

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INTRAMEDULLARY REAMING

KÜNTSCHER:


- Extended the length of the Isthmus by reaming
- Increased contact between nail and endosteum.



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**REAMING
+
NAIL**

**BIO
+
MECHANICS**



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**POTENTIAL DISADVANTAGES
OF REAMING**

- THERMAL NECROSIS
- MEDULLARY PRESSURIZATION
- (WEAKENS THE BONE).

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ENDOSTEAL THERMAL NECROSIS



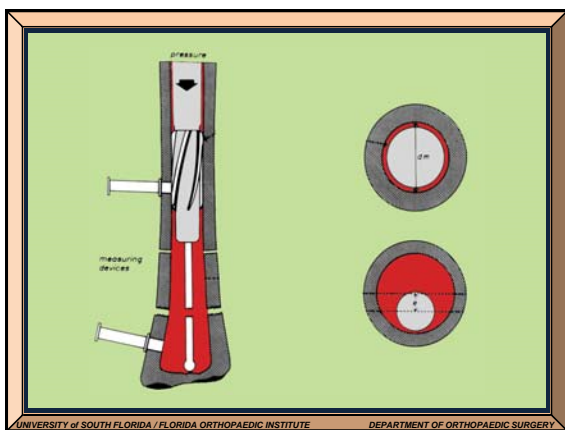
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Measurement of intramedullary pressure in an animal experiment and propositions to reduce the pressure increase

K.M. Stürmer
Universitätsklinikum
Abteilung für Unfallchirurgie
45122 Essen, Germany

INJURY, 1993. VOLUME 24

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PRESSURIZATION 2^o REAMING

The image shows two medical scans. On the left is a chest X-ray showing the ribcage and spine. On the right is a brain scan (likely MRI) showing a cross-section of the brain with a white arrow pointing to a specific area of interest.

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REAMER IRRIGATOR ASPIRATOR SYSTEM (RIA)

- REDUCES MEDULLARY PRESSURE
- ALLOWS SINGLE-PASS REAMING
- BONE HARVESTING APPLICATION



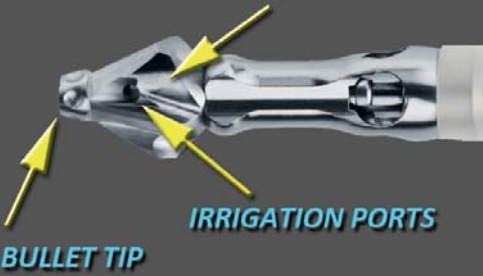
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UNIQUE HEAD DESIGN

DEEP CUT FLUTES

IRRIGATION PORTS


BULLET TIP



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CANAL MEASUREMENT

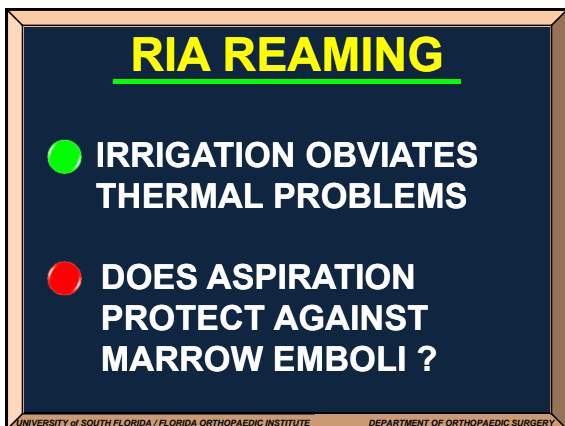
- RULER FOR CANAL SIZE
- PLACE RULER AT ISTHMUS
- SELECT HEAD 1 – 1.5 mm ABOVE NAIL SIZE

