Evaluation of Range of Motion

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14.1 Introduction

The elbow is a complex hinge joint that comprises three bony articulations responsible for its stability. Physical examination is very important and begins with the inspection of the affected elbow and comparison with the contralateral side. The examiner should observe the resting position of the elbow. In patients with effusion, the elbow is often held in 70–80° of flexion, a position accommodating the greatest capsular volume [1].

14.2 Carrying Angle

The examiner should also assess the carrying angle of the elbow. The carrying angle is a clinical measurement of the angle formed by the forearm (specifically an ulna) and the arm (humerus) with the elbow extended in the coronal plane [2, 3]. In full extension, a normal valgus carrying angle is approximately 11° in men and 13° in women (Fig. 14.1).

The changes in the carrying angle can be seen in sequelae of elbow fractures (supracondylar fractures in children—varus) and in throwing athletes (may indicate an adaptation to repetitive valgus stress) [4].

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J. G. Lane et al. (eds.), *The Art of the Musculoskeletal Physical Exam*,
https://doi.org/10.1007/978-3-031-24404-9_14

Fig. 14.1 The carrying angle in man and woman

14.3 Motion

The loss of full extension is the first motion alteration caused by the majority of pathologies and the last movement to be regained. Normally, the arc of flexion–extension, although variable, ranges from about 0° to 140° plus or minus 10° [5] (Fig. 14.2). This range exceeds the range normally required for daily living activities, which ranges from 30° to 130°.

Pronation–supination range can change more than the flexion–extension one. Acceptable degree of pronation and supination are 75° and 85°, respectively, whereas functional motion is about 50° in each direction [6]. The examiner should record both active and passive movements. The arm is at the side and the elbow flexed 90° during the assessment of the arc of forearm rotation to avoid abduction of the shoulder that could occur when patients tend to accommodate for loss of pronation (Fig. 14.3).

The measurement of the range of motion with the elbow in extension is inadequate because the values could result overestimated for the compensation of the shoulders (Fig. 14.4).

Chapleau et al. found an association between body mass index (BMI), age, hyperlaxity, arm and forearm circumferences, as well as elbow range of motion (ROM), in healthy adults. Among these factors, BMI and forearm circumferences seem to have a greater effect on ROM. Women had more flexion than men. No clear association was found between the laterality (or hand dominance) and elbow ROM [7].

In patients with extension or flexion contracture, the examiner should evaluate the solid or soft end points as well as the pain or crepitus elicited during the arc of the movement. The examiner should make a careful assessment of any compromised arc of motion from the shoulder to the wrist. Often, the disability will arise from a combination of factors, but it should be stressed that a full ROM at the elbow is not essential for performance of the activities of daily living as described previously. Because the loss of extension up to a certain degree only shortens the lever arm of the upper extremity, flexion contractures of less than 45° may have little practical significance although patients may be concerned about the cosmetic appearance [5, 6].

