SURGERY OF ARTHRITIS

ROBERT A. MILCH, M.D., Editor

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EDITED BY

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Preface

"Arthritis" means many, often quite different things to different people, depending in large part upon which side of a hospital bed the individual may happen to be at any specific time. Clinicians and investigators, for example, clearly have views which are strikingly different from those of affected, living patients and, amongst themselves, not infrequently hold to astonishingly diverse concepts of the nature and pathogenesis of the various disease processes considered to be arthritis. It is thus no small wonder that there is no uniformity of opinion as to the precise therapeutic procedure of choice in any given instance.

To patients, on the other hand, "arthritis" has but a single meaning and presents but a single indication for which medical attention is usually sought; namely, relief from painful limitation or abnormality of motion in one or more joints. More often than not, they first present themselves for medical care long after the disease process *per se* has become established and indeed long after the development of symptoms of internal joint derangement.

For one or other reason, a large segment of the medical public has regrettably been confirmed in the mistaken impression that, except for the prevention of progressive mechanical derangements, little or nothing can be accomplished surgically in the treatment of the arthritic patient. As a consequence, surgical intervention has been recommended and often accepted with limited enthusiasm and largely as a last resort when all acute symptoms have more or less permanently remitted.

A fairly large and constantly growing body of surgical opinion, however, stands in virtually total disagreement with this belief. As in most controversial matters, the truth of the matter no doubt lies somewhere between these two apparently irreconcilable views. The question really is to determine when in the course of the pharmacological therapy of any specific arthritic process surgical intervention should be undertaken and what should be the specific nature of the operative procedure. Unfortunately, only passing attention is given to surgical management in most discussions on any of the arthritides. Surgical management is not infrequently simply considered in a rather parenthetical fashion. Thus, there is a rather woeful lack of information especially in the medical, rheumatological and physiatric literature on the great majority of the surgical techniques that are available to patients with intra-articular derangements.

The primary purpose of the present volume is to acquaint a wider circle of physicians with the views of those who have had a particular interest in these disorders. Little or no attempt has purposely been made here to discuss in any depth the clinical, radiological or microscopic findings and the various modalities for the nonoperative management of the various arthritides. These are outlined in great detail in a number of excellent texts and their repetition here would hardly serve any useful function. Rather, an attempt has been made to focus attention on the gross pathological anatomy of the various arthritides and the rationale for the operative techniques whereby alterations due to disease may be modified.

In short, this is essentially a surgical primer for physicians and for those surgeons who are not primarily concerned with the care of patients with arthritis. It is not intended to assert that surgical intervention is always beneficial or even necessarily desirable, or indeed that the procedures that are here outlined are uniformly adopted by all arthritis surgeons. They are not. Each procedure has, and no doubt will continue to have its strong advocates and its equally strong opponents. It was felt important, however, that at least some of the widely applicable procedures that are currently employed throughout the world be presented for each of the several joints of the body.

In most cases, multiple procedures have been outlined in some technical detail together with the reasons for their acceptance. The procedures outlined are in every case those chosen by each individual author, and represent in general his personal opinion and experience. They have been edited only with respect to format. With two exceptions, no attempt has been made to reflect the clinical importance of arthritic involvement of any specific joint by the length of each chapter. These include the four chapters concerning the management of arthritis of the hip joint and the chapter on the temporomandibular joint. The clinical importance of arthritis of the hip from the surgical point of view need hardly be emphasized, nor is it necessary to state that such problems have been far from resolved. The four major types of approach have therefore been included together, each as a separate chapter. Slight emphasis has also been directed to the temporomandibular joint largely because so little attention is ever given to its involvement in either anatomical or rheumatological texts.

It is hoped that this present volume may provide a basis for stimulating dedicated controversy and constructive discussion between physicians and surgeons so that together they may be able to supply a coordinated therapeutic front to help patients with crippling disease to help themselves back into socially and economically useful lives within their respective communities. Until the causes and pathogenesis of the various arthritides are clearly delineated at a molecular level and a means provided for their

nondestructive resolution, there would seem to be no other intelligent means to treat diseases about which, one must sadly admit, relatively little fundamentally new has been learned since the days of Hippocrates.

