Osteochondral Grafting in Proximal Row Carpectomy:
An old idea in a new place

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  University of Pittsburgh Medical Center
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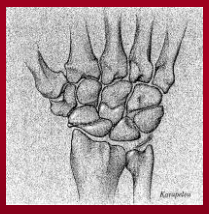
  Hand Fellow
  University of Pittsburgh Hand Fellowship

Proximal Row Carpectomy

Indications:

- Scapholunate Advanced Collapse
- Scaphoid Nonunion Advanced Collapse
- Kienbock's disease with carpal collapse
- Other arthritides of the wrist



Proximal Row Carpectomy

Benefits:

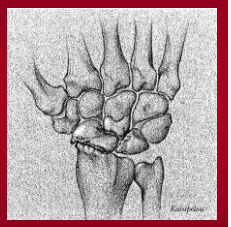
- Pain relief
- Motion preserving
- Grip strength improvement

Proximal Row Carpectomy

Contraindication:

- Significant capitate arthritic degeneration

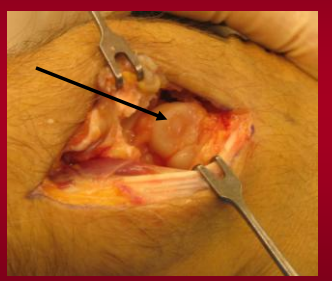
since the new articulating surfaces will be the capitate and lunate fossa of the radius . . .



Proximal Row Carpectomy

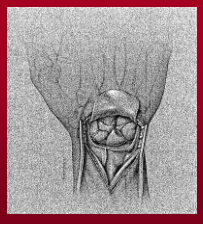
- With an arthritic capitate, other procedures should be chosen:

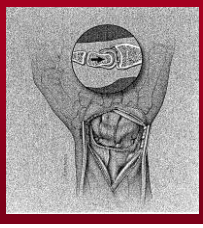
  scaphoid excision and midcarpal fusion or total wrist fusion



Proximal Row Carpectomy

- When there is minimal involvement (ie. < 3 mm, J Hand Surg 1990), PRC or PRC with capsular interposition may still benefit the patient





What is the limiting problem?

CARTILAGE

Hunter stated in 1743 that,

"from Hippocrates down to the present age, we shall find, that an ulcerated cartilage is universally allowed to be a very trouble-some disease; that it admits of a cure with more difficulty than a carious bone; and that, when destroyed, it is never recovered."

(Philos Trans R Soc London B Biol Sci 1743)

CARTILAGE

- Is a unique tissue lacking vascular, nerve and lymphatic supply
- Lack of vascular and lymphatic circulation thought to be one reason for the poor intrinsic capacity to heal
- No inflammatory response elicited unless the subchondral bone is violated
- Any healing is with fibrocartilage which lacks the biomechanical properties of hyaline cartilage

(Surgery of the Knee 2001)

How have other fields dealt with this problem?

In the knee . . .

Symptomatic Treatment

- Lavage
  - allows removal of loose articular particles, released enzymes, and inflammatory mediators
  - effect only temporary, underlying pathology not addressed
- Debridement
  - Removes mechanical symptoms
  - Symptomatic relief, 80% improvement in first year with gradual decline

(Surgery of the Knee 2001)

Treatments that increase vascularity

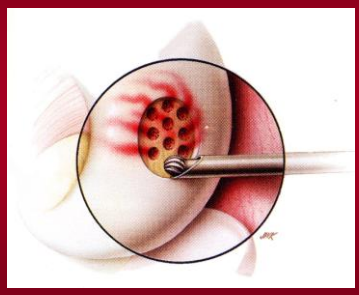
- Multiple Drilling
  - Pridie 1959
  - Insall showed 40% success at 6 yrs
- Multiple Microfracturing
  - Introduced by Steadman and Rodrigo
  - 75% success at 7 yrs
- Abrasion Arthroplasty
  - Introduced by Johnson who showed success rate of 77% at 2 yrs

(Surgery of the Knee 2001)

Multiple Microfracturing

(Oper Tech Orthop 1997)

Abrasion Arthroplasty

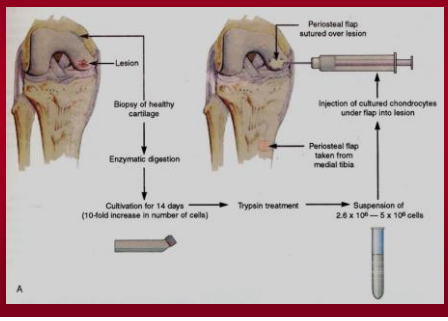


(Oper Tech Orthop 1997)

Autologous chondrocyte transplantation

- chondrocytes harvested from patient and cultured
- cultured chondrocytes transplanted under periosteal flap

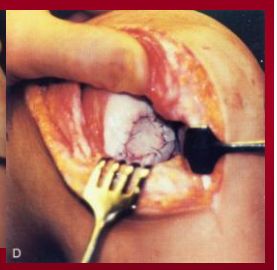
Autologous chondrocyte transplantation



Autologous chondrocyte transplantation

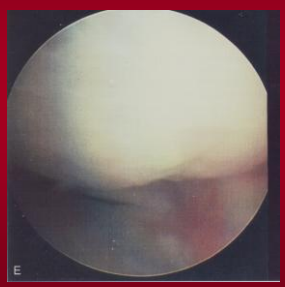
17 y.o. female 1 year after pinning of osteochondral fragment

Autologous chondrocyte transplantation



Autologous chondrocyte transplantation

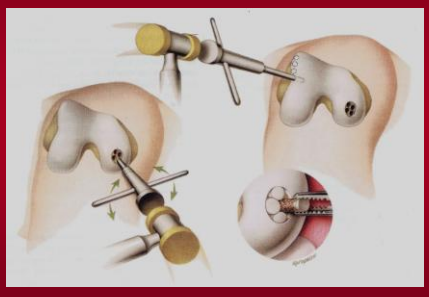
Two years after autologous chondrocyte transplantation



Osteochondral Autografting

- Matsusue first reported in 1993
- Hangody reported a 2 – 5 yr follow-up with good or excellent results in 86% to 90% of cases
- Histologic evaluation from animal studies show:
  1. Survival of transplanted hyaline cartilage
  2. Composite of 80% transplanted hyaline cartilage and 20% fibrocartilage
  3. Deep matrix integration at the recipient site

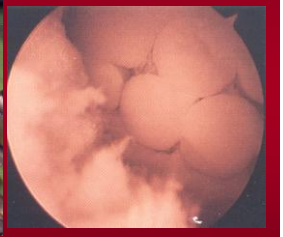
Osteochondral Autografting – Mosaicplasty (Cobblestoning)



(Oper Tech Orthop 1997)

Osteochondral Autografting – Mosaicplasty (Cobblestoning)

OPEN



ARTHROSCOPIC

Osteochondral Autografting

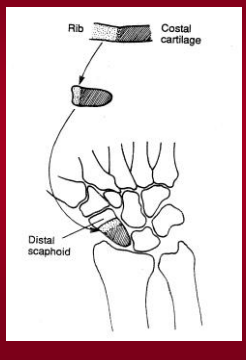
5 1/2 years after mosaicplasty

Osteochondral Autografting

In the wrist . . .

- Sandow in 1998 reported using rib bone/cartilage autografts in 22 pts for deficiency of the proximal scaphoid due to fx or necrosis
- Found good to excellent results at median 24 mos follow-up with the use of the costo-osteochondral autograft

(J Hand Surg Br 1998)



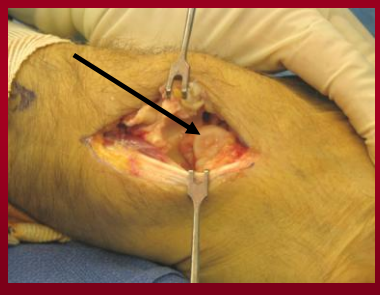
Osteochondral Autografting

- Salon reported in 2003, 2 cases of Kienbock's disease in which peri-lunate chondral lesions contraindicated classical PRC or 4 corner arthrodesis
- In one case the lunate fossa of the radius was damaged
- An osteochondral graft was harvested from the triquetrum and implanted into the fossa

(Chirurgie de la Main 2003)

Osteochondral Autografting in Proximal Row Carpectomy

THE PITTSBURGH SERIES



Osteochondral Autografting in PRC

Essentials:

- Identify patients in whom PRC was planned, but found to have capitate chondrosis intraoperatively
- Utilize the resected scaphoid, lunate, and triquetrum as sources of osteochondral grafts
- Osteochondral autograft these arthritic lesions

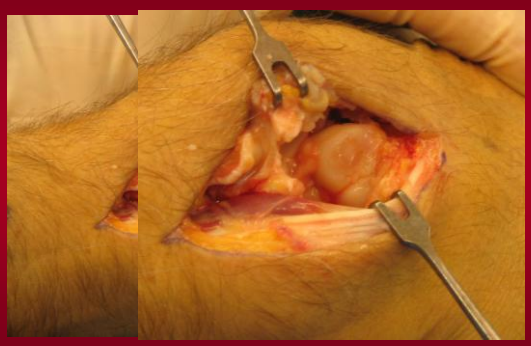
Osteochondral Autografting in PRC

To date:

