A bone of contention: A dynamic ultrasound assessment of the role of the radial head in the arthrokinematics of the proximal radioulnar joint

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SCAN TO REVEAL **AUGMENTED REALITY**

INTRODUCTION

The arthrokinematics of the proximal radioulnar joint (PRUJ) are believed to follow the convex-concave rule, meaning that when the concave ulnar notch of the radius moves on the convex distal head of the ulna, rolling and gliding occur in the same direction. Previous research using helical computerized tomography (CT) identified that the sequence of joint actions is in contrast with this rule, which would indicate a posterior glide of the radius on the ulna during pronation movement and the converse during supination.

OBJECTIVES

The aims of this study were to determine the arthrokinematics of the PRUJ in vivo while being assessed via ultrasound (US) imaging and to assess the impact the direction of joint mobilization has on active and passive range of motion (ROM) during forearm supination and pronation at the PRUJ.

METHODS

53 healthy individuals (14 male:39 female) with a mean age 28 (age range of 21 – 55 yrs) were recruited. The experimental upper extremity was randomly selected. Arthrokinematics of the PRUJ were observed via US cine-loops using a linear transducer applied in the transverse plane over the radial head during two testing conditions (Fig. 1). A metronome standardized the rate of forearm pronation and supination at 1Hz (60 bpm). Radial head motion was assessed in two different elbow positions during US and joint range of motion assessment. The elbow was flexed to 90° with a neutral forearm position and fully extended with a neutral forearm position. The glenohumeral joint was stabilized during all testing conditions. A repeated measures design randomizing joint mobilization direction to the radial head was utilized to assess forearm pronation and supination via inclinometer data measured in degrees. Joint glides were applied according to the convex-concave rule to facilitate forearm motion. An anteromedial glide was utilized to facilitate forearm supination and a posterolateral glide to facilitate forearm pronation, while a metronome standardized the rate of mobilization at 2Hz (120 bpm). A bubble inclinometer assessed active and passive PRUJ ROM at the wrist during all testing conditions.

