The intraoperative radial groove view and dorsal tangential view of the distal radius to assess potential dorsal protrusion of screw tips: feasibility and difficulties in clinical practice

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Introduction
Open reduction and internal fixation (ORIF) using volar locking plates is a common method for treating displaced distal radius fractures. However, volar locking plates can cause irritation or rupture of the extensor tendons in general in 2-6% of patients and particularly the extensor pollicis longus (EPL) tendon in the radial groove. Standard and lateral intraoperative fluoroscopic views have been shown to be unreliable in detecting screw protrusion. Thus, the dorsal tangential view (DTV = “skyline view”) and the radial groove view (RGV) were added to the standard intraoperative views in our department. It was the aim of this study to evaluate the DTV and RGV regarding reproducibility and image quality.

Methods
The DTV and RGV were introduced in our department in April 2016. All surgeons involved in orthopedic trauma surgery received an instruction how to apply these techniques and how the images are to be assessed. The ideal angle between the radius and the X-ray beam required to assess the dorsal cortex of the radius to detect over-long screws in a DTV is 15° (Fig. 1A, B and 2A). The ideal angles for the RGV are 20° in the horizontal plane and 5° in the sagittal plane (Fig. 2B, 3A, B and 4).

Intraoperative images were collected from all patients undergoing volar locking plate osteosynthesis (2.4mm Variable Angle LC® Two-Column Volar Distal Radius Plate, Duy Synthes, Oberdorf, Switzerland) for fractures of the distal radius from June to November 2016. The images were analyzed regarding the correctness of the views with the identification of the radiological landmarks (dorsal cortex of the distal radius and the radial groove).

Results
The operations were performed by 19 different surgeons, 10 of which were residents in a teaching setting. Intraoperative fluoroscopy images (DTV and RGV) from 30 consecutive patients were included in this study. The DTV was performed in all cases. An additional RGV was documented in only 19 of the patients. From 30 DTV, only 5 images (17%) were technically correct (Fig. 5) or acceptable (Fig. 6). An additional RGV was documented in 19 patients (63%) of which only 3 images (16%) were technically correct (Fig. 7) or acceptable (Fig. 8). All other images demonstrated different technical deficiencies such as superimposition of the proximal carpal row cortices or the impossibility to identify the radial groove (Fig. 9). A proper assessment of potential screw tip penetration through the dorsal cortex and/or into the radial groove with a set of correct DTV and RGV was documented in 3 patients (10%) only.

Conclusions
DTV and RGV may be good methods to assess possible protrusion of screw tips through the dorsal cortex or into the radial groove if properly performed. Their application is associated with technical difficulties which may limit their clinical value. Meticulous instruction and training is required to improve image quality and with it the clinical benefit.

References