Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Distal Radius External Fixation

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UCSF Department of Orthopaedic Surgery

Disclosures

None

Surgery Article

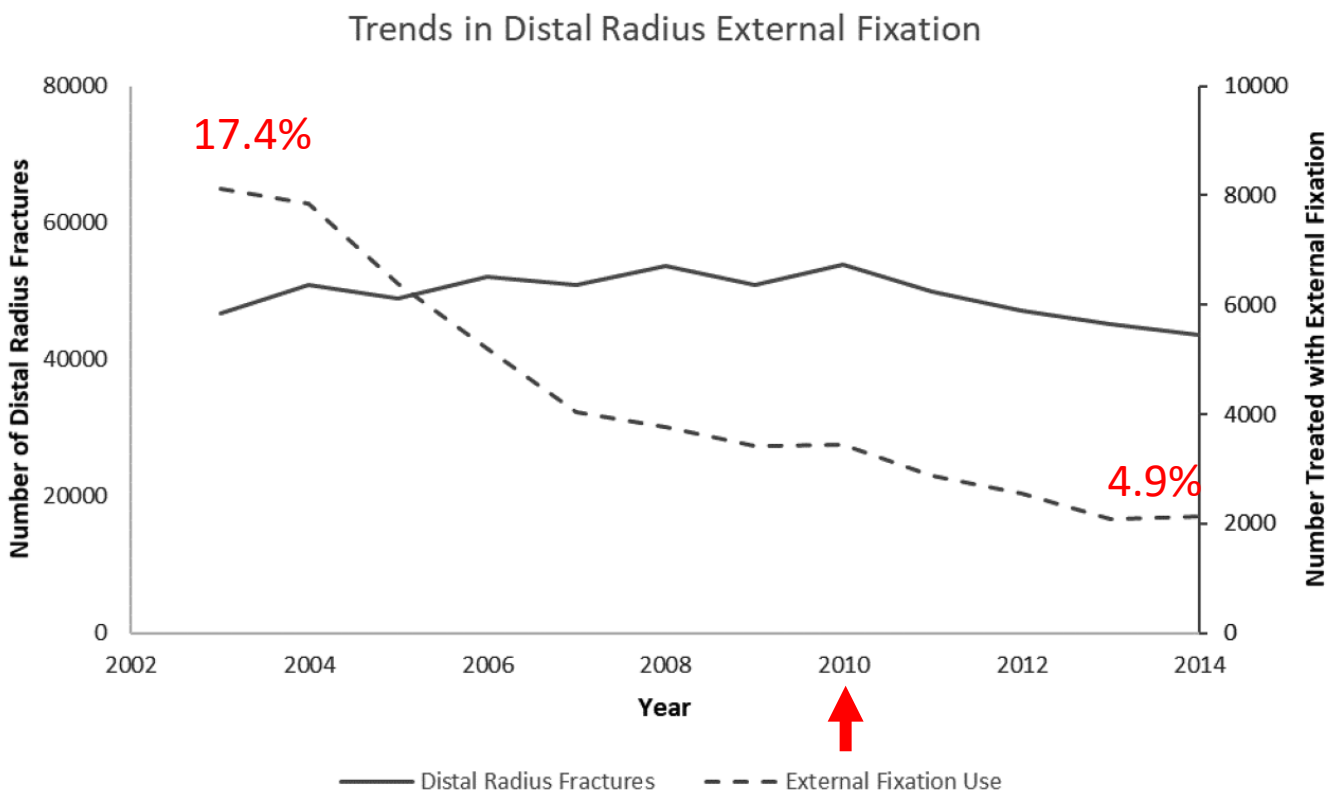
AAHS AMERICAN ASSOCIATION FOR HAND SURGERY

The Declining Use of Wrist-Spanning External Fixators

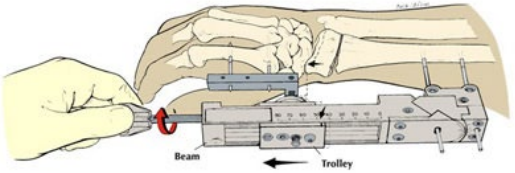
HAND
2020, Vol. 15(2) 255–263

DOI: 10.1177/1558944718791185
journals.sagepub.com/home/HAN

Venus Vakhshori[1], Alexis D. Rounds[1], Nathanael Heckmann[1], Ali Azad[1], Jessica M. Intravia[1], Santano Rosario[1], Milan Stevanovic[1], and Alidad Ghiassi[1]



NIS database



Epidemiological and Treatment Trends of Distal Radius Fractures across Multiple Age Groups

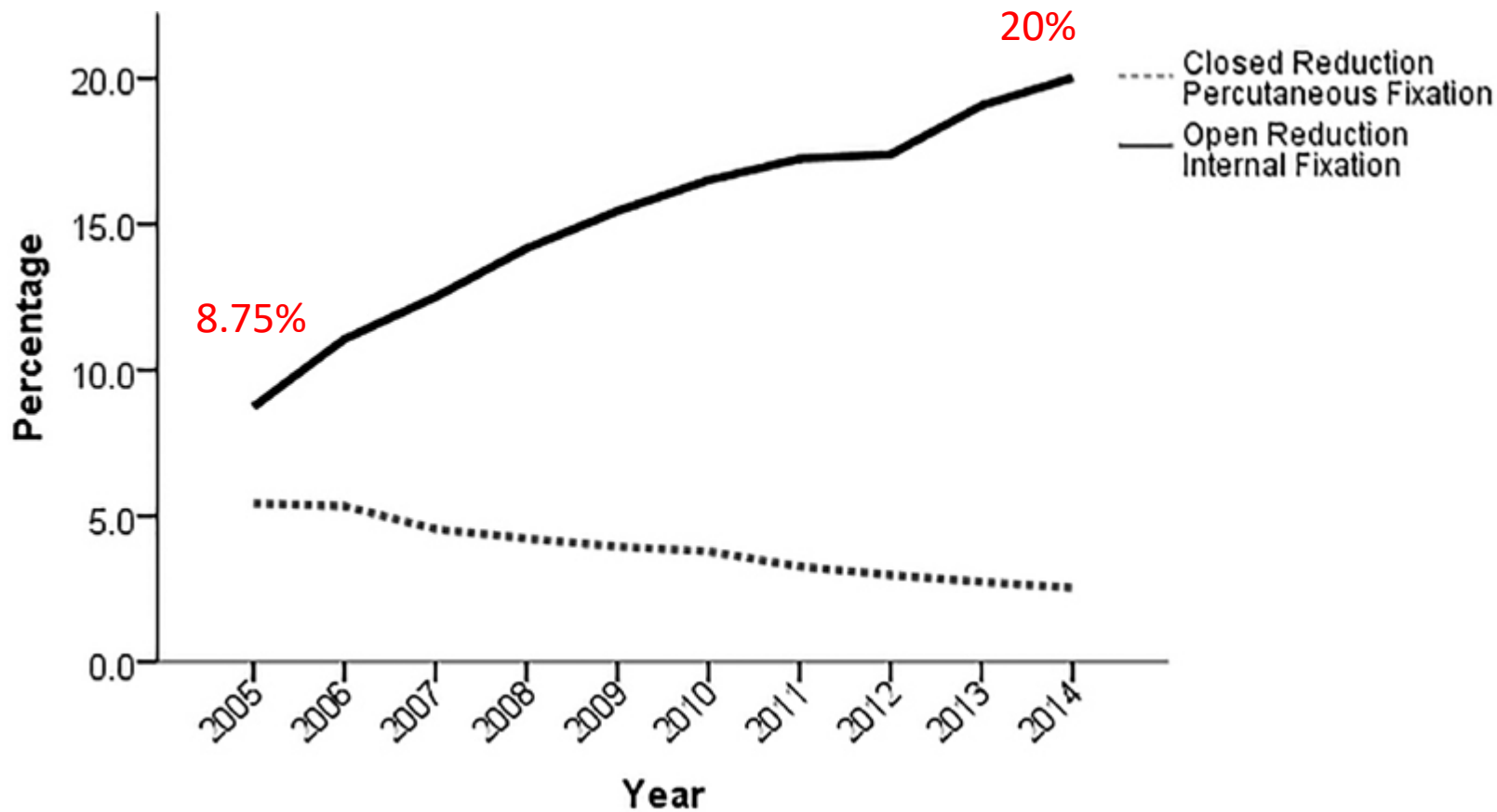
Ali Azad, MD[1] H. Paco Kang, MD[1] Ram K. Alluri, MD[1] Venus Vakhshori, MD[1] Harrison F. Kay, MD[1] Alidad Ghiassi, MD[1]

[1] Department of Orthopaedic Surgery, Keck Medical Center at the University of Southern California, Los Angeles, California

J Wrist Surg 2019;8:305–311.

