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Volume one

ORAL SURGERY

Fourth edition

With 1790 illustrations, including 161 in color

THE C. V. MOSBY COMPANY

Saint Louis 1963

Fourth edition

Printed in the United States of America
Library of Congress Catalog Card Number 63-7620
Distributed in Great Britain by Henry Kimpton, London

Volume one **ORAL SURGERY**

Preface to fourth edition

Because oral surgery is a relatively new and dynamic specialty, periodic revisions of standard texts are necessary. As oral surgery graduate training centers mature and as basic science application to clinical problems becomes increasingly essential, the oral surgeon must apply new biologic facts to the needs of his patients. The results of the research laboratories and the ever-expanding arsenal of pharmaceuticals quickly modify surgical techniques. Thus new developments on all fronts dictated the necessity for this fourth edition of *Oral Surgery*.

The entire text has been updated and reorganized so that the undergraduate, postdoctoral student, investigator, and clinician seeking a reference, a technique, or a guide to the common or the unusual oral surgical problem will be assisted. In addition, a new chapter on bioanatomy, supplemented by fine color plates by Dr. Frank Netter, and a new chapter on microbiology have been added to this edition. Furthermore, international articles of merit and reports from abroad of successful refinements in technique have been given consideration in the text to complement the advances made in this country. Pertinent references have been added in each chapter.

In a book of this size many acknowledgments are due. Thus I am indebted to many authors whose names appear in the various reference lists. Dr. Daniel J. Holland, my associate, again has made many good suggestions, and Dr. Robert I. Litwin has been of assistance in the evaluation of new drugs. Esther L. Sweet, B.S., has once again aided in preparing the manuscript, and Mr. Arthur Bloom has produced the many excellent microscopic sections made from the specimens described in the case reports. To Dr. Henry M. Goldman and Dr. Jack Bloom I am indebted for the production of some of the new photomicrographs.

Although this revision has been long and painstaking, my rewards in the form of better patient care and the satisfaction of assisting the clinician and guiding the student are many.

Kurt H. Thoma

Preface to first edition

Oral Surgery is a clinical book dealing principally with the science and art of oral surgical procedures. It should be used in conjunction with *Oral Pathology,* which gives in greater detail the etiology, pathogenesis, and the morbid anatomy and histology of the region dealt with by the oral surgeon.

Oral surgery may be defined as a specialty encompassing all of the surgical diseases, injuries, and developmental abnormalities of the oral cavity, teeth, jaws, and adjacent structures. Oral surgery is a recognized specialty of dentistry included in the curriculum of all dental schools. That this surgical specialty was fostered and developed under the aegis of dentistry is natural when one considers that both the diagnosis and the treatment of oral diseases require knowledge of the anatomy and pathology of the teeth and jaws, and that dentists are primarily concerned with the preservation and restoration of the proper functioning of the masticatory apparatus.

The oral surgeon should, however, have adequate training beyond that of the undergraduate dental curriculum, whether he be a general practitioner whose practice is to include oral surgery, or whether it is his desire to limit his practice to this field. The requirements established by the newly created American Board of Oral Surgery include graduate study in oral surgery for a period of two years or more in a recognized graduate school or hospital under auspices satisfactory to the Board. The period of training shall cover the basic sciences as they are related to oral surgery, such as anatomy, physiology, bacteriology, and biochemistry, as well as the clinical and technical phases of oral surgery, including oral roentgenology, anesthesia, and the general care of the patient. One of the principal purposes and functions of the American Board of Oral Surgery is to assist in the improvement of the quality of graduate education and the establishment of minimum educational and training standards in oral surgery. The Board thus has set a milestone for the education of the oral surgeon. The value of advanced training through dental internships and residencies in hospitals depends, however, entirely on whether the department has been organized as a service clinic or as a teaching clinic, the members of which have the ability to instruct dental graduates properly in the care of oral surgical conditions.

