Anatomie clinique et caractéristiques de la plaque palmaire du radius distal

Junya IMATANI MD PhD

Okayama Saisiekaï General Hospital, Okayama, JAPAN
Surgical treatment of unstable DRF

Percutaneous pinning

Bone cement

Volar Locking Plate (VLP) fixation

Ex-Fix

VLP fixation has become increasingly popular
### Systematic review comparing 5 common techniques

Diaz-Garcia R JHS 2011

<table>
<thead>
<tr>
<th>Complication</th>
<th>VLPS</th>
<th>Non-BrEF</th>
<th>BrEF</th>
<th>PKF</th>
<th>CI</th>
<th>P value</th>
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<tr>
<td><strong>Minor</strong></td>
<td></td>
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<td>Superficial infection</td>
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<td>25</td>
<td>39</td>
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<tr>
<td>Total (%)</td>
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<td>31</td>
<td>16</td>
<td>2</td>
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<td>&lt;0.001</td>
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<td>Nerve lesion</td>
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<td>10</td>
<td>4</td>
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<td>CRPS</td>
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<td>16</td>
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<td>11</td>
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<td>6</td>
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<tr>
<td>Total (%)</td>
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<td>13</td>
<td>7</td>
<td>7</td>
<td>&lt;0.001</td>
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<tr>
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<td></td>
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<td>3</td>
<td>3</td>
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<tr>
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<tr>
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<tr>
<td>Total (%)</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>&lt;0.001</td>
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</table>

VLP had significantly more major complications requiring surgery.
## Complications following VLP fixation

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<th>Author</th>
<th>no</th>
<th>rate</th>
<th>Tendon rupture</th>
<th>Tendinitis</th>
<th>Metalwork</th>
<th>Nerve</th>
<th>CRPS</th>
<th>Infection</th>
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<td>Drobetz(2003)</td>
<td>50</td>
<td>32%</td>
<td>7(14%)</td>
<td>1(2%)</td>
<td>1(2%)</td>
<td>1(2%)</td>
<td>3(6%)</td>
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<td>Arora(2007)</td>
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<td>27%</td>
<td>4(3.6%)</td>
<td>14(12.5%)</td>
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<td>3(2.7%)</td>
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<td>Egol(2008)</td>
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<td>1(2.6%)</td>
<td>-</td>
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<td>1(2.6%)</td>
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<tr>
<td>Arora(2011)</td>
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<td>36%</td>
<td>1(2.7%)</td>
<td>9(25.0%)</td>
<td>-</td>
<td>1(2.7%)</td>
<td>2(5.6%)</td>
<td>-</td>
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<tr>
<td>Grewal(2011)</td>
<td>18</td>
<td>39%</td>
<td>3(16.6%)</td>
<td>3(16.6%)</td>
<td>-</td>
<td>-</td>
<td>1(5.6%)</td>
<td>-</td>
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<tr>
<td>Matschke(2011)</td>
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<td>8(3.0%)</td>
<td>10(3.9%)</td>
<td>5(1.9%)</td>
<td>5(1.9%)</td>
<td>1(0.4%)</td>
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<td>Lattmann(2011)</td>
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<td>14%</td>
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<td>-</td>
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<td>9(3.9%)</td>
<td>1(0.4%)</td>
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<tr>
<td>Arora(2011)</td>
<td>36</td>
<td>36%</td>
<td>1(2.7%)</td>
<td>9(25.0%)</td>
<td>-</td>
<td>1(2.7%)</td>
<td>2(5.6%)</td>
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<tr>
<td>Johnson(2014)</td>
<td>206</td>
<td>10%</td>
<td>4(1.9%)</td>
<td>7(3.4%)</td>
<td>4(1.9%)</td>
<td>1(0.5%)</td>
<td>4(1.9%)</td>
<td>1(0.5%)</td>
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<td>Imatani(2012)</td>
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<td>10%</td>
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<td>0(%)</td>
<td>9(2.7%)</td>
<td>16(4.8%)</td>
<td>2(0.6%)</td>
<td>2(0.6%)</td>
</tr>
</tbody>
</table>

Tendon complication remains a **severe, significant problem**
Pathomechanism of Flexor tendon injury

Be falling into ruin the positional relationship
Clinical Anatomy and Characteristics for Volar Distal Radius Plating

