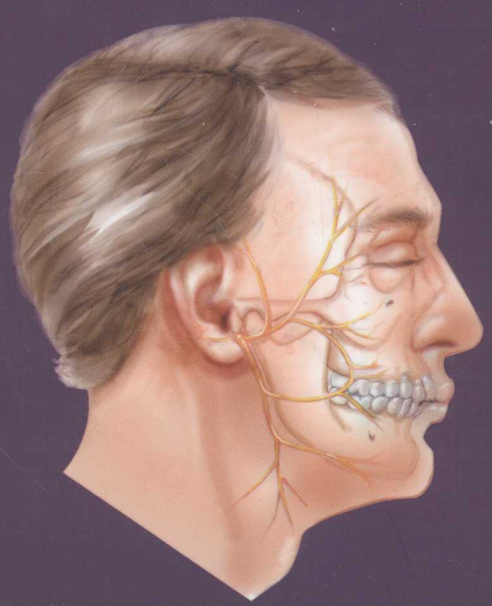
FONSECA · MARCIANI · TURVEY

ORAL AND MAXILLOFACIAL SURGERY

Second Edition

Anesthesia and Pain Control
Dentoalveolar Surgery
Practice Management
Implant Surgery



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Fonseca · Barber · Matheson

SAUNDERS
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VOLUME I

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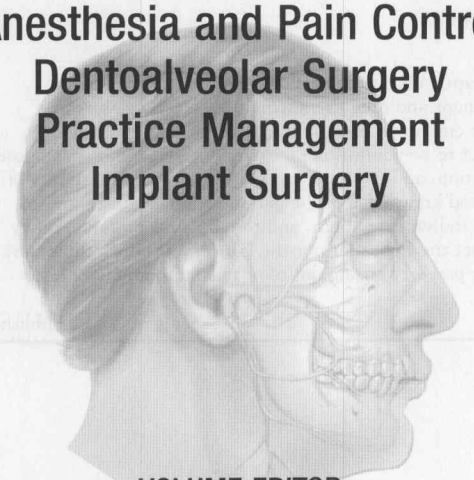

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ORAL AND MAXILLOFACIAL SURGERY, VOLUME I

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DEDICATION

I would like to dedicate this book to Dr. Robert Moore and Dr. Donald Obson. These two oral and maxillofacial surgeons were friends and role models and their death at an early age was a loss not only to those who knew and loved them, but also to our specialty.

Raymond J. Fonseca

To Kymberly, Taylor, David, and Noah with much love and appreciation for your love and support. To Mom and Dad for your love and the dedication you have provided for your children.

H. Dexter Barber

To Lynne; our children John Jr., Marion, and Kate; and to Denny Hillenbrand, surgeon, teacher, and friend.

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FOREWORD

The breadth and scope of this book in three volumes evokes wonderful memories of another era for me. When I first became head of the oral surgery residency program at our institution in 1956, there were *no* guidelines, as we have today, for the educational content or range of surgical procedures to be included in the curriculum. Knowledge and procedures were usually taught at the level of practice in the community. The most worthy surgeon and author at the time was Kurt Thoma whose two volume second edition of *Oral Surgery*, 1952,[1] comprised of 10 parts that included 47 chapters on contemporary and leading-edge oral surgery, was in every respectable practitioner's library. The book included fresh information relative to everyday office needs and just enough edgy, bold surgery, such as open reductions of fractures and condyles, to make for engrossing reading. There was nothing in that age to even closely rival his monumental and inspirational work. I kept the table of contents of Thoma's book before me at all times. If a surgical procedure or treatment method was included in the book, it became a part of the training of our residents. It *became* our curriculum. And here we have the same attractiveness in Fonseca's, Marciani's, and Turvey's book, which is eerily the same—but, contemporary, with more authors and a far wider scope. There is no merit in comparing the books, which are two generations apart. But the point is, if there were a need to start a new education program in the specialty today with nothing more than this book as a guideline for a curriculum, and the program could deliver education at the level and reach described in the book, the program would be flooded with applicants.

