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Recent evidence related to the microanatomy of the cranial suture offers the basis for a newly postulated mechanism for recurrent head pain and for mild to moderate cerebral dysfunction. A noncomplicated approach to the diagnosis and treatment of these problems is described.

Diagnosis and Treatment of Temporoparietal Suture Head Pain



John E. Upledger, D.O., F.A.O.
Associate Professor
Ernest W. Retzlaff, Ph.D.
Professor
Department of Biomechanics
College of Osteopathic Medicine
John D. Vredevoogd, M.F.A.
Assistant Professor
College of Human Ecology
Michigan State University
East Lansing, Michigan

Mechanism and Functional Anatomy

A complete understanding of the described techniques of diagnosis and treatment requires an appreciation of the recently illuminated microarchitecture of the temporoparietal suture; a review of the gross anatomic features of the suture itself; and of the temporalis muscle, its function, and the bones to which it attaches.

Traditionally, anatomists have taught that the sutural articulations of the adult human are fused and hence immovable. Recent histologic work done by us^{1,2} on adult human sutural material would contradict this view. The specimens studied were taken from living adult skulls at the time of neurosurgical craniotomy. Hence, these tissues studied resemble more closely the *in vivo* circumstance.

By the use of modified staining techniques³, the authors have been able to demonstrate the presence of viable myelinated and unmyelinated nerve fibers, nerve receptor endings, a potentially functional vascular network, and collagen elastic fiber complexes within the adult human cranial suture. We have also demonstrated that these structures frequently penetrate the sutural bone margins and traverse from the diploë into the suture and vice versa. There is also evidence to suggest that some of the intrasutural vascular and neural structures may arise from the intracranial meninges (Fig. 1).

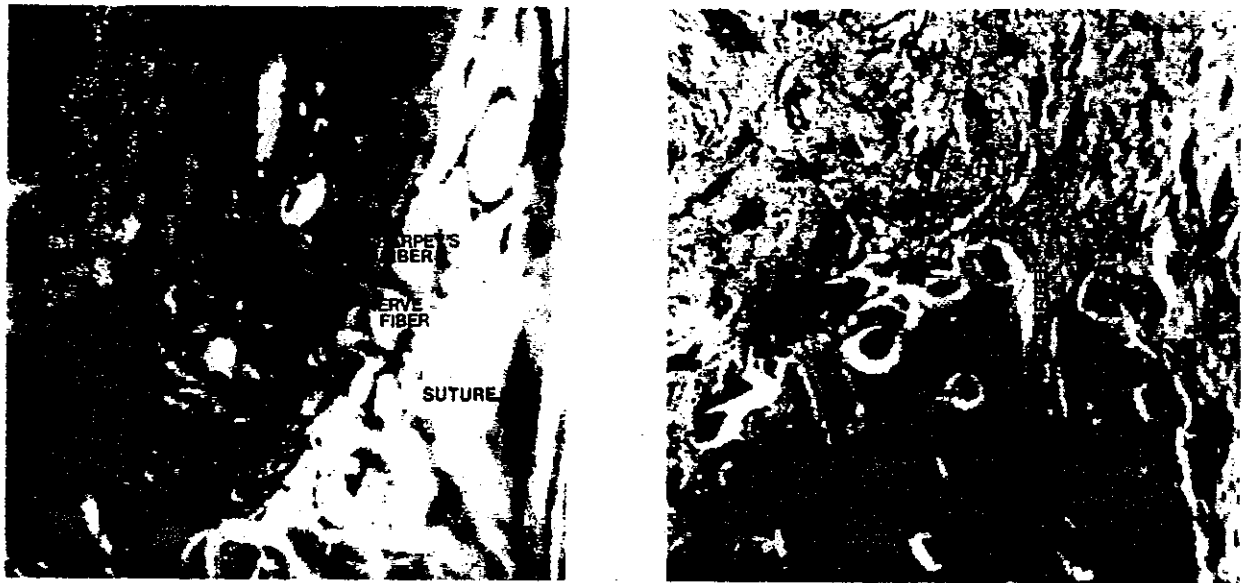


Figure 1. Photomicrographs of human cranial bone and suture showing penetrating Sharkey's fibers. Photograph on left demonstrates how sensory nerve fibers accompany the Sharkey's fibers. Photograph on right stained by protargol/silver-gelatin method. Photograph on left stained by Masson's acid fuchsin-aniline blue connective tissue method.

The significance of these findings is simply that now the human cranial suture may be (and in fact must be) considered as a functional anatomical complex capable, therefore, of dysfunction resultant to various unbalances, stresses, and traumas.