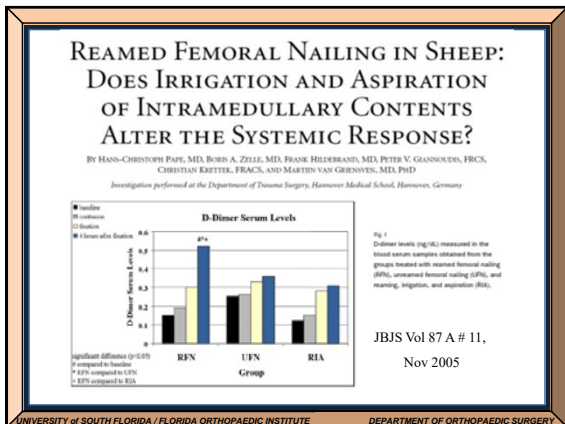


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RIA REAMING

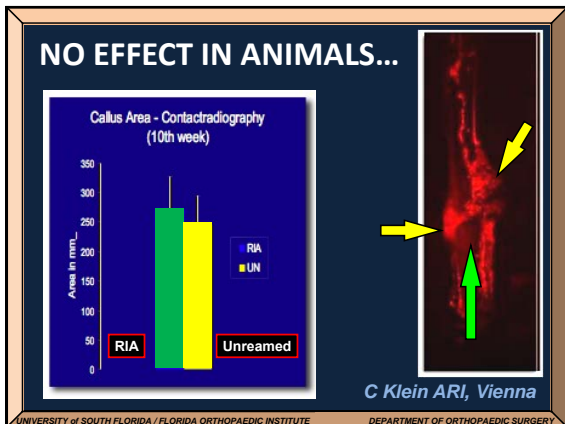
- IRRIGATION ASPIRATION PROTECTS AGAINST EMBOLIC PROBLEMS
- DOES IT PREVENT HEALING BY REMOVING ALL THE MARROW REAMINGS ?

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DOES "ASPIRATION" OF MARROW NEGATIVELY AFFECT HEALING?

- Frolke, *Acta Ortho Bel* 2000
Reaming debris accumulate at fracture site
- Trinkaus, *Unfallchirurg* 2005
Reaming debris a source of viable stem cells

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RIA AS GRAFT

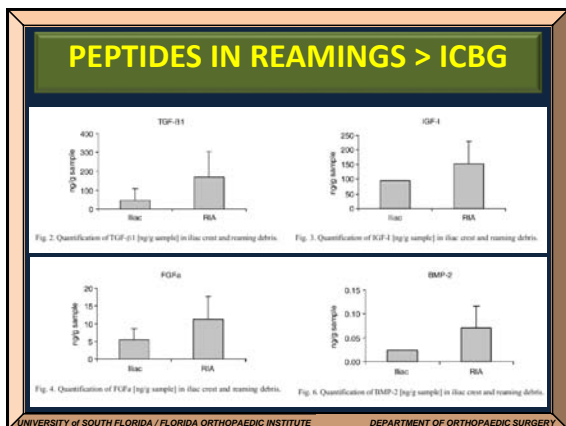
- CAN THE REAMINGS BE SAVED FOR GRAFT?
- ARE RIA REAMINGS EQUAL TO ICBG ?

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RIA AS GRAFT

- REAMINGS SIMILAR TO ICBG IN VOLUME & CONSISTENCY
- RIA REAMINGS ARE EQUAL TO ICBG BIOLOGICALLY


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CASE REPORT

Complications Associated With Negative Pressure Reaming for Harvesting Autologous Bone Graft:
A Case Series

Jason A. Lowe, MD,* Gregory J. Della Rocca, MD, PhD,* Yvonne Martha, MD,*
Frank A. Liporace, MD,† Michael D. Stover, MD,‡ Scott E. Nork, MD,§ and Brett D. Crist, MD*

MUST BE VIGILANT WITH SIZE OF REAMER & TECHNIQUE



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SO HOW DO WE USE RIA BONE GRAFT TODAY

?

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2004

Journal of Orthopaedic Research

Journal of Orthopaedic Research 22 (2004) 73–79

www.elsevier.com/locate/jor

Induced membranes secrete growth factors including vascular and osteoinductive factors and could stimulate bone regeneration

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Abstract

Based on a new concept, a procedure combining induced membranes and cancellous autografts allows the reconstruction of wide diaphyseal defects. In the first stage of this procedure, a cement spacer is inserted into the defect; the spacer is responsible for the formation of a pseudo-synovial membrane. In the second stage, the defect is reconstructed two months later by an autologous cancellous bone graft. The aim of this study was to evaluate the histological and biochemical characteristics of these membranes induced in rabbits. Histological studies carried out two, four, six, and eight weeks following implantation revealed a rich vascularization. Qualitative and quantitative immunohistochemistry showed production of growth factors (VEGF, TGF- β) and osteoinductive factors (BMP-2). Maximum BMP-2 production was obtained four weeks after the implantation, and, at this time, induced membranes favored human bone marrow stromal cell differentiation to the osteoblastic lineage. Should these results be confirmed in humans, bone reconstruction could be carried out earlier than previously thought and in better conditions than expected, the membrane playing the role of an in situ delivery system for growth and osteoinductive factors.