- 5 patients have undergone grafting to their capitate
- Chondrosis rated: Grade 3 in three pts, grade 3-4 in two pts
- Size of defects: 5x5 mm (x4) and 10x6 mm
- 1 patient underwent grafting from the triquetrum to the lunate fossa of the radius

Case 1

Case 1



Case 1

Case 1

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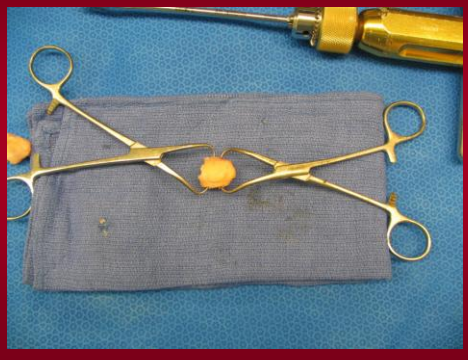

Case 1

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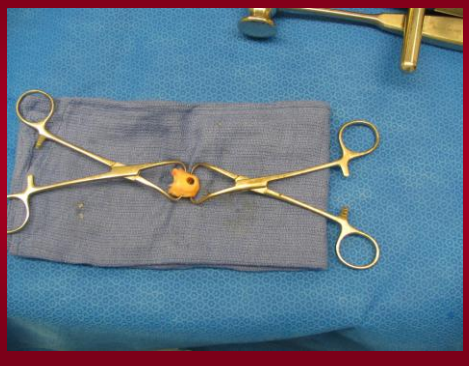

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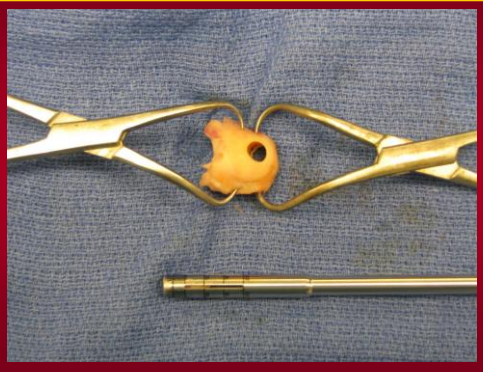

Case 1

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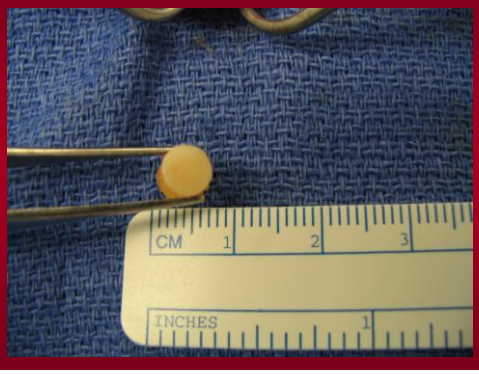
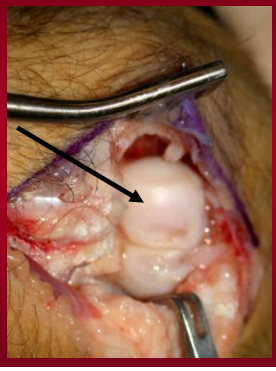


Case 1

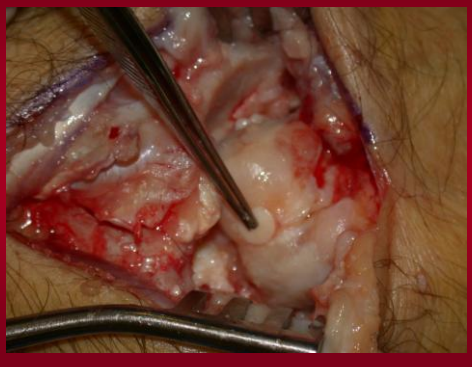
Case 2



Case 2

Case 2

Case 2



Case 3


Case 3

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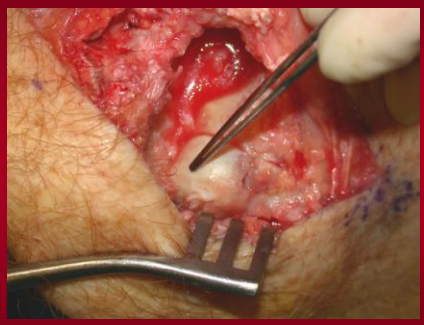
Case 3



graft in place

Osteochondral Autografting in PRC

Summary:

- Osteochondral autografting can be successfully done in the PRC with capitate chondrosis
- The resected carpal bones provide an adequate source of autograft
- PRC with osteochondral autografting extends the indications of PRC and
- broadens the treatment options for arthritides of the wrist

Sponsors & Acknowledgements

We would like to thank Arthrex for their kind donation of grafting tools for this research.

Thanks to our Arthrex Representative Carol Pribela for her support and interest.

Thanks to our Arthrex Engineer Robert Sluss.

The Curtis
National Hand Center
at Union Memorial Hospital

Descending Geniculate Artery flaps for reconstruction of the recalcitrant scaphoid nonunion

James Higgins, MD

Chief of Hand Surgery
Raymond Curtis National Hand Center
Baltimore, MD

NATIONAL HAND SPECIALISTS

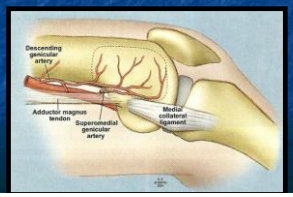
Medial femoral condyle corticoperiosteal flap: Scaphoid Nonunions

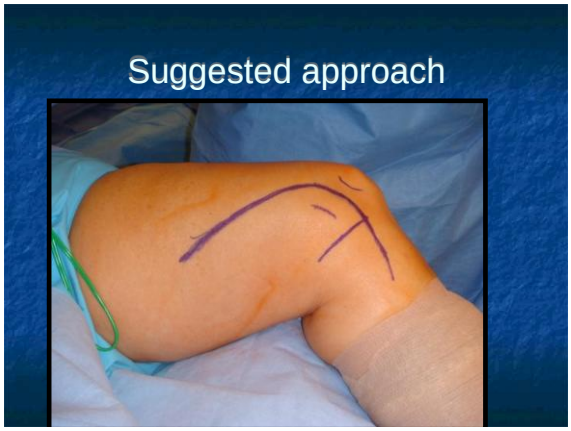
Doi K et al.
JHS 25(3):507-519. 2000.

- 10 patients with established nonunions
- 10 achieved union at avg 12 weeks

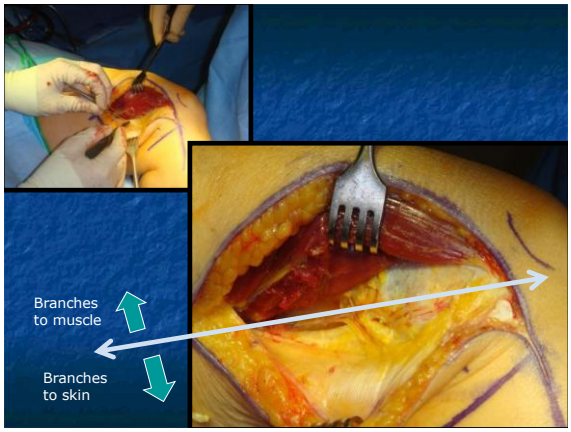
Jones DB, Buerger H, Bishop AT,.
PRS 125:1176-84. 2010.

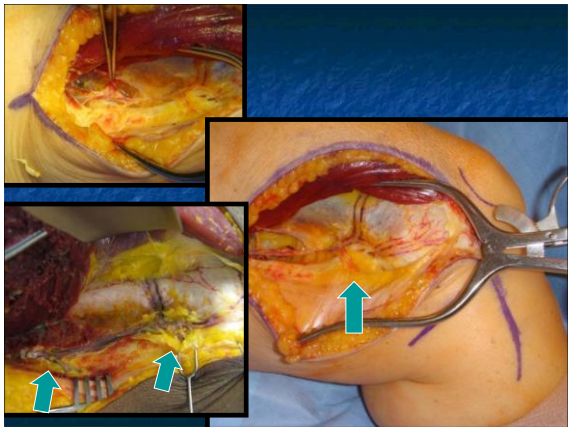
- 12 patients
- All achieved union avg 13 weeks (6-26)

