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ORIGINAL ARTICLE

Validity of modified radiological views to detect screw protrusion at the distal radius. A comparative study with computerized tomography☆

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KEYWORDS
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Abstract Volar fixed-angle plates (VFAP) are currently widely used for the treatment of extra-articular distal radius fractures. Using these plates has a high risk of articular and dorsal screw protrusion due to their special configuration. The aim of this study is to assess the validity of the standard x-rays, performed with the help of wedged supports, in order to detect articular and dorsal screw protrusion. A comparison with computed tomography (CT) scan imaging has been made. The outcome of 26 patients with distal radius articular fracture, treated with a VFAP, is reported. Good correlation between modified x-rays and CT scan was observed. A sensitivity of 100% for articular protrusion and 66% for dorsal has been obtained. When detecting screw protrusion at the distal radius, the use of wedged supports to perform special x-rays intraoperatively is an effective tool.

PALABRAS CLAVE
Fractura radio distal;
Protrusión tornillos;
Proyecciones radiológicas

Validez de la radiología simple con proyecciones especiales para detectar la protrusión de tornillos en el radio distal. Estudio comparativo con tomografía axial computarizada

Resumen El tratamiento de las fracturas intraarticulares del radio distal mediante placas volares de ángulo fijo (PVAF) está ampliamente difundido en la actualidad. El uso de estas placas, debido a su peculiar configuración, conlleva un elevado riesgo de protrusión de los tornillos a nivel intraarticular y dorsal. El objetivo de nuestro trabajo es determinar la validez de las proyecciones radiológicas habituales, realizadas con la ayuda de soportes en forma de cuña, para detectar la protrusión de los tornillos a nivel intraarticular y dorsal, utilizando la

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tomografía axial computarizada (TAC) como prueba de referencia. En el estudio se presentan los resultados obtenidos en 26 pacientes tratados de una fractura articular de radio distal mediante una PVAF, modelo DVR®. Se ha observado una correlación satisfactoria entre los resultados de las radiografías con soportes cuando han sido comparadas con la TAC, con una sensibilidad del 100% para las protrusiones intraarticulares y del 66% para las protrusiones dorsales. Se recomienda la realización de estas proyecciones especiales de muñeca como una herramienta intraoperatoria útil para detectar la protrusión de los tornillos en las PVAF.

Introduction

Osteosynthesis of distal radius fractures with a volar fixed-angle plate (VFAP)[1,2] involves the risk of protrusion of the screws, which can invade the joint space or pierce the dorsal cortex. Tendon complications derived from dorsal protrusion are currently well documented.[3–5]In our department we have used the DVR® plate for the treatment of distal radius joint fractures since its introduction. Inadvertent protrusion of the screws is not uncommon, given the three-dimensional, diverging configuration of the screws of the DVR® plate, like that of many other VFAP, and the peculiar shape of the distal radius. This should be avoided during surgery through a careful radiological examination, which should take into account the natural, specific angulations of the distal radius: 11° palmar tilt and 22° ulnar tilt.[6,7]

Suspicion of protrusion of a screw during the postoperative follow-up period is difficult to confirm through a conventional radiographic study with anteroposterior (AP) and lateral (L) projections, since these are routinely performed without taking into account the aforementioned specific angulations. In general, it is necessary to conduct studies by computed tomography (CT) in order to determine if protrusion is truly present. Our group has developed a model of wedge-shaped supports which facilitate correct radiographic studies in order to obtain radiographs which are tangential to the joint surface of the distal radius.

The objective of this study is to evaluate the usefulness of special radiographic projections, with the aid of wedge-shaped supports, to detect intra-articular and dorsal protrusion of VFAP screws, using the CT diagnostic test as a reference.

Materials and methods

Out of all patients undergoing VFAP surgical interventions for distal radius fractures in our service, 26 agreed to participate in the study. We obtained informed consent in all cases. We conducted a physical examination of both wrists, measuring active palmar flexion, active and passive dorsal extension, ulnar and radial deviation and grip strength with a Jamar® dynamometer. We assessed 2 subjective parameters: pain measured by a visual analog scale (VAS) and satisfaction index expressed on a numerical scale from 0 to 10, with 0 representing total dissatisfaction and 10 representing the maximum possible satisfaction.

Following the examination, we conducted studies with 2 specific scales to assess independence and mobility of the affected upper limb: the Quick Dash[8] scale and the Mayo[9] wrist scale.

Radiographs (Rx) of each operated wrist were obtained using AP and L projections. Both projections were obtained by positioning wrists on wedge-shaped supports, designed for this study. The supports had inclinations of 11° and 22°, so as to obtain Rx which were tangential to the joint surface of the radius in the AP and L projections, respectively (Fig. 1).

We requested a multisection CT scan of all patients, obtaining images in all 3 dimensions. This imaging test was considered as the reference against which to compare radiographic images in the AP and L projections.

The evaluation of the images from the plain radiography and the CT scan were performed independently by the 2 researchers, with each patient being assigned a number, and findings were subsequently contrasted.

We defined the following situations:

- Absence of any type of protrusion.
- Slight articular protrusion of a screw.
- Slight dorsal protrusion of a screw.
- Clear articular protrusion of a screw.
- Clear dorsal protrusion of a screw.

Slight protrusion was considered as the simple prominence of the end of a screw beyond the cortex, whereas clear protrusion was considered when the prominence included the thread of the screw.

The results of the evaluation of the images were entered into an Excel® spreadsheet and statistical analysis was performed using the software package SPSS® for Windows version 15.0 (SPSS Inc., Chicago, IL, USA).

Results

The sample consisted of 17 females and 9 males, with a mean age of 58.55 ± 10.12 years (range: 36–76 years). A total of 17 patients suffered left wrist fractures, whereas 9 suffered right wrist fractures.

Of the 26 CT requested we only obtained images from 20 patients, for reasons unrelated to the study (appointment errors and computer problems).

The results of the physical examination are shown in Table 1. Regarding the results of the scales, the Quick Dash presented a mean score of 17.5 ± 18 (range: 0–66), whilst the Mayo wrist scale presented a mean score of 74.5 ± 12.43 (range: 35–90).

The subjective test results presented a mean VAS score of 1.76 ± 6.34 (range: 0–8), and a mean satisfaction score