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Original article

What is the real angle of deviation of metacarpal neck fractures on oblique views? A radiographic study☆

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ABSTRACT

Objective: The aim of this study was to establish an indirect, easy-to-use, predictable and safe means of obtaining the true degree of displacement of fractures of the neck of the fifth metacarpal bone, through oblique radiographic views.
Methods: An anatomical specimen from the fifth human metacarpal was dissected and subjected to ostectomy in the neck region. A 1-mm Kirschner wire was fixed to the base of the fifth metacarpal bone, perpendicular to the longitudinal axis of the bone and parallel to the ground. Another six Kirschner wires of the same diameter were bent over and attached to the ostectomized bone to simulate fracture displacement. Axial rotation of the metacarpus was used to create oblique radiographic views. Radiographic images were generated with different angles and at several degrees of rotation of the bone.
Results: We deduced a mathematical formula that showed the true displacement of fractures of the neck of the fifth metacarpal bone by means of oblique radiographs.
Conclusions: Oblique radiographs at 30° of supination provided the best view of the bone and least variation from the real value of the displacement of fractures of the fifth metacarpal bone. The mathematical formula deduced was concordant with the experimental model used.

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Qual é o ângulo real do desvio da fratura do colo do metacarpo nas incidências oblíquas? Estudo radiográfico

Palavras-chave:
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RESUMO

Objetivo: Estabelecer uma forma indireta, fácil, previsível e segura na obtenção do valor real do desvio da fratura do colo do quinto metacarpo a partir de radiografias oblíquas.
Métodos: Uma peça anatômica de quinto metacarpo humano foi dissecada e submetida à ostectomia na região do colo. Um fio de Kirschner de 1 mm foi fixado perpendicular ao eixo longitudinal do osso e paralelo ao solo. Outros seis fios de Kirschner do mesmo diâmetro foram dobrados e presos ao osso ostectomizado para simular o desvio das fraturas. Rotação axial do metacarpo foi usada para criar as radiografias nas incidências oblíquas. Imagens radiográficas foram obtidas com diferentes ângulos e em vários graus de rotação do osso.
Resultados: Deduzimos uma equação matemática que demonstra o real desvio da fratura do colo do quinto metacarpo por meio de radiografias oblíquas.
Conclusões: A radiografia oblíqua com 30° de supinação apresenta melhor visualização do osso e menor variação do valor real do desvio da fratura do colo do quinto metacarpo. A fórmula matemática deduzida foi concordante com o modelo experimental usado.

Introduction

Fractures of the neck of the fifth metacarpal result from direct axial or oblique trauma on this bone. They may be due to a fall or to receiving a blow. These fractures occur frequently in the general population and account for around 20% of all fractures of the hand.[1,2]

Clinical evaluations on patients with these fractures take into consideration shortening, rotation and angular deviation during flexion.[2–4]

The reduction technique most used is the Jahss maneuver, which improves the degree of deviation of the distal fragment of the fracture.[5]

The decision to implement surgical treatment depends on clinical and radiographic parameters and also on the patient's age, profession, activity level and handedness.[6]

It has been recommended in the recent literature that radiographic assessments on these fractures should be conducted using anteroposterior, lateral and oblique radiographic views.[5]

It is known that the best way of evaluating the real angle of deviation of a fracture is by means of a radiographic view perpendicular to the fracture line.[4] However, lateral radiographs are often limited because of superposition of the other metacarpals, the technical quality of the image, the presence of plaster-cast immobilization after the reduction and the printing on photographic paper.[7,8] Tasbas et al.[9] studied the influence of the radiographic method on the measurements obtained for analyzing these fractures.

The objective of the present study was to establish an easy-to-use, predictable and safe indirect method for ascertaining the real degree of deviation during flexion in fractures of the neck of the fifth metacarpal, through application in oblique-view radiographs, which provide a better view of the bone in question.

Material and methods

An anatomical review of the human fifth metacarpal was conducted in order to understand the spatial positioning of this bone in the hand.

After the fifth metacarpal of the donor cadaver had been dissected to remove soft tissues, it was subjected to wedge ostectomy in the neck region, with a volar basis. This resection was performed using an oscillating saw guided by a transfer system and enabled simulation of fractures with deviations of up to 90°.

A 1 mm Kirschner wire was attached to the base of the fifth metacarpal, perpendicular to the longitudinal axis of the bone and parallel to the ground. Another six wires of the same diameter, with predetermined angular measurements that would reproduce the deviation of the fracture during flexion, were then attached to the dorsal cortex of the bone (Fig. 1) and were maintained oriented orthogonally to the first wire.

The angles used to simulate fractures were 15°, 30°, 45°, 60°, 75° and 90° (Fig. 2). The axial rotation determined by the wire that was parallel to the ground was used to create oblique radiographic views at 0°, 15°, 30°, 45°, 60°, 75° and 90° (Fig. 1), which were established with the aid of a goniometer.

The bone was fixed using a 2 mm metal screw in a plastic support equipped with a goniometer (Fig. 1).

All the radiographs were produced with an X-ray beam parallel to the ground, at a distance of 1 m between the specimen and the device. We used a digital radiography machine (model RO 1750 ROT 360, Philips Medical Systems DMC GmbH, Hamburg, Germany), with parameters appropriate for radiographs of the hand (46 kV; 5.00 mAs; 20 ms). In this manner, images with a variety of angular deviations of the ostectomy and degrees of rotation were produced, which thus comprised oblique images (Fig. 3).