ARTHROPLASTY

OF METACARPOPHALANGEAL & INTERPHALANGEAL JOINTS

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BY

HANNA FIKRY HANNA

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SUPERVISED BY

PROF. F. BORG

PROF. OF ORTHOPAEDIC SURGERY

FACULTY OF MEDICINE

AIN SHAMS UNIVERISTY

PROF. ABUL-FOTOOH MOUSTAFA EID

PROF. OF ORTHOPAEDIC SURGERY

FACULTY OF MEDICINE

ALEXANDRIA UNIVERSITY

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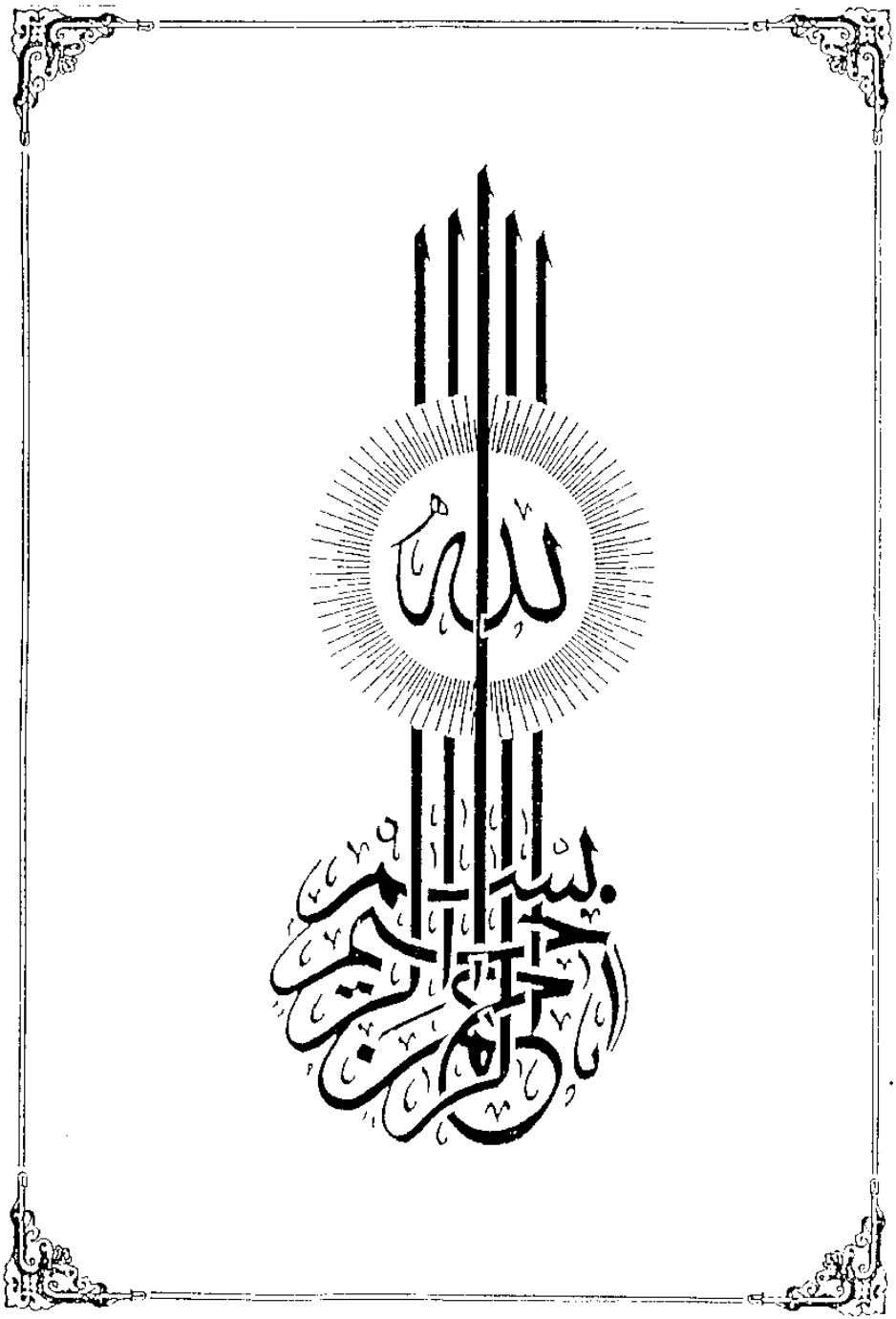

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CHAPTER I.

AIM OF THE WORK

The aim of the work is to review the different methods of arthroplasty of metacarpophalangeal and interphalangeal joints of the fingers and their relative indications, advantages, and disadvantages.

CHAPTER II.

INTRODUCTION

The importance of a normally functioning hand needs no emphasis, whether in earning a living, practicing a hobby, or allowing independence in daily activities.

The function of the hand depends on the co-ordinated movements of its digits; activated by nicely balanced extrinsic and intrinsic muscles. Stiffness of the fingers will derange such harmony, even when it affects one finger. In fact, the hand is peculiar in that it is prone to stiffness evidently because the joints are fitted together so accurately, and there are more close fitting gliding structures than elsewhere in the body (Bunnell 1956). Such mis-fortune is very common following trauma, infection and many other ailments of the hand with great financial, social and psychological implications to the patient, his family, and the community as a whole.

As a medical problem, stiffness of the fingers has been known since a long time, as a result, different modalities of treatment have have been tried with varying and often controversial results.

CHAPTER III.

ANATOMY AND BIOMECHANICS OF METACARPO-PHALANGEAL & INTERPHALANGEAL JOINTS

Distal to the wrist, there are 17 mobile synovial joints activated by nine long extensors, nine long flexors, and 19 intrinsic muscles, all packed together within the hand and digits.