Address for correspondence Ali Azad, MD, Department of Orthopaedic Surgery, Keck Medical Center at the University of Southern California, 1520 San Pablo Street, #2000, Los Angeles, CA 90033 (e-mail: Ali.Azad@med.usc.edu).

Humana and Medicare



Trends in the United States in the Treatment of Distal Radial Fractures in the Elderly

By Kevin C. Chung, MD, MS, Melissa J. Shauver, MPH, and John D. Birkmeyer, MD

Investigation performed at the University of Michigan, Ann Arbor, Michigan

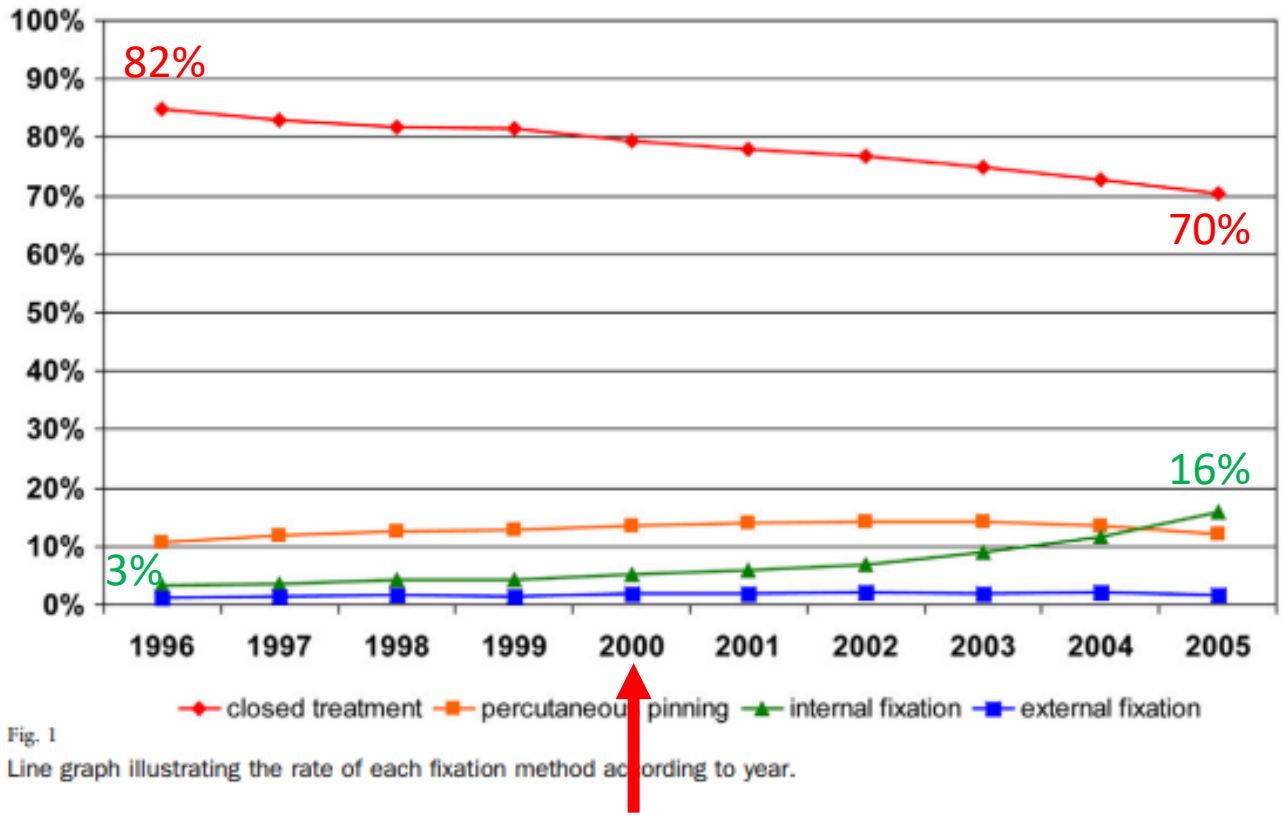


Fig. 1

Line graph illustrating the rate of each fixation method ac ording to year.

Sample Medicare Claims

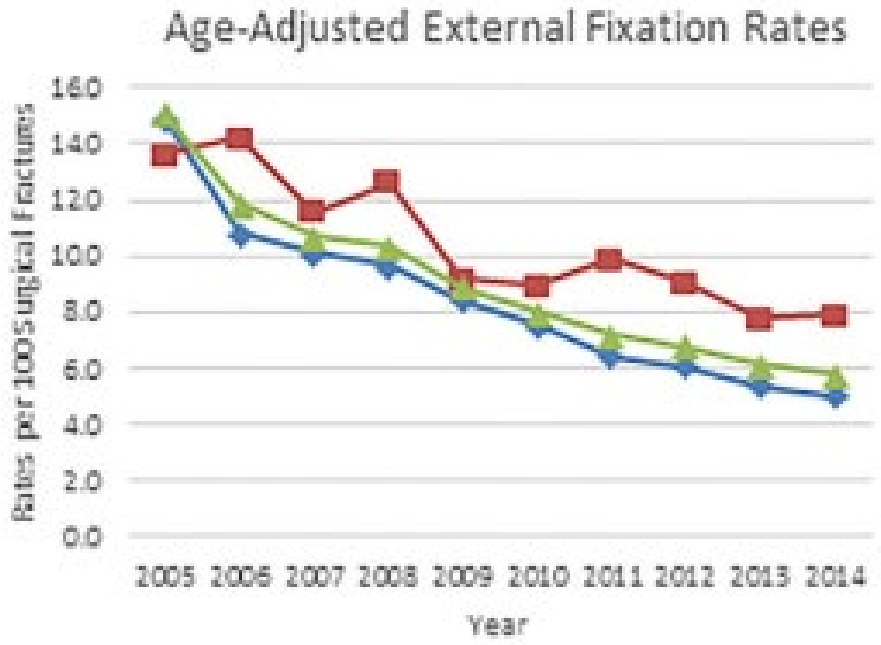
Surgery Article

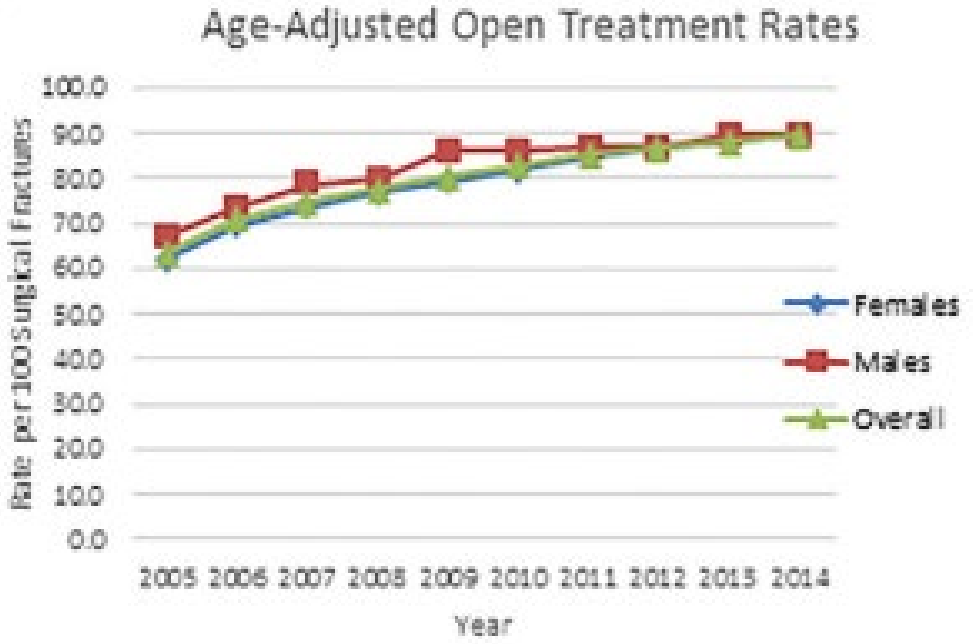
HAND
2022, Vol. 17(2) 331–338

DOI: 10.1177/1558944720928475
journals.sagepub.com/home/HAN

Trends in the Incidence and Treatment of Distal Radius Fractures in the United States in Privately Insured and Medicare Advantage Enrollees

Sanjeev Kakar[1], Mohamed Noureldin[2], Holly K. Van Houten[1,3], Raphael Mwangi[1], and Lindsey R. Sangaralingham[1,3]





Injury 54 (2023) 110802

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Changes in the incidence and treatment of distal radius fractures in adults – a 22-year nationwide register study of 276,145 fractures

Bjarke Viberg [a,b,c,*], Søren Tofte [a], Anders Bo Rønnegaard [b,d], Signe Steenstrup Jensen [b,d], Dennis Karimi [b,d], Per Hviid Gundtoft [b,e]

[a] Department of Orthopaedic Surgery and Traumatology, Odense University Hospital, Denmark
[b] Department of Orthopaedic Surgery and Traumatology, Lillebaelt Hospital – University Hospital of Southern Denmark, Denmark
[c] Department of Clinical Research, University of Southern Denmark, Denmark
[d] Department of Regional Health Research, University of Southern Denmark, Denmark
[e] Department of Orthopaedic Surgery and Traumatology, Aarhus University Hospital, Denmark

Fig. 3. Surgery vs. non-surgery of distal radius fracture over time.