ULTRASOUND RESULTS

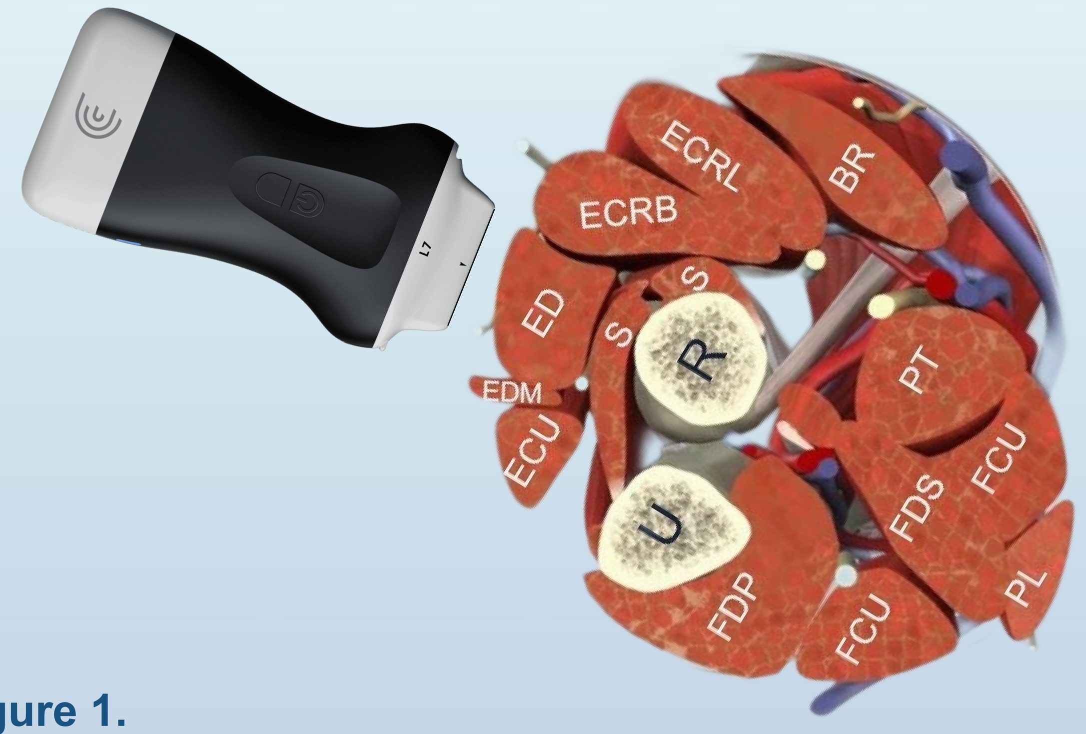

Figure 1.
Illustration showing US transducer placement and labeled anatomy of the forearm