Skin :

On the volar surface of the palm and fingers, the skin is tough and thick to stand wear. It covers a thick pad of fat with many fibrous septa connecting the skin to the deep fascia, thus making it rigid and inelastic. A system of creases, where the skin is adherent to the deeper layers, allows for closing the hand without bunching up in folds. The relative inelasticity of the volar skin makes itself evident when there is any skin loss or scarring by limitation of extension of fingers. In contrast, the skin of the dorsum is thin, mobile, and elastic. Such properties are used to their limit in making a fist; the whole area of dorsal skin of the hand is one third greater on making a fist.

Palmar Aponeurosis :

It is very strong, somewhat triangular, fibrous sheet that occupies the central part of the palm. It expands from a blunt apex at the distal edge of the transverse carpal

ligament where it blends with it and receives the insertion of the palmaris tendon.

The aponeurosis is a special thickening of the central portion of the deep fascia of the hand. It is formed of fibres which run longitudinally towards the fingers, linked together by transverse ones. The aponeurosis gives off from its superficial surface, fibres that attach it to the skin especially marked at the creases. As the region of the metacarpal heads is reached, the transverse fibres cease, but the longitudinal ones run distally towards each of the four fingers. When these diverging slips reach the region of the webs, they are again connected by less distinct superficially lying transverse fibres; the natatory ligament or the superficial transverse metacarpal ligament. As the four longitudinal slips pass distally, they are closely overlying the long flexor tendons. Some of the more superficial fibres often termed the pre-tendinous bands, continue distally in front of them. The major portion of each longitudinal slip divides into two bands that passe deeply on each side of the flexor tendons to attach to the metacarpal bone and the deep transverse metacarpal ligament. Four tunnels are thus formed. In the interspace between the metacarpals, four other tunnels, the lumbrical canals, are formed. The

fibres about the sides of the tendons blend with their fibrous sheath and are often described as attached to the proximal and sometimes even the middle phalanges (Hollinshead 1958).

Bones of the Hands :

The versatility of hand action is due to the mobility of its two borders. The thumb contributes the larger part because it can separate widely from the palm, swing around in front of the fingers and oppose any of them. The mobility of the ulnar border is provided by movements of the fourth and fifth metacarpals at the carpometacarpal joints. These two mobile borders are slung from a rigid central pillar which consists of the two metacarpal bones of the index and middle fingers (Flatt 1961).

To provide for both mobility and strength of the skeleton of the hand, the bones are arranged in a series of arches, all of which have their concavity towards the palm; thereby turning the hand into a cup.

There are two transverse arches and a series of longitudinal arches. The proximal transverse arch is rigid and is formed of the bones of the carpus. The distal transverse

arch, located at the level of the metacarpal heads, is mobile. Its presence allows the palm to adapt to objects of various sizes. The series of longitudinal arches are constructed by the finger rays. The apex or keystone of each longitudinal arch is the metacarpophalangeal joint. The longitudinal arches are very mobile and alter their shape in response to the demands of grasp. The integrity of all these arches is directly controlled by the intrinsic muscles.

The Metacarpophalangeal Joints :

Each joint is formed by the head of a metacarpal bone articulating with the base of the opposing proximal phalanx. The head of the metacarpal presents a convex distal articular surface which is broader on the volar surface than on the dorsum. The side of the head is bulging in relation to the shaft and presents a tubercle for the attachment of the collateral ligaments lying nearer to the dorsal surface. The articular surface of the base of the phalanx is shallowly concave.

The joint allows flexion, extension, side to side movements and some passive rotation, pronation accompanies radial deviation and supination accompanies ulnar deviation. It is of condyloid type with the exception of that of the thumb which

is more of the hinge type as movements of lateral deviation are much restricted.

Each joint has a thin articular capsule, a thick ligament on the palmar surface and two collateral ligaments on the sides. Dorsally, it is protected by the extensor expansion. The collateral ligaments span the joint running from a dorsally placed proximal attachment on the side of the metacarpal head to a volar and distal insertion on the base of the phalanx. From their direction, these ligaments become lax on extension thereby allowing the movements of abduction and adduction to occur. In flexion, the ligaments become taut in two places. In the longitudinal direction, the tightening is caused by the cam-like action produced by the shape of the metacarpal head. In the transverse plane, the bulging sides of the head of the metacarpal tightens the ligaments Figure (1).

The dense palmar ligament (volar plate) is usually described as fibrocartilagenous in structure. It is firmly attached to the base of the phalanx, but somewhat loosely to the head of the metacarpus , thus facilitating flexion of the joint. Flatt (1961) described the volar plate as being formed of two parts : a proximal membranous and a distal fibrocartilagenous portion. The membranous part is wrinkled in flexion and can become irreversibly shortened during

prolonged immobilization. The volar plate is continuous laterally with the collateral ligaments. On its palmar surface, it is gooved by the long flexor tendons and the edges of the groove give attachment to the fibrous flexor sheath.

Hakstian and Tubinana (1967) have found definite structural features of the articular surfaces, especially of metacarpal heads that distinguish onemetacarpal from another. In addition, differences are observed in the lengths of the radial and ulnar collateral ligaments.

The ring finger metacarpophalangeal joint in both hands is almost symmetrical with respect to the shape of bones and length, and position of the collateral ligaments. This joint most closely resembles the classical form, attributed to metacarpophalangeal joint.

Dealing with the index finger, the articular surface of the metacarpal head is not symmetrical; the ulnar portion of the articular condyle is more prominent especially when the head is viewed from the volar aspect. There is thus a definite shoulder on the ulnar side, while the radial portion of the articular surface is sloping. When viewed head-on, the medial anteroposterior dimensions of the condyle are seen to be greater than the Lateral. The radial collateral ligament is much thicker and