# PLASTIC SURGERY

VOLUME 7

THE HAND

Part 1

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## Part 1



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# PLASTIC SURGERY

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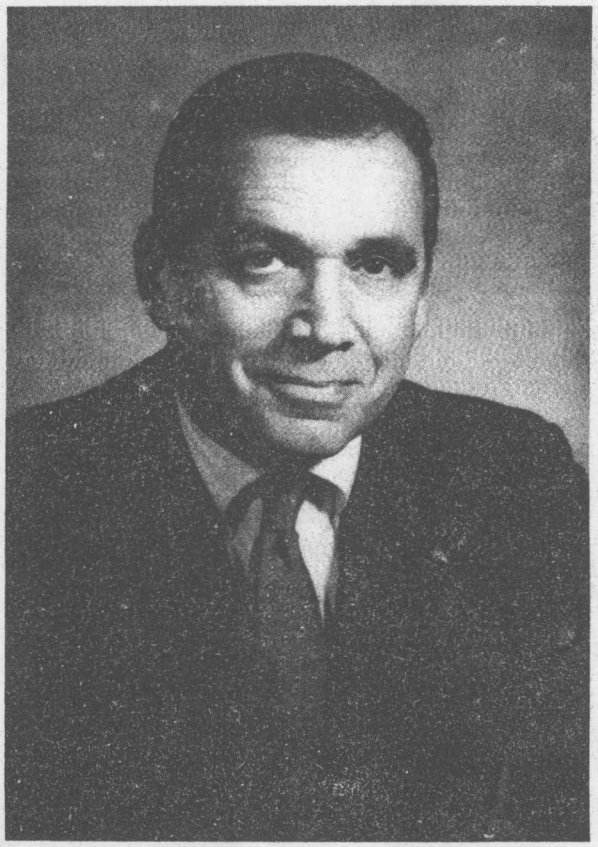

Richard J. Smith, M.D.

*(June 13, 1930–March 30, 1987)*

*The Hand Surgery volumes are dedicated to Richard J. Smith. A family man, a scholar, a teacher, and a surgeon of the hand, whose professional life transcended specialty boundaries.*

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# Preface

Were it not for the continuing expansion of knowledge, experience, and change, older textbooks would need no replacement. These two Hand Surgery volumes represent nearly one-fourth of the material contained in this edition of *Plastic Surgery,* a testament to the enormous contribution made by the subspecialty of hand surgery to the contemporary field of Plastic Surgery. It is of particular interest to compare this work of over 1300 pages with the 30 pages devoted to the hand in *Plastic Surgery,* the first American textbook on the subject by Dr. John Stage Davis, published in 1919.

The authors for these chapters were considered and selected with two criteria in mind: first, their personal experience of treating a large number of patients with hand problems related to their assigned topic, and second, their devotion to teaching and their accomplishments relative to the subject. The fact that the authors spent many hours of essential time in pursuit of this endeavor reflects a special will in making their expertise available in these comprehensive volumes. Each chapter is single authored and offers the undiluted experience of world class contributors; to them the credit and value of this work is due.

The content of the volumes on The Hand is organized into topic related chapters with an outline at the beginning of each one. This format should orient the reader throughout each volume of the book and within each chapter. Although no single part can be wholly comprehensive, each author has worked toward a sound basis for understanding the topic being discussed and has provided an extensive bibliography to assist in the pursuit of further information.

The opportunity to guide, contribute to, and edit a text in one's chosen field comes to few and is cherished by those who are selected. We thank Dr. Joseph McCarthy for the opportunity he provided by inviting us to edit these two volumes within this edition of *Plastic Surgery*. We also join our valued contributors in hoping that the content and organization of Hand Surgery will benefit and aid those physicians and surgeons who treat with knowledge, compassion, and precision the many patients of all ages with hand afflictions.

JAMES W. MAY, JR., M.D.
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# PLASTIC SURGERY

# Contents

Volume 7

**The Hand (Part 1)**

**Volume 8**

**The Hand (Part 2)**

# 89

Robert A. Chase, M.D.

# Examination of the Hand and Relevant Anatomy



During the Renaissance Vesalius corrected early misconceptions and brought gross anatomy into proper focus. Since that time many investigators have embellished the basic structural studies with functional, physiologic, and philosophical observations. The forearm and hand have been prominently included in those observations. Sir Charles Bell (1834), in his thought-provoking little volume *The Hand—Its Mechanism and Vital Endowments as Evincing Design,* presented a concept of hand anatomy that places it in proper context with man's position in the animal kingdom. Frederick Wood-Jones (1920) probed more extensively into comparative anatomy and anthropology in his excellent work *The Principles of Anatomy as Seen in the Hand.* Duchenne (1867) carried out detailed analysis of muscular function by isolated electrical stimulation, described in his classic volume *Physiologie des Mouvements.*

Allen B. Kanavel (1925) published his monograph *Infections of the Hand,* which reported detailed analysis of the spaces and synovial sheaths. *Surgery of the Hand* by Sterling Bunnell (1944) became an indispensable reference during World War II. Emanuel B. Kaplan (1953) produced the nicely illustrated, detailed volume *Functional and Surgical Anatomy of the Hand.* Detailed studies of the integration of the intrinsic and extrinsic muscles operating the polyarticular digits may be found in the work of Landsmeer (1949, 1955, 1958, 1963), Kaplan (1953), Eyler and Markee (1954), Stack (1963), Tubiana and Valentin (1963), and others.