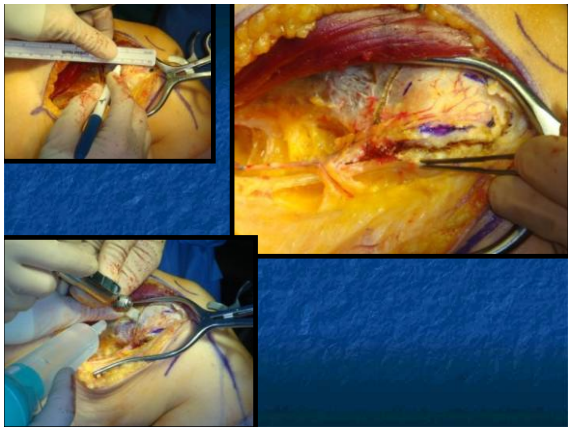


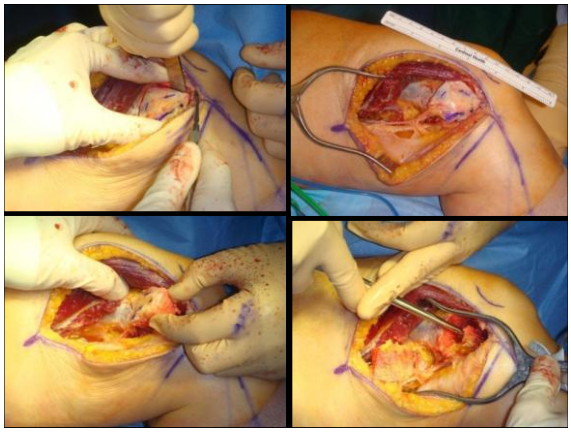

Suggested approach

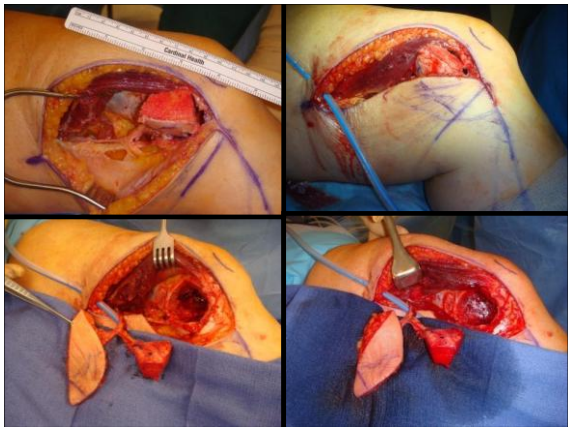

Subfascial dissection protects skin perforators


Branches to muscle
Branches to skin





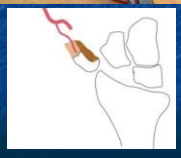




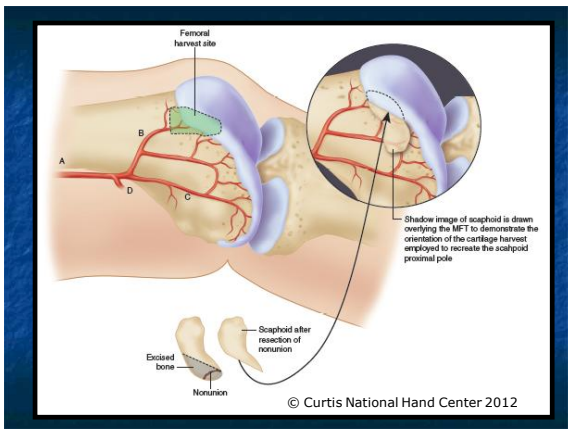
Cartilage-bearing Medial Femoral Trochlea (MFT) flaps

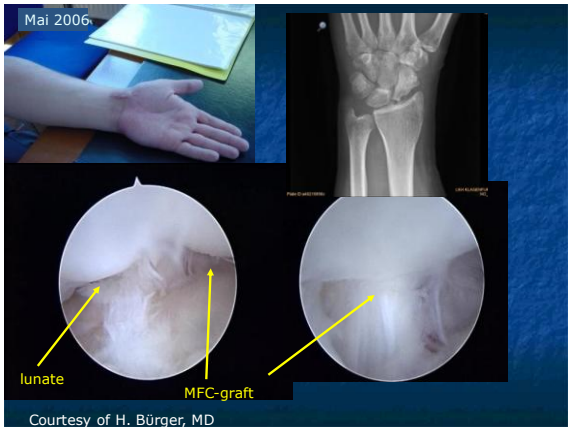
20y/o male with 3 year hx scaphoid nonunion
Reconstruction 2006

Kalicke T, Burger H, Muller EJ. Unfallchirurg 2008; 111:201-205.

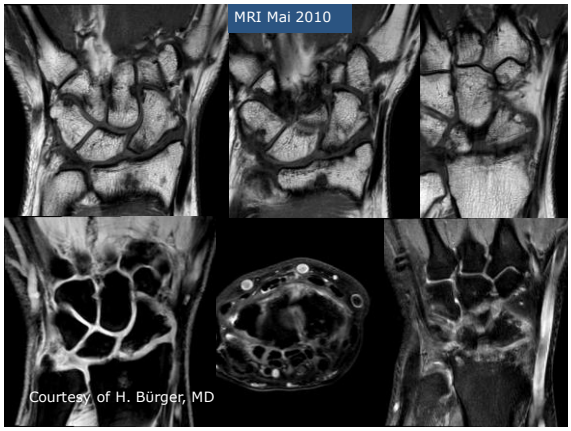


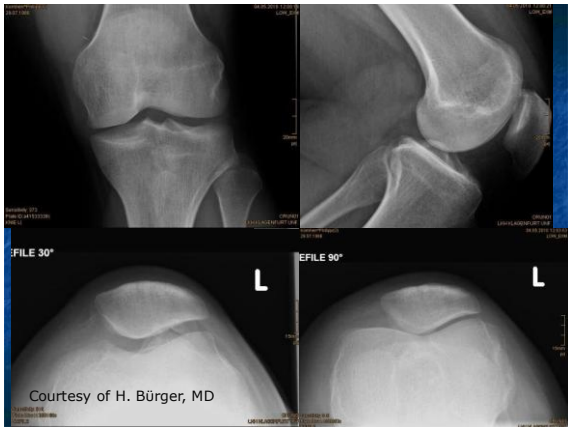
Courtesy of H. Bürger, MD

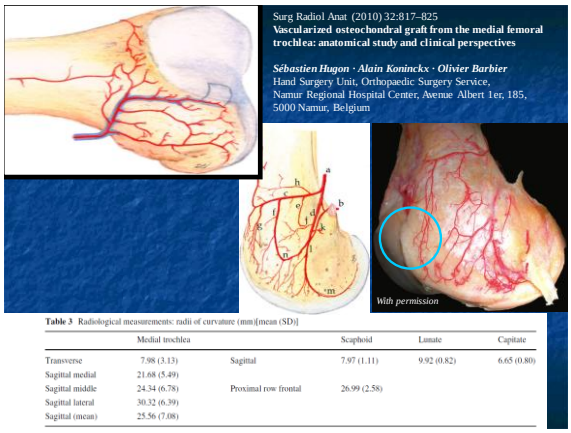


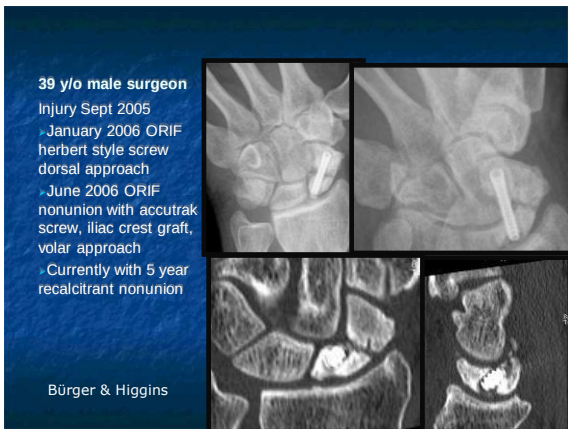

Mai 2006
lunate
MFC-graft
Courtesy of H. Bürger, MD

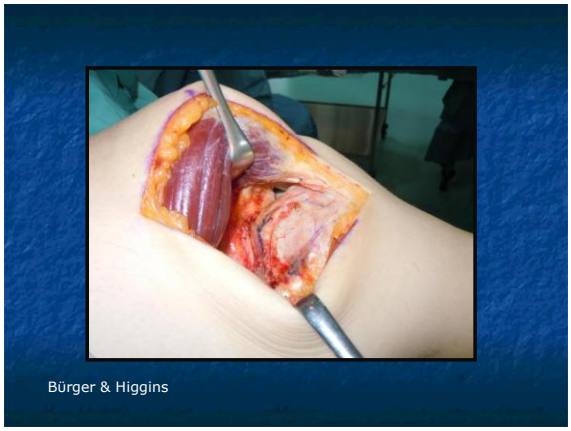

Video
Mai 2006
Mai 2010
Mai 2010
Courtesy of H. Bürger, MD

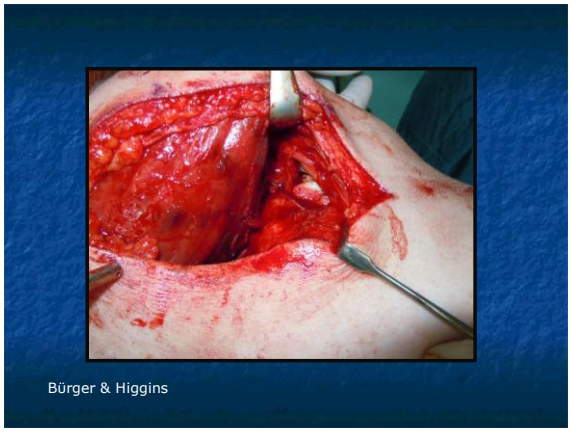

MRI Mai 2010
Courtesy of H. Bürger, MD


EFILE 30°
L
EFILE 90°
L
Courtesy of H. Bürger, MD


Surg Radiol Anat (2010) 32:817–825
Vascularized osteochondral graft from the medial femoral trochlea: anatomical study and clinical perspectives
Sébastien Hugon · Alain Koninckx · Olivier Barbier
Hand Surgery Unit, Orthopaedic Surgery Service, Namur Regional Hospital Center, Avenue Albert 1er, 185, 5000 Namur, Belgium
With permission
Table 3 Radiological measurements: radii of curvature (mm)[mean (SD)]
Medial trochlea
Transverse 7.98 (3.13)
Sagittal medial 21.68 (5.49)
Sagittal middle 24.34 (6.78)
Sagittal lateral 30.32 (6.39)
Sagittal (mean) 25.56 (7.08)
Sagittal
Proximal row frontal
Scaphoid 7.97 (1.11)
Lunate 9.92 (0.82)
Capitate 6.65 (0.80)
26.99 (2.58)


