Distal Radius Volar Locking Plates: A Comparison of Volar Lunate Facet Support

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Introduction

- Comminuted, intra-articular fractures of the distal radius that have extension into the volar lunate facet pose a challenging problem.
- The small, volar extension of the lunate articular surface may prevent conventional distal radius volar locking plates (VLP) from effectively supporting the fragment without violating the watershed line distally.
- We conducted a 3D anatomical study, to determine the size of the volar lunate facet fragment that could be effectively stabilized by various VLP designs.

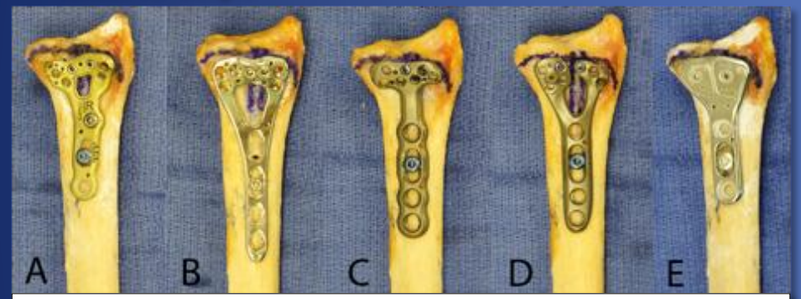


FIGURE 1: (A) Acu-Loc 2 Proximal VDR Plate (Acumed) standard size; (B) 2.4 mm LCP Two-Column Volar Distal Radius Plate (Synthes) standard size 7-hole; (C) DVR Anatomic (Hand Innovations) standard size; (D) Geminus distal radius volar plate (Skeletal dynamics) standard size; and (E) CoverLoc volar plate (Tornier) head width 25 mm.

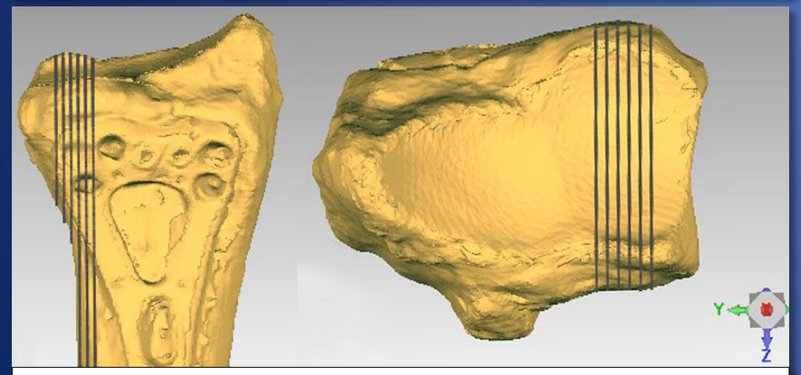


FIGURE 2: Each plate-bone combination was entirely scanned by 3D laser scanner to create a computer model. A serial of sagittal-plane cuts was applied through the lunate facet with an interval of 1 mm.