This book was written to give specific descriptions of the various operating techniques for the correction and elimination of oral surgical abnormalities and diseases, but the general treatment of the patient has not been overlooked. To some, it may seem that supportive care has been overemphasized. I feel, however, that the general treatment is inseparable from the treatment of the regional disease. Especially important are the considerations of the correction of deficiency diseases, the improvement of the general health by diet and rest, general medication to relieve pain, and the administration of drugs to prevent or eliminate infection and decrease the risk of the operation, as well as postoperative physiotherapy to improve function.

The text encompasses the operations which are considered by the writer to comprise the field of the oral surgeon. It was written while developing an oral surgical clinic at the Massachusetts General Hospital. Most of the case reports used to illustrate the various operative procedures are cases treated during the last five years in the general or private wards of this hospital, although some are from the Brooks Hospital or other hospitals with which the author is affiliated. The patients referred to in these reports, therefore, were treated during a time when rapid changes occurred in the use of chemotherapy and the availability of antibiotics, first penicillin and finally streptomycin. The use of

these drugs in the cases chosen to illustrate the application of the techniques, therefore, is not based solely on the efficacy of these drugs in the individual instances, but rather on their availability and the changes which were dictated by experience. The discovery and introduction of the sulfonamides and antibiotics, furthermore, altered many procedures to the extent that some methods antedating their use have become antiquated.

It is hoped that the general practitioner of both dentistry and medicine will find much of interest in this book. The general dentist, because he is frequently consulted regarding oral surgical diseases and has a great opportunity to see them in their incipient stage when making his periodic checkup examinations, should be especially interested not only in the diagnostic features but also in the modern therapeutic measures described. Even though he does not attempt major oral surgical operations, it will aid him to give proper advice and guidance to his patients. Since many general dentists are interested in the extraction of teeth and other intraoral operations it is hoped that the latter will find the chapter on dentoalveolar surgery of particular interest. The oral surgeon, on the other hand, it is hoped, will find the more intricate procedures adequately described, though the book is primarily a text for the undergraduate and especially the graduate student interested in dental and oral surgery.

The treatment of harelip and cleft palate, the pathogenesis and diagnosis of which were thoroughly discussed in *Oral Pathology,* has not been included in this book. To a few this may appear to be a great omission. The author, however, feels that excellent special texts on this vast subject which deal most comprehensively with this phase of oral surgery are already available. Those interested in harelip and cleft palate defects will, therefore, be better served by the study of one of the excellent books written by an expert in this field. Another purposeful omission is the topic of surgical prosthesis. The use of surgical prosthesis has been touched upon, but for details of construction the reader again is referred to special texts.

A bibliography of the more recent literature has been appended to each chapter. No pretense is made that the entire literature has been reviewed, nor were all the methods included that have been advocated in the past for the treatment of the various diseases; the methods recommended are those the writer has found to be most effective in his clinic. It is granted that other oral surgeons may prefer and have good success with different procedures. In some instances, references are given to these so that the reader may look up another clinician's technique. Of the procedures advocated, a few are new and original, while others are well-established methods revised to include some of the modern scientific innovations that have been developed with accelerated tempo during the last few years.

The most pleasant part of this introduction is to acknowledge the many personal favors extended to me by the staff of the Massachusetts General Hospital, and the aid I received in gathering material and writing case reports from my interns, especially Dr. Daniel J. Holland, Jr., while he was my resident at the hospital. The author is indebted, also, to those who have given permission for the inclusion of cases which the writer thought would help to make the book more complete. Acknowledgment has been made in each instance in the text, and a list of these contributions is therefore omitted here.

Dr. Henry Goldman, formerly Oral Pathologist of the Department of Pathology of the United States Army, has helped with many of the pathologic descriptions. Dr. Daniel Holland, when he became my associate, was kind enough to help correct the manuscript and has made valuable suggestions for additions to the text. To Dr. Francis F. Foldes of the Department of Anesthesia of the Massachusetts General Hospital, and now Director of Anesthesia of the Mercy Hospital, Pittsburgh, Pennsylvania, I am indebted for suggestions regarding the chapter on anesthesia. Thanks are also due to Esther L. Sweet, B.S., for her aid in preparing the manuscript and, especially, the index of this book.