It should be noted, finally, that the writing of a general text to accomplish these objectives is at best not an easy task. Frankly, it has proven to be considerably more difficult then was originally contemplated. Therefore I should particularly like to express publicly my permanent indebtedness to the authors of each of the separate chapters who labored so unhesitatingly and so industriously to make this volume possible at all. I am most grateful. I should also like to express my sincere thanks to Mr. Dick M. Hoover of The Williams & Wilkins Company, who is exclusively responsible for the excellent technical quality of this book. My thanks, too, are offered to my secretary, Miss Carole Edwards, who so diligently pursued the seemingly endless re-typing of edited upon re-edited versions of the text.

Last, but by far from least, I want to express my deepest thanks and perpetual love to my long suffering but always enthusiastic wife Margot, who, despite all but entire disruption of her household and life, provided not only constant encouragement and counsel, but also practically interminable hours devoted to proofreading and the host of other factors which, in a very real and practical sense, have permitted the completion of what was once only a visionary ideal.

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Baltimore
July, 1963

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1 | Temporomandibular Joint

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THE temporomandibular joint is important in many functions other than chewing and, either conciously or unconciously, each joint is excessively used either in speech, respiration, straining, deglutition or in emotional responses. Any of these can place repeated and uncommon stresses upon the articulation.

Each temporomandibular articulation consists of two different synovial joint cavities, which are lodged within a common capsule and completely separated by a thin fibrous articular disc. Unlike most other joints, the articulating surfaces are covered with avascular connective tissue rather than cartilage; there is cartilage present deep to the surface connective tissue. The fibrous articular meniscus, set anteriorly on the head of the condyle, conforms to the shape of the articulating bony surfaces and is attached so firmly that, under normal circumstances, there is synchronous movement with the mandible. The capsule itself is very lax to permit the wide variety of movements and is weakest in its forward aspect. It is strengthened and stabilized by four major ligaments (temporomandibular, sphenomandibular, stylomandibular and stylohyoid) which have a distinct gyroscopic influence (Fig. 1.1).

The only muscle physically a part of the temporomandibular articulation is the tendon of the superior belly of the external pterygoid. This penetrates the articular capsule, inserts into the vascularized anterior periphery of the articular disc and draws the disc towards its origin during contraction. All other muscles and tendons are extra-articular. They participate in jaw movements by singular or coordinate action in: (1) elevation, (2) depression, (3) retrusion, (4) protrusion, and (5) lateralization of the jaw. All of these

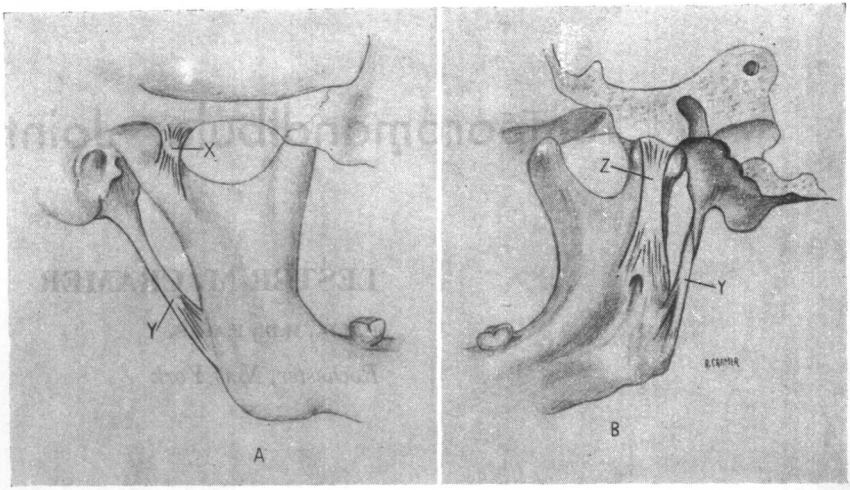

FIG. 1.1. *A*, lateral view of the temporomandibular joint ligaments. *B*, medial view of the temporomandibular joint ligaments. *X*, temporomandibular ligament; *Y*, stylomandibular ligament; *Z*, sphenomandibular ligament.

motions involve the four joints, acting as separate yet synchronous entities, situated in pairs on each end of a horseshoe-shaped bone which is doubly bent and contains from 0 to 16 teeth.

The major function of mastication is a combination of muscle actions upon a combination of the two basic condylar motions: rotation (hinge) and gliding. Rotation occurs between the condyle and the disc, gliding between the disc and the fossa. Both condyles must move simultaneously during all mandibular movements, even on the nonmoving side which has to have fixation.

