Arthroscopic Surgery of the Temporomandibular Joint

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Arthroscopic examination and surgery of the temporomandibular joint is described, with illustrated preliminary reports on the procedure and follow-up in clinical cases.

KEY WORDS: • ARTHROSCOPY • COMPUTERIZED TOMOGRAPHY • • TEMPOROMANDIBULAR JOINT •

An initially casual discussion between two of the Authors, private practitioners of orthopedic surgery and orthodontics, led to the clinical studies reported here. That initial conversation revolved around the possibility of using the arthroscope in the evaluation of temporomandibular joint disease. At that time, we felt that this was a novel idea. However, as one knows in academics, if you think you have discovered something new, it may be because you don't know how to read German; or in the case of arthroscopy, that you don't know how to read Japanese. After an extensive literature search, it became apparent that there have been previous isolated cases of clinics performing diagnostic arthroscopies in Japan and Sweden. The largest series is from OHNISHI (1980) in Japan. He reported primarily diagnostic arthroscopies, but in addition, minor punch biopsies were also reported.

After our literature search, we reviewed the anatomy on cadavers at the University of South Florida in Tampa. In the course of those dissections, we demonstrated to our satisfaction that it was possible to insert an arthroscope, and

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possibly some additional instruments, into this small joint.

Some time elapsed before the first patient was selected. The dramatic and successful outcome of that first case prompted us to continue to investigate the arthroscope as both a diagnostic and therapeutic tool in temporomandibular joint disease.

The purpose of this paper is to review, with an orthopedic surgeon's view, the anatomy, physiology, and pathophysiology of the temporomandibular joint, the history of arthroscopy, arthroscopic technique in general, and finally, to present case results with illustrations from the videotape record of surgical procedures.

The arthroscopic endoscope is a very useful tool for visualizing the interior of joints in vivo. The last twenty-five years have seen the development of precisely engineered instruments that are both small and strong, equipped with powerful light sources, fiberoptic light guides, and optic systems that can transmit a clear image through a telescope less than 2mm in diameter. These innovations have brought many previously inaccessible anatomical structures within the range of endoscopy.

Greater experience with diagnostic arthroscopy, together with the development of suitable operating instruments, made the performance of intra-articular surgical procedures without full-scale arthrotomy the next logical step. For the patient, the benefits of endoscopic surgery include more accurate diagnosis, more precise surgery, much less in surgical trauma, and more rapid rehabilitation.

However, the skills needed for this type of surgery are new. There are few similarities to open surgery. Each step must be learned slowly and often painfully through experience. The small size and complexity of the temporomandibular joint present unique challenges, and certainly no surgeon should consider beginning arthroscopic surgery on the temporomandibular joint until fully competent and confident in arthroscopic technique in other joints.

The first endoscopes were used to view the bladder, rectum, vagina, and nasopharynx. The interior of a joint was first examined with an endoscope in 1918, by K. Takagi of Tokyo. He used a cystoscope, but he quickly developed an instrument specifically designed for the knee. This was 7.3mm in diameter, and had no lens system. The principal use of the instrument in Japan in those days lay in the management of tuberculosis of the knee, which caused ankylosis that made squatting and kneeling impossible, with serious social and physical incapacity (Dandy, 1981).

World War II brought an abrupt halt to intellectual dialogue throughout the world. It was not until 1957, when Takagi's successor, M. Watanabe, published his first Atlas of Arthroscopy, which included water-colored endoscopic photographs. The arthroscope was first brought back to North America by R. W. Jackson of Toronto in December of 1964, after working with Watanabe. Since that time, as we all know from reading the lay press and sports journals, arthroscopy of the knee has become a standard of care.

For a complete history of arthroscopy, the reader is referred to Dandy's *Arthroscopy of the Knee* (1981).

Arthroscopy of the temporomandibular joint was not reported until 1980, when Ohnishi described the technique that he had used since 1974 and reported four illustrative cases. These included biopsy and mobilization. Cadaver studies in Sweden documented the best location for puncture sites (Holmlund and Helsing, 1985). Animal studies at the University of Illinois were reported by WILLIAMS AND LASKIN (1980).

Helsing in Sweden and Murakami in Japan have reported isolated cases of patients with disk derangement in the temporomandibular joint and their arthroscopic findings. Murakami has also reported two cases of fibrosis of the joint treated with manipulation. The usefulness of arthroscopy was also demonstrated in the treatment of suppurative arthritis by Murakami.

The only report in the literature of human temporomandibular joint arthroscopy in the United States was by BURKE IN 1985, where he describes a technique but no specific cases. The case report by the present Authors (Nuelle and Alpern 1986) is believed to be the first case of arthroscopic surgery of the TMJ using motorized equipment. This subject is also addressed in WATANABE's book *Arthroscopy of Small Joints* (1985).

— The Temporomandibular Joint —

The temporomandibular joint is a diarthrodial joint with characteristics not unlike those of other joints. It is made up of two articular surfaces of bone coming in contact with one another. The surfaces are covered with cartilage. In the case of the skull this cartilage is fibrocartilage, and in the case of the condyle it is hyaline cartilage.

The joint has a tough outer capsule and an inner smooth synovial lining. The joint space itself is divided into superior and inferior portions by an articular disk. This articular disk is made of a rather thin and very flexible layer of dense fibrous tissue or fibrocartilage not unlike that of a diskoid meniscus sometimes seen in the knee of juveniles.

Embryologically, the diarthrodial joints, taking the knees as an example, are divided into superior and inferior portions by a similar articular disk. However, during intrauterine development the central portion of this disk normally disappears, leaving only the peripheral rim. This peripheral rim forms the meniscus in the knee, where it is made of a material very similar to that of the TMJ articular disk (Hollingshead, 1967).