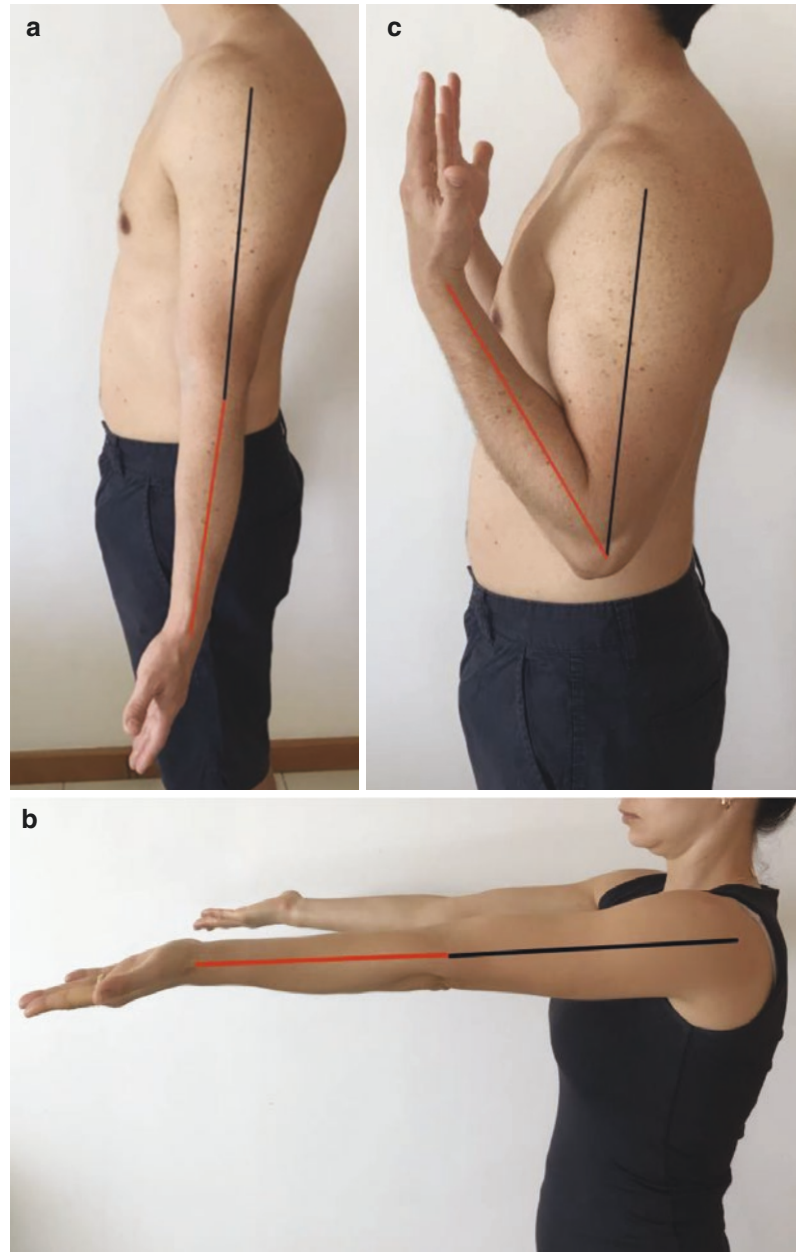

Fig. 14.2 The arc of flexion–extension of the elbow. (**a** and **b**) Extension; (**c**) Flexion

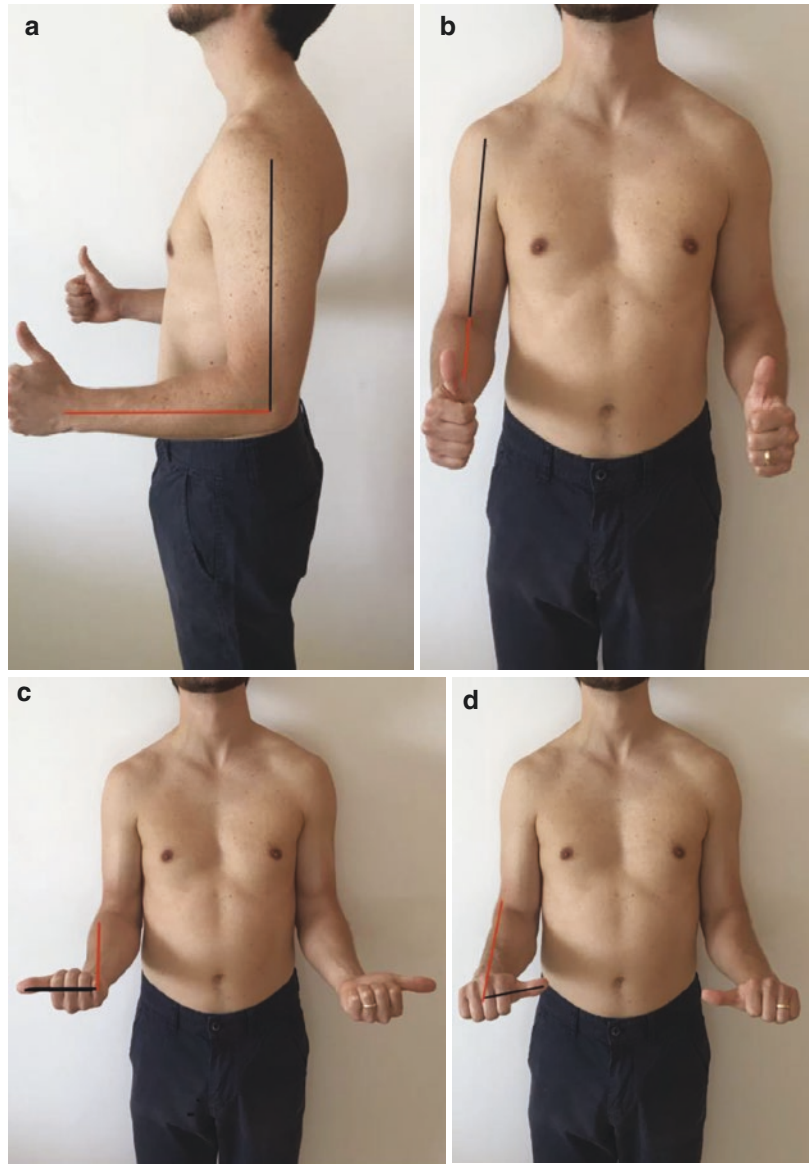

Fig. 14.3 The arc of pronation–supination of the elbow: exam done with elbow flexed 90° (**a** and **b**). (**c**) Maximum supination; (**d**) Maximum pronation

Fig. 14.4 The arc of pronation–supination of the elbow: Incorrect measurement with total extension of the elbow

14.4 Range of Motion in Daily Activities

Latz et al. described elbow's range of motion while driving a car on different road types. When driving a car with a left-sided steering wheel and a manual transmission on the right side, mean pronation of the right elbow is significantly higher than that of the left elbow. Their results suggest that movement restrictions in pronation could possibly affect driving capability earlier than restricted supination [8].

14.5 Limitation of Motion (LOM)

LOM of the elbow joint can derive from different factors, including acute or chronic trauma, burn scar contracture, heterotopic ossification, coma, postoperative scarring spasticity. Intra-articular lesions causing LOM are adhesion, loose bodies, osteochondritis dissecans of capitellum, chondromalacia of the radial head, synovitis, and osteophytes on the olecranon or coronoid process [9].

Function of the elbow is essential for the activities of daily living. The outcomes of treatment are favorable when the etiology is considered in the decision-making process. Nonoperative management should be attempted in all cases of the stiffness of the elbow, except when the stiffness is due to heterotopic ossification or intrinsic causes. Operative intervention should be considered after nonoperative treatment has failed and should be performed within the first year to 19 months after the injury (cases with postoperative elbow stiffness).

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