Since illustrations are often more comprehensive than thousands of words, the artist should not be forgotten. The anatomical sketches and drawings of operative techniques have, as in previous publications, been executed with painstaking care and great ability by Miss Etta R. Piotti, while for the expert photography I owe thanks to Laurence B. Brown.

Finally, the author and, it seems to me, the readers as well are indebted to the publishers for their interest and for the excellent production of this book.

BOSTON, MASS. JANUARY 15, 1948 *Kurt H. Thoma*

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PART 1

THE SCIENCE AND ART OF SURGERY

Introduction

Surgery, and there is only one kind no matter what region may be chosen as the field of endeavor, must be based on a sound scientific foundation. A broad fundamental knowledge makes the surgeon a student of disease and a master of therapeutics. The great surgeon Halsted stated that a surgeon is a person who uses his head as well as his hands: when using only his hands he becomes an operator who practices a handicraft, because he loses sight of the reasons why.

The study of anatomy gave the first scientific background to surgery; a surgeon had to be a good anatomist. Later, surgery and bacteriology were linked together. Only seven or eight decades ago the science of bacteriology was unknown, and most operative procedures were associated with infection. Gradually, the findings of bacteriologists were applied to surgery, and rules were developed for an aseptic technique. In the last decades pathology has been emphasized. The study of pathology was, and still is, an excellent foundation for surgery. On a clear understanding of pathogenesis depends the development of treatment; and the recognition of the etiologic factor, whether local or somatic, is of greatest importance because scientific treatment demands, first of all, the elimination of the cause of the disease. The oral surgeon, therefore, must be well versed in pathology because it is the pathologist who, after examining the excised tissue microscopically, speaks the last word in diagnosis. Bacteriology and pathology, however, are not the only, nor the most recent, sciences applied to surgical practice. Physiologic principles, nutritional, chemical, and biologic discoveries are even now at work to improve the general care of the patient. Still more and even greater contributions to surgery are sure to come.

Surgery, however, is not only a science—it is also an art. The art of surgery consists of three essential parts: a method to obviate infection, asepsis; a method to arrest hemorrhage, hemostasis; and a method to prevent pain, anesthesia.

Surgical anatomy. Since Galen, and particularly since Vesalius, who revolutionized the study of anatomy, the science of anatomy has become a foundation for the practice of medicine and surgery. Vesalius came from the University of Padua to Basel to publish in 1543 the first book on human anatomy entitled *De humani corporis fabrica libra septem.* The seven volumes contained a description and illustrations of human dissections as contrasted to Galen's comparative studies on animals which were applied to man without being checked and criticized.

Since then, anatomy has remained a guide for the development of surgical procedures, and it remains today a basic requirement not only for the study of general surgery but for all the surgical specialties as well. Therefore, a chapter will be devoted to bioanatomy.

Surgical pathology. Already at the time of Vesalius in the early part of the seventeenth century, an embryonic science was born, the science of pathologic anatomy. This resulted from the investigations of the human anatomy by dissection, which led to the observation of abnormal conditions. It was Giovanni Bat-

tista Morgagni, Professor of Anatomy at the University of Padua, who, through his early essays entitled *Adversaria anatomica,* a collection of autopsy reports, and later through the *De sedibus et causis morborum per anatomen indagatis* (1761)—seats and causes of disease, provided a book of "anatomical sections giving the history of the disease" and the "pathognomonic signs" from which the disorder of this or that organ could be foreseen. This mighty book containing over seven hundred necropsies made Morgagni famous and an outstanding figure in the medical world of Europe. Years later, in an article entitled "Morgagni and the anatomic concept," Virchow, the famous German pathologist, attested Morgagni to be the founder of pathologic anatomy. Rudolf Virchow, however, is considered to be the father of modern pathology and is famous for his doctrine of cellular pathology, as is attested by his best known work, *Cellular pathologie,* published in 1858.

Since then pathology has been acknowledged as a fundamental science for the practice of surgery. It was Osler who stated, "A man's practice is as his knowledge of pathology."