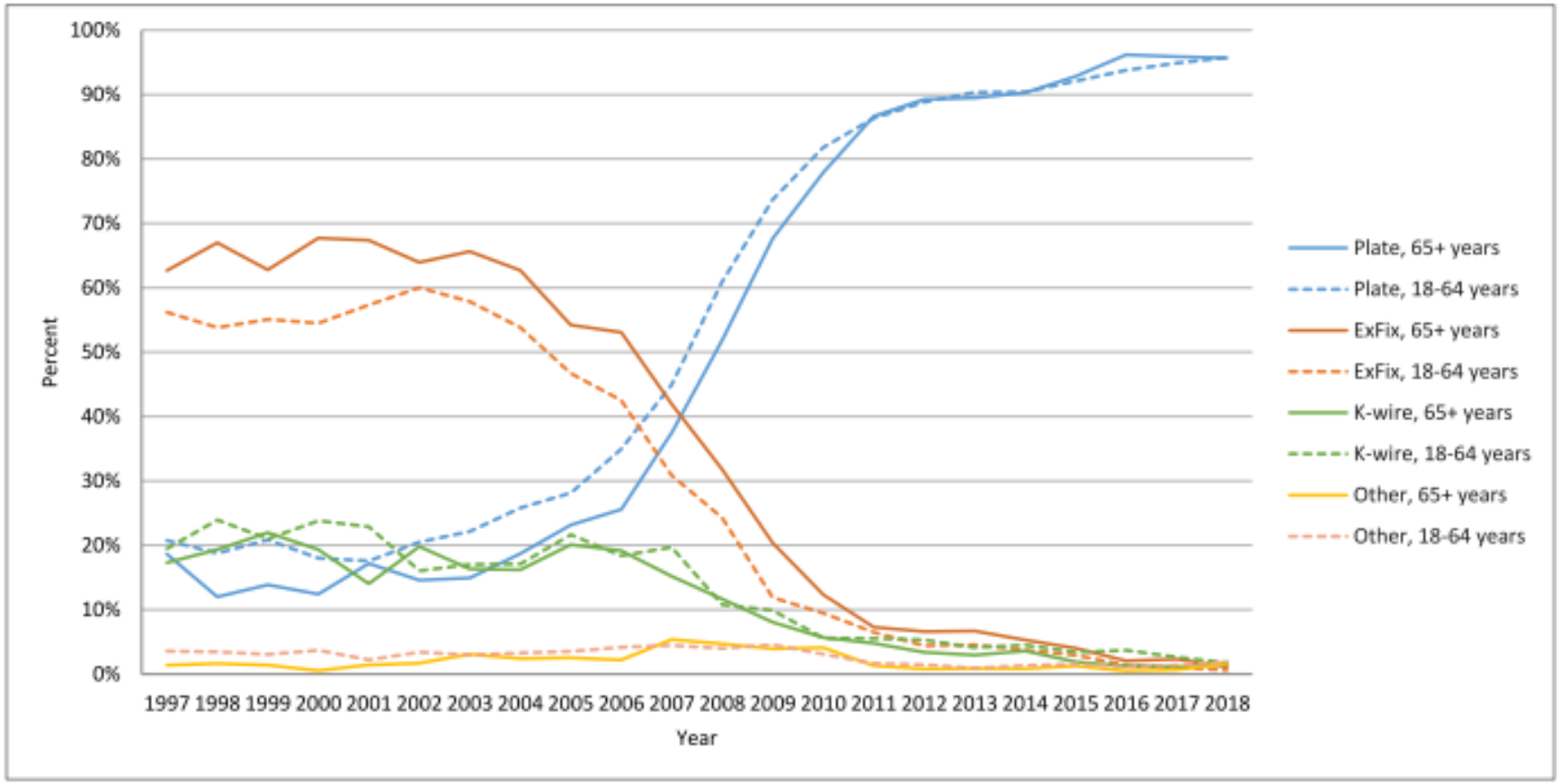


Fig. 4. Type of surgery for distal radius fracture over time.

What has caused a decrease in external fixation use?

1895 – Wilhelm Röntgen

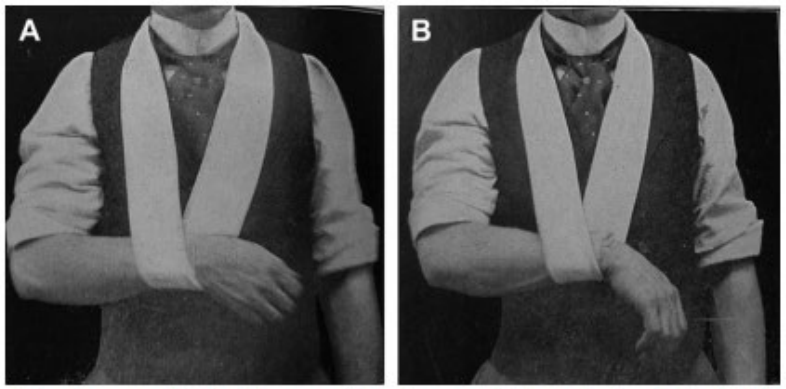


Fig. 2. Images of how to properly (*A*) and improperly (*B*) don a cravat sling as treatment of a distal radius fracture. Note how in the proper position (*A*), the wrist is held in slight flexion, slight supination, and ulnar deviation to maintain radial length. (*Reprinted from* Scudder CL. The treatment of fractures. Philadelphia: WB Saunders; 1902.)

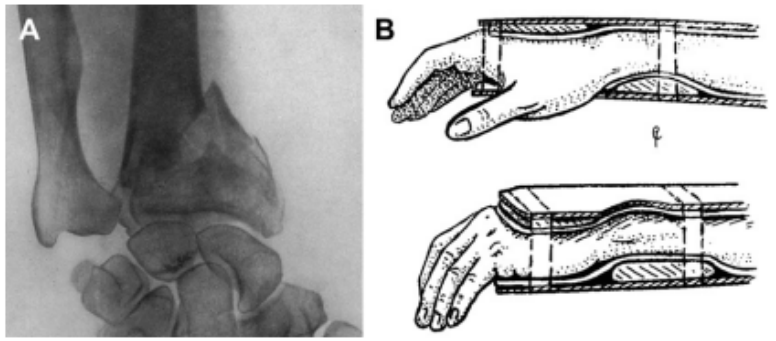


Fig. 3. X-rays allowed physicians at the turn of the twentieth century to better diagnose distal radius fractures, but treatment options were still limited. Even comminuted fractures (*A*) were treated with splinting (*B*). (*Reprinted from* Cotton FJ. The pathology of fracture of the lower extremity of the radius. Ann Surg 1900;32:194–218; and Cotton F. Dislocations and joint fractures. Philadelphia: W.B. Saunders; 1910.)

Fig. 4. Reduction and plaster immobilization of shortened fractures often required multiple hands to maintain reduction and place a well-fitted cast. Nevertheless, reduction was often lost, leaving suboptimal results. (*Reprinted from* Böhler L. Treatment of fractures. Vienna (Austria): Wilhelm Maudrich; 1929; with permission.)