Contents

1. Morphology of the volar distal radius
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3. Relationship between the FPL and the radius
4. Epilogue
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Landmarks for safe placement of the VLP

Orbay JL CORR 2006

Soong M JBJS 2011

Cross A JHS 2008

Watershed line

Critical line

G 0: Distal to critical line
G 1: Volar to critical line, proximal to rim
G 2: Volar to critical line, at or distal rim

The definition of the ‘watershed line’ has not been clear yet.
1) Macroscopic study of the volar distal radius

Imatani J. et al, JHS 2012

An Anatomical Study of the Watershed Line on the Volar, Distal Aspect of the Radius: Implications for Plate Placement and Avoidance of Tendon Ruptures

20 cadaveric specimens

✓ Five males, Five females
✓ Age: mean 78.5y/o (56-88y/o)
✓ Dissected & examined the volar distal radius macroscopically and the positional relationship between the radius, the ligaments, the pronator quadratus (PQ) muscle and flexor tendons
Gliding surface of the flexor tendons

Rt wrist
In the 2/3 ulnar aspect, two bony lines on the volar radius

Imatani J. et al JHS 2012

In the 1/3 radial aspect, these two lines merged
Two demarcation points in the ulnar aspect

Imatani J. et al JHS 2012
Two bony prominences on distal higher line

Imatani J. et al JHS 2012
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2) Histologic study of the volar distal radius

A series of sagittal sections of the wrist regions
5 μm thickness in every 100 μm

Investigating the positional relationships over
the radius, the volar ligaments and PQ muscle.
Radial side

- Attachment of the volar joint capsule & lig.

- Distal higher prominence

- IFZ = Intermediate fibrous zone

Ulnar side

- Proximal lower prominence
Positional relationship between the flexor tendons and the bony prominences

FPL ran in a shallow groove between two prominences.

‘Interfossa sulcus’
Orbay J. ASSH 2013

‘Reliable landmark’

Imatani J. Akita K. JWS 2018
Dangerous zone for the flexor impingement between the ulnar and radial bony prominences
Don’t protrude the volar implants anterior to the rim of the distal radius in this zone.
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3-D models from CT DICOM data

Kondou H, Imatani J JSSH 2012

Bone condition

Tendon condition

Superimpose &
Image registration

Ulnar bony prominence

FPL
- FPL tendon ran through av 56% from the ulnar corner
- Av. distance FPL - Ulnar bony prom.: 9.8mm (SD1.5)
3D model with the FPL tendon path

Av. Position of FPL tendon from the ulnar corner: 54%
What or Where is the ‘Watershed Line’?

If the ‘watershed line’ is to serve as a guideline for safe plate placement …
What or Where is the ‘Watershed Line’?

In the 1/3 radial aspect:
- The ‘Watershed Line’ corresponds to the merged line.

In the 2/3 ulnar aspect:
- The ‘Watershed Line’ corresponds to a hypothetical line between the proximal lower line and distal higher line.

The location of this hypothetical line may vary depending on particular plate designs and their thickness.
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Unique studies from JAPAN
Contact pressure between the FPL tendon and the distal plate ridge

Tanaka Y et al JHS 2011

External load 3.0 Kg

Plates placed distal to the watershed line have the potential to impinge on the FPL tendon
Quantitative analysis of the radius morphology based on CT scans

The volar surface of the distal radius was supinated about 10 degrees from proximal to distal

Oura et al JOR 2015
Evaluation of 200 lateral wrist Xrays

- Interindividual variation in the shape of the teardrop
- Its influence on the fit of the volar plate
Anatomy and characteristics of volar aspect

- Volar aspect
- Dorsal aspect
- Scaphoid
- Capitate
- Lunate
- Radius
- Ulnar bony prominence
- FPL

- The distal higher line
- The proximal lower line
- The ‘Watershed Line’

- 56% of Width
- 9.8mm

- Ulnar bony prominence
- FPL

- 10°
In order to step forward of Volar Distal Radius plating

SAFE

Minimally Invasive

VLP fixation

Stable

Secure

Anatomy

Implant & Instrument

Indication (Elderly)

Surgical Technique
Thank you for your attention!

Okayama Castle & Korakuen Garden