39 y/o male surgeon
Injury Sept 2005
January 2006 ORIF herbert style screw dorsal approach
June 2006 ORIF nonunion with accutrak screw, iliac crest graft, volar approach
Currently with 5 year recalcitrant nonunion
Bürger & Higgins


Bürger & Higgins

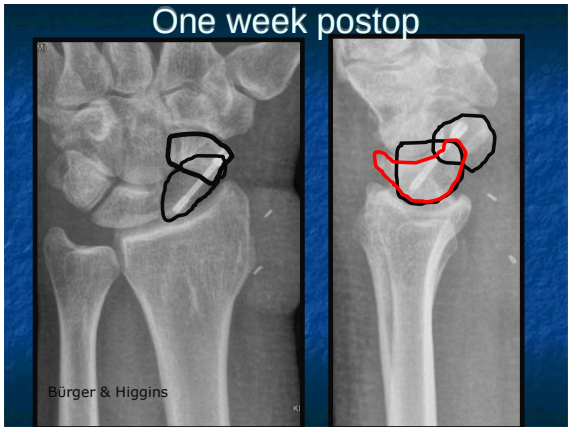

Bürger & Higgins


Bürger & Higgins


Bürger & Higgins


One week postop
L
Bettaufnahme
Bettaufnahme
Bürger & Higgins


1 week postop
Bürger & Higgins


One week postop
Bürger & Higgins

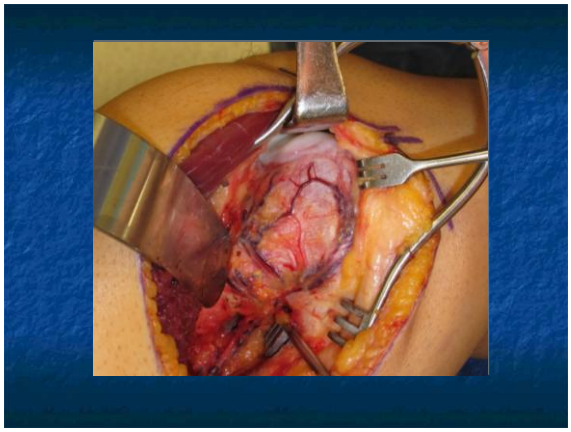

One week postop
Bürger & Higgins

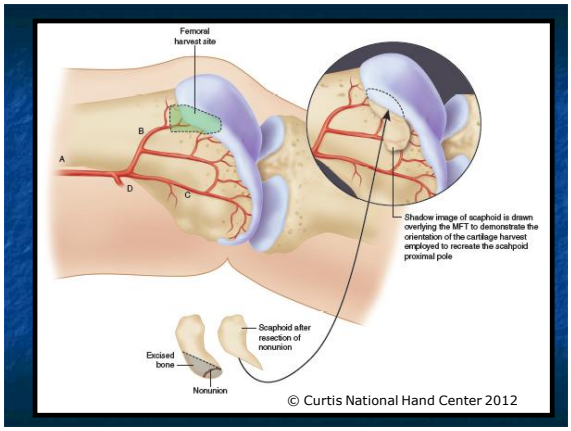

8 months postop

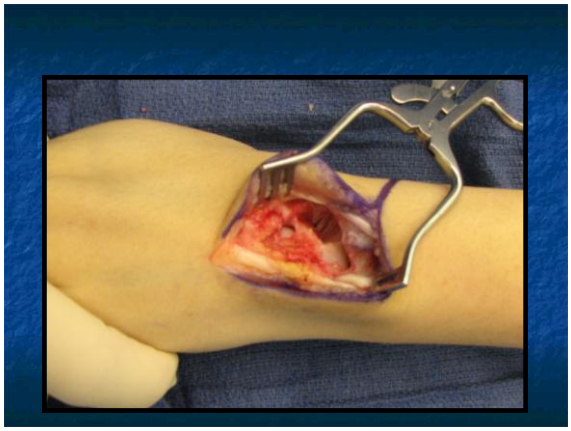
One year postop

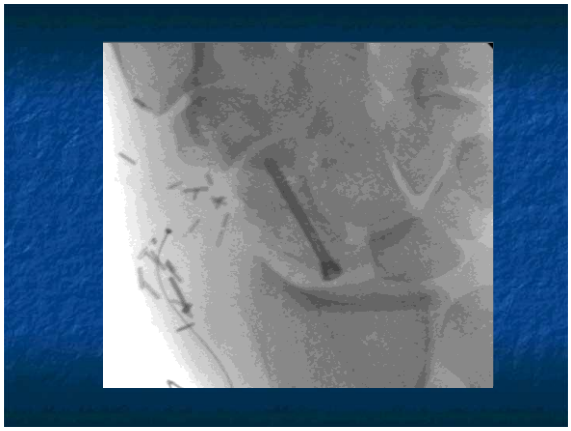
3 years postop

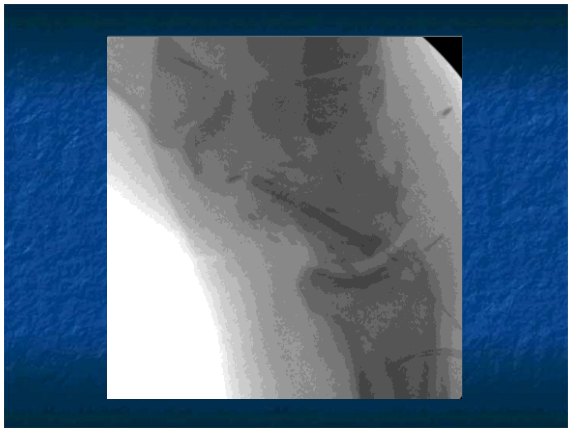
- 27 y.o. RHD male proximal scaphoid fx 2 years ago
- Initially treated conservatively > non-union.
- One year ago treated with 1,2-ICSRA vascularized bone-grafting and screw fixation. Continued to have pain and difficulty with function.

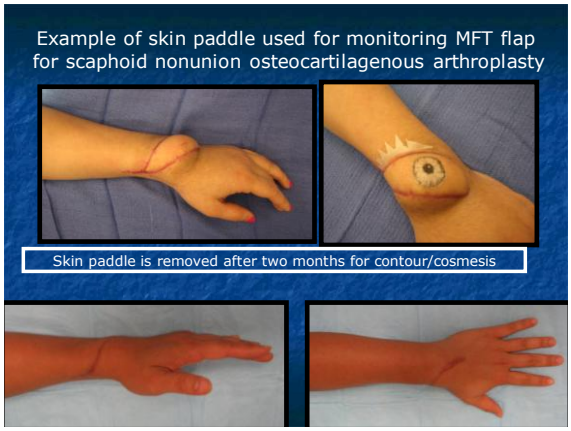



Femoral harvest site
A
B
C
D
Shadow image of scaphoid is drawn overlying the MFT to demonstrate the orientation of the cartilage harvest employed to recreate the scahpoid proximal pole
Scaphoid after resection of nonunion
Excised bone
Nonunion
© Curtis National Hand Center 2012





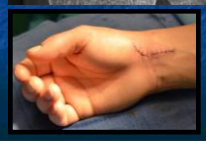



Example of skin paddle used for monitoring MFT flap for scaphoid nonunion osteocartilagenous arthroplasty
Skin paddle is removed after two months for contour/cosmesis


4 weeks postop.


One year postop
Bürger H, Windhofer C, Gaggl A, Higgins, JP. Jour Hand Surg (A) April 2013

Alternative volar approach



Courtesy Dr Heinz Bürger

Thumb Carpometacarpal Arthroplasty with Ligament Reconstruction and Interposition Costochondral Arthroplasty

Thomas Trumble M.D., Gregory Rafijah M.D., Dennis Heaton MSPA,PA-C

Overview

- Multiple techniques currently available for stabilization, and reconstruction of the basal joint of the thumb.
- Ultimate goal is to provide substantial pain relief while maintaining TM height, stability, and overall strength and function.