The ambition and organization of this book—covering the full scope of oral and maxillofacial surgery—is remarkable not only for its huge content, but because it introduces a new generation of knowledgeable contributors to the specialty. The book has many known and authoritative colleagues with respected academic affiliations who are at their best in their writings. However, it is the new breed largely still in training or private practice with adjunct university positions bringing front-line experience to the pages that is exciting. We are accustomed to thinking that new advances and scholarship are the provenance of seasoned workers in universities and hospitals. But it is the growing underground of dedicated, amateur scholars still in residency or fellowship training or early in private practice or academia who have discovered that the joy of learning and writing is a big reward for the revelations of their exciting, young work. Even though Fonseca, Barber, Costello, Dembo, Gregg, Jensen, Smith, Marciani, Carlson, Braun, Alpert, Dierks, Ghali, Hudson, Helman, Indresano, McCoy, Mercuri, Ochs, Swift, Williams, Turvey, Waites, Epker, Frost, Guerrero, O'Ryan, Posnick, Prescious, Reyneke, Schendel, Van Sickels, and Wolford are rightfully big attractions of the book, be prepared for fulfillment in reading the work of a host of fresh names, which will soon be well known to you. The editor is commended for bringing this nascent talent to the book.

Beyond surgery, there is a valuable and needed section of the book devoted to practice management with expert coverage of the aggravations, which are a part of current practice. These partially include office management, accreditation of surgicenters, credentialing and hospital privileging, office design, coding, insurance, and third party payers and risk management. There is much to appreciate in this solid address to the business of the specialty.

There is always more to learn in the world of oral and maxillofacial surgery than any of us has time to achieve or do. Today's immense, expanding frontier of knowledge, procedures, and technology pertinent to the specialty is so vast that we now need a lifetime even to penetrate the body of scholarship and skills at hand. These are reasons why an encyclopedia of the kind compiled by Fonseca, with assistance from Marciani and Turvey, is so comforting as an immediate all embracing resource to what is current and important to everyone captivated by oral and maxillofacial surgery—or even as an emergency curriculum.

This is a *big* book with an ambitious scope that will appeal to a large readership engaged in oral and maxillofacial surgery. It is not for the person described by Beecher:

> *"If a man has come to that point where he is so content that he says,*
> *'I do not want to know any more,*
> *or do any more or be any more,'*
> *he is in a state in which he ought to be changed into a mummy."*[2]

No one will remotely suggest that the editor of this marvelous book be relegated to that state. He does things—and he does them *well*. He has an amazing and enviable record in the production of excellent, multiple-authored, surgical tomes. He has outdone himself with this one.

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[1]Thoma K: Oral Surgery, ed. 2, St. Louis, 1952, The C.V. Mosby Co.

[2]Beecher HW: in Thoughts on Leadership, The Forbes Leadership Library, Chicago, 1995, Triumph Books, p.17.

PREFACE

It is our privilege to present the second edition of *Oral and Maxillofacial Surgery*. This multiauthored, comprehensive text will be presented in three volumes. The first edition, published in 2000, was well received; but 8 years later, with all the extensive changes in techniques and technology, we felt that a second edition was overdue. Drs. Marciani and Turvey have been brought on board to bring together the best minds to create a contemporary and comprehensive text. They have recruited section editors who have worked tirelessly to ensure that the authors submitted chapters that reflected the state of the art in their area of responsibility.

This book is a comprehensive resource on oral and maxillofacial surgery, examining the full scope of the field, including dentoalveolar surgery, orthognathic surgery, trauma surgery, surgical pathology, temporomandibular joint surgery, dental implantology, cosmetic surgery, cleft and craniofacial surgery, and reconstructive surgery. Every surgical procedure performed by oral and maxillofacial surgeons today is covered in detail. The set's greatest strength is its comprehensive grasp of the subject. This multivolume text provides solid coverage of a wide range of issues related to surgical care, such as anesthesia, diagnostic imaging, treatment planning, rehabilitation, physical therapy, and psychological considerations. We have included additional content in diagnosis, treatment planning, and surgical decision making. There are more than 80 new chapters in three volumes.