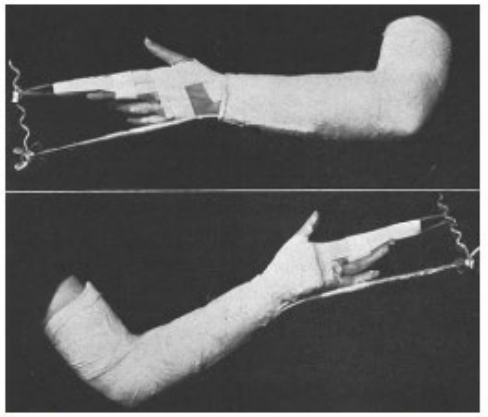
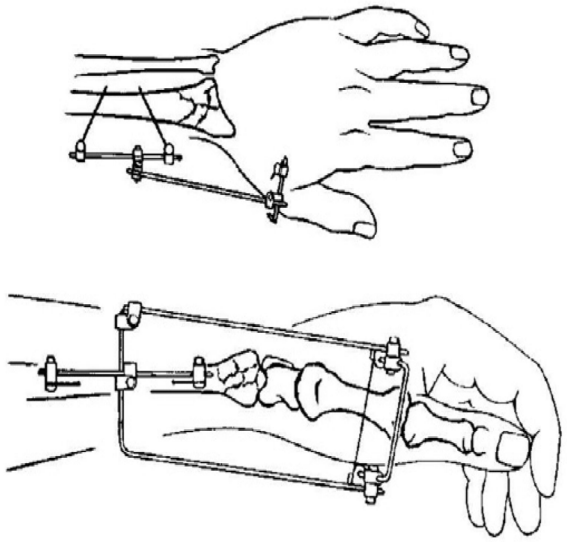


Fig. 5. Adhesive traction, advanced by surgeons, such as Murray, was a precursor to external fixation for comminuted distal radius fractures that was based on the principle of ligamentotaxis. (*Reprinted from* Murray DA. Treatment of fractures of the carpal end of the radius by traction. Am J Surg 1939;44:135–8; with permission.)

1944



Anderson R, O'neil G. Comminuted fractures of the distal end of the radius. Surg Gynec Obstet. 1944;78:434-440

Complications of external fixator

Table IV. Complications for each study group, shown as number and percentage of total cases

	University Hospital, Pins and plaster	*University Hospital, External fixation*	*Kaiser Hospital, Pins and plaster*
Pin infection	0	3 (23%)	3 (6.5%)
Loose pins	3 (18%)	2 (15%)	11 (23%)
Pin tract osteomyelitis	0	0	3 (6.5%)
Iatrogenic fracture	1 (9%)	0	4 (8.6%)
Nonunion	0	1 (7.6%)	2 (4.3%)
Iatrogenic nerve palsy	1 (5.9%)	1 (7.6%)	0
Loss of reduction	3 (18%)	1 (7.6%)	6 (13%)
Radioulnar synostosis	1 (5.9%)	0	0
% of patients with complications	53%	61%	52%

Complication Rate: 61%

JHS 1986

Severely comminuted distal radial fracture as an unsolved problem: Complications associated with external fixation and pins and plaster techniques

Seventy-six patients with severely comminuted distal radial fractures were treated at two institutions, of which the overwhelming majority were Frykman class VIII. Fifteen fractures were open. Thirty patients were seen at the University Hospital; 17 had pins and plaster and 13 had external fixation. Forty-six patients were seen at Kaiser Hospital; all had pins and plaster treatment. The complication rate for those with pins and plaster at the University Hospital was 53%; the complication for external fixation rate was 62%. The affiliated-hospital complication rate was 52%. All patients with ipsilateral forearm shaft and carpal fractures developed a nonunion of the carpal fracture. Few patients maintained anatomic reduction, and many had significant intra-articular malalignment. External fixation with threaded half pins did not obviate pin problems in our series. These methods may help manage severely comminuted distal radial fractures, but complications should be anticipated and alternative treatment considered, especially when ipsilateral carpal or forearm shaft fractures are present. (J HAND SURG 11A:157-65, 1986.)

Stephen C. Weber, M.D., *and* Robert M. Szabo, M.D., *Sacramento, Calif.*

External fixation of distal radial fractures: Results and complications

External fixation of unstable fractures of the distal radius yields satisfactory results but has a high complication rate. We studied thirty-five fractures in thirty-four patients to determine whether the results obtained with external fixation warranted its use. At a mean follow-up period of 31 months, the results of treatment were assessed by interviews and clinical and radiographic examination of both wrists. Twelve fractures had an excellent result, twelve had a good result, ten had a fair result, and one had a poor result. Radiographic results were graded excellent in ten fractures, good in thirteen, fair in five, and poor in seven. No correlation was found between the anatomical results and the clinical results or the patients' subjective ratings. Complications that were related directly to the fixation pins occurred in fourteen of the fractures. There were forty-five additional complications. The frequency of complications and the limitations of external fixation demand caution on the part of the surgeon to prevent iatrogenic morbidity, which would limit the benefits of the technique. (J HAND SURG 1991;16A:385-91.)

Richard A. Sanders, MD, Frederick L. Keppel, MD, *and* John I. Waldrop, MD, *Columbus, Ga.*

JHS 1991

- N = 34 patients

Complications:

- 8 pin sites infections (2 developed Osteomyelitis)
- 2 pin loosening
- 2 broken pins
- 16 patients lost some reduction
- 6 patients had paraesthesias
- 8 patients had incomplete grip at 2 years
- 2 patients had CRPS
- 2 patients distressed with pin site scars
- 1 patient ECU tendinitis

Dissatisfaction leads to Creative Innovation

1958 Arbeitsgemeinschaft für Osteosynthesefragen (AO) or Association of the Study of Internal Fixation (ASIF)

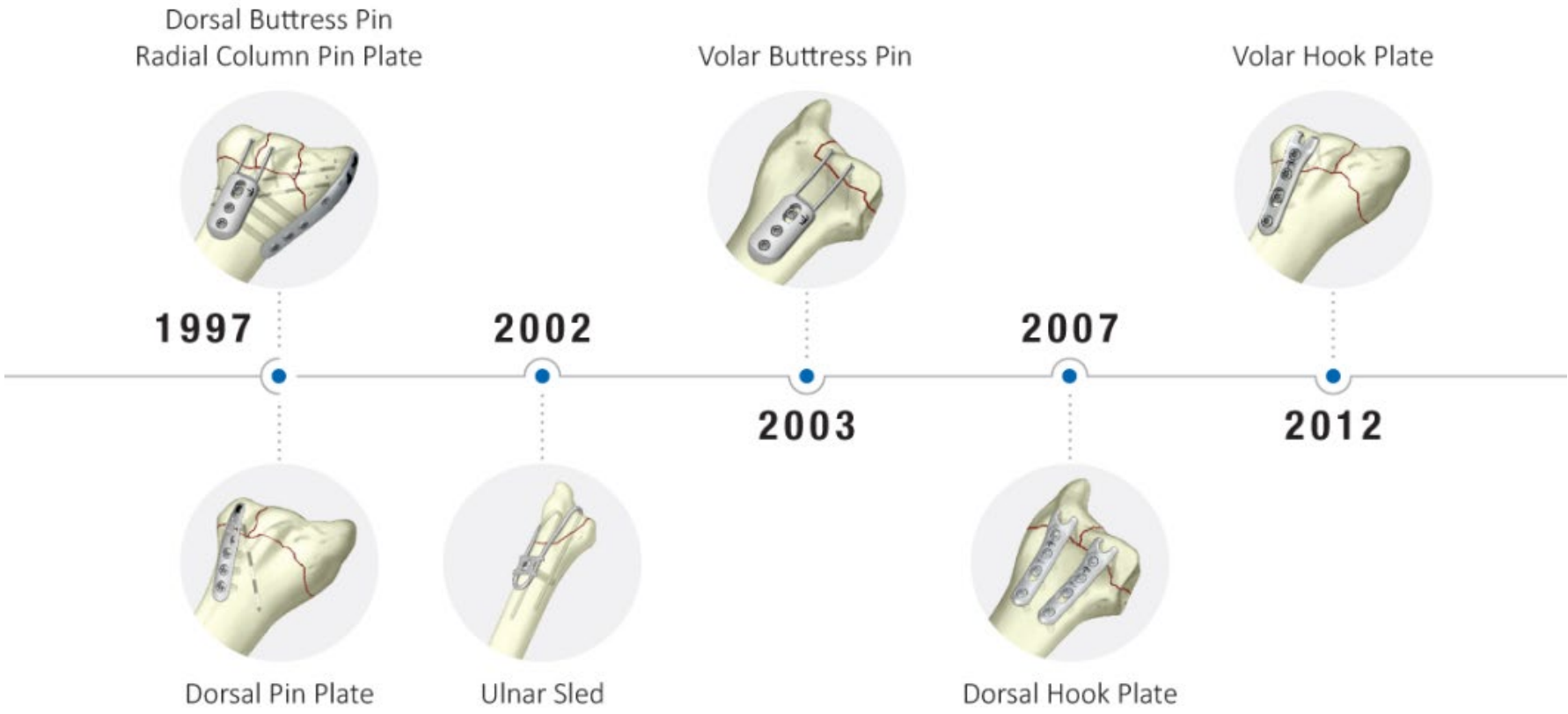
Founders of the AO

Maurice E Müller | Martin Allgöwer | Walter Bandi | Robert Schneider | Hans Willenegger