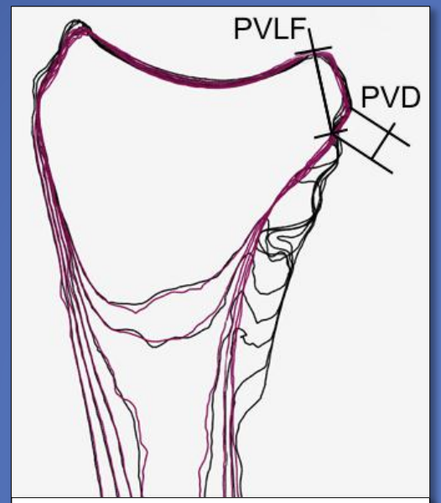
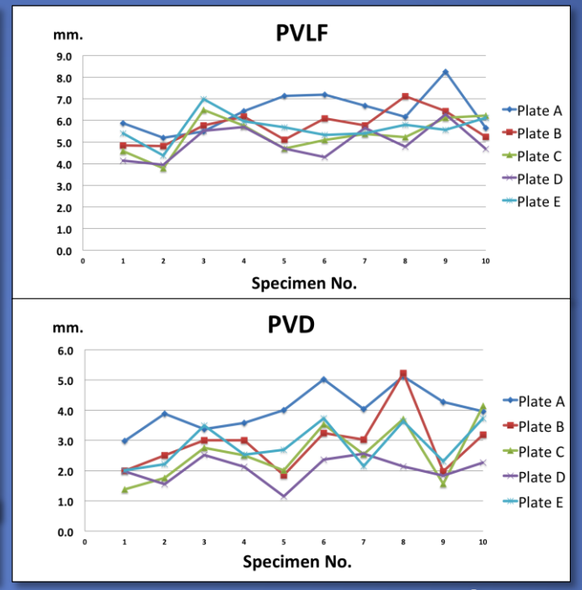
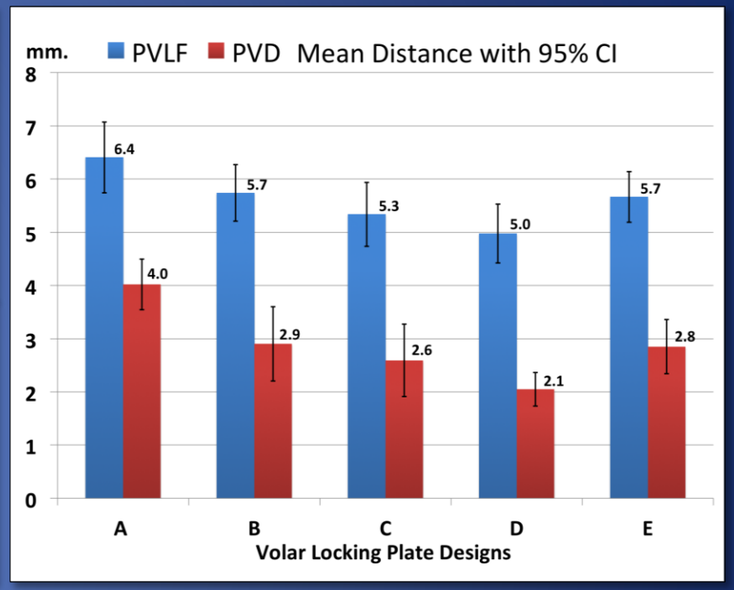


FIGURE 3: Six of sagittal-plane cuts through the most volar prominence of the lunate facet, was merged and used for measurements.





Methods:

- 10 fresh-frozen match-pair distal radius specimens were dissected. The watershed-line was marked.
- 5 VLP designs were fixed to each specimen (Fig.1) by:
  1. positioning the plate in its optimal anatomic fit
  2. using similar axial alignment
  3. fine-tuning the position of the plate by sliding it distally until it reached the watershed line
  4. screws were placed within 2 mm of subchondral bone
- Fluoroscopy was used to adjust the plate positions, and classified according to Soong's grading system.
- A 3D laser scanner was used to create computer models (Fig.2).
- Volar lunate facet support was measured using a combination of 6-sagittal-plane cuts through the most volar prominence of the lunate facet (Fig.3). Parameters of interest were: Plate-edge to Volar-rim of the Lunate articular Facet (PVLF) and the plate-edge to Volar-rim of the Distal radius (PVD) for each design (Fig.3).
- One-way ANOVA was used to analyze the data.

Results:

- The average PVLF was 5.6 ± 0.9 mm (min 3.8; max 8.3 mm) and PVD was 2.9 ± 1.0 mm (min 1.2; max 5.2 mm) for all VLP design. Significant differences were noted for various designs.

Discussion:

- Positioning of the VLP just proximal to the watershed line revealed differences in the size of the lunate facet fragment that could be supported by each plate.
- The lunate facet fragment may be difficult to distinguish on lateral x-rays due to overlapping bony and plate shadows. 3D inspection enabled us to evaluate the volar lunate facet size that could be captured with conventional VLP fixation.

Clinical Relevance:

- The described measurement parameters may guide preoperative and intraoperative planning when faced with a volar lunate facet fragment.
- A PVLF distance of 5mm or less should prompt the surgeon to consider a fixation strategy that does not exclusively rely on standard volar locking plate fixation.