Demographics

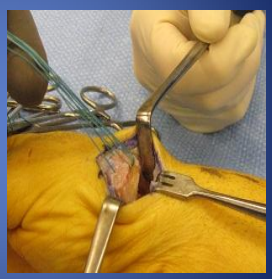
- 58 patients; 66 thumbs.
- Eaton Stage III STT sparing pattern OA.
- Age range 40-88 years
- 48 female, 10 male.
- No patients were insulin dependent diabetics, or suffered from inflammatory arthropathies.

Technique

- **Curvilinear incision is made along the volar radial aspect of the thumb CMC joint. EPB tendon, DRSN, and deep branch of the radial artery are carefully dissected and retracted volarly and dorsally of the incision .**

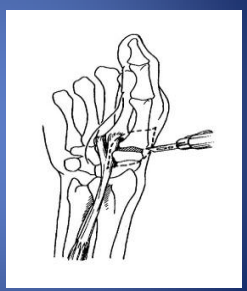
Technique

- The capsule including, including the APL insertion, are sharply dissected off the metacarpal, and later reattached with braided, non-absorbable, sutures through drill holes.



Technique

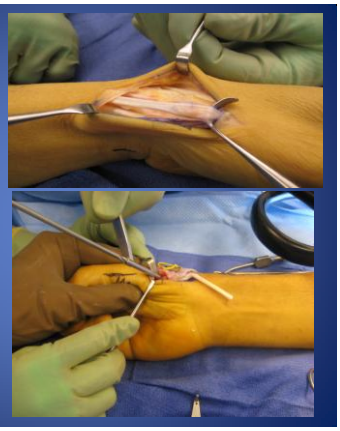
- An arthrotomy is performed and the STT joint is inspected to confirm that it is free of degeneration.
- The trapezium is then partially resected using an oscillating saw.



Technique

-The FCR tendon is split longitudinally, and a length of 12cm is harvested through a longitudinal incision at the junction of the distal medial thirds of the forearm.

-Drill holes are placed from the base of the metacarpal to the radial aspect of the thumb metacarpal, and from the palmar surface of the trapezium to the distal articular surface.



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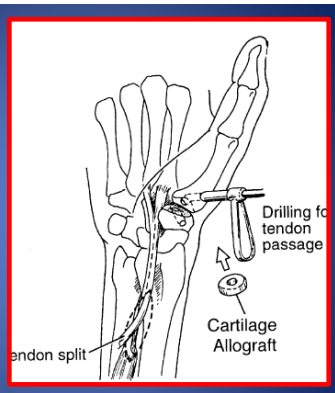


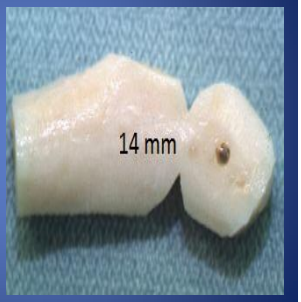
Littler ref

-The FCR tendon is split longitudinally, and a length of 12cm is harvested through a longitudinal incision at the junction of the distal medial thirds of the forearm.

-Drill holes are placed from the base of the metacarpal to the radial aspect of the thumb metacarpal, and from the palmar surface of the trapezium to the distal articular surface.

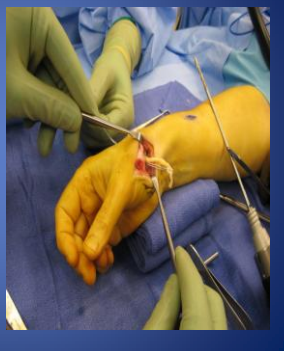
Technique

- A costochondral allograft is shaped into a disc to fit the dimensions of the resected portion of the trapezium.



Technique

- **22 gauge cerclage wire is used to weave the FCR tendon through the trapezium, the allograft cartilage, and the metacarpal. The tendon is then sutured back on itself with a non-absorbable braided suture.**



Post-operative

- **0-6 weeks:The patient is placed in a forearm based thumb spica cast**
- **6-12 weeks: A removable splint is then fitted, and the patient begins AROM of the MCP, and abduction and rotation of the CMC. PROM is not started to avoid stress to the ligament reconstruction.**
- **At 8- 10 weeks unrestricted thumb motion is started.**

Results

- **DASH questionnaires were completed by each patient.**
- **Grip strength and lateral pinch.**
- **TM height.**
- **TM subluxation.**
- **Radial abduction**
- **Palmar abduction.**
- **MCP ROM**
- **IP ROM**

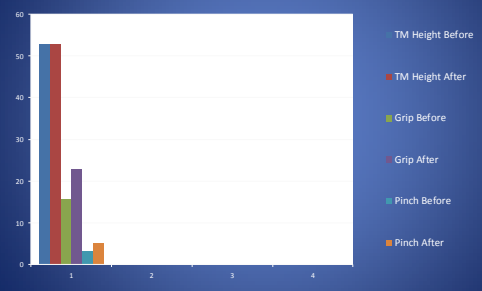
Results- Radiographic

- TM Height is measured by taking the distance from PA radiographs.
- Measurments are taken from the proximal edge of the trapezium to the distal end of the subchondral bone of the metacarpal.
- The proximal phalanx of the thumb was used as a comparative standard.

Outcomes

- Avg. DASH postop was 11
- Grip increased by 32%
- Pinch increased by 38%
- TM height well maintained (53.1mm pre; 52.9mm post.)
- TM alignment maintained, minimal subluxation.(0.21mm pre; 0.22mm post.)
- Radial abduction increased by 3˚ (± 6°)
- Palmar abduction **increased by 1˚ (± 8°)**
- **MCP and IP ROM** did not significantly increase or decrease

Outcomes



Outcomes

- Postoperative pain relief and pinch/grip strength had a direct correlation with patient satisfaction.
- Grip and pinch improved with maintenance of TM height and decreased TM subluxation.
- DASH score decreased as function and stability were maintained, as evident in the maintenance of pinch, grip, and overall TM stability.

Complications

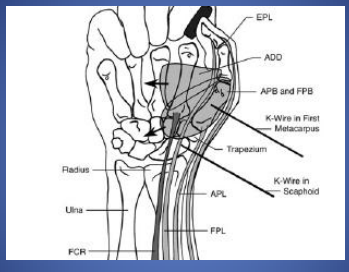
- 1 patient in the series progressed to develop stage IV OA ofthe STT joint.
- A complete trapeziectomy was performed. A silastic tie-in prosthesis was used to maintain TM height. At one year follow up, the patient had excellent pain relief, and was able to return to all pre-operative activity.

Discussion

- Research published by Luria et al, entitled, "*Biomechanic Analysis of Trapeziectomy, Ligament Reconstruction, and Tie-In Trapezium Implant Arthroplasty for Thumb Carpometacarpal Arthritis: A Cadaver Study."(J. Hand Surg. 2007;32A 697-706)*

Thumb Stability and Function

- Conclusions: Interposition arthroplasty to maintain height and ligament reconstruction for stability provided the most stable construct.

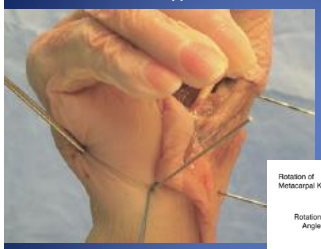


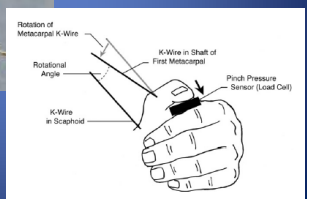
Luria Et al, J. Hand Surg 32A 697-706

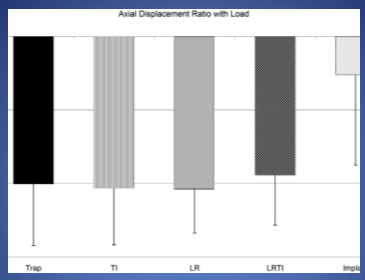
Figure 5. The average axial displacement (proximal metacarpal migration) ratio with loading of the tendons (n 12). Implant, silicone trapezial implant; Trap, trapeziectomy

Luria Et al, J. Hand Surg 32A 697-706

Tension Applied to Tendons Simulates Pinch







Luria Et al, J. Hand Surg 32A 697-706

Figure 5. The average axial displacement (proximal metacarpal migration) ratio with loading of the tendons (n 12). Implant, silicone trapezial implant; Trap, trapeziectomy

Discussion

- This technique of interposition arthroplasty and ligament reconstruction showed improved patient outcomes, based on clinical measurments obtained postoperatively, including DASH, TM height, TM subluxation, grip, pinch

Thank You

Scaphoid Nonunion

Jeffrey Yao, MD
Associate Professor of Orthopaedic Surgery
Stanford University Medical Center
II Curso Internacional de Post Grado
Actualización en Cirugía de
la Mano, Muñeca y Codo
August 8, 2013

Disclosures

- The following relationships exist:

1. Grants
   American Foundation for Surgery of the Hand
2. Royalties and stock options
   Arthrex
3. Consulting income
   Smith and Nephew Endoscopy, Arthrex, Axogen
4. Research and educational support
   Arthrex
5. Editorial Honoraria
   Elsevier, Lippincott
6. Speakers Bureaus
   Arthrex, Trimed

Treatment Options for Scaphoid Nonunions

- Bone Graft
  - Iliac Crest, Russe Method, Volar Wedge Graft (Humpback)
- Vascularized Bone Grafts
  - 1,2 ICSRA
  - Vascular Bundle Implantation (Hori)
  - Pronator Pedicle Graft
  - Volar carpal artery pedicled graft
  - Free medial femoral condyle graft

Treatment Options for Scaphoid Nonunions, Cont.