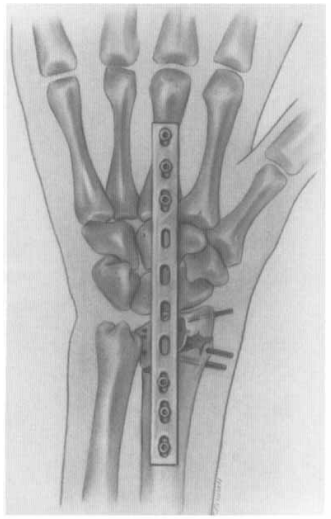
- Ernst Baumann
- Fritz Brussatis
- August Guggenbühl
- Willy Hunziker
- Walter Ott
- René Patry
- Walter Schär
- Walter Stähli

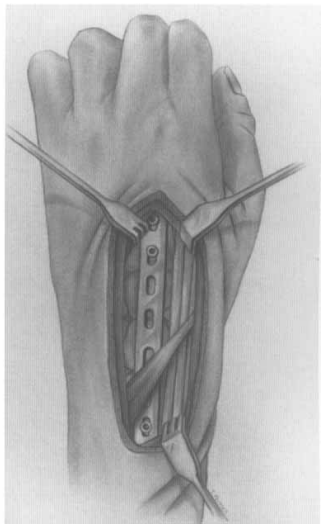
AOTRAUMA

Fragment specific fixation



Burke and Singer 1998 (3rd Metacarpal)





Techniques in Hand and Upper Extremity Surgery 2(4):248–252, 1998

TECHNIQUE

Treatment of Comminuted Distal Radius With the Use of an Internal Distraction Plate

EDWARD F. BURKE, D.O.
RICHARD M. SINGER, M.D.
Departments of Orthopedic and Plastic Surgery,
Wayne State University,
School of Medicine,
Detroit, Michigan, U.S.A.

Becton and Goodrich 1998 (2nd metacarpal)

Am J Orthop (Belle Mead NJ). 1998 Sep;27(9):619-23.

Use of an internal fixator device to treat comminuted fractures of the distal radius: report of a technique.

Becton JL[1], Colborn GL, Goodrich JA.

Author information

Abstract

An internal fixator technique for stabilizing comminuted Colles fractures has been developed in the anatomy laboratory and used in 35 clinical cases. The Colles Fracture Plate (Biomet, Inc, Warsaw, Indiana) can be used to treat any comminuted Colles fracture for which an external fixator is considered proper management. We have determined, based on our surgical experience with both the internal and external fixator techniques, that internal fixation using the Colles Fracture Plate is technically just as simple as external fixation. In addition to requiring a significantly less expensive device, internal fixation using this technique offers the advantages of better patient acceptance and fewer complications. This report will be followed by a more comprehensive analysis of the technical outcome of this procedure to further substantiate the initial results presented here. The process of compiling and analyzing these data is under way.

12/2000

US 20010011172A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2001/0011172 A1**

Orbay et al. (43) **Pub. Date: Aug. 2, 2001**

(54) **VOLAR FIXATION SYSTEM WITH ARTICULATING STABILIZATION PEGS**

(75) Inventors: **Jorge L. Orbay**, Miami, FL (US); **James Leone**, Miami, FL (US)

Correspondence Address:
David P. Gordon, Esq.
65 Woods End Road
Stamford, CT 06905 (US)

(73) Assignee: **Hand Innovations, Inc.**

(21) Appl. No.: **09/735,228**

(22) Filed: **Dec. 12, 2000**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/524,058, filed on Mar. 13, 2000. Continuation-in-part of application No. 09/495,854, filed on Feb. 1, 2000.

Publication Classification

(51) **Int. Cl.**[7] **A61B 17/80**

(52) **U.S. Cl.** **606/69**

(57) **ABSTRACT**

A volar fixation system includes a T-shaped plate intended to be positioned against the volar side of the radial bone, a plurality of bone screws for securing the plate along an non-fractured portion of the radial bone, and a plurality of bone pegs which extend from the plate and into bone fragments of a Colles' fracture. The plate is a T-shaped plate including a plurality of screw holes and a plurality of threaded peg holes. According to a preferred aspect of the invention, pegs can be articulated through a range of angles within respective peg holes and fixed at a desired angle within the range. The volar plate is positioned against the radius and screws are inserted through the screw holes to secure the volar plate to the radius. The bone fragments are aligned, and the holes are drilled through the peg holes into the fragments. The pegs are inserted through the peg holes and into the drilled holes in the bone. The pegs can be oriented at various angles relative to an axis normal to the lower surface of the plate. For each peg, once the peg has been appropriately positioned within the peg hole, a set screw is thread into the peg hole and tightened, thereby securing the peg in the selected orientation.

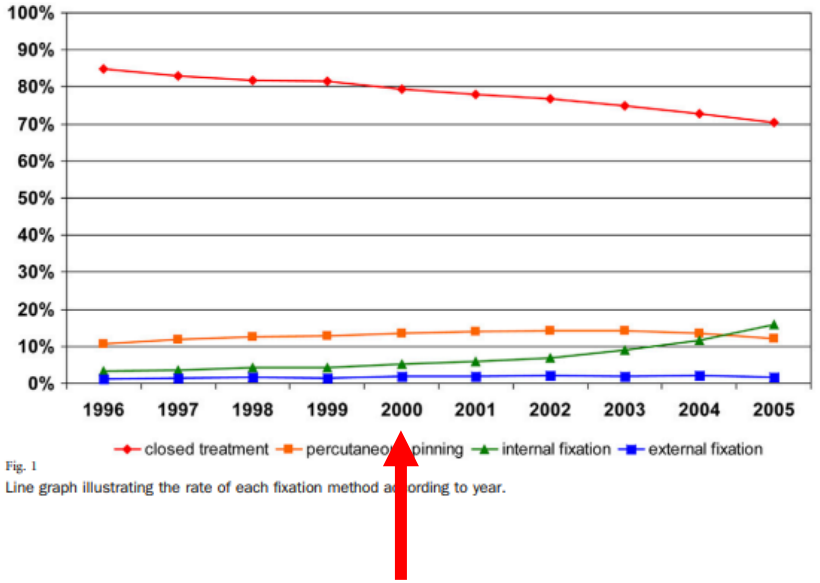
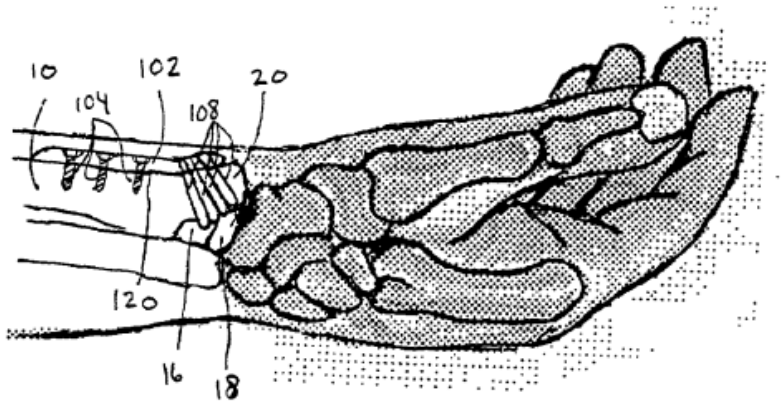


Fig. 1
Line graph illustrating the rate of each fixation method a ording to year.



