

**Comparison between external
fixation and plate fixation for intraarticular
distal radial fractures**

Essay

Submitted for fulfillment of master degree in

Orthopedic Surgery

By

Bassem Mostafa Khalil Khater
(MB, B.ch.)

Under supervision of

Prof. Dr. Sherif Nabil Amin

*Professor of orthopedic Surgery
Faculty of Medicine,
Cairo University.*

Dr. Sherif Abdellatif Othman

*Assistant Prof. of orthopedic Surgery
Faculty of Medicine,
Cairo University.*

**Faculty of Medicine
Cairo University
2011**

Acknowledgement

Praise to "*Allah*", the most gracious and the most merciful who guides us to the right way.

I would like to express my deepest gratitude and thanks to **Professor Dr. Sherif Amin**, Professor of Orthopaedic Surgery and Traumatology, Faculty of Medicine, Cairo University for his meticulous guidance, constructive criticism and encouragement were indispensable in accomplishing this essay.

My extreme appreciation to **Dr. Sherif Abdellatif**, Assistant Professor of Orthopaedic Surgery and Traumatology, Faculty of Medicine, Cairo University for his willing help and critical review. His generous advice was illuminative throughout the work.

I would like to thank **all members** of the Department of Orthopaedic Surgery and Traumatology, Faculty of Medicine Cairo University for their support and cooperation.

I am forever grateful to **my family** for their ever after love and support.

Abstract

The final outcome in distal radius fracture management is dependent on many factors and can be influenced by accurate restoration of the anatomy, minimal disruption of the surrounding tissues, and early active wrist rehabilitation

Key word: fixation, intraarticular, orthopedic

Contents

	Page
Introduction	1
Aim of the work	3
Review of literature	4
• Anatomy, Biomechanics	4
• Classification of Distal Radial Fractures	40
• Treatment	55
o Different methods of fixation.	101
o Discussion	112
Summary	119
References	122
Arabic summary	

List of Figures

	<i>Figures</i>	<i>Page</i>
Figure 1	View of the articular surfaces of the distal radius and ulna.	6
Figure 2	: A lateral view from the ulnar side shows the plane defined by the volar surface of the distal radius and the extent of the lunate facet anterior to this plane.	7
Figure 3	: Anatomical landmarks of the volar surface of the distal radius.	7
Figure 4	: The palmar vascular anatomy includes a series of two transverse arches that traverse the radial and ulnar arteries.	12
Figure 5	: Cross section at the wrist level illustrating the basic anatomic relations of major structures.	13
Figure 6	: Volar wrist extrinsic and intrinsic ligaments.	14
Figure 7	: Anatomy of the TFCC. (A) End view of the DRUJ. (B) Coronal view of the DRUJ	17
Figure 8	: Wrist joint: Capsular attachment and synovial lining.	19
Figure 9	: Ulnar variance is measured on a standardized PA radiograph.	24
Figure 10	Tension patterns in the dorsal radioulnar ligament (DRUL) and the palmar radioulnar ligament (PRUL).	27
Figure 11	: PA x-ray of a wrist	30
Figure 12	: Measurement of ulnar variance	31

Figure 13 : Radial width	32
Figure 14 : Diagram showing the palmar inclination of the distal radius.	33
Figure 15 : measurement of the AP distance	34
Figure 16 : Assessing volar and dorsal rim on PA view.	35
Figure 17 : Three-dimensional computed tomography scans of a distal radial fracture	39
Figure 18 Fernandez classification of DRFs	41
Figure 19 : AO Classification.	46
Figure 20 : Schematic representation of the three-point contact cast.	60
Figure 21 : Numerous percutaneous pinning techniques	64
Figure 22 : Plain radiograph and a photo of a patient show the nonbridging wrist fixator.	72
Figure 23 : Plain radiograph showing AO external fixator fixing fracture of the distal end radius	73
Figure 24 : Dynamic wrist Fixator	74
Figure 25 : Plain radiograph showing the radiolucent wrist fixator in combination with k wire fixation.	75
Figure 26 : Plain radiograph and photo of a patient showing the hybrid wrist fixator.	76
Figure 27 : A. Intramedullary nail B.X-ray of implanted intramedullary nail.	79