As a functional puppet, the hand responds to the desires of man; its motor performance is initiated by the contralateral cerebral cortex. The conscious demands relayed to the hand and forearm from the central nervous controlling mechanism are sent as movement commands. At the subconscious levels, such a movement command is broken down, regrouped, coordinated, and sent on as a signal for fixation, graded contraction, or relaxation of a specific muscular unit. The degree of contraction or relaxation is then modified by relayed evidence that the motion created is that desired by the person. The modifying factors arrive centrally from a multiplicity of sensory sources such as the eye, peripheral sensory end organs, and muscle or joint sensory endings. The surgeon planning recon-

structive surgery on the upper extremity must be aware not only of the complex anatomy of the hand and arm, but also of the physiologic interplay of balanced muscular functions under the influence of complex central nervous coordination. The maintenance of physiologic viability by the central and peripheral circulatory and lymphatic systems must also concern the reconstructive surgeon.

## SKIN, SUBCUTANEOUS TISSUE, AND FASCIA

There is great disparity in the character of the integumentary envelope covering the dorsum of the hand and that covering the palm. Dorsal skin is thin and pliable, anchored to the deep investing fascia by loose, areolar tissue (Fig. 89–1). These characteristics, coupled with the fact that the major venous and lymphatic drainage in the hand courses dorsally, serve to explain that hand edema is first evident dorsally regardless of its cause. The prominent, visible veins in the subcutaneous tissue make it the standard site in which to evaluate venous filling and limb venous pressure on physical examination. The same characteristics make the dorsum of the hand vulnerable to skin avulsion injuries.

Palmar skin by contrast is characterized by a thick dermal layer and a heavily cornified epithelial surface. The skin is not as pliable as dorsal skin, and it is held tightly to the thick fibrous palmar fascia by diffusely distributed vertical fibers between the fascia and dermis. Stability of palmar skin is critical to hand function. At the same time, if scar fixation or loss of elasticity occurs in palmar skin, contractures and functional loss result. The skin of the palm is laden with a high concentration of specialized sensory end organs and sweat glands, the diagnostic importance of which is discussed under Peripheral Nerves (p. 4277).

The surgeon must understand the relationship of skin creases and the underlying joints in order to plan precise placement of skin incisions for exposure of joints and their related structures (Fig. 89–2).

Examination of hand skin during normal ranges of motion in various planes is important in planning incisions or geometrically rearranging lacerations that might result in disabling scar contractures. Absent a significant loss of skin from the dorsum of the hand and fingers, most loss of elasticity and some longitudinal shortening is compensated for quite adequately by mobility and elasticity of the uninjured dorsal skin. On the palmar aspect, however, scar shortening and inelasticity of the skin alone may result in contracture. The nature of palmar skin, its stabilizing fixation to the palmar fascia, and its position on the concave side of the hand are the bases for such contractures. Littler (1974) outlined the specific sites in the palm where longitudinal scar will impede extension (Fig. 89–3). For example, in each digit the geometry has been worked out by noting each joint

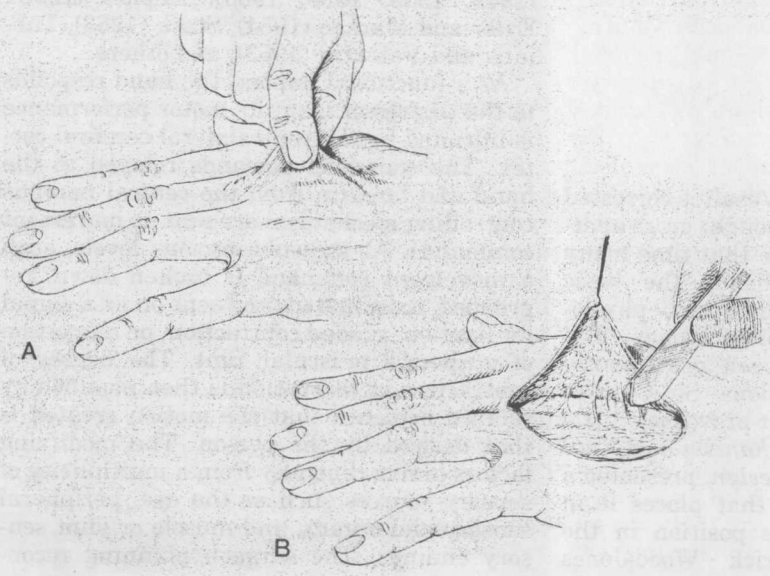


**Figure 89–1.** *A, B,* Dorsal skin is mobile as a result of the loose areolar subcutaneous fascia. It may be bluntly dissected and is subject to avulsion injuries.