Volume I covers anesthesia, dentoalveolar and implant surgery, and office management. Although all sections have new material, the area of implant surgery has undergone the greatest change since the first edition was published. Dr. H. Dexter Barber has recruited an outstanding group of contributors who present current techniques and technology related to this discipline. Drs. John Matheson and Raymond J. Fonseca also elicited contributions from authorities in the other sections of this volume.

Dr. Robert Marciani was in charge of editing Volume II. He recruited Dr. Eric Carlson to oversee the section on surgical pathology and Dr. Thomas Braun to edit the section on the temporomandibular joint. These three individuals recruited top-notch authors who have covered their area of responsibility comprehensively. The chapter on bisphosphonate related osteonecrosis of the jaws is not only timely but informative. The diagnosis and management of facial pain is presented in this section and complements Dr. John M. Gregg's chapter in Volume I on chronic maxillomandibular pain, head and neck pain, and TMJ pain. Dr. Marciani has assembled a variety of specialists to cover the complete gamut of maxillofacial and head and neck trauma.

Volume III has been organized by Dr. Timothy Turvey. He recruited Drs. Bernard J. Costello and Ramon L. Ruiz to oversee the cleft and craniofacial sections, and Dr. Peter D. Waite oversee the esthetic surgery section. Dr. J. Robert Scully assisted Dr. Turvey in editing the orthognathic surgery section. Perhaps the greatest improvement in this volume is an added emphasis on diagnostic and treatment planning. The esthetic surgery and cleft and craniofacial surgery sections have been expanded in scope and depth.

After an analysis of the changing field of oral and maxillofacial surgery, we strove to present a comprehensive, current book that defined the present scope of our specialty. We hope that the reader appreciates and agrees with our efforts. We stated in the preface of the first edition that we hoped that our future attempts will present an even broader scope of oral and maxillofacial surgery. The fact that this edition has succeeded in that regard is a testament to the individuals who are constantly expanding the envelope.

ACKNOWLEDGMENTS

The second edition of *Oral and Maxillofacial Surgery* is a team effort. Drs. Robert Marciani and Timothy Turvey were tireless in their efforts to improve on the first edition. They brought numerous authors on board who added depth and breadth to this edition. The section editors were equally invaluable contributors to the success of this effort. Drs. H. Dexter Barber, Thomas W. Braun, Eric R. Carlson, Bernard J. Costello, John Matheson, Ramon L. Ruiz, J. Robert Scully, and Peter D. Waite diligently pestered authors so that deadlines could be *almost* met. This edition attempts to comprehensively define the scope of oral and maxillofacial surgery and could not have come to fruition without these contributors.

Residents are the lifeblood of our specialty. Many have contributed portions of chapters in this book. They also have provided us with friendship, dedication, intellectual stimulation, and humility, without which this book would not have been written.

Last, we would like to thank all the staff who helped prepare these manuscripts and the editorial staff at Elsevier, who were so patient with our procrastination, and meticulous in their development and editing of this book.

CONTENTS

VOLUME I CONTENTS

Anesthesia and Pain Control, Dentoalveolar Surgery, Practice Management, Implant Surgery

Volume Editor: Raymond J. Fonseca

CHAPTER 1

PREOPERATIVE EVALUATION

Amin Kazemi

To provide the ultimate in surgical care, the surgeon must be intricately intoned with the complex risks wrought by anesthesia and surgery in concurrence with the patients preexisting medical conditions. It is the surgeon's responsibility to investigate each patient's unique risk factors and assemble the appropriate plan to maximize surgical outcome.

Oral and maxillofacial surgeons have the unique privilege of providing an array of various anesthetic methods. As such we must be dually prepared to identify and deal with the risks associated with performing the surgery and anesthesia in concert. Therefore given this task, one must be keenly aware of the tools available to fully evaluate the patient before a surgical procedure. Complete and detailed history and physical examination, previous anesthetic and surgical history, appropriate family and social history, laboratory and radiographic tests, proper involvement of a specialist, prophylactic measures, and behavioral modification each provide an invaluable method to prepare the patient for successful surgery.[1] In combination with complete mastery of the anesthesia and surgical techniques, the practitioner is well prepared to deliver a custom designed and well-planned surgical treatment.