A thorough pathologic foundation is also an undisputed requisite for a good oral surgeon. Pathology teaches the surgeon to visualize the changes that have been produced as well as the methods by which they have been effected. Much has been learned from the experimental reproduction of disease processes, a method by which individual factors can be analyzed. In diagnosis, microscopic examination of excised tissues furnishes a control for the correct interpretation of clinical findings, and biopsy examination is without peer in dealing with neoplasms. Today, in addition, exfoliative cytology has been applied to the detection of malignancy. The contemplated surgical treatment is thus based upon and altered by the microscopic examination of the abnormal tissue. In no other way can the surgical intervention, whether conservative or radical, be free of dangerous empiricism. Even the most innocuous cystic lesion may be a dangerous neoplasm, the treatment of which without pathologic investigation is unscientific and harmful. Years of broad experience are of unquestionable value in preoperative diagnosis, but, because of the vagaries of human tissue responses, they are never a substitute for the pathologist's critical examination.

Although the surgical procedures described in this book are based on a sound pathologic investigation, pathology is not discussed in great detail, since it is hoped that the information contained in this book will be supplemented by reference to Thoma and Goldman's *Oral pathology* which should be considered as a companion book.

Microbiology. Bacteriology is an important subject to the oral surgeon. Not only does he see many cases of oral infection or lesions complicated by infection, but almost all of his operations are performed in a field in which bacteria abound. The discovery and use of the antibiotics have done a great deal to improve this handicap, and they have created new interest in bacteriology. Antibiotics today play an important role in the treatment of infection as well as in its prevention. Microbiology, therefore, is part of the basic knowledge the oral surgeon should possess.

Pharmacology. The knowledge of the use of drugs for therapeutic reasons is important for the patient's comfort, the prevention of complications, and a speedy recovery. New drugs are constantly produced by the research departments of the drug industry. A review of those used in oral surgery will be presented for easy reference.

Asepsis and antisepsis. Asepsis has made it possible to perform successfully operations without fear of complications. It was Lister who applied the discoveries of Pasteur to the surgical art and introduced antiseptic surgery. Before that, 80% of all wounds developed "hospital gangrene," whereas today 98% of operative wounds heal by first intention. From the first crude methods, the principles upon which modern surgery is founded have gradually been evolved.

The aim of modern surgery is to inhibit or destroy microorganisms that may contaminate a wound. In aseptic surgery living pathogenic organisms are excluded. Disinfection of instruments should produce sterility by absolute destruction of pathogenic microorganisms.

The problem of asepsis in oral surgery presents great difficulties, and the prevention of infections still leaves a great deal of room for improvement. Nevertheless, I am sure that much progress can be expected if we combine the developments of science with new and improved techniques. The prophylactic use of the various antibiotics already has made it possible to perform many major jaw operations from an intraoral approach without fear of complications.

Physical examination of the patient. It is very important to keep in mind that patients

seen for oral lesions or operations on the teeth, jaws, and adjacent tissues may have other associated general diseases, which, whether connected or coexistent, greatly affect the result of local surgical procedures. A chapter dealing with the problem of general health in which pertinent systemic diseases are discussed is included.

Roentgen examination. This important diagnostic method is a great aid to the practicing oral surgeon. Although the roentgen diagnosis is not always conclusive, it gives valuable information regarding the extent and anatomic involvement of disease processes, which in addition may produce important roentgen signs.

General care of the patient. The proper care of the patient includes the treatment of many of the diseases mentioned under physical examination. In addition, the patient must be kept in as good a physical state as possible during recovery. This includes care of hydration, electrolyte requirements, and nutrition, which will be discussed in a chapter on that subject.

Anesthesia. Since the advent of modern anesthesia, speed in operating has ceased to be important. There is a great deal to be said for slow and careful surgical procedures. The tissue can be handled gently, and unnecessary pulling and pressure which traumatize it can be avoided.