- Salvage Procedures
  - In the case of DJD
  - Denervation
    - PIN, AIN
  - Radial Styloidectomy
  - Proximal Row Carpectomy
  - Partial or Total Wrist Arthrodesis
  - Scaphoid Arthroplasty

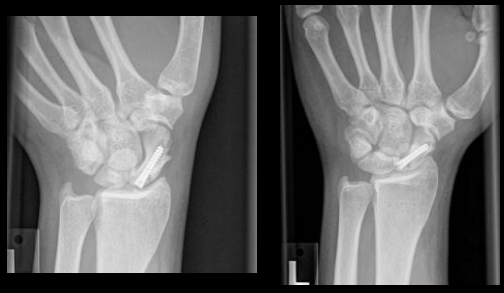
What About a Unsalvagable Proximal Pole Scaphoid Nonunion with no DJD?

History

- 20 y/o football lineman sustained a L scaphoid fracture during a game
- Treated with CRPF
- 5 months later, resumed high impact activity, developed pain with wrist motion

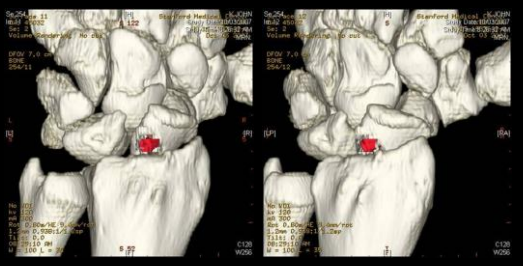
Initial Post-Op Xrays

5 Months Post-Op



5 Mos Post-Op CT

CT Reconstructions



Options?

- Proximal pole excision
  - Too large
- Salvage Procedures
  - Too young
  - No DJD
- Excision and Interposition
  - Silastic- synovitis
  - Pyrocarbon – more data
  - Tendon – carpal height
  - Scaphoid allograft – ? healing potential
  - Rib osteochondral autograft?

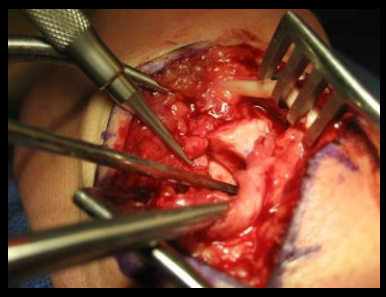
Rib Osteochondral Autograft

- Used for mandibular reconstruction
  - Stone, Arch Otolaryngol. 1965
- Also described for:
  - Plastic surgery
    - Nasal reconstruction
  - Treatment of osteochondral articular defects
- Scaphoid Reconstruction
  - Sandow (1989)

Fragmented Proximal Pole

Void Following Excision

Bleeding at the Remaining Waist

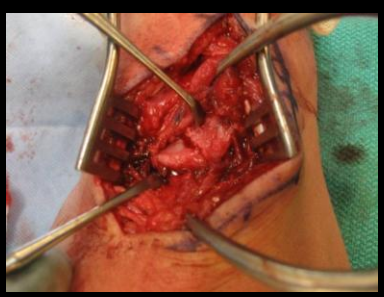


Rib Osteochondral Autograft from 7th Rib via Submammary Incision

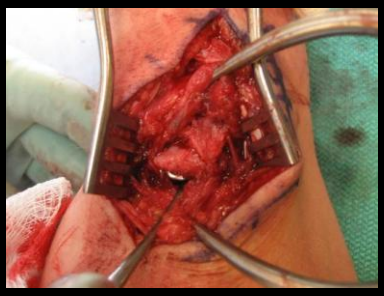
Rib Osteochondral Autograft from 7th Rib via Submammary Incision

Cartilage / Bone

Autograft Implanted



Autograft Pinned

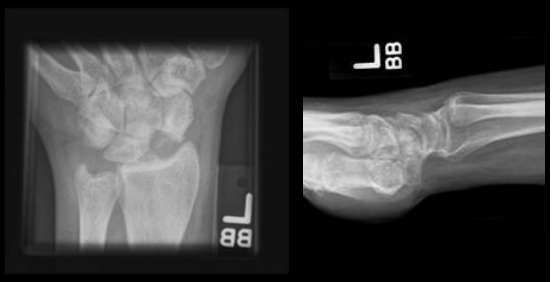


Post-Operative Regimen

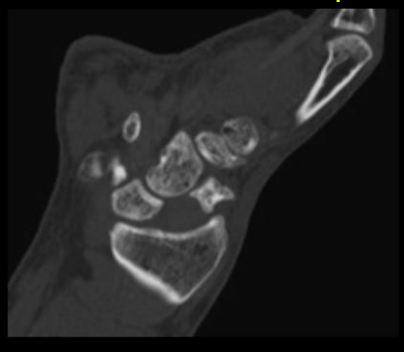
- Chest radiograph in PACU
- 7-10 days: Splint immobilization
- 2-6 weeks: Cast immobilization
- After healing is confirmed (6-12 weeks): Pins are removed and onset of ROM exercises, advance to strengthening exercises as tolerated
- 12 weeks: Weight-lifting, pushups
- 4-5 mos: Contact sports

2 Weeks Post-Op

24 Months Post-Op



24 Months Post-Op



24 Months Post-Op

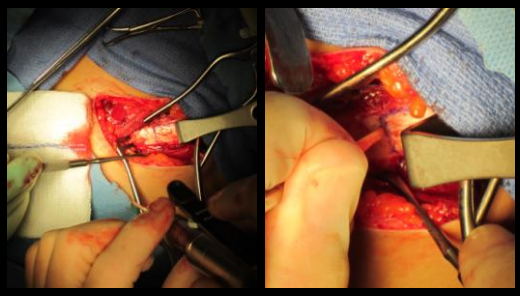
24 Months Post-Op

- DASH: 9.1
- PRWE: 18
- ROM:
  - Flexion: 80/70
  - Extension: 60/65
  - RD: 20/15
  - UD: 40/40
- JAMAR: 100/110