The mechanical studies of Hjortsjo clarify these movements and explain the relations of the forces (Fig. 1.2). The accentuated grinding joint does not normally appear as a joint type in the human body. However, insertion of an articular disc into a rolling joint or into an accentuated grinding joint will transform both types into double grinding joints. From the point of wear and tear, there is now no longer any difference between them, pointing up another significant function of an articular disc, which is to equalize wear and tear. According to Hjortsjo, the temporomandibular joint represents an accentuated grinding joint, but with an articular disc inserted to reduce wear and tear. (It is especially valuable to bear this in mind when contemplating extirpation of the disc of the temporomandibular joint. The indications for the removal of the disc may weigh heavy, but before the intervention is carried out, it must be clearly realized that the joint will

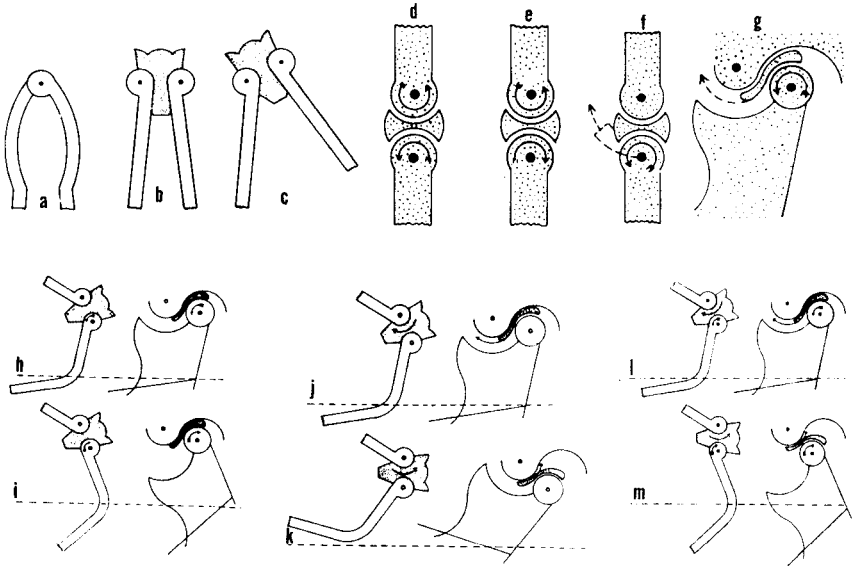

FIG. 1.2. Motions of the temporomandibular joint: *a*, uniaxial nutcracker; *b*, biaxial nutcracker; *c*, biaxial nutcracker, centerpiece moved along one axis; *d*, a turning joint with a meniscus; *e*, an accentuated sliding joint with a meniscus; *f*, an accentuated sliding joint with a meniscus moving in space; *g*, the temporomandibular joint; *h*, forward rotation of the condyle; *i*, backward rotation of the condyle; *j*, tubercle rotation with anterior sliding of the meniscus; *k*, tubercle rotation with posterior sliding of the meniscus; *l*, forward rotation of the condyle combined with tubercle rotation and anterior sliding of the meniscus; *m*, backward rotation of the condyle combined with tubercle rotation and posterior sliding of the meniscus.

All motions are in relation to one or more of the three axes: capitulum, tuberculum, and capitulum-tuberculum. The capitulum axis, transverse through the head of the condyle, is concerned with raising and lowering of the mandible and its rotation forward and backward. Lowering of the mandible is accomplished by the addition of three motions. There is forward rotation in the head of the condyle plus forward rotation of the disc around the capitulum axis. To these are added forward rotation of the head of the condyle around the tuberculum axis. In reverse, this raises the mandible. The tuberculum axis, a transverse axis through the articular eminence, is mainly concerned with the gliding action of linear movements. It changes its position in space. By this translation in space it is unique. Protrusion and retrusion occur about this axis when the teeth are in contact during chewing. Incorrect occlusion will then lead to stresses on the joints. The capitulum-tuberculum axis, drawn from the center of one tubercle to the center of the opposite condyle, is the axis of import for lateral movement in chewing. On the working side, the head of the condyle remains in the fossa. On the balancing side, the rotation occurs about this capitulum-tuberculum axis, usually with some moving forward of the condyle.

be transformed into an accentuated grinding joint with increased wear and tear of the articular surfaces.)

Other than the external pterygoids, the primary muscle actions are concerned with mandibular closure. All motions are in relation to one or more of the three axes: capitulum, tuberculum, and capitulum-tuberculum (Fig. 1.2).