Dr. William T. G. Morton is given credit for the first public demonstration of surgical anesthesia, which took place in the Massachusetts General Hospital on Oct. 16, 1846. Dr. Crawford W. Long of Georgia, however, is said to have used ether for an operation in 1842, and Dr. Horace Wells of Hartford, Connecticut, is known to have extracted teeth under nitrous oxide gas in 1844. The term "anesthesia" was suggested by Oliver Wendell Holmes to indicate "a state without pain." Before the days of anesthesia, the suffering associated with surgical operations was so great that patients put off operations, even put off seeing a doctor, until suffering became unbearable. After anesthesia became available, great developments took place in the field of surgery. It made possible operations undreamed of only a few decades before. Thus, the two dentists, Morton and Wells, who were primarily interested in finding a method to alleviate the dreaded pain of tooth extraction have given the world a discovery that has become a benefit to almost every individual in civilized society and have provided an inspiration to others who came after them for the development of new drugs and new procedures. Thus anesthesia has developed into a highly specialized branch of surgery. For oral operations special techniques are needed. A separate chapter will be devoted to anesthesiology.

Emergency procedures. Emergencies during anesthesia or operating procedures are likely to occur without warning. The surgeon, therefore, must be familiar with, and have within easy reach, information required to counteract an unexpected incidence by rapidly administering the proper drugs or performing lifesaving emergency procedures. Chapter 9 has been added to meet these needs.

General techniques. There are some fundamental techniques that form the art of surgery. These will be described separately, because their use is general and is repeated in most types of operation. They will be described in the basic part of this book.

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Chapter 1

Bioanatomy

Detailed knowledge of the relationship of the anatomic structures encountered during operative procedures is a prerequisite for the performance of surgery. It is imperative that the surgeon knows the location of important structures to prevent their injury and to prevent permanent defects and unfortunate functional debilities.

The addition of a chapter for a quick review of the anatomy of the face and oral structures and the physiologic and biologic processes associated with them, it is felt, would be useful for the diagnosis of the anatomic involvement of disease processes as well as their treatment.*

BONY SKELETON OF THE FACE

The bones of the face are made up of the parts composing the middle face and the mandible, which represents the lower part. Although both are equal in importance concerning their function in supplying the masticatory apparatus, they differ greatly in their development, anatomy, and biologic activity.

Middle face. The middle face is composed of the maxillae and accessory bones, the nasal, malar, palatine, and sphenoid.

The *maxillae* are firmly attached to the skull, from the base of which they are formed. The embryonic formation is dependent on the preosseous cartilaginous skeleton, and processes modifying its growth will later result in permanent abnormalities.

The *maxillary sinuses* are contained in and follow the shape of the maxillae and are the largest pneumatic paranasal chambers. Sometimes an ethmoidal cell encroaches on and becomes confluent with the antrum proper, simulating doubling of the latter. The floors of these sinuses are at varying distances below the floor of the nasal fossae (Fig. 1). The maxillary sinus has an opening into the nasal cavity, the ostium maxillare. It is disadvantageously placed for drainage, located at the highest place in the median wall. Sometimes an accessory ostium is found opening into the middle nasal meatus. The maxillary teeth, the second premolar and molars, are in close relationship to the maxillary sinus (Fig. 805), and in brachyfacial individuals they may even form projections covered by bone in the floor of the antrum.

The paired nasal fossae lie between the maxillary sinuses. The anterior opening known as the piriform aperture is bounded above by the inferior margins of the nasal bones and laterally by the borders of the nasal notch, leading to the nasal spine projecting in the center. Through the piriform aperture the nasal septum dividing the nasal fossae and the middle and inferior conchae are seen laterally.

The *pterygopalatine (sphenomaxillary) fossa* is of great interest to the oral surgeon. It is a small space, the shape of an inverted pyramid, between the maxilla, the pterygoid process of the sphenoid, and the palate bones, opening laterally into the infratemporal fossa. Through the superior orbital fissure it communicates indirectly with the cranial cavity and directly through the foramen rotundum. It contains the sphenopalatine ganglion, the maxillary nerve, the terminal part of the internal maxillary artery, and the pterygoid venous plexus.