Figure 28	The three-column concept of the structural anatomy of the distal radius and ulna.	83
Figure 29	: Fragment-specific implants.	83
Figure 30	: Volar non-locking T-plate "Synthes".	89
Figure 31	: Force distribution of a plate osteosynthesis without angular stability.	91
Figure 32	: Locking compression plate with combination hole.	91
Figure 33	: The Hand Innovations DVR plate using 2.0-mm distal locking buttress pins with terminal thread and 3.5-mm non-locking shaft screws.	96
Figure 34	: T-shaped LCP (Mathys Medical Ltd, Bettlach, Switzerland)A volar locking plate with combi-holes and a locking screw.	97
Figure 35	: Second generation DVR plate.	97
Figure 36	: Early osteotomy and use of a volar fixed-angle plate to correct dorsal angulation and radial inclination.	111

List of Tables

	Tables	Page
Table (1):	Main different points between volar fixed-angle locked plating and external fixation with percutaneous wiring .	121

List of abbreviations

AO	Arbeitsgemeinschaft fur Osteosynthesefragen
AP	Anteroposterior
BR	Brachioradialis
CRPS	Complex regional pain syndrome
DRF	Distal radial fractures
DRUJ	Distal radioulnar joint
EPL	Extensor Pollicis Longus
FCR	Flexor carpi radialis
FFH	Fall from a height
FPL	Flexor pollicis longus
IFZ	Intermediate fibrous zone
LCP	Locking compression plate
LHS	Locking head screw
ORIF	Open reduction and internal fixation
PMMA	Polymethyl methacrylate
PQ	Pronator quadratus
RSC	Radioscaphocapitate
SRL	Short radiolunate
TCL	Transverse carpal ligament
TFCC	Triangular fibrocartilage complex

INTRODUCTION

Distal radius fractures remain an injury that fosters considerable interest and debate.⁽¹⁾ Distal radial fractures account for 20% of fractures among medicare enrollees and are second only to hip fractures in terms of incidence in the elderly population. These fractures represent approximately one-sixth of all fractures that are treated in emergency departments.⁽²⁾

In the older population, the mechanism of injury usually involves a fall onto the outstretched hand in an elderly patient whose bone quality is diminished by osteoporosis. In younger patients, high-energy injury mechanisms lead to wide displacement and marked comminution in bone of normal quality.⁽³⁾

The goal of surgical fixation in the unstable distal radius fracture is to restore intra-articular and extraarticular anatomic alignment.⁽⁴⁾ Persistent step or gap deformity of the articular surface after distal radius fracture may predispose to the development of posttraumatic arthritis of the radiocarpal joint. Although the clinical manifestations of post traumatic arthritis may not be disabling, yet the goal of surgical treatment of intra-articular distal radius fractures remains anatomic reduction.⁽⁵⁾

Introduction

Many methods are available to treat distal radius fractures, each with its own benefits and potential complications, which must be weighed when choosing which procedure to use. ⁽⁶⁾

Many fixation techniques have been described including pin and plaster fixation, percutaneous pinning, intramedullary pinning, external fixation (bridging or nonbridging, static or dynamic), injectable bone cement, and various forms of internal fixation with customized implants. ⁽⁷⁾

Aim of the work

Aim of the work

This essay aims at evaluating the outcome of external fixation versus plating through volar approach in treating Intraarticular Distal Radial Fractures .