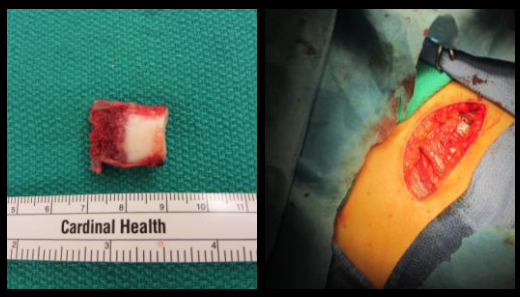
Scaphoid Nonunion Failed VBG

Exposure to the 7th Rib

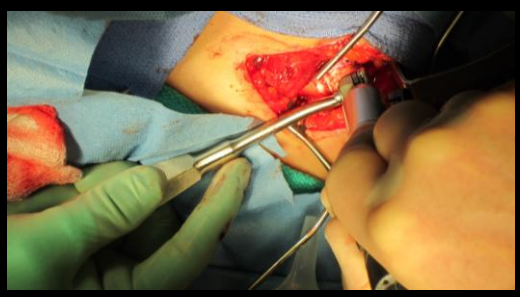
Harvest Rib Graft



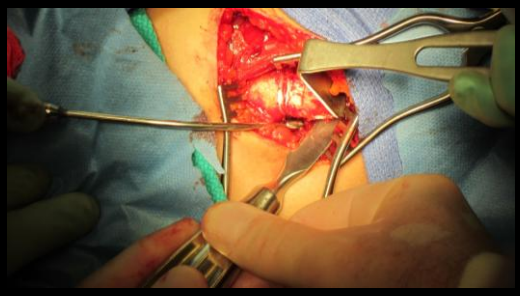
Harvested Graft



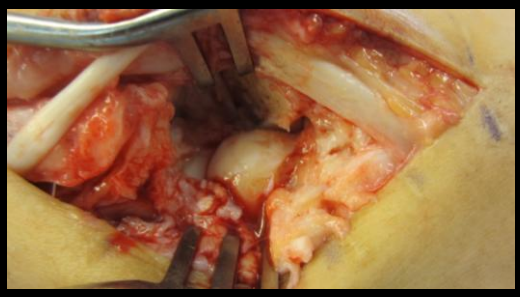
Harvest Rib with Saw



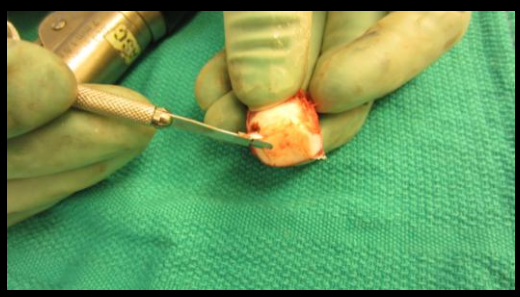
Elevate the Rib from the Pleura



Scaphoid Defect



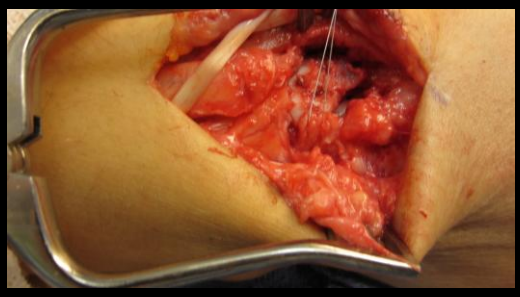
Shape the Graft



Inset the Graft

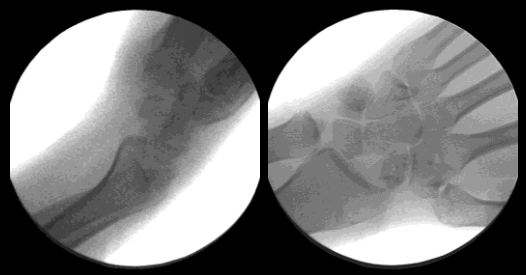
Graft Implanted

Repair SLIL



Final Fixation

2 Months Postop (pins removed)



Case #2

- 24 y/o with L proximal pole scaphoid nonunion treated with 1,2 ICSRA VBG 8 months ago
- Continued to have painful ROM

8 months Post VBG

Post-Op Rib Osteochondral Autograft

3 Years Post-Op Rib Osteochondral Autograft

3 Years Post-Op Rib Osteochondral Autograft

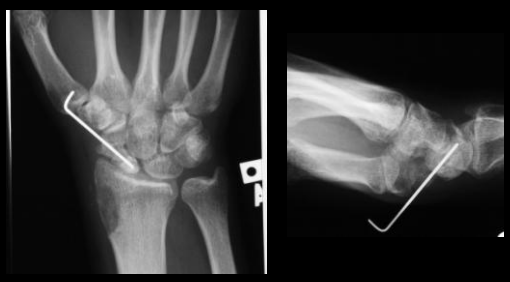
3 Years Post-Op Rib Osteochondral Autograft

- DASH: 4.5
- PRWE: 11
- ROM:
  - Flexion: 85/60
  - Extension: 80/70
  - RD: 30/10
  - UD: 40/38
- JAMAR: 95/75

Case # 3

- 18 y/o with L scaphoid nonunion treated with 1,2 ICSRA VBG 12 months prior
- Continued to have painful ROM

2 months Post VBG



12 months Post VBG

Post-Op Rib Osteochondral Autograft

Returned to work as a heavy laborer

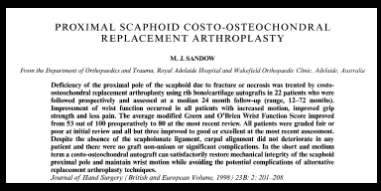
9 Years Post-Op Rib Osteochondral Autograft

9 Years Post-Op Rib Osteochondral Autograft

9 Years Post-Op Rib Osteochondral Autograft

- DASH: 36
- PRWE: 56
- ROM:
  - Flexion: 80/50
  - Extension: 66/40
  - RD: 25/12
  - UD: 45/35
- JAMAR: 100/62

Outcome Studies



PROXIMAL SCAPHOID COSTO-OSTEOCHONDRAL REPLACEMENT ARTHROPLASTY

M. J. SANDOW

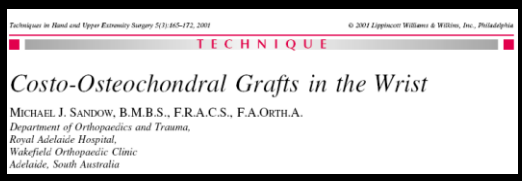
From the Department of Orthopaedics and Trauma, Royal Adelaide Hospital and Wakefield Orthopaedic Clinic, Adelaide, Australia

Deficiency of the proximal pole of the scaphoid due to fracture or necrosis was treated by costo-osteochondral replacement arthroplasty using rib bone/cartilage autografts in 22 patients who were followed prospectively and assessed at a median 24 month follow-up (range, 12–72 months). Improvement of wrist function occurred in all patients with increased motion, improved grip strength and less pain. The average modified Green and O'Brien Wrist Function Score improved from 53 out of 100 preoperatively to 80 at the most recent review. All patients were graded fair or poor at initial review and all but three improved to good or excellent at the most recent assessment. Despite the absence of the scapholunate ligament, carpal alignment did not deteriorate in any patient and there were no graft non-unions or significant complications. In the short and medium term a costo-osteochondral autograft can satisfactorily restore mechanical integrity of the scaphoid proximal pole and maintain wrist motion while avoiding the potential complications of alternative replacement arthroplasty techniques.

Journal of Hand Surgery (British and European Volume, 1998) 23B: 2: 201–208

- Sandow (JHS Br, 1998)
  - 19/22 G/E results at median 24 month f/u
    - Improved grip (59-80%), ROM, less pain
    - No deterioration of carpal alignment
    - No non-unions, no major complications (1 mild hemothorax)

Outcome Studies



Techniques in Hand and Upper Extremity Surgery 5(1):165–172, 2001 © 2001 Lippincott Williams & Wilkins, Inc., Philadelphia

TECHNIQUE

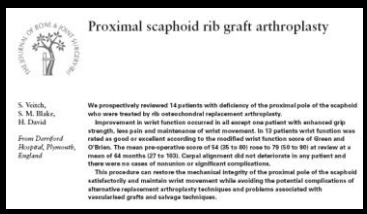
Costo-Osteochondral Grafts in the Wrist

MICHAEL J. SANDOW, B.M.B.S., F.R.A.C.S., F.A.ORTH.A.

Department of Orthopaedics and Trauma,
Royal Adelaide Hospital,
Wakefield Orthopaedic Clinic
Adelaide, South Australia

- Sandow (Techniques H&UE, 2001)
  - 47 patients
  - 85% G/E results at median 15 month f/u
    - No apparent non-unions, no major complications (1 mild hemothorax, 1 pleural effusion)

Outcome Studies



Proximal scaphoid rib graft arthroplasty

S. Veitch, S. M. Blake, H. David

From Derriford Hospital, Plymouth, England

We prospectively reviewed 14 patients with deficiency of the proximal pole of the scaphoid who were treated by rib osteochondral replacement arthroplasty.

Improvement in wrist function occurred in all except one patient with enhanced grip strength, less pain and maintenance of wrist movement. In 13 patients wrist function was rated as good or excellent according to the modified wrist function score of Green and O'Brien. The mean pre-operative score of 54 (35 to 80) rose to 79 (50 to 90) at review at a mean of 64 months (27 to 103). Carpal alignment did not deteriorate in any patient and there were no cases of nonunion or significant complications.

This procedure can restore the mechanical integrity of the proximal pole of the scaphoid satisfactorily and maintain wrist movement while avoiding the potential complications of alternative replacement arthroplasty techniques and problems associated with vascularised grafts and salvage techniques.

- Veitch (JBJS Br, 2007)
  - 13/14 G/E results at mean 64 month f/u
  - Improved grip, ROM, less pain
  - No non-unions, no complications

Unsalvageable Proximal Pole Scaphoid Defects

- Uncommon
- Osteochondral autografts
  - Viable alternative
    - Chronic scaphoid nonunions
    - No evidence of arthritis
  - where salvage procedures may not be ideal
    - Younger patients
    - No DJD
  - Outcomes studies remain promising

Thank You!

Osteochondral Autograft Transplantation for Articular Defects in the Hand and Wrist

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PETER F. DELUCA, M.D.

Disclosures

- I have no conflicts of interest.

Purpose

- The osteochondral autograft transfer system (OATS) procedure has been described for osteochondral defects
  - i.e., knee/talus
- Hypothesize that this procedure can be used for articular defects in the hand and wrist, with good functional results

Background

- Hyaline cartilage has a poor intrinsic healing capacity
  - treatment of focal osteochondral defects remains a challenging problem
- Osteochondral defects in the hand and wrist are relatively infrequent injuries and often present in young patients with high levels of activity or trauma
- No gold standard of treatment
- Joint preserving techniques
  - Debridement, microfracture, ACI, OATS
- Salvage techniques predictable for pain relief
  - Expense of strength/motion
- OATS advantages
  - Hyaline cartilage transplantation
  - Low morbidity

Methods

- Retrospective chart review of four male patients
- Treated with an OATS procedure for an articular defect of their hand or wrist
  - May 2010 and February 2011.
- Avg age: 30 y/o
- All pts had failed months to years of conservative management

Methods

- Injuries consisted of osteochondral defects in:
  - proximal lunate (2)
  - proximal scaphoid
  - index metacarpal head

Outcome variables

- four month postoperative grip strength
  - Jamar III position
- range of motion (wrist/MCP)
- time to return to normal activity
- radiographic evidence of osteochondral plug in-growth