Since the suture is now known to possess the neural structures necessary for nerve reflex activity, sensory input into the nervous system, and motor activity, it becomes apparent that a distortion of the functional relationships between the sutural osseous boundaries may produce abnormal neurogenic activity as well as intrasutural ischemia. Either one or both of these conditions may result in local as well as referred pain. Further, our conjecture is that although evidence is scant at present, the intracranial vascular delivery system may be in-

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fluenced by neurogenic reflex mechanisms that possess intrasutural stimulus receptors.

In view of the aforesaid findings, it seems obvious that the restoration of sutural mobility is desirable. Several mechanisms which underlie sutural dysfunction are possible. One which has been almost completely overlooked is hypertonus or contracture of the

temporalis muscle. This muscle is frequently and chronically contracted in situations of increased emotional stress, dental malocclusion, and/or temporomandibular joint dysfunction, among other things.

Consideration of the anatomy of the temporalis muscle shows that during its contracted state it is capable of producing compression of the temporoparietal suture.

The insertional attachments of the temporalis muscle are from the ramus of the coronoid process and from the anterior border of the ramus of the mandible. The muscle arises from the floor of the temporal fossa and from the temporal fascia. It can be seen in Figure 2 that the temporal fossa extends superior to the temporoparietal suture and, therefore, that contraction of the temporalis

muscle does, in fact, cause the parietal bone to move in an inferior direction thereby producing a compression of the temporoparietal suture contents. The potential results of this sutural compression have been discussed earlier.

The anatomy of this suture is such that temporalis muscle contraction will produce a gliding motion of the parietal bones' sutural surface inferiorly after the superior motion of the mandible is effectively resisted by the approximation of the upper against the lower molar teeth or by the surfaces of the mandibular ramus coming into opposition with the roof of the mandibular fossa of the temporal bone.

The bony surfaces of the temporoparietal suture are beveled and grooved in such a way that a sutural shearing force is generated by temporalis muscle contraction (Fig. 3).

This shear may longitudinally stress the collagen (Sharkey's) fibers that appear to be innervated. It may also reduce the cross-sutural physical dimensions and, therefore, produce intrasutural pressure ischemia, as well as disrupt normal neurogenic reflex activity resulting from pressure stimulation of receptors. It may interfere with normal nerve fiber conduction as well.

Diagnosis and Treatment

The diagnosis of symptoms (head pain-cerebral dysfunction) resulting from dysfunction of the temporoparietal suture is usually straightforward.

Sutural compression when exaggerated, will quickly increase symptom severity if the examination is done during an exacerbation. If the patient's condition is

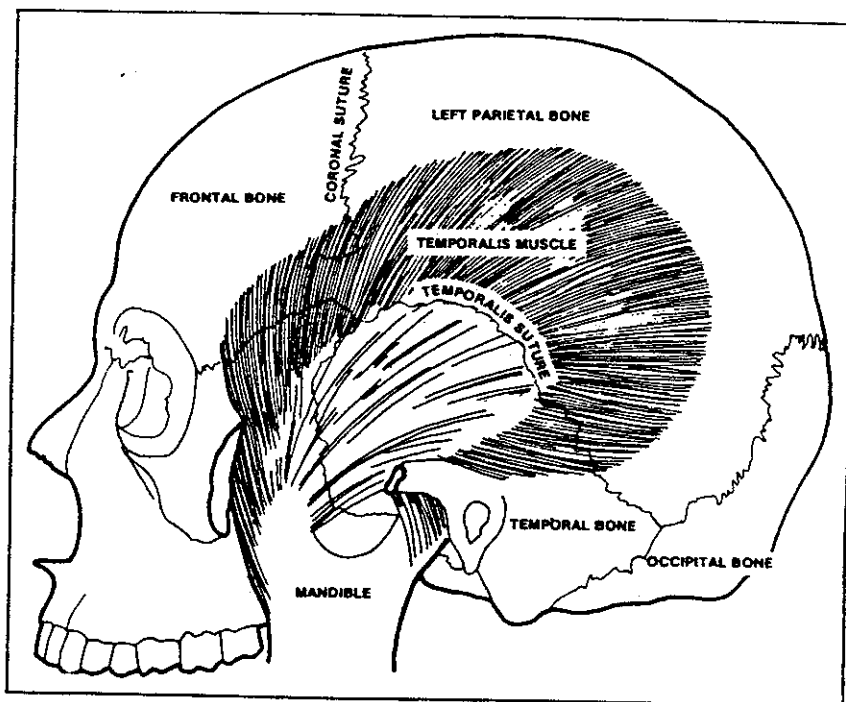


Figure 2. Temporalis muscle attachment.