The *infratemporal (zygomatic) fossa* is located below and to the medial side of the

*Huber (1958) has presented a well-illustrated article on the anatomy of the mouth and associated structures which has been drawn upon in writing this chapter, and I am indebted to him as well as to Ciba Pharmaceutical Products, Inc., for the excellent illustrations by F. Netter, M.D., which they have made available to include in this chapter. Other books consulted are Weinmann and Sicher's *Bone and bones,* Shapiro's *Maxillofacial anatomy,* Schaeffer's *Human anatomy,* and *Gray's anatomy.*

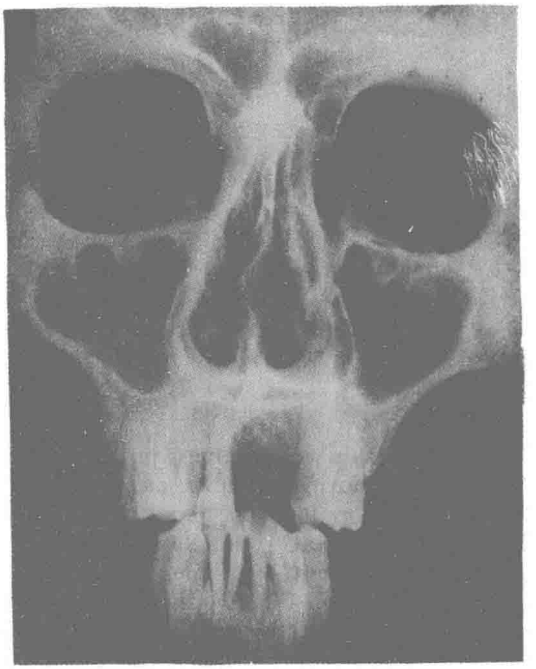


Fig. 1. Frontal section through head.

zygomatic arch, bordered laterally by the mandibular ramus. It is bounded in front by the infratemporal surface of the maxilla where the orifices of the alveolar canals admit the posterior superior alveolar nerves and vessels. It is directly continuous with the temporal fossa above. It contains the lower part of the temporal muscle and coronoid process of the mandible, which often becomes involved in cases of infectious processes located in the zygomatic fossa. It also contains the internal and external pterygoid muscles, the internal maxillary vessels, and the third division of the fifth nerve which enters through the foramen ovale. It connects with the pterygopalatine fossa by way of the sphenomaxillary fissure.

Mandible. The mandible is an independent bone articulated with the cranium so as to perform its designated functions. It develops independently from the embryonic Meckel's cartilage, but the os mentis takes part in the formation of its symphysis, and the condylar and coronoid processes develop from separate centers uniting with the main part. The condyle also has its separate blood supply, which probably accounts for the fact that diseases rarely spread from the mandible into the condyle and vice versa. Important, however, is the condylar growth, often spoken of as being of an epiphyseal nature. It contributes much to the forward growth of the jaw.

Mandibular joint. This has been the subject of many investigations of both its anatomic and functional aspects. It is agreed that it consists of an articular fossa and the articulating condyle, separated from the former by the articular disk, and attached by a capsule which is reinforced by articular ligaments. Controversial points, Choukas and Sicher (1960) point out, are the relation of the disk to the capsule, the relation of the disk to the condyle, and the relation of the external pterygoid muscle to the two.

The temporal bone contains the articular fossa, known as the glenoid, and the articular eminence. The fact that a disk is interposed between the fossa and the condyle makes it a complex type of joint.

The disk or meniscus is composed of interwoven bundles of connective tissue containing scattered basophilic cartilage cells. Posteriorly it forms a thick pad. Its central part is much thinner than the periphery, and in persons of advanced age, perhaps because of edentulousness, it may become perforated. Otherwise it divides the joint into an upper and a lower articular chamber, being attached medially and laterally to the condyle, not the capsule, as pointed out by Krough-Poulson and Moelhave (1957). This attachment, according to Sicher, is achieved by strong short ligaments like the collateral ligaments of a hinge joint.

The capsule of the joint is funnel shaped

and loose. It is attached at the anterior border of the articular eminence and posteriorly over a broad area to the anterior surface of the postglenoid process. Medially it extends to the base of the angular spine of the sphenoid. The lower end of the capsule is attached to the lateral and medial aspects of the condylar neck below the attachment of the disk. Posteriorly the attachment is lower than on the anterior surface. The lateral part of the capsule is reinforced to form the strong, triangular temporomandibular ligament (Fig. 2). Synovial membrane lines the inner surface of the capsule, which posteriorly reflects upon the bone to end at the posterior part of the articulating surface of the condyle.