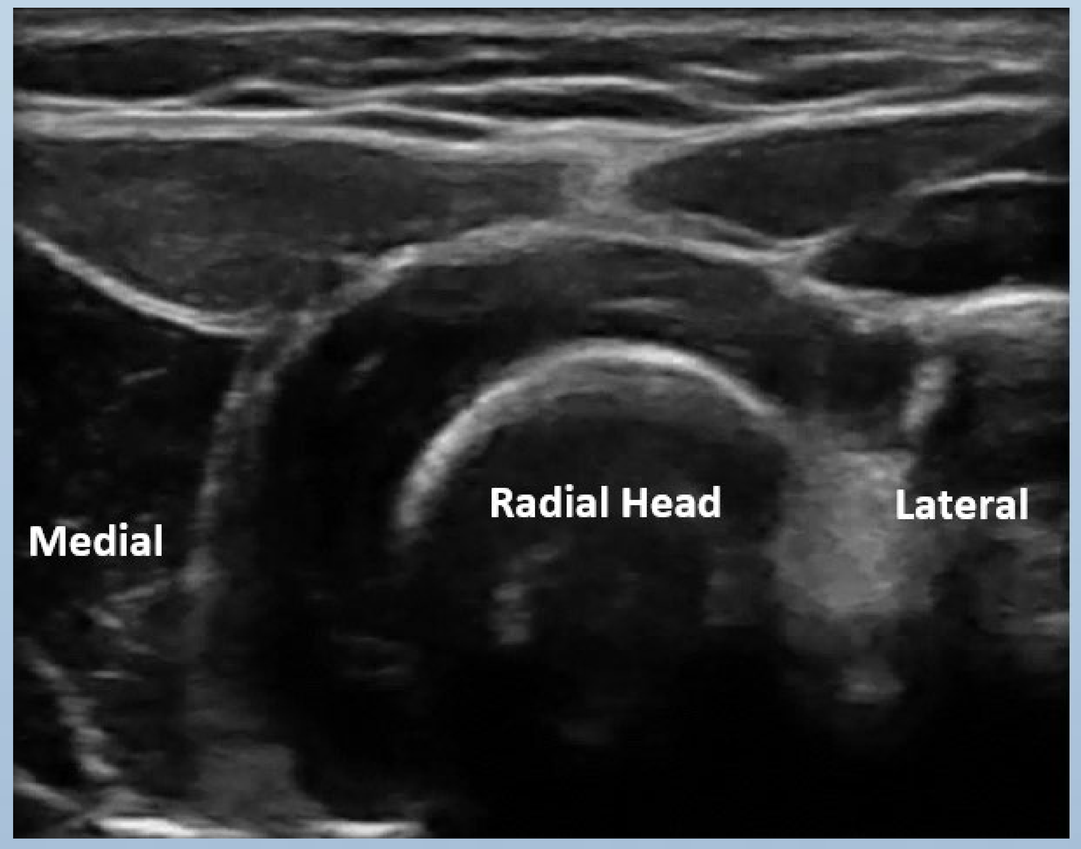

Figure 2.
Radial head motion during forearm supination

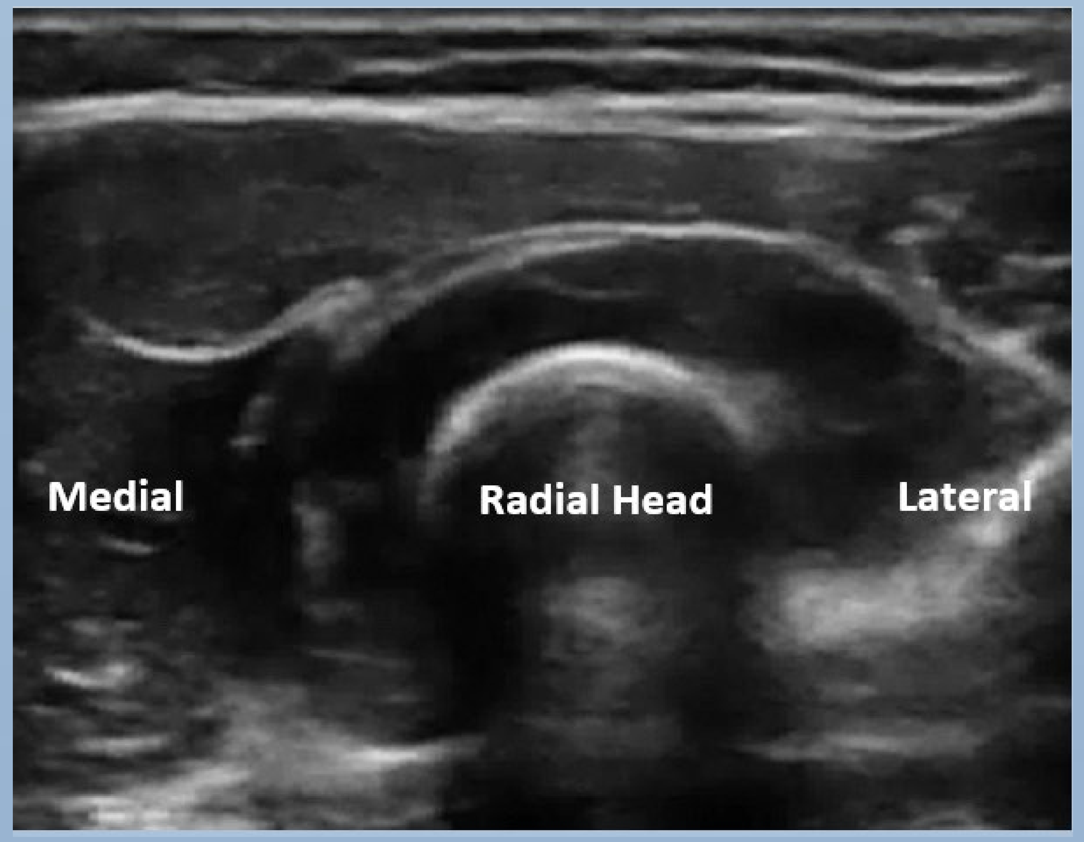

Figure 3.
Radial head motion during forearm pronation

RESULTS

US imaging cine-loops showed the radial head rolled anteromedially during pronation and posterolaterally during supination, with no translation/gliding evident (Figs. 2 & 3). Multivariate analysis revealed that the direction of joint mobilization had a significant impact on ROM $F(1,47.0) = 6.964$, $p=0.11$, partial $\eta^2 = .129$), with anterior mobilization increasing pronation and posterior mobilization increasing supination. The degree of elbow flexion impacted supination and pronation. Supination ROM was significantly increased $F1(1, 47.0) = 78.03$, $p<0.001$, partial $\eta^2 = .624$), when the elbow was flexed to 90° when compared to full extension, with full extension favoring greater pronation ROM.

CONCLUSION

Our findings are in agreement with another study which reported inconsistencies that are paradoxical to the convex-concave rule. Consequently, our findings could impact the effectiveness of manual therapy techniques used by physical therapists at the PRUJ since most are governed by the convex-concave rule. Should we now reconsider the efficacy of applying this rule to improve joint ROM at the PRUJ?

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