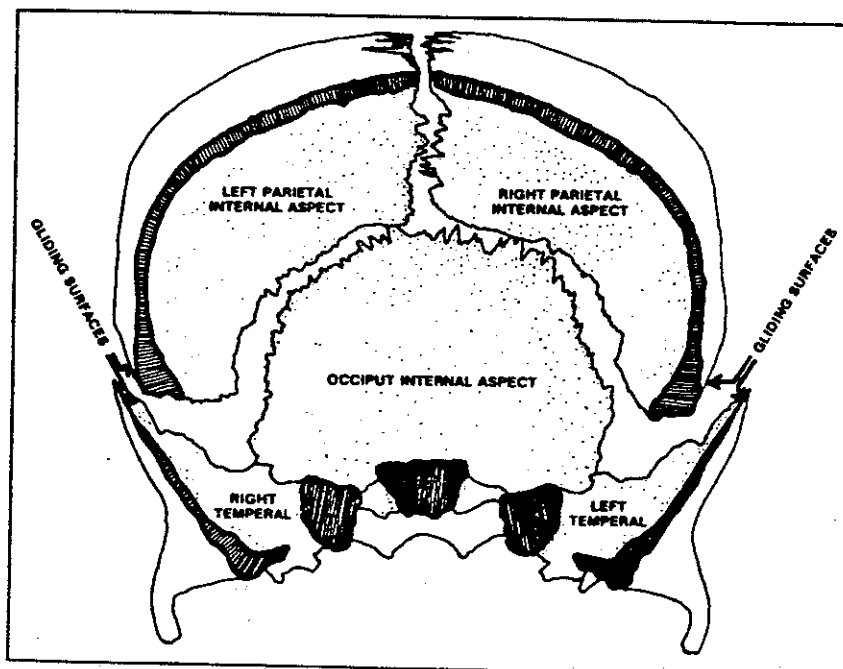


Figure 3. Coronal section: temporoparietal suture bevel.

quiescent during the examination, the symptom complex can often be produced in a matter of minutes.

The examination technique is done with the patient comfortably in the supine position. The physician should be seated above the patient's head with the forearms and elbows comfortably resting on the examination table beside and superior to the patient's head. The physician then makes finger contact with the tissues immediately overlying the inferior posterior borders of the mandibular rami bilaterally. A bilaterally equal, superiorly-directed force is then applied to the mandibular rami (Fig. 4) so that the expression of force carries through the temporomandibular joints causing the temporal bones to move slightly in a superior direction. This force stresses the temporoparietal sutures bilaterally. The force is initiated gently and is slowly increased until the patient reports either an increase in the present symptoms or the onset of their familiar symptom pattern. If this result occurs, we consider that the diagnosis is confirmed.

Next, the physician must consider the causes of temporoparietal sutural dysfunction. A visual examination of the posterior molars will offer evidence either for or against dental malocclusion. (Consultation with a dentist may be in order at this juncture.)

The tonus of the temporalis muscles should be evaluated by palpation. A fibrous texture and extraordinary tissue firmness coupled with an apparent wearing down of the molar surfaces is supportive of chronic temporalis muscle hypertonus most often resulting from emotional stress or repressed anger.

Temporomandibular joint dysfunction is best diagnosed by

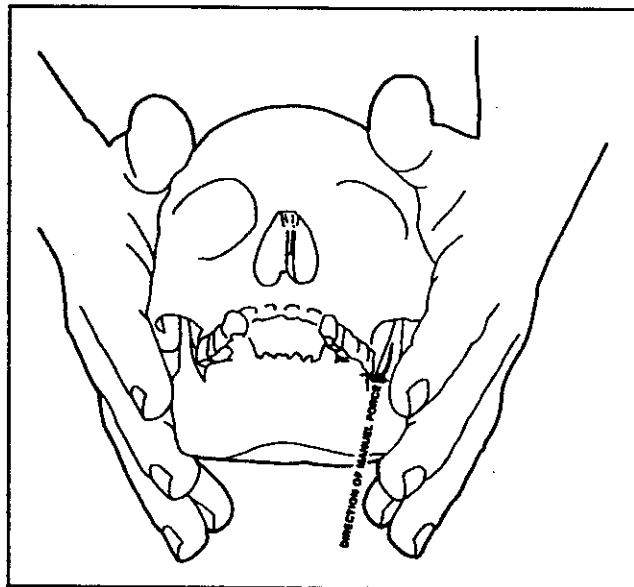


Figure 4. Physician hand placement for technique to exacerbate symptom.

palpation and observation as the mandible is put through its range of motion. Primary treatment must be directed toward the cause of the abnormal condition of the temporalis muscle be it emotional, dental, or temporomandibular joint.