Six further factors must be emphasized for total understanding of the complex biomechanical relationship of the position of the mandible, the occlusion of the teeth and the temporomandibular joints. (1) Of the structures in the mechanism involved, the periodontium of the teeth is the one best designed for absorption of stresses and strains. The quick-motioned, multifaceted temporomandibular joint is not designed for excess strains. (2) Malocclusions can produce stresses normally intended to be absorbed in the periodontium, but which are transmitted to the temporomandibular joint. These may lead to degenerative or inflammatory changes. (3) The complex neuromuscular apparatus, designed to keep the mandible in its rest position and in relation to the four joints, is in a constant state of musculature tonus. This makes it vulnerable to myofascial pain syndromes. Comparable to the referred pain from myocardial infarction, the pains of the proprioceptive disturbances of these muscles are readily transmitted through the auriculotemporal nerve and referred to the temporomandibular joint. (4) The teeth do not contribute to the actual height of the face. (5) The rest position of the mandible, constant and unalterable, is maintained by the tonus of the muscles of mastication and the cervical muscles. (6) The normal freeway space of 2 to 3 mm. is determined by the amount of space between the maxillary and mandibular teeth when the mandible is at rest.

PATHOLOGICAL ANATOMY

Degenerative joint disease secondary to traumatic internal derangement is the prime pathological process manifested in most instances of "arthritis" of the temporomandibular joints.

The chronic joint has soft, roughened, and cracked articular cartilages and menisci. The cracks fill with blood and may undermine the cartilage, separating it from the bone. The cartilages may fracture or be worn away, exposing and eburnating the subchondral bone. Erosion of the articular tubercle and marginal proliferations of the condylar heads (osteophytes) also occur and the articular discs may become grooved, ridged, fractured and may later disappear. Actual tears or a dense heavy transverse ridge of scar tissue are directly related to the "clicking" and "locking" experienced clinically. This type of locking depends upon the height of the ridge and is to be contrasted from that which arises from capsular laxity, in which case

"locking" is due to the head of the condyle being anterior to the articular eminence.

In contrast, in early rheumatoid arthritis, granulation tissue ingrowth over the cartilage, great increase in synovial fluid and major capsular involvement, eventually lead to bone atrophy, erosion of the articular surfaces of the bones, and then to fibrous or bony ankylosis. In the late stages, the picture is quite similar to that seen with degenerative joint disease.

CLINICAL EVALUATION

Rheumatoid arthritis, usually mild in the adult temporomandibular joint, may be very disabling in Still's disease. Four per cent of all rheumatoid arthritis is the juvenile type (Still's disease). Approximately 15 per cent of these young patients will have involvement of the temporomandibular joints which may lead to ankylosis, change in the occlusion with a progressive anterior bite opening, or interference with mandibular growth. The resultant micrognathia and other physical findings associated with this disease will be discussed subsequently.

Osteoarthritis, a gradually increasing painful condition, is accompanied by stiffness of the jaw muscles. This is most marked on arising, disappears with use during the day, but reappears with fatigue. Crepitus is a common finding. X-ray shows the characteristic degenerative and hypertrophic changes, including osteophytic lipping.

The general physical examination must concentrate on lesions suggestive of rheumatoid arthritis, osteoarthritis, collagen diseases, neuromuscular disorders and emotional states of tension.

Of special emphasis in the regional examination is the distribution of the referred pain after palpation of the joint or the muscles, the absence of sensory and reflex abnormalities, and the normality of the pharynx, mouth and ear. Examination of the temporomandibular joints themselves includes palpation to determine translatory condylar motion, joint tenderness, pain radiations, deviations, swellings and stethoscopy.*

* Stethoscopy. Auscultation of the temporomandibular joint can be rewarding when the symptoms are secondary to internal derangements. The four normal sounds that must be recognized are crackling, rumbling, rasping and pulsing. The crackling, a crumpled cellophane noise, is secondary to cerumen in the external auditory canal. The rumbling noise is caused by muscle contraction, especially the masseter. The rasping is a grating noise from the rubbing of hair on the stethoscope. Pulsations are from the superficial temporal artery.