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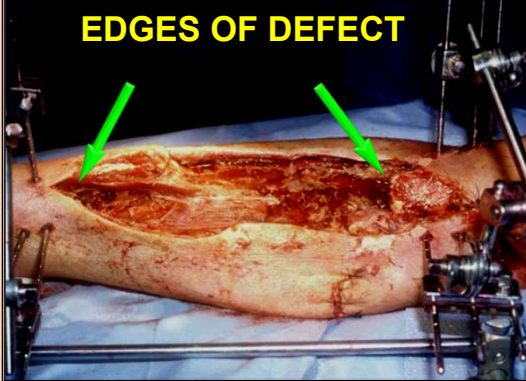
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INDUCED MEMBRANE – EXPRESSION OF VEGF, TGF- β 1 AND BMP-2 AT 2, 4, 6 & 8 WEEKS

The technique for bone reconstruction described by Masquelet combines the induction of a membrane by the means of a cement spacer with a later cancellous autograft [10,12,17]. The first role of the spacer is mechanical as it obviates fibrous tissue invasion of the recipient site. The second role is biological, by the induction of the surrounding membrane.

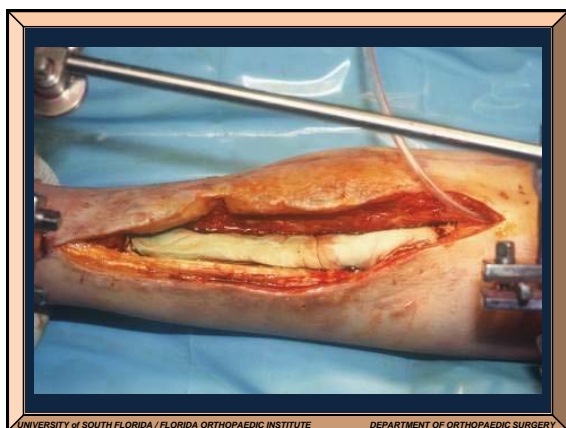
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EDGES OF DEFECT



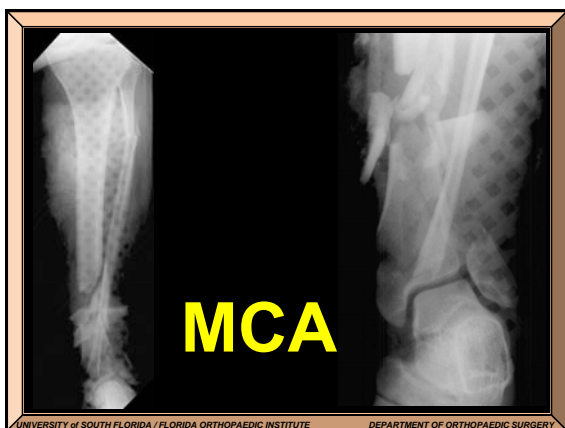
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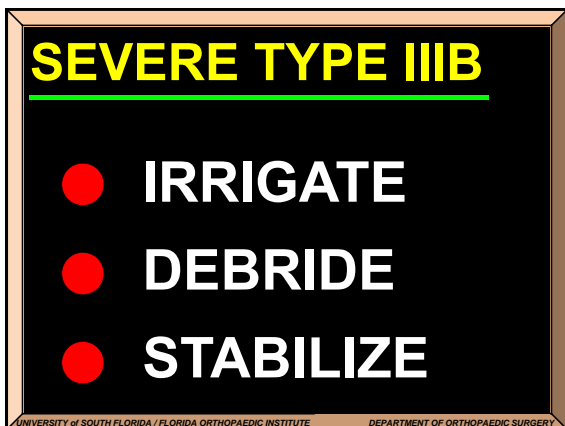


