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.

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.