THE FUNCTIONAL RANGE OF MOTION OF THE FINGER JOINTS.

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INTRODUCTION

The ability to perform functional tasks is closely related to the available motion of the joints. Despite the significant functional deficits, the literature on the functional range of motion of the fingers is limited. Hume et al. measured the range of motion of the finger joints while grasping 11 different objects. All subjects were male between 26-28 years.

MATERIALS AND METHODS

1) We assessed the dominant hand of five male and five female asymptomatic volunteers, between the ages of 18 and 53 years.
2) The finger joints were measured with an electronic goniometer from the EVAL Computerized Evaluation System which has an accuracy better than 1˚.

RESULTS

Active Range of Motion

1) The average active range of motion was MCP 109˚, PIP 108˚, and DIP 90˚. This accounts for 36%, 35% and 29% of the total active motion of the finger.
2) The pregrasp posture to perform 90% of the functional activities utilised MCP 49%, PIP 54% and DIP 56% of the active joint motion.
3) The active ROM of the MCP, PIP and DIP joints was measured in maximal flexion and extension. Passive extension of each joint was also measured.
4) The subjects completed the 20 tasks from the Sollerman Test of Hand Grip Function which assesses the eight main types of grip. For each activity the pregrasp (Fig. 2) and grasp measurement (Fig. 3) were recorded. A total of over 5000 measurements were recorded.

DISCUSSION

Clinical Value of functional ROM

Different fingers

The index finger is important when performing precision movements with the thumb, such as manipulating small objects. The ulnar side of the hand is non-functional when performing these manoeuvres. The ulnar side of the hand is important for power grasp, grasping of large objects and for cupping of the hand. Flexion power in the ulnar side of the hand is provided by the strong long flexors and supported at the MCP joint by the bipennate lumbricals. The little finger has the most passive, active and functional extension. MCP joint passive extension is important for increasing the span of the hand to grasp large objects. Greater active extension is provided by the extensor tendons (MCP extension), and bipennate lumbricals (interphalangeal joint extension). The mobility of the little finger is increased by the saddle shaped CMC joint which increases the mobility of the fifth ray and adds rotation, to allow opposition. It enables the ulnar side of the hand to ‘cup’ around an object (e.g. hammer) or extend when picking up a large cube or placing the hand flat on the table. The hypothenar musculature allows the mobile fifth ray to be manipulated with precision and controls opposition. The increased mobility, dexterity and opposition increase the function of the fifth ray and may represent the evolution of a “second thumb”.

Different joints

The MCP joint is designed to increase the span of the hand. It has a relatively large active ROM, but a small functional ROM. In extension the collateral ligaments are lax and the metacarpal-carpal head allows abduction and rotation, so that the MCP joint will adapt to the shape of the object in the process of grasp. As the MCP flexes to grasp, the collateral ligaments lock the MCP joint.

The PIP joint has the greatest functional ROM and is functionally important to the finger. It has a relatively large active ROM and large functional ROM which is flexed. The PIP joint is controlled by two long flexors and the extensor hood. The interosseous muscles provides controlled extension, while the lumbricals facilitate a unique interaction between the flexors and extensor hood.

The DIP joint has a relatively small active ROM and large functional ROM which is extended. It works in tandem with the PIP joint in performing precision movements via the intrinsic muscles, extensor hood and the oblique retinacular ligament.

REFERENCES

5) The grasp posture to perform 90% of the functional activities utilised MCP 49%, PIP 54% and DIP 56% of the active joint motion.
6) The pregrasp posture to perform 90% of the functional activities utilised MCP 40%, PIP 34% and DIP 38% of the active joint motion.
7) The index finger DIP joint hyperextended when holding a knife or a pen (Fig. 1). Hyperextension places the volar plate under tension, which locks the joint to allow a greater force to be applied to the tip of the finger (FDS and FDP).