

# PROBLEMS IN AESTHETIC SURGERY

Biological Causes and Clinical Solutions

*Edited by*

**ROSS RUDOLPH, M.D., F.A.C.S.**

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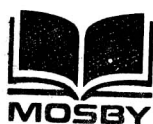
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## Preface

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No one is a keener observer of wound healing than a cosmetic surgeon with an impending bad result! Dusky skin after a facelift or a contracting breast capsule leads the surgeon to the most minute inspection of technique and to much soul searching. The solutions to these problems are often based solely on empiricism, and cosmetic surgeons commonly complain about the dearth of sound research on which to base therapeutic decisions. The thoughtful surgeon, attending meetings at which techniques are described in glowing anecdotal terms this year, yet quietly abandoned next year, often wonders how to obtain solid information about cosmetic surgery.

Yet considerable scientific research does bear on the problems of cosmetic surgery. To date this information has not been readily available or in one volume. The goal of this book is to assemble the latest information, both from basic science and from clinical experience, that has been studied in a scientific manner. The disciplines of biochemistry, biomechanics, electron microscopy, physiology, and animal experimentation have been drawn on as they apply to the biology of cosmetic surgery.

This is a problem-solving book. Three types of problems are addressed: the acute problem occurring after surgery, the problem of how to prevent trouble, and the problem of understanding the basic nature of the tissues involved in cosmetic surgery.

The first type of problem is that faced by the cosmetic surgeon who on the first day after a facelift realizes that the patient has a nonfunctioning facial nerve or a large hematoma covered by dusky skin. In this uncomfortable situation, with visions of unhappy patients and lawsuits flitting about, the surgeon can look up the latest information on nerve regeneration or on the effects of hematomas on tissue and whether hyperbaric oxygen might help. If tissue is lost or hypertrophic scarring occurs, what is the best treatment to reduce the deformity? This book deals with these and similar issues.



Staying out of trouble is at least as important to the cosmetic surgeon as dealing with it, and many chapters in this book deal with preventing poor results. Thus information is available on the question of how long patients must stop smoking, how to prevent intraoperative hypertension, how to prevent pigmentation problems, and when and how to use antibiotics prophylactically.

The third area of scientific interest for the cosmetic surgeon is understanding the biologic behavior of the tissues that we manipulate and shape. Chapters on fat, elastosis, collagen, wound healing and biomechanics, aging skin, and cosmetics all provide information that will allow better results from cosmetic surgery.

Multiple authors, both basic scientists and clinicians, have contributed thorough, scientifically valid information that will allow specific answers to the challenges of cosmetic surgery, and I am grateful to them for their contributions. I am also exceedingly grateful to Karen Berger and Sandy Gilfillan of The C.V. Mosby Company, without whose considerable expertise and gentle advice this book would not have been.

**Ross Rudolph, M.D.**



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## CHAPTER 1

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# Wound healing in cosmetic surgery

## An overview

I. KELMAN COHEN and ROBERT F. DIEGELMANN

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Collagen metabolism  
Contraction  
Epithelialization  
Inflammation  
Summary and conclusions

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The biologic principles of wound healing following aesthetic surgery are essentially the same as those for other types of surgery. Wound healing involves at least four major biologic processes, each of which must be considered as a distinct entity: *collagen metabolism*, *contraction*, *epithelialization*, and *inflammation*. Inflammation is considered separately because recent data suggest that it orchestrates or regulates the other three wound healing phenomena. These four basic principles of wound healing will be examined here in an overview as they apply to the clinical practice of aesthetic surgery.

The nature of a wound mandates which of the major repair processes are required to achieve healing. For example, a primarily closed wound heals mainly by collagen deposition, whereas a partial-thickness skin wound heals by epithelialization and an open full-thickness skin wound heals by contraction and collagen deposition. These processes are important in varying degrees when healing occurs after suction lipectomy, breast implantation, or scar revision. Moreover, natural changes in collagen metabolism and inflammation are probably responsible for specific aesthetic deformities such as the sagging breast and the tired facies of late life. Potentially these processes of wound healing may be manipulated by the cosmetic surgeon in the search for ideal and long-lasting tissue improvement.



## COLLAGEN METABOLISM

Collagen is synthesized intracellularly in the same general manner as other proteins. It then is secreted into the extracellular matrix, where it becomes cross-linked with other collagen molecules to produce fibrils and fibers that provide strength and integrity for the repaired wound. Alternatively, these newly secreted collagen molecules may be broken down in a process initiated by the very specific enzyme(s)—collagenase. Normally the synthesis and degradation of collagen are in a state of finely controlled equilibrium—miraculously so—otherwise all patients with healing wounds would have keloids, or conversely, always disrupt their wounds. In spite of sophisticated knowledge of collagen metabolism, even on a molecular level, we do not have definitive answers for some very simple clinical questions related to collagen metabolism.

For example, When is the wound strong enough for suture removal? Sutures hold the wound edges together until they are strong enough to be fused by new collagen. Although most studies conclude that a skin wound does not have significant tensile strength for at least 3 weeks after primary wound repair,<sup>29</sup> this is not always applicable to aesthetic surgery. Clearly, one should remove a single-layer blepharoplasty closure suture in 3 to 4 days to avoid epithelial tract. In spite of this mandatory early suture removal, a fine linear scar usually results.

In contrast, early suture removal after repair of a knee wound may result in dehiscence. However, even prolonged suture presence does not always prevent recurrent wide scar formation. It has been taught that buried dermal sutures will keep the scar narrow because these sutures maintain strength for at least 3 weeks, allowing sufficient time for collagen cross-linking to produce wound tensile strength. However, all surgeons have experienced recurrence of wide scars in areas of "excess" tension after revision of such scars.

These clinical observations contradict the argument that permanent buried suture material will prevent a wide scar. We have identified permanent dermal buried sutures, still tied, in the center of a wide scar. When revision of a wide scar is attempted in an area of tension, chances are good that a wide scar line will recur. The common dogma that dermal sutures are the answer to the wide scar is invalid. The aesthetic surgeon must recognize that a knife, needle, and suture will never alter human biology. Why? A feasible hypothesis for wide scar formation and recurrence is that there is more collagen degradation than cross-linking when the incision is under tension. Hence the wound spreads until a particular tension equilibrium is reached, and then the process stops. Given this sequence of events, it is unlikely that a suture will ever com-