The course of preoperative evaluation provides an opportunity for the practitioner to declare a genuine care and interest for the patient, which in turn allows for further global success and satisfaction. It allows for involvement of the patient and their support team, thus gaining tangible insight into the surgical procedure and obtaining realistic expectations. This can be invaluable for the patient because the amount of satisfaction with the surgical treatment is maximized when the patient's expectations are close to reality.

A complete immersion into the preoperative evaluation process is conducted in this chapter to provide the reader with a clear understanding of current methods and the reason for their use.

HISTORY AND PHYSICAL EXAMINATION

A complete history and physical examination is an integral part of the preoperative evaluation. It is the practitioner's first opportunity to identify any abnormalities or dysfunctions that could require further evaluation or planning before the operative procedure. To streamline this process and allow the patient adequate anonymity to disclose important health information that one can then further explore, a health questionnaire is valuable. This form and also any history and physical examinations performed by other admitting house staff, should not in any way become the preoperative history and physical examination required. The form should only be used as an aid to identify the most critical risk factors and guide one to further scrutinize them. For example, if the form identifies a patient as an asthmatic, one needs to further understand the extent of this dysfunction by conducting a detailed interview with the patient regarding their disease. (When was the diagnosis made? How often do the attacks occur and under what circumstances? How do they control their asthma? How often are medication(s) used? How often do they visit the emergency department for their asthma?, etc.)

A patient's medication(s) can have a large effect on anesthesia and surgical planning. The general rule is to continue most medications as prior; however, there are unique situations that require altered dosing, change to shorter acting preparations, and even discontinuing the medication temporarily[2] (Table 1-1). Furthermore, the patient's current medication(s) can require the modification of postoperative medications used for the treatment of pain, swelling, infection, and so forth.

Allergies and reactions to medication(s) are important to identify. It is of further importance to explore the circumstances and extent of such reaction (from a mild rash to an anaphylactic reaction). The offending drugs are obviously avoided, unless formal immunologic treatment has been performed or pretreatment with antihistamines or steroids is conducted.

A complete list of previous surgical procedures along with the mode of anesthesia used should be obtained. Moreover, detailed exploration of each surgical and anesthesia experience to identify any complications, effective pain control, and

TABLE 1-1 Medications, Anesthetic Implications, and Recommendations for Preoperative Management

Medications	Anesthetic Implications	Recommended Management
Aminoglycosides	Can potentiate nondepolarizing relaxants	Monitor neuromuscular relaxants carefully
Aspirin	Platelet dysfunction, bleeding potential	Consider preoperative discontinuation for at least 10-14 days; discuss with prescribing physician regarding risk of stroke, myocardial infarction (MI), or thrombosis with discontinuation
Clonidine	Acute withdrawal can cause hypertensive crisis; decrease anesthetic requirements	Continue therapy the day of surgery; can use dermal delivery perioperatively; decrease anesthetic requirements intraoperatively
Insulin	Hypoglycemia if not monitored	Depends on time of surgery and serum glucose range; recommend to continue partial dose (one-half or one-third) of long-acting insulin and delete short-acting insulin the day of surgery; monitor serum glucose closely perioperatively; watch for combined long- and short-acting preparations
Lithium	Potentiate neuromuscular blockers, induce hypothyroidism in some patients; lithium concentrations increase with decreased serum sodium	Monitor neuromuscular blockade carefully; obtain thyroid function tests preoperatively if indicated; monitor serum sodium and avoid sodium wasting diuretics
Monoamine oxidase inhibitors (isocarboxazid, pargyline, phenelzine, tranylcypromine)	Increased catecholamine stores; hepatotoxicity; rare but potentially fatal reactions with opioids, especially meperidine	Avoid indirect-acting sympathomimetics and use reduced doses of direct-acting agents; serum liver function tests if not done; avoid opioids, especially meperidine; for elective surgery, request psychiatrist to discontinue for 14-21 days unless suicide risk; less time needed for pargyline and tranylcypromine because reversibly bound
Warfarin	Excessive intraoperative bleeding	Manage with prescribing physician; withdrawal in advance; substitute with heparin; heparin may be stopped immediately preoperatively and restarted postoperatively