The four characteristic patterns of abnormal sounds which accompany mandibular internal derangement are explained by the disharmonious action of the two parts of the external pterygoid muscle. The superior part moves the disc asynchronous to its usual relation with the inferior part which is moving the condyle. *Pattern I.* Single sound, beginning of opening. The articular disc moves forward first, the head of the condyle produces the sound by riding up onto the trailing, thickened edge of the disc. *Pattern II.* Single sound, end of opening. The head of the condyle moves forward

An exact description of the pain is important. Pain with the internal joint symptoms will usually be dull, constant, unrelenting and without limitation to regions innervated by the trigeminal nerve. Occasionally it does involve both the neck and the shoulder. Usually it will be unilateral, aggravated by mandibular movements, and will simulate the characteristic diffuse muscle pain originally described by Sir Thomas Lewis. It is precipitated by a traumatic episode, such as a sudden or continuous stretching of muscles (yawning, long dental procedure), or sudden or extensive changes in proprioception (occlusal alterations through restorations or selective grinding).

When pain is produced by internal derangement of the joint, pressure on the external pterygoid muscle will reproduce the exact pain of the joint. This may be elicited by pressing a finger along the ascending ramus of the mandible up to the coronoid process and then exerting medial pressure between the mandible and behind the tuberosity of the maxilla. To find the external pterygoid muscle in spasm and then to reproduce the joint pain by pressure upon the muscle is usually absent in true arthritis and therefore is of great importance in differential diagnosis.

X-RAY EXAMINATION

Radiographical evaluation of the temporomandibular joint is still an inexact science, suffering from the inability to establish the normal relation of the condyle to the fossa. Defining normal is made more difficult because similar x-ray findings, which may appear abnormal, can be correlated with symptomatology in one patient and be asymptomatic in another patient. Even in one normal individual there can be wide variation between the left and right fossal slopes and in the depth of the fossae. There is a great variation of size, shape and inclination of the right and left condyle heads, and in the amount and rate of their movement in relation to the disc, the fossa, the tubercle and the opposite joint.

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first, produces sound by riding up on the thickened, leading edge of the disc on going forward. There may be a second sound at the beginning of closing, if the condyle rides on this leading edge when it returns backward.

The following is the situation with the most marked deviation from the midline to the *opposite* side. *Pattern III.* Single sound, middle of opening, usually a second sound at the end of closing. The disc moves forward first, the condyle produces the noise by riding on the trailing edge of the disc as the mandible goes forward. If the disc remains forward, and the mandible starts back first, the second sound will be produced by the condyle on the trailing edge as the condyle moves backward. *Pattern IV.* Sound one, middle of opening; sound two, end of opening; sound three, beginning of closing. This is the only pattern which may be bilateral. Sound one is the condyle on the trailing edge of the disc which has moved forward first; sound two is caused by the condyle moving up onto the leading edge of the disc, accomplished only if hypermobility is present. Sound three is formed only if the disc returns before the mandible so that the condyle then impinges upon the leading edge of the disc as the condyle moves forward. A fourth sound is occasionally heard as the condyle rides on the trailing edge of the disc. This will be heard only in an extremely loose joint. This is the situation which usually has no midline deviation and is almost always heard in subluxations or dislocations.

Despite all these drawbacks, there is value in the x-ray study of an individual case to determine the type of condyle and fossa erosions and to demonstrate the presence of calcific deposits, spurs, fractures or neoplasms. Ankylosis can be conclusively demonstrated and the actual side confirmed.

Correctly taken projections are necessary, for small errors in positioning can lead to major errors in the view. Flat films studied should be taken with the patient erect, with the mouth either opened or closed, and should include at least three views of the articulation. The recommended views are (1) lateral transcranial, (2) anteroposterior, and (3) submentovertex (infracranial). The anteroposterior view is excellent to show the mediolateral position; the clarity of this can be increased by a transorbital approach taken with the mouth held widely open by a bite block. By taking an oblique anteroposterior view as recommended by Zimmer, delineation of the inferior tubercle border and the transverse dimension of the condylar head are made more accurate. The submentovertical view is most valuable in ankylosis.

Laminagraphical, stereoscopical, cephalometrical and cineradiographical techniques are all employed in studying this joint. The major technical problem encountered in all x-ray modalities is the simultaneous exposure of both joints in relation to one fixed point without distortion, correlation and recording the movements in the three axes of motion, and relating the motion to muscular action and dental occlusion.

NONOPERATIVE MANAGEMENT

Historical, physical and special examinations generally classify all patients into four treatment groups, with the following problems: (1) noise, (2) pain, (3) hypermobility, and (4) ankylosis.