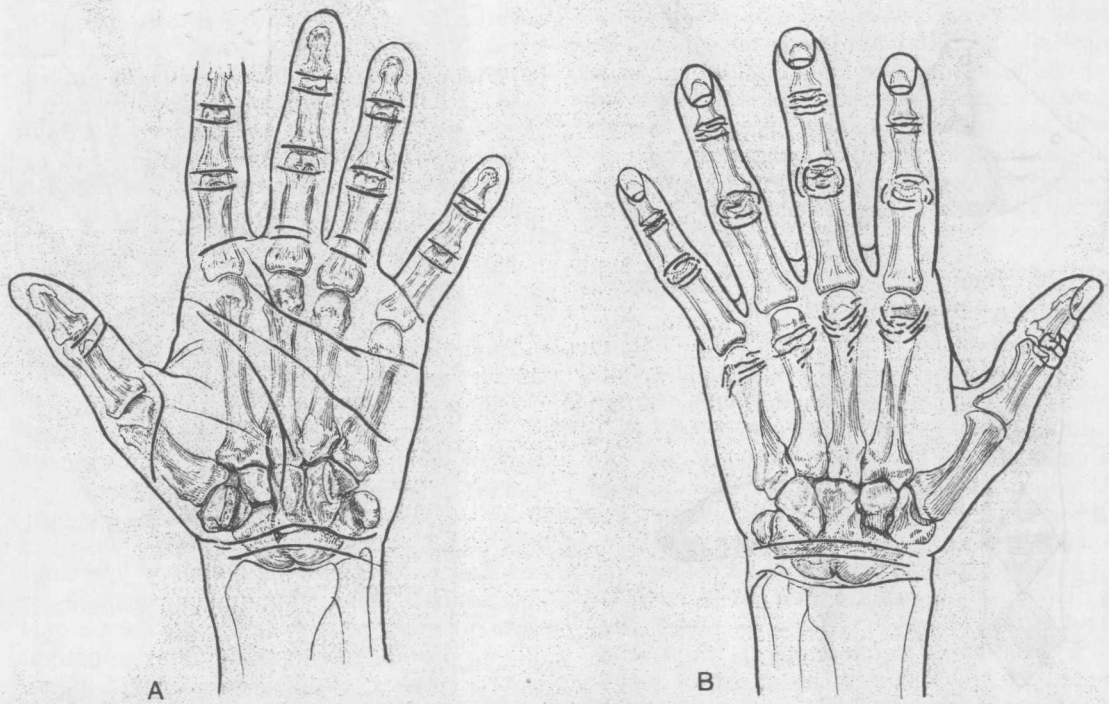


**Figure 89–2.** *A, B,* Palmar and dorsal skin creases and relationship to underlying joints. Note the fixed palmar creases esulting from skin fixation to the underlying palmar fascial plate by numerous vertical fibers. (From Chase, R. A.: Atlas of Hand Surgery. Vol. 1. Philadelphia, W. B. Saunders Company, 1973.)

axis and the kissing surfaces of the palmar skin in full flexion. These diamond-shaped skin surfaces should not be shortened and rendered inelastic by longitudinal scars if limitation of extension is to be avoided.

A host of systemic diseases are reflected in integumental findings in the hand (Bradburn and Chase, 1962). These signs may include ecchymosis, calcium depositions, circulatory and temperature changes, and alterations in skin texture.

Examination of the integument may also show evidence of tumor (see Chap. 133). Epithelial tumors are not infrequently complicated by the inflammatory signs of secondary infection. Tumors of the deep structures may be manifested by distortion of the integumental contour. They are readily palpated and their relation to the skin may cause fixation. Color changes are characteristic of some vascular tumors. Arteriovenous intercommunications elevate the temperature of the area and discolor and distort the surface; often a thrill can be felt and a bruit heard over the lesion.

In hand injuries and during transfer of composite tissues either by pedicle techniques or by free transfer with immediate revascularization, the skin may be the best monitor site for evaluation of vascular perfusion. The examination is enhanced and is made more objective through use of pulse oximeter technology, intravenous fluoroscein and Wood's lamp, or electronic fluoroscanning devices (Graham and associates, 1984).

## Palmar Fascia

The palmar fascia consists of resistant, fibrous tissue arranged in longitudinal, transverse, oblique, and vertical fibers. The longitudinal fibers concentrate at the proximal origin of the palmar fascia at the wrist, taking origin from the palmaris longus when it is present (in about 80 to 85 per cent of individuals). The fascia at this level is separable from the underlying flexor retinaculum, being identified by the longitudinal orientation of its fibers in contrast to the transverse fibers of the retinaculum. The palmar fascia fibers fan out from this origin, concentrating in flat bundles to each of the digits. Generally, the fibers spread at the base of each digit and send minor fibers to the skin and the bulk of fibers distal into the fingers, where they at-