From Longnecker DE, Murphy FL: *Introduction to anesthesia*, vol 1, ed 9, 1997, Philadelphia WB Saunders, p 13.

patient's social and emotional experience is invaluable. The anesthetic plan can be fine-tuned based on such previous experience. For example, ease or difficulty of airway intubation, reaction to anesthetic(s) used, and other detailed history are vastly important to reduce anesthetic risks. Past surgical dictations pertinent to the surgical procedure planned should also be obtained and reviewed to gain insight into pitfalls and success of previous techniques.

Identifying a family history of malignant hyperthermia, pseudocholinesterase abnormalities, or glucose-6-phosphate dehydrogenase (G6PD) deficiency can be lifesaving for the patient.[3] History of smoking, drug use, and alcohol abuse should be further explored with detailed cardiovascular, pulmonary, and hepatic evaluation. Women of child-bearing age should be questioned in regards to the possibility of being pregnant, and if any doubt proper testing should be conducted.

The physical exam should both be global and targeted. An organized evaluation including vital signs, height, weight, airway evaluation, head and neck, cardiac, pulmonary, gastrointestinal (GI), renal, neurologic, musculoskeletal, and other physical markers pertinent to the history is essential. A more scrupulous examination of the surgical site is immensely valuable, to identify possible complicating factors and plan for them.

With the above complete, the practitioner can further submerge into the specific review of systems to uncover any dysfunctions that would require possible laboratory or radiographic testing along with proper specialist consultation. Once all the above information has been amassed, the practitioner can use a risk stratification scheme to more globally expose the level of risk and allow for better communication of such risks amongst the medical staff. The American Society of Anesthesiologists Physical Status Classification System (ASA) has provided a simple and effective means of communicating the severity of patient's illness since 1940. However, there has been no proven direct correlation between the ASA classification and surgical and anesthesia risk.[4] Therefore certain modifications have been implemented to safeguard the simplicity of this design and yet add more true risk stratification. Such modifications have been put forth by Natalie F. Holt et al at the Yale University Department of Anesthesiology that take into account the physical status modified for individual system, surgical invasiveness and risk, anesthetic risk and complexity, and other special "risk indicators." This information is then communicated in a simple integrated system to facilitate categorization and communication of large amounts of information, highlight potentially high-risk situations, guide perioperative planning, and provide a means by which to analyze outcomes.[5]

■ SYSTEM APPROACH TO PREOPERATIVE SURGERY

CARDIOVASCULAR

It is widespread knowledge that cardiovascular disease is extremely common in the industrialized world. As such, cardiovascular complications are the most common cause of

TABLE 1-2 Goldman's Criteria (Computation of the Cardiac Risk Index)

Criteria	Points
HISTORY	
Age >70 yr	5
Myocardial infarction <6 mo	10
PHYSICAL EXAMINATION	
S_3 gallop or jugular venous distention	11
Aortic valvular stenosis	3
ELECTROCARDIOGRAM (ECG)	
Rhythm other than sinus or premature atrial contraction	7
>5 Premature ventricular contractions/min	7
GENERAL STATUS	
PO_2 <60 or PCO_2 >50	3
K <3.0 or HCO_3 <20 mEq/L	3
BUN >50 or creatinine >3.0 mg/dL	3
Abnormal SGOT or chronic liver disease	3
Bedridden	3
OPERATION	
Intraperitoneal, intrathoracic, or aortic operation	3
Emergency operation	4
TOTAL	Possible 53 points

BUN, blood urea nitrogen; *SGOT,* serum glutamic-oxaloacetic transaminase.
From Goldman L et al: Multifactorial index of cardiac risk in noncardiac surgical procedures, *N Engl J Med* 297:26, 1977.

perioperative mortality. Of the 27 million patients undergoing surgery in the United States every year, 8 million have significant coronary artery disease or other cardiac comorbidities.[6] One million of these patients will go on to have perioperative cardiac complications with substantial morbidity, mortality, and cost.[6] Given these facts, meticulous assessment of the cardiovascular system is intensely important in determining a patient's surgical candidacy, preoperative planning, and anesthesia planning.