Indications

- Intra-articular fractures with metaphyseal and diaphyseal comminution

Use of a Distraction Plate for Distal Radial Fractures with Metaphyseal and Diaphyseal Comminution

By David S. Ruch, MD, T. Adam Ginn, MD, Charles C. Yang, MD, Beth P. Smith, PhD, Julia Rushing, MStat, and Douglas P. Hanel, MD

Investigation performed at the Department of Orthopaedic Surgery, Wake Forest University School of Medicine, Winston-Salem, North Carolina

JBJS 2005

Indications

- Intra-articular fractures with metaphyseal and diaphyseal comminution
- Polytrauma patients (early weight bearing)

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 445, pp. 91–99

Bridge Plating of Distal Radius Fractures

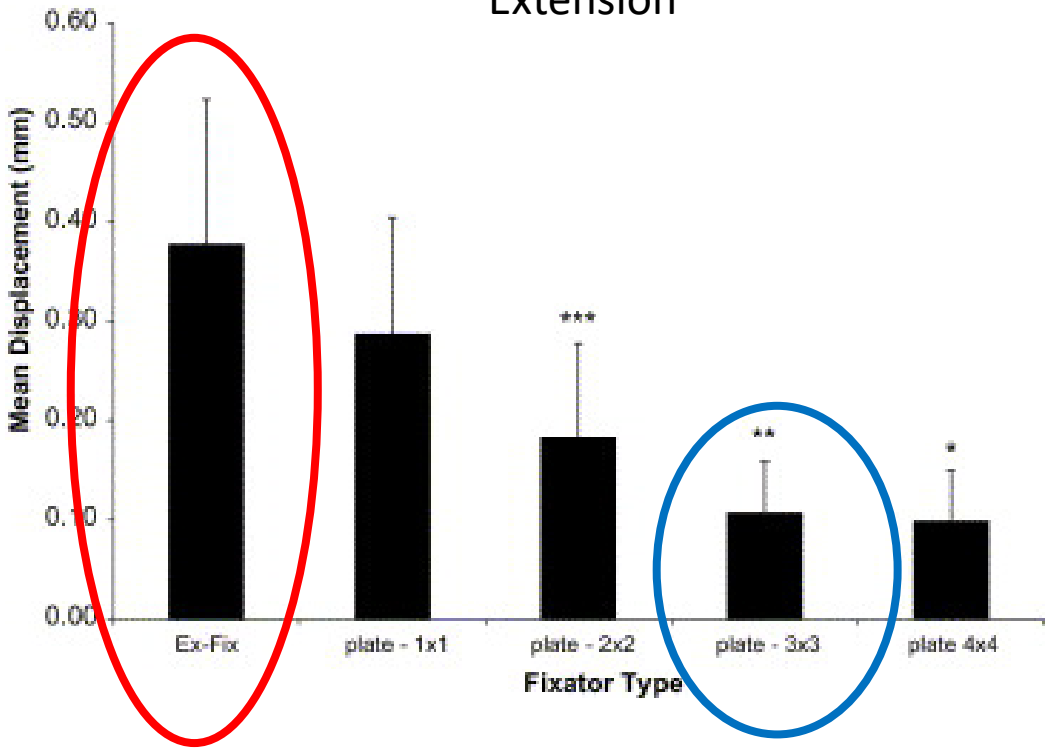
The Harborview Method

Douglas P. Hanel, MD; Thomas S. Lu, MD, FRCPC; and Wayne M. Weil, MD

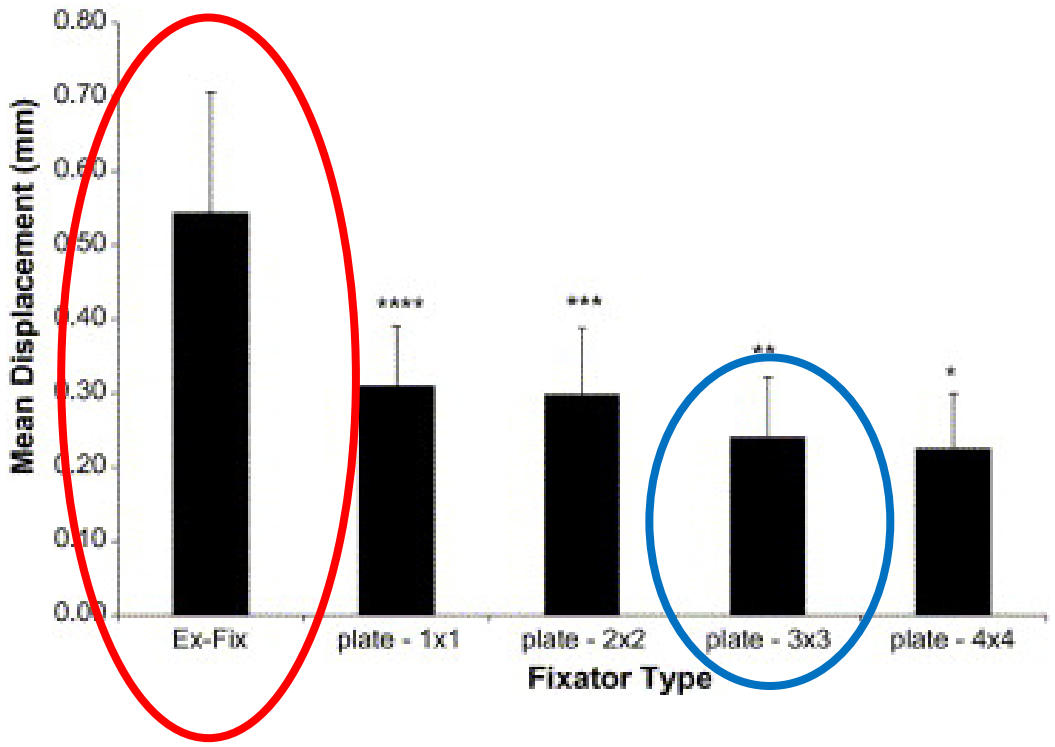
CORR 2006

Dorsal spanning plate is more stable than external fixator

Extension



Flexion



A Biomechanic Comparison of an Internal Radiocarpal-Spanning 2.4-mm Locking Plate and External Fixation in a Model of Distal Radius Fractures

Jonathon C. Wolf, BS, Wayne M. Weil, MD, Douglas P. Hanel, MD, Thomas E. Trumble, MD

Complications

Complications Associated with Distraction Plate Fixation of Wrist Fractures

Douglas P. Hanel, MD[a,*], Scott David Ruhlman, MD[a], Leo I. Katolik, MD[b], Christopher H. Allan, MD[a]

Minor complications: 4.9%
Major complications: 6.9 %
Overall: 12%

Table 1
Major and minor complications

Minor Complications	
Wound healing	2
Hardware failure without loss of reduction	5
Total	7
Major Complications	
Malunion	2
Nonunion requiring surgery	2
Wound complications, unplanned surgery	1
Deep infection	2
Extensor tendon adhesions, tenolysis	2
EPL rupture requiring EIP transfer	1
Total	10

Abbreviations: EIP, extensor indicis proprius; EPL, extensor pollicis longus.

Indications Dorsal Spanning Plate

1. Intra-articular fractures with metaphyseal and diaphyseal comminution
2. Polytrauma patients (early weight bearing)
3. Elderly patients with osteoporotic bone (locking plate)
4. Supplementary fixation to unload radiocarpal joint

Indications External Fixator

1. Comminuted DRF
2. Damage-Control
3. Polytrauma
4. Adjunct to internal fixation

Volar Fixed-Angle Plate Fixation for Unstable Distal Radius Fractures in the Elderly Patient

Jorge L. Orbay, MD, *Miami, FL*, Diego L. Fernandez, MD, *Berne, Switzerland*

JHS 2004

Results:

- N = 23 pts, age > 75, f/u 4.5 years
- Volar tilt 6^0, radial tilt 20^0, radial shortening < 1 mm, WF 55^0, WE 58^0, pronation 80^0, supination 76^0, grip strength 77%

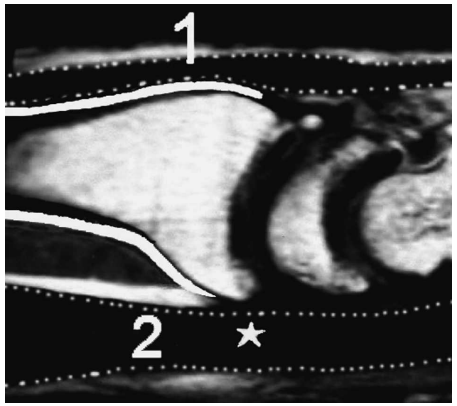
Conclusions

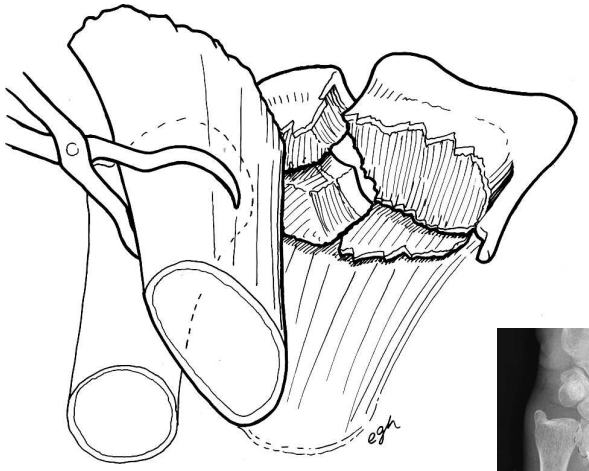
- The treatment of unstable distal radius fractures in the elderly patient with a volar fixed-angle plate provided stable internal fixation and allowed early function.
- This technique minimized morbidity in the elderly population by successfully handling osteopenic bone, allowed early return to function, provided good final results, and was associated with a low complication rate.