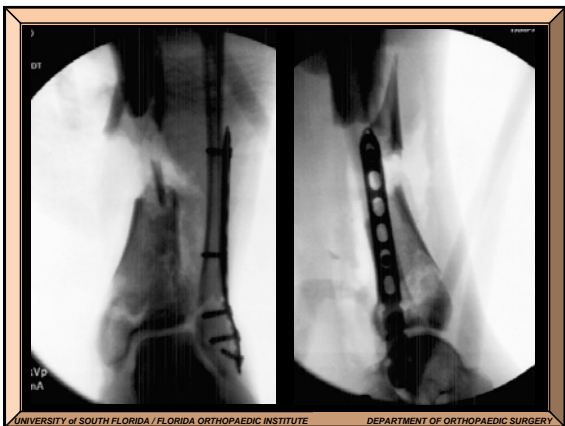


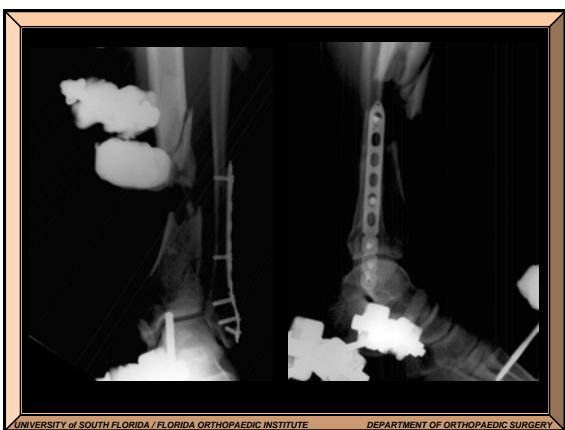








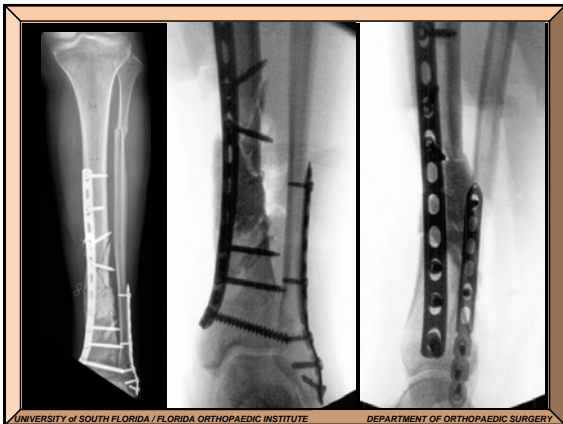




7 DAYS LATER,

- ANTIBIOTIC SPACER
- ANATOMIC PLATING
- FREE LAT FLAP

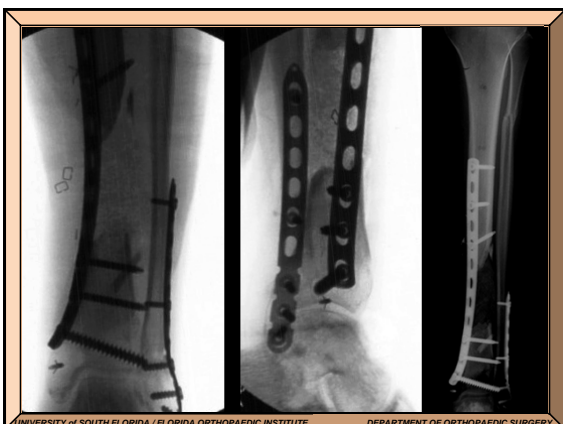
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6 WEEKS LATER,

- SPACER REMOVED
- FLAP LIFTED
- ICBG PLACED

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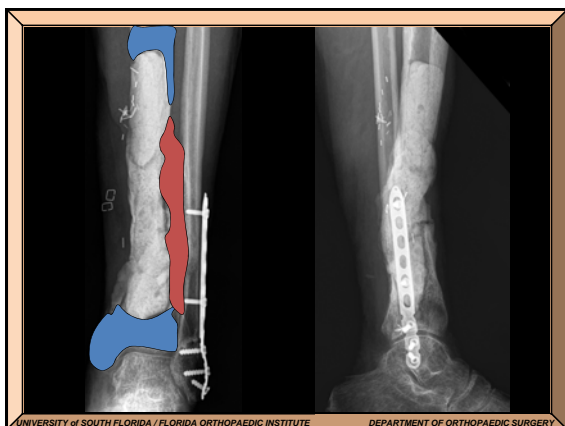
6 MONTHS LATER,

- BACK FROM MIAMI
- SLIGHT PROBLEM.....

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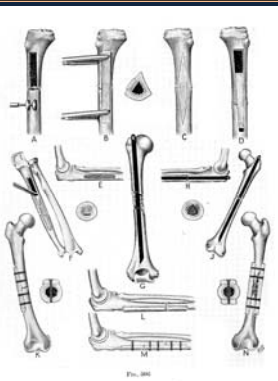


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We have come a long way in our understanding of bone healing and defect treatment over the last century,

AND CERTAIN TRUTHS HAVE APPEARED

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RIA AS GRAFT

- REAMINGS SIMILAR TO ICBG IN VOLUME & CONSISTENCY
- RIA REAMINGS ARE EQUAL TO ICBG BIOLOGICALLY

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MASQUELET TECHNIQUE

- CEMENT SPACER PROTECTS CAVITY FROM FIBROUS TISSUE
- STIMULATES FORMATION OF A MEMBRANE THAT RELEASES BMPs



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