As mentioned earlier, one of the early risk stratification methods was the ASA classification, which lacked accuracy in predicting risk and was not easily reproducible among physicians. Recent methods rely more on easily defined and measured parameters and were enhanced by multivariate statistical methodology.[7] An exemplary example is the Goldman's criteria, which is reliant on multivariate analysis and assigns points to easily reproducible characteristics.[8] Once tallied the point total correlates well with the cardiac risk (Table 1-2).

Class I	(0 to 5 points)	has a 0.9% risk of serious cardiac event or death
Class II	(6 to 12 points)	has a 7.1% risk
Class III	(13 to 25 points)	has a 16.0% risk
Class IV	(greater than 26 points)	has a 63.6% risk

A major advancement in the above method of risk stratification is the inclusion of the patient's functional capacity, clinical signs and symptoms, and operative risk assessment to estimate overall risk and plan preoperative intervention.[9]

The American College of Cardiology and the American Heart Association (ACC/AHA) guidelines first introduced in 1996, and then updated in 2002 and 2006, further enhance the assessment and cardiac risk evaluation of patients undergoing noncardiac surgery. The ACC/AHA guidelines further take into account patients' functional capacity and surgery types to determine risk and then counsel properly based on an easy-to-follow flowchart[10] (Figure 1-1).

Once the risk assessment process is complete, the practitioners, along with consultants (if appropriate), need to consider perioperative interventions, which can include coronary revascularization (bypass, percutaneous transluminal coronary angioplasty), modification of anesthetic technique, and use of invasive monitoring.[11]

Current general recommendations regarding the optimal timing of elective surgery after a myocardial infarction (MI) is 4 to 6 weeks.[12] This is mildly different than the 3-month delay previously recommended through the evidence presented by Tarhan et al and Steen et al.[13,14] Today this decision is based on assessment of ischemic risk either by clinical or noninvasive studies. The infarction event is considered a major clinical predictor in the context of ongoing ischemic risk.[15]

Recent ACC/AHA update (2006) focuses on the perioperative use of beta-blockers to reduce cardiovascular morbidity and mortality in the noncardiac surgery patient. The perioperative risk of cardiovascular morbidity and mortality was decreased by 67% and 55%, respectively, in patients receiving beta-blockade in the perioperative period versus those receiving placebo.[16] The general philosophy behind beta-blockade and aspirin use perioperatively is to reduce the effects of adrenergic surge and halt platelet activation and microvascular thrombosis. The specific perioperative beta-blocker recommendations for each patient class (based on size of treatment effect and estimate of certainty of treatment effect) are well illustrated in the 2006 update and are beyond the scope of this chapter.[16]

Prevention of endocarditis through appropriate prophylactic measures is a vital part of the preoperative evaluation of a cardiac patient. The American Heart Association recommendations have been illustrated in Tables 1-3, 1-4, and 1-5.[17]

In summary, it is extremely important to have a consistent and reliable way to stratify cardiac risk in a noncardiac surgical patient. Furthermore the practitioner needs to be completely clear on the steps required for each patient to decrease cardiac risk and to safely plan a surgical and anesthetic treatment. Appropriate and clear communication with the anesthesia and cardiac specialists regarding the patient's cardiovascular risk will also increase the patient's confidence before an invasive procedure.

PULMONARY

Postoperative lung complications are a significant source of overall perioperative morbidity and mortality.[18] In some review articles, pulmonary complications have proven to be as common as or more common than cardiac complications.[19] Some of the most common pulmonary problems, such as