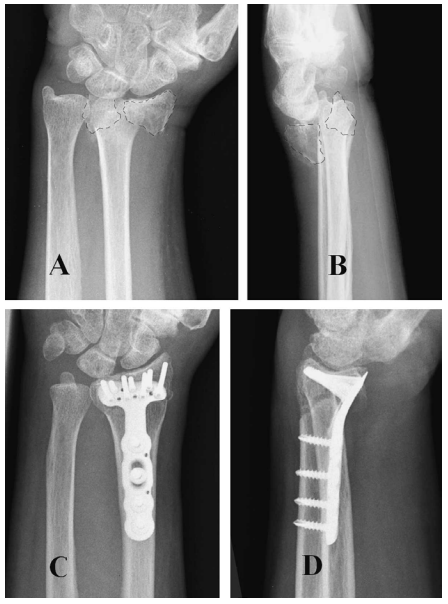
Current Concepts in Volar Fixed-angle Fixation of Unstable Distal Radius Fractures

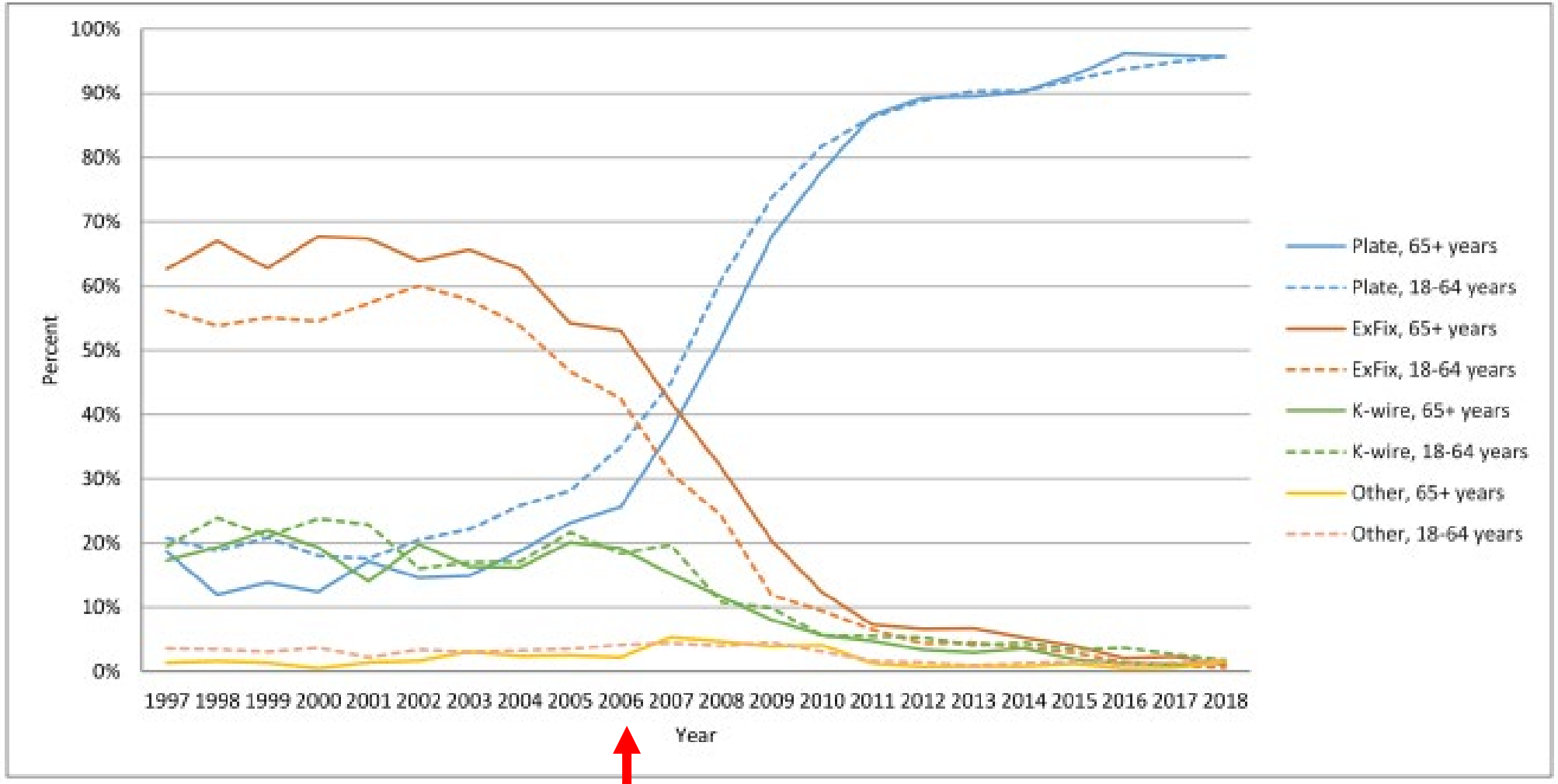
CORR 2006

Jorge L. Orbay, MD; and Amel Touhami, MD









Jan 2006 – Hand Innovations acquired by J&J

Fragment specific fixation 1997
Bridge Plate 1998
Volar Locking Plate 2000

Ruch JBJS 2004
Orbay JHS 2004
Medoff Hand Clinic 2005
Hanel CORR 2006
Orbay CORR 2006

What has caused a decrease in external fixation use?