Often the primary cause is no longer in existence; however, the physiologic state of the temporoparietal suture has been so disrupted by previous events that it has become immobilized in an abnormal anatomicophysiological state of compressed immobility. In this circumstance, a simple mobilizing procedure may only require a few repetitions. If there is a continuing cause for the sutural dysfunction, temporary relief of symptoms can usually be obtained by the use of one or all of the therapeutic techniques described below.

—Osteopathic manipulative technique to relieve temporoparietal suture dysfunction. After the diagnostic temporoparietal suture compression technique the gentle pressure is continued until the tissues are perceived to relax or soften. This phenomenon probably occurs because of neurogenic fatigue with secondary reduction in tissue tonus. The palms of the hands can be used to determine when temporalis muscle relaxation occurs.

After this change in tissue tonus, gentle traction is applied over the superficial surfaces of the mandibular rami bilaterally. This traction is extremely gentle and incorporates a balancing effort on the part of the physician. It is directed inferiorly following the direction of least resistance. The technique is aimed at decompressing the temporomandibular

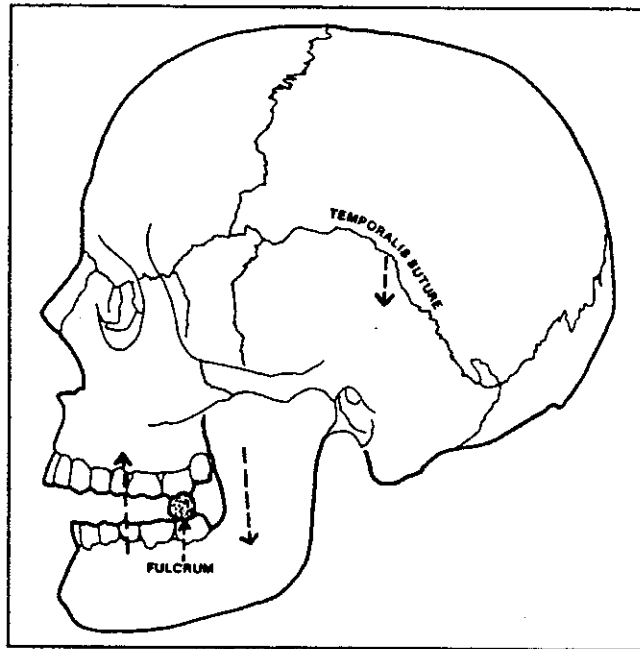


Figure 5. Fulcrum placement for decompression of temporoparietal suture and temporomandibular joint.

joints, the temporoparietal sutures, and at stretching the temporalis muscles by traction. Gentleness is the rule. If the physician perceives a contractile response to his traction from the tissues the efforts are too vigorous and will be self-defeating. There are limits of tractional force within which tissues can be gently stretched and which are below the contractile reflex threshold. It is within this range that this treatment technique can be effectively applied.

The same technique will effectively assist in the treatment of temporomandibular joint dysfunction.

—*Transcutaneous needle stimulation for the treatment of temporoparietal suture dysfunction.* Gentle palpation of the involved suture

will usually reveal localized areas of tenderness along its course. The transcutaneous insertion of a disposable 27-gauge hypodermic needle through the scalp into the subcutaneous tissues immediately over the tender area will almost invariably normalize the sutural dysfunction. The needle should be inserted at approximately a 30° angle to the scalp surface along a line parallel to the direction of the suture. Because of the reciprocal innervation principles that seem effective in all parts of the body, these needles should always be inserted bilaterally. Aseptic techniques should, of course, be employed.

If temporomandibular joint dysfunction is present, bilateral transcutaneous needling immediately over the tender areas will

prove to be a valuable adjunct. Needles should be left in place at least 5 minutes or until pain is relieved.

—*Mandibular fulcrum technique for temporoparietal suture dysfunction.* Another effective treatment technique makes use of two rolls of gauze or other suitable material. The rolls should be about ¼ inch to ⅜ inch in diameter. They are placed between the upper and lower teeth bilaterally at about the region of the second molar (Fig. 5). A gentle force is then applied manually in a superior direction on the anterior inferior aspect of the mandible. The gauze rolls act as fulcrums and the mandibular rami as levers which apply decompressive tractional force to the temporomandibular joints and to the temporoparietal sutures. The force applied is light so that a contraction response is not stimulated.

Patients can be taught this technique as a method of self-help. The patient can usually learn to judge accurately the amount of force to be applied. They can easily learn to discern when their own tissues are changing from relaxed to contracted states. []

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