Patient #1

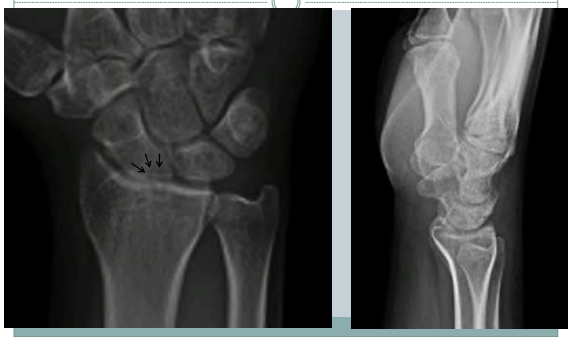
- 20 y/o M student
- Recreational hockey
- LHD
- 17 mths prior – fall off roof
- R distal radius fx and L both bone fx – ORIF
- Persistent R wrist pain despite PT
- ROM
  - F/E: 60°/55°
  - R/U: 20°/45°
- Jamar III grip (**R**/L): 52/65 PSI

Patient #1 (pre-op)

Patient #2

- 36 y/o M financial advisor
- Avid golfer
- RHD
- Fall off ladder 1 ½ yrs earlier
- R min displaced radial/ulnar styloid fx – non-op tx
- Failed 5 mths of PT
- ROM
  - F/E: 25°/40°
  - R/U: 20°/45°
- Jamar III grip (**R**/L): 100/110 PSI

Patient #2 (pre-op)



Patient #3

- 40 y/o M CFO
- Recreational golf/hockey
- RHD
- 2 yrs s/p R wrist arthroscopy and TFCC repair
- Persistent R wrist pain, crepitus radio-lunate joint
- ROM
  - F/E: 40°/40°
- Jamar III grip (**R**/L): 55/80 PSI

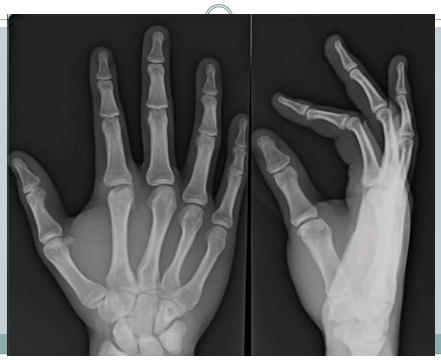
Patient #3 (pre-op)

Patient #3 (pre-op)

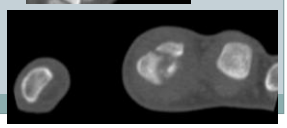
Patient #4

- 23 y/o M minor league baseball player
- RHD
- Hit by pitch 16 mths prior
- Pain at index MCP
- Steroid injection – minimal relief
- ROM (MCP) w/ crepitus
  - F/E: 60°/0°
- Jamar III grip (**R**/L): 75/140 PSI

Patient #4 (pre-op) – 5 mths after injury



Patient #4



Surgery

- All cases were performed by me
- Appropriate-sized graft from pt's contralateral lateral femoral condyle was performed by our sports medicine colleagues

Technique for lunate/scaphoid injuries

- Diagnostic wrist arthroscopy initially used to assess the articular surface for carpal injuries (patients #1-3)
  - No distal radius lesions noted
  - Adhesions debrided
- 3rd/4th compartment extensor interval approach used and graft tapped into position using press-fit technique into recipient site
- Articular congruity confirmed via direct visualization and fluoroscopy
- Full ROM achieved with no crepitus

Technique for MC head injury

- EDC/EIP interval and dorsal capsulotomy utilized
- Osteophyte removed
- Base of proximal phalanx uninjured
- Donor/graft site technique same as for carpal injuries
- Direct/fluoroscopic visualization again confirmed articular congruity

Post-op Protocol

- Active range of motion was initiated following the first post-operative visit
- Removable splint for comfort
- WBAT to lower extremity
- Strengthening w/ formal OT/PT began at 4 weeks post-operatively
- Post-operative radiographs were obtained at 6 weeks

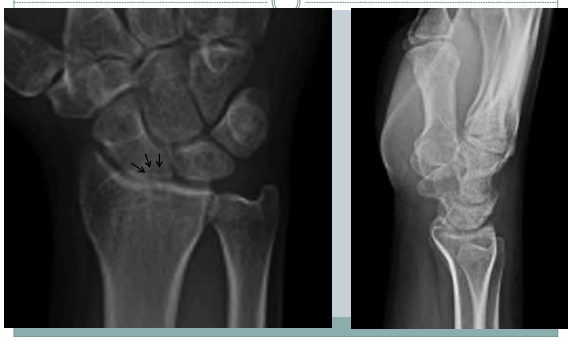
Post op Results

- Patient #1 (lunate)
  - ROM (F/E): 55°/50° ↓
  - Grip (R/L): 80/80 ↑
- Patient #2 (scaphoid)
  - ROM (F/E): 30°/55° ↑
  - Grip (R/L): 60/95 ↓
- Patient #3 (lunate)
  - ROM (F/E): 50°/40° ↑
  - Grip (R/L): 70/88 ↑
- Patient #4 (MC head)
  - ROM (F/E): 0°/80° ↑
  - Grip (R/L): 90/100 ↑

Patient #1 (pre-op)

Patient #1 (post-op) (12 mths)

Patient #2 (pre-op)

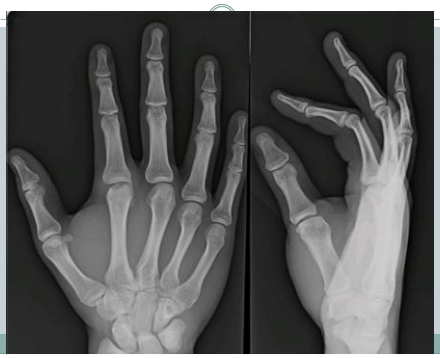


Patient #2 (post-op) (4 mths)

Patient #3

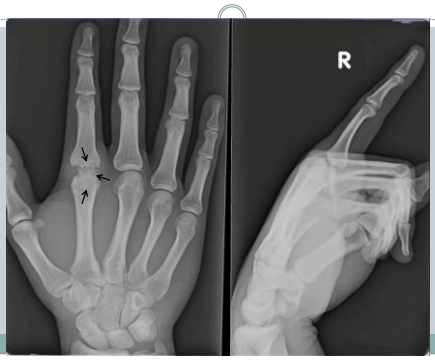
- No digital post-op films available – outside films showed graft in-growth

Patient #4 (pre-op) (17 mths after injury)



Patient #4

Patient #4 (post-op (4 mths)



Results

- Avg time from injury to surgery: 29 mths
- Minimum follow up: 6 mths
- Avg gain of motion: 6° (range: -5-20°)
- Avg gain of grip strength: 18 PSI (range: -40-28°)
- XR evidence of graft position and in-growth seen in all cases
- 1 pt w/ knee stiffness that resolved
- All patients satisfied with outcome and resumed their prior levels of activity
  - Golf/hockey/baseball

Results

Patient	Sex	Injury	Age	Occupation	Wrist F/E		MCP F/E		Jamar III R/L		Subjective	Time to full activity (mths)
					Pre	Post	Pre	Post	Pre	Post		
1	M	Osteochondral defect proximal lunate, prior ORIF distal radius fracture	20	College student	60/55	55/50	-		52/65	80/80	No crepitus or pain. No knee symptoms Returned to hockey	1
2	M	Osteochondral defect proximal scaphoid, prior radial styloid fracture treated non-operatively	36	Financial advisor	25/40	30/55	-		100/110	60/95	No crepitus or pain Mild knee stiffness	4
3	M	Osteochondral defect proximal lunate, prior arthroscopic TFCC repair, no history of trauma	40	Chief financial officer	40/40	50/40	-		55/80	70/88	No crepitus or pain No knee symptoms Returned to golf and hockey	3
4	M	Osteochondral defect index metacarpal head and AVN	23	Minor league 3rd baseman	-		60/0	80/0	75/140	90/100	No crepitus or pain No knee symptoms Returned to prior level of play	5.5

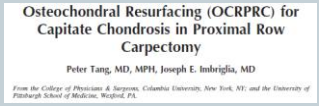
Case Reports


SCIENTIFIC ARTICLE

Osteochondral Autograft Transplantation for Osteochondritis Dissecans of the Scaphoid: Case Report

Young-Keun Lee, MD, PhD, Maley Lee, PhD, Jun-Mo Lee, MD, PhD

JHS Feb 2011


Osteochondral Resurfacing (OCRPRC) for Capitate Chondrosis in Proximal Row Carpectomy

Peter Tang, MD, MPH, Joseph E. Imbriglia, MD

From the College of Physicians & Surgeons, Columbia University, New York, NY; and the University of Pittsburgh School of Medicine, Wexford, PA.

JHS Nov 2007

OATS Procedure Conclusions

- Viable treatment option for the treatment of hand and wrist osteochondral defects in young, active patients who have failed conservative management
- Technically demanding
- Incorporates hyaline cartilage plug into the defect site
  - Capabilities of regrowth/regeneration[7]
  - Biomechanically superior to fibrocartilage[9]
- Successful outcomes:
  - congruent articular surface is achieved
  - motivated patient is able to complete an appropriate course of occupational hand therapy

Thank you!

- Questions?