Multifactorial

1. External fixator complications and morbidity

2. Innovations in technology and treatment methods

a. Volar Locking Plate

b. Fragment specific fixation

c. Bridge plating

3. Improved understanding of wrist injury patterns, diagnosis, biomechanics

4. Shared decision making

a. Patient preference

b. Surgeon preference

ELSEVIER
SAUNDERS

Hand Clin 21 (2005) 279–288

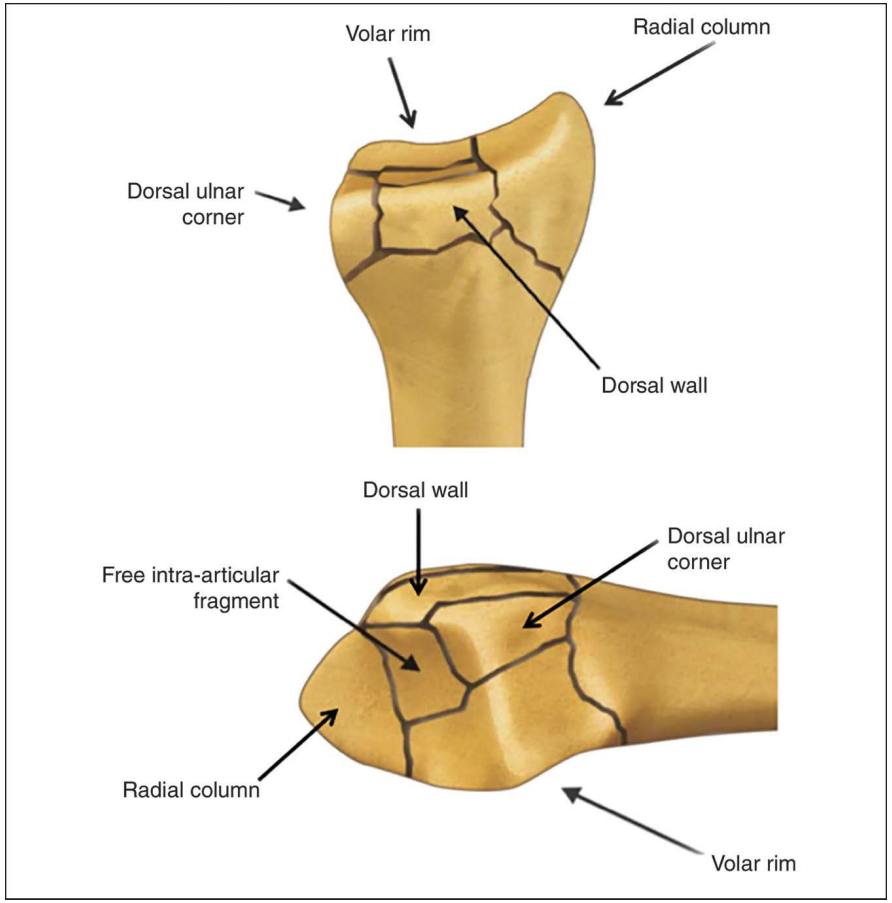
HAND
CLINICS

Essential Radiographic Evaluation for Distal Radius Fractures

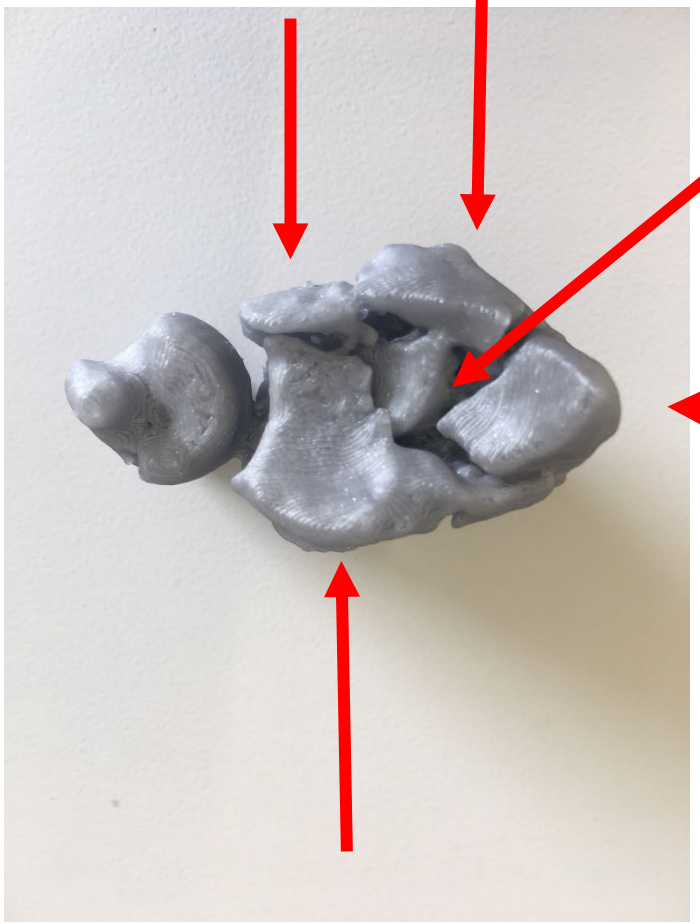
Robert J. Medoff, MD

Department of Orthopaedic Surgery, University of Hawaii, 30 Aulike Street #506, Kailua, HI 96734, USA

Predictable Pattern



Rhee et al

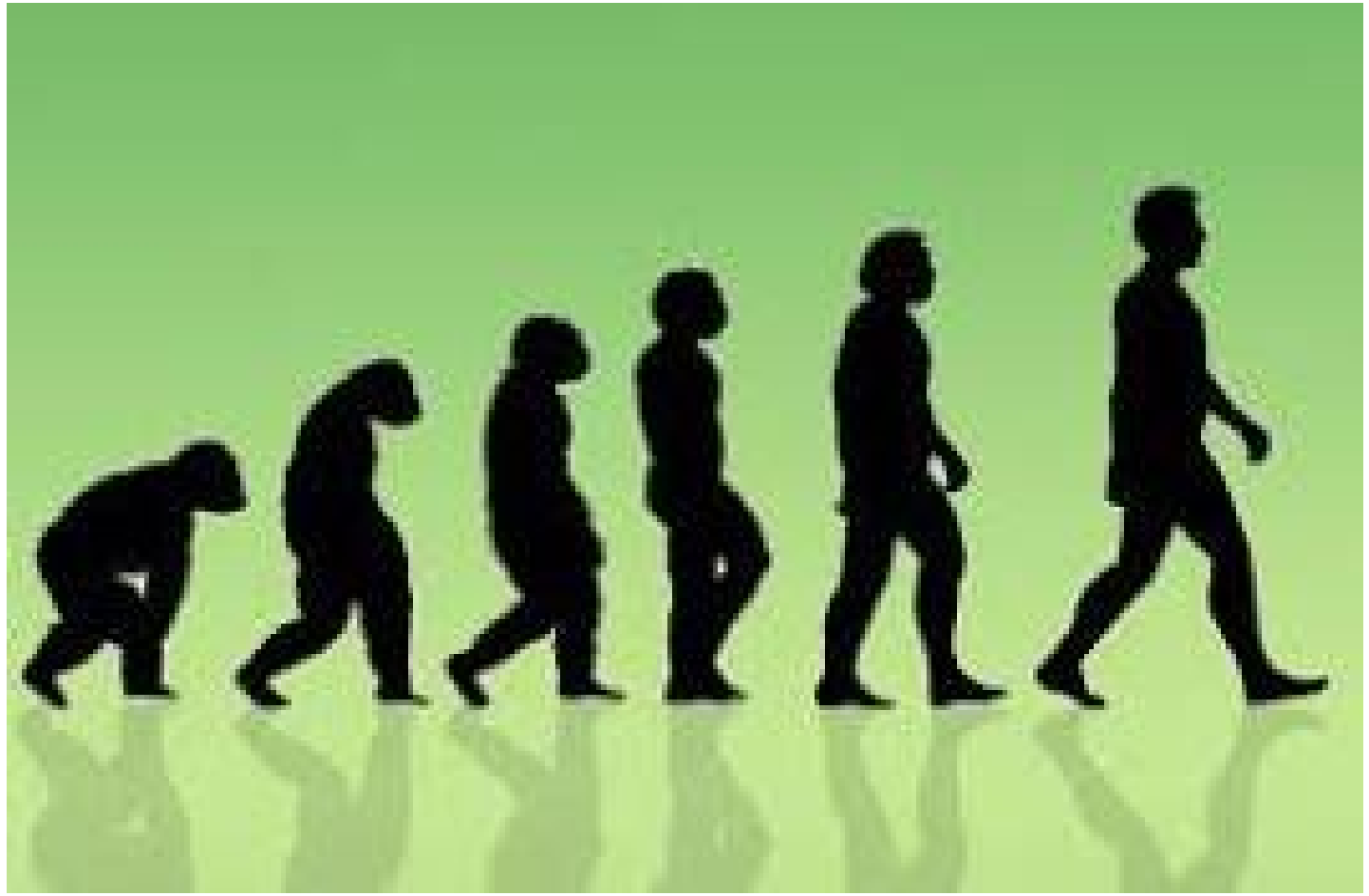


Patient Comfort and Preference

External Fixator

vs

Bridge Plate and
Distal Radius Plate



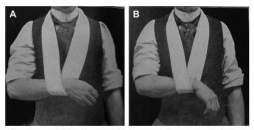


Fig. 2. Images of how to properly (*A*) and improperly (*B*) don a cravat sling as treatment of a distal radius fracture. Note how in the proper position (*A*), the wrist is held in slight flexion, slight supination, and ulnar deviation to maintain radial length. (*Reprinted from* Scudder CL. The treatment of fractures. Philadelphia: WB Saunders; 1902.)

1902

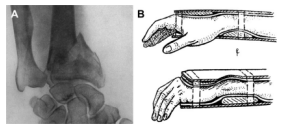


Fig. 3. X-rays allowed physicians at the turn of the twentieth century to better diagnose distal radius fractures, but treatment options were still limited. Even comminuted fractures (*A*) were treated with splinting (*B*). (*Reprinted from* Cotton FJ. The pathology of fracture of the lower extremity of the radius. Ann Surg 1900;32:194–218; and Cotton F. Dislocations and joint fractures. Philadelphia: W.B. Saunders; 1910.)

1910

Fig. 4. Reduction and plaster immobilization of shortened fractures often required multiple hands to maintain reduction and place a well-fitted cast. Nevertheless, reduction was often lost, leaving suboptimal results. (*Reprinted from* Böhler L. Treatment of fractures. Vienna (Austria): Wilhelm Maudrich; 1929; with permission.)

1929

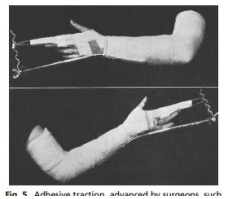


Fig. 5. Adhesive traction, advanced by surgeons, such

1939

1944

Thank You

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