ANATOMY

THE DISTAL RADIUS

A) Osseous anatomy

The lower end of the radius is large, quadrilateral, and provided with two articular surfaces; one below, for the carpus, and another at the medial side, for the ulna. The carpal articular surface is triangular, concave, smooth, and divided by a slight antero-posterior ridge into two parts. The lateral, triangular, articulating with the scaphoid bone and called the scaphoid fossa; the medial, quadrilateral, with the lunate bone and called the lunate fossa. The articular surface for the head of the ulna is called the ulnar notch (sigmoid cavity) of the radius. These two articular surfaces are separated by a prominent ridge, to which the base of the triangular articular disk is attached; this disk separates the wrist-joint from the distal radioulnar articulation (**Figure1**).

The distal radius has three non-articular surfaces: volar, dorsal, and lateral. The dorsal surface is convex, affords attachment to the dorsal radiocarpal ligaments, and is marked by three grooves and a prominent ridge "Lister's tubercle". The lateral surface is prolonged obliquely downward into the styloid process, which gives attachment by its base to the tendon of the

Review of literature

Brachioradialis, and by its apex to the radial collateral ligament of the wrist-joint. The lateral surface of this process is marked by a flat groove, for the tendons of the Abductor pollicis longus and Extensor pollicis brevis.⁽⁸⁾

The volar surface, is broad, flat, affords attachment to the volar radiocarpal ligaments and the pronator quadratus. The volar lunate facet projects an average of approximately 3mm anterior to the relatively flat volar surface (**Figure 2**).⁽⁹⁾ Plates placed over this prominence can risk tendon irritation and can be more palpable to the patient.⁽¹⁰⁾

The concave surface of the volar radius is limited distally by a transverse ridge or the **watershed line**. Distal to the watershed line, the radius slopes in a dorso-distal direction and receives the proximal attachments of the volar wrist capsule and the volar capsular ligaments. This ridge lies close (2 mm) to the joint line on its ulnar aspect and well proximal (10–15 mm) from the joint line on its radial aspect. Fixation implants must be placed proximal to and their profile must not project above the watershed line to avoid impingement on flexor tendons.⁽¹⁰⁾

Review of literature

Volar Radial Tuberosity is a prominence on the radial margin of the pronator quadratus (PQ) fossa. Plates that are placed too radial will overlie this tuberosity, will be pronated, and will not lie flat on the radius and may become palpable to the patient, requiring subsequent removal. **Volar Radial Ridge** a ridge of varying prominence extends proximally from the volar radial tuberosity and marks the radial limit of the pronator quadratus fossa (**Figure 3**).⁽¹⁰⁾

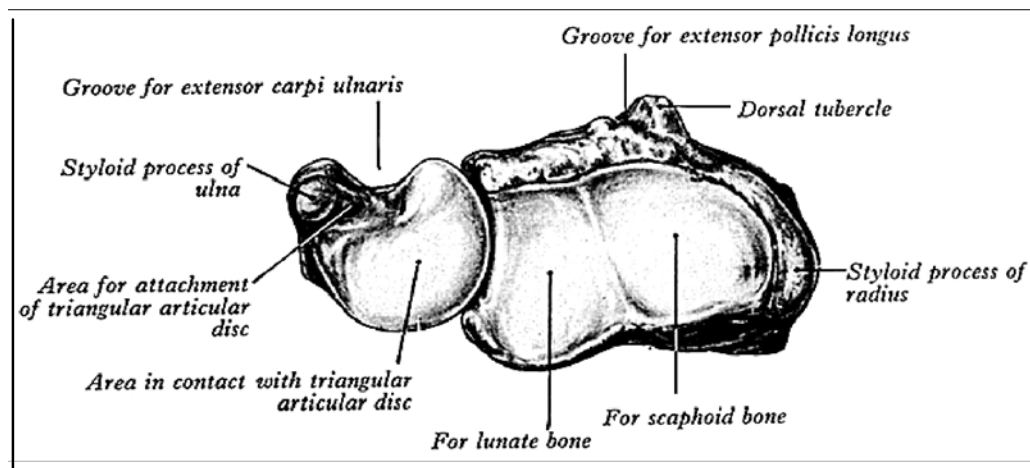


Figure 1: View of the articular surfaces of the distal radius and ulna.⁽¹¹⁾