More than 75 per cent of such patients can usually be controlled by various combinations of the following nonoperative methods: rest; anesthesia; occlusal adjustments; medications (analgesic, sedative, antispasmodic, ataractic, muscle relaxant); physiotherapy (diathermy, ultrasound, exercise, massage); joint instillations (anesthesia, sclerosants, steroids, hyaluronidase); and psychiatric.

Rest. Two opposing pairs of Ivy loops with intermaxillary elastic traction will accomplish good immobilization. For acute strains, hematomata and capsular tears, 10 days is recommended. Following dislocation with locking, 3 weeks of immobilization is recommended.

Anesthesia. This should be accomplished either by ethyl chloride surface spray, or intramuscular or intra-articular injection of Pontocaine (Fig. 1.3).

Occlusal Adjustment. This should be done after muscle spasms have been controlled, usually 48 to 72 hours after initial treatment but the methods employed are not within the scope of this text.

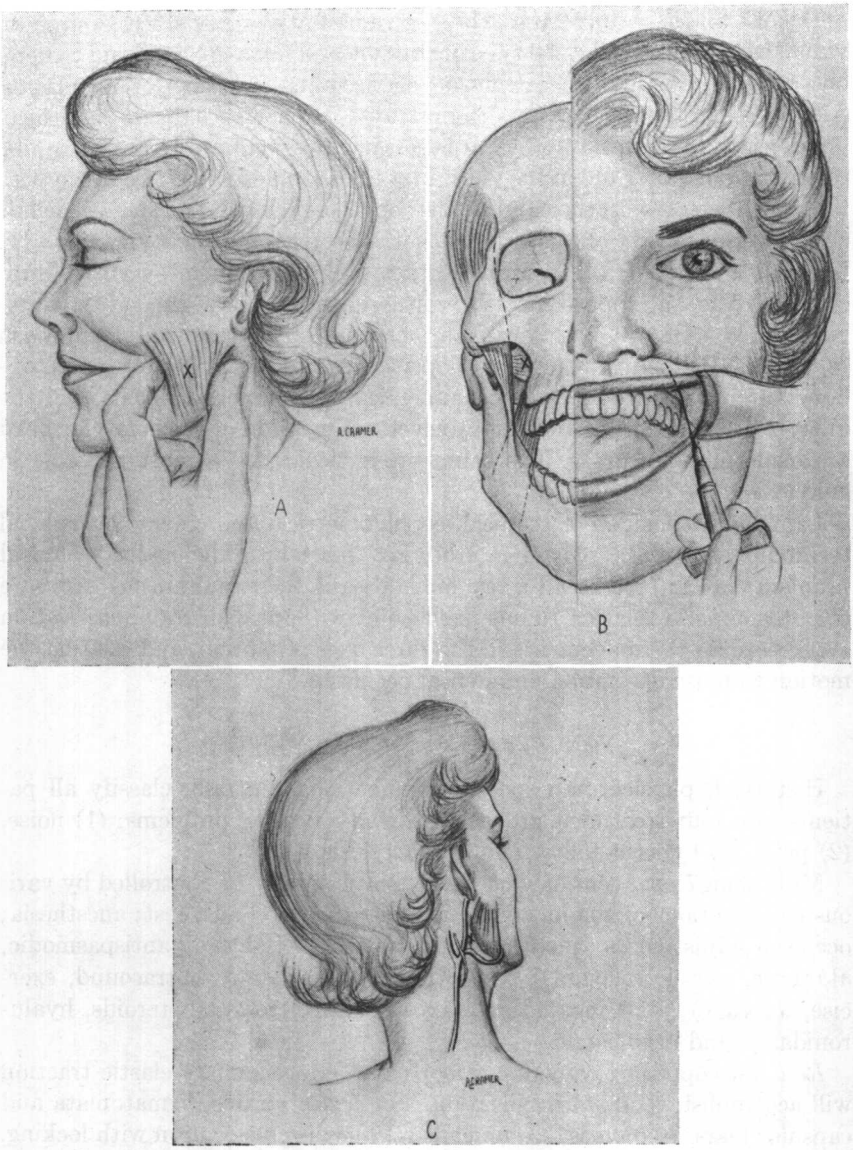

FIG. 1.3. Technique of injecting the muscle spasm areas. *A*, masseter; *X*, site of injection. *B*, external pterygoid; *X*, site of injection. *C*, internal pterygoid; *X*, site of injection.