The condyle is covered with dense fibrous or fibrocartilaginous tissue, as is the articulating surface of the temporal bone. In the fossa the covering is thin, becoming thick, however, on the posterior slope and the articular eminence. Basophilic cartilage cells may be present, especially on the condylar surface in advanced age, whereas at the articular eminence a definite line of calcification may be noted adjacent to the bone.

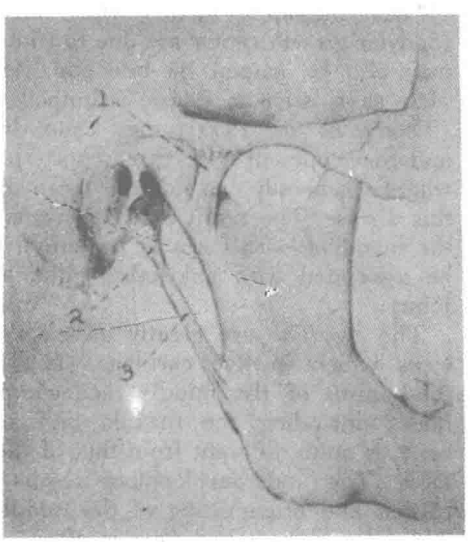
The retrodiskal pad is made up of loose connective tissue. There are folds of synovial membrane seen when the jaw is at rest. They stretch out when the condyle moves forward. The anterior part of the disk is fused to the capsule because here the external pterygoid is attached to the condyle and by its superior head to the meniscus. This description was given by Prentiss (1918), who called it the sphenomeniscal muscle. Choukas and Sicher, however, found that only the most medial and superior fibers of the superior head of the pterygoid are attached to the medial anterior corner of the disk, and they believe that this attachment is not the important factor in moving the disk but that it only aids to maintain a balanced position of the disk during mastication. The simultaneous and automatic movements of disk and condyle, these authors claim, is due to the direct attachment of the disk to the poles of the condyle, which forces it to follow all movements of the latter. The muscle would only be able to pull the disk forward, but its retrusive motion could not be affected by it.

Extra-articular ligaments. These are very strongly developed. They help to hold the jaw in suspension. They also have the function of limiting the motion of the jaw and protecting the articulation.

The temporomandibular ligament extends from the zygomatic process and tapers down to the external and posterior side of the condyle. Its posterior fibers are united with the capsular ligaments; it prevents posterior dislocation and limits the anterior excursion of the jaw (Fig. 2).

The *sphenomandibular ligament* is separated from the capsule by loose connective tissue. It is attached on one side to the angular

Fig. 2



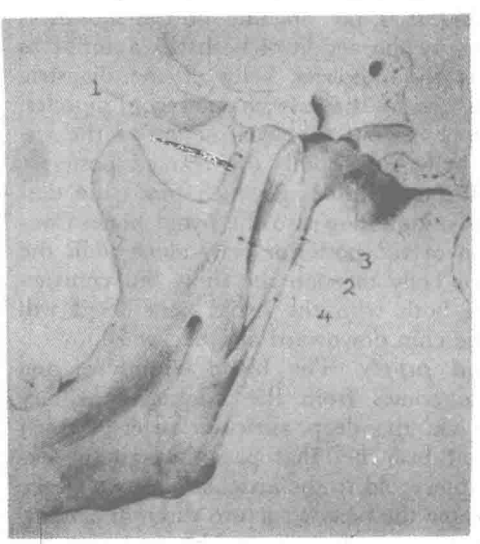


Fig. 3

Fig. 2. External aspect of mandibular articulation: **1**, temporomandibular ligament; **2**, styloid process; **3**, stylomandibular ligament.

Fig. 3. Internal aspect of mandibular articulation: **1**, condyle; **2**, sphenomandibular ligament; **3**, styloid process; **4**, stylomandibular ligament.