

Factors affecting lunate's sagittal alignment

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INTRODUCTION

The lunate classically is described to have tendency to rotate dorsally under the capitate compressive force due to its shape of a wedge with apex towards the dorsum[1]. However no correlation could be demonstrated between the shape of the lunate and the radiolunate angle (RLA)[2]. The sagittal axis of the midcarpal joint lies parallel and dorsal to that of the radiocarpal joint, creating a force couple tending to rotate the lunate dorsally [1,3]. Despite this, lunate is found to maintain an attitude of flexion in most individuals [4].

The dorsal placement of the lunato-triquetral articulation on the lunate provides extension torque to the triquetrum causing lunate to rotate dorsally and balancing the scaphoid's flexion torque. Magnitude of such extension torque should presumably vary among various lunates depending upon inclination and extent of the triquetral's articulation on the lunate and triquetrum's alignment in sagittal and axial plane.

Review of literature failed to provide a study quantifying dorsal orientation of the midcarpal axis. Moreover, there has been no definite description also of how to measure and exactly draw the midcarpal (MCA) and the radiocarpal axes (RCA). It was felt that identifying MCA and RCA accurately on CT, quantifying their displacement with each other and establishing correlation among various parameters might be able to throw some light on the lunate's ambiguous behavior.

METHODS

Database from our earlier studies [5] was utilized to provide material for the present study and included CT wrist of 70 healthy volunteers who never had any symptoms pertaining to their wrist joint. The mean age was 34 years with a range of 19-55 years. There were 49 males and 21 females.

Sagittal section through the middle of the capitate head was used to measure volar tilt of the distal radial articular surface (VT), lunate's sagittal axis (LSA) and the wedge ratio (WR) for the shape of the lunate[2]. Sagittal cuts were also measured for the axis of the triquetrum (TSA) and the midcarpal (MCA) and the radiocarpal axes (RCA). The distance between the two axes was measured and taken as positive value if MCA was found posterior to the RCA while anteriorly placed MCA measured as negative value. The axial sections were reformatted and measured for the lunate axis (LA), triquetro-hamate axis (THA) and luno-triquetral angle (LTA).

RESULTS AND DISCUSSION

The midcarpal axis was found to be dorsal to the radiocarpal axis in 21 patients (30%), volar in 29 patients (41%) while the two axes were nearly collinear in 20 patients (29%). The mean distance between the two axes was 1.6 mm (S.D. 0.87) in the former group and -1.3 mm (S.D. 0.71) in the later. The distance between the two axes showed a strong correlation

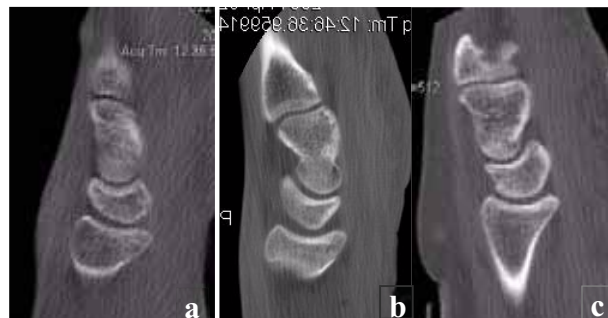


Figure 1: Lunate is seen not to rotate towards its thinner side. It is rather rotating in the opposite direction in b, & c.

with the LSA ($p < .001$) and mild correlation with WR measurements ($p < .005$) while it showed no correlation with the VT. The LSA demonstrated significant correlation with TSA and LTA while no correlation was seen with the WR measurements, VT and the LA.

One out of every three persons is reported to have a lunate with shapes not favoring the tendency to dorsiflex. The whole proximal carpal row including the lunate was found to flex, radially deviate and supinate under the axial loading [6]. Elimination of the physiological axial load in anaesthetized patients with complete muscle relaxation reported producing extension of the lunate and the scaphoid and concluded that axial loading due to the normal tone of the forearm muscles tends to flex the scaphoid and the lunate[7]. Despite this, it is rare to find lunate maintaining an attitude of flexion in patients with scapholunate dissociation. The CT measurements of most lunates failed to classify them into the described three shapes since many lunates showed dissimilar typing on the various chosen sagittal sections of the same lunate[5]. It is thus not surprising that lunate's alignment failed to conform to its shapes (Fig.1).

CONCLUSIONS

Relationship between MCA and RCA in terms of the dorso-volar displacement has key role in determining the lunate's sagittal alignment while the lunate's shape may be affecting it secondarily only. The other important factors are scaphoid's flexion torque and extension torque from the triquetrum, with TSA, LTA and THA in turn influencing the latter.

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