In the TMJ, the complete articular disk is retained, as it is in the joints at both ends of the clavicle. In the pathologic condition of the lateral compartment of the knee known as a diskoid meniscus, the full disk may also be retained.

The TMJ is not a simple ball and socket joint. The condyle is kept in position by the restraining joint capsule, its attendant capsular thickenings or ligaments, and the surrounding muscles of mastication. In addition, the stylomandibular ligament forms an extra-articular suspensory ligament to the mandible that provides a mobile pivot during mouth opening.

The condyle of the mandible is the mobile component, moving on the skull as a fixed base. The condyle both translates and rotates during normal movements of the mouth. In addition, there is a right and left rocking motion and some axial deviation as well. This great degree of freedom is necessary to accomplish the multiple functions required of the oral cavity.

A peculiar characteristic of the temporomandibular joint is that both the right and left joints are locked in bony congruity. Therefore, abnormalities which occur in one joint will be reflected in abnormal motion in the opposite joint. When the teeth are in centric occlusion, the condyle is at rest as usually seen on radiographs and CT scans.

It is particularly important to recognize that this is a highly mobile joint.

What we are usually asked to treat is *pain with motion.* We must focus our attention on abnormal patterns of motion during chewing. Dentistry has been concerned with precise positioning of the condyle in the fossa at centric occlusion. From an orthopedic viewpoint, correcting the way that the condyle gets to this position is the key to relief of pain.

The joint must *function normally,* not just look good on film or CT scan. The single most important advantage of arthroscopy of the TMJ is that it allows one to *witness motion* of the TMJ from the inside, and to deal directly with pathologic processes causing abnormal motions under direct vision of the structures themselves. However, it must be emphasized that arthroscopic surgery can only diagnose and possibly treat intra-articular pathology.

In and of itself, this is insufficient treatment for the patient in many cases. This joint is a complex structure which also responds to pathology in the extra-articular anatomy. Without correction of such extra-articular pathologic conditions, secondary joint pathology will probably recur. Likewise, treating only the extra-articular pathology cannot effectively relieve the symptoms in those cases where the intra-articular pathology is a significant factor; it must also be dealt with.

Pathophysiology of the Joint

In dealing with the pathophysiology of the TMJ, I would like to consider three specific symptoms that patients complain of —

-locking-
-crepitus-
-pain-

The *"locking, or clicking"* symptom is the feeling of the joint being "hung up," then giving way with an audible click. This can be secondary to tears in the intra-articular disk with disk displacement. However, other pathologic conditions in the joint can also cause this symptom. We have found that intra-articular adhesions, irregularities, and loose bodies in this joint can cause symptoms of locking as they can in any other joint. Any pathology which interferes with the free movement of the condyle or the disk can produce symptoms of locking for the patient.

In some cases, only one joint may be locked, resulting in abnormal excursion and pain on the contralateral side with opening of the jaw.

Crepitus is a "grinding" or "grating" sensation that the patient experiences with opening or closing of the mouth. This grinding sensation can be secondary to degenerative changes on any of the articular surfaces. It is a common sensation in all joints with high wear, such as shoulder and patellofemoral joints. Frayed elements of articular cartilage or cartilagenous disk will sometimes break off in the joint and form microscopic debris which can cause gritty sensations.

Pain is a universal symptom. It is important to recognize that articular cartilage, bone, and the articular disk have no nerve fibers. Since the articular cartilage is avascular, it does not even have the sympathetic and pain fibers that sometimes travel with the blood vessels in structures such as bone. The sensation of pain must come from inflammation or abnormal traction on pericapsular tissues affected by either disease or injury.

Rheumatoid arthritis, gout, and suppurative arthritis are all possible causes of pain secondary to inflammation in any joint. Major trauma to the joint can produce internal derangement leading to degenerative arthritis. Chronic microtrauma to the TMJ from malocclusion can start the cycle of cartilagenous degeneration and inflammation that leads to the formation of intra-articular adhesions, fibrosis, and ultimately complete loss of cartilage. Spasm of the controlling muscles is also a known source of pain.

One of the most common pathologic conditions in other joints is the syndrome known as adhesive capsulitis. In the shoulder, this is called a "frozen shoulder." Our concept of TMJ disease is one in which chronic trauma, possibly secondary to malocclusion and hyperfunction in many cases, produces articular damage with a resultant mechanical inflammation. Due to the pain associated with this inflammation, the patient simply limits chewing forces and excursion of the joint. By holding the joint still in the attempt to relieve pain, the inflammatory process with its normal physiologic response of fibrin formation and scarring produces retraction of the periarticular tissues, and in particular causes adhesion between the pericapsular tissue and the articular disk.

The patient now has a "fixed joint" on one side. Translation is lost entirely, and rotation is restricted. As the inflammatory process dies down and ceases to hurt, the patient begins to gain increased excursion in translation on the uninvolved side in compensation for the lack of translation in the adhered side. That excess translation on the contralateral side causes pain from traction in the pericapsular tissues and accelerated wear due to the abnormal motion.

Based on our observations, it appears that the clicking or clunking that occurs in this condition is due to the restriction of motion of the articular disk. The undersurface of the disk has two ridges or bands. When the mandibular condyle pushes against the anterior band and the disk doesn't move, the condyle translates *under* this band, causing a clunking sensation. The lower compartment becomes a sliding instead of rotating component.

It is this specific condition which we have seen and treated, with gratifying results.

— Surgical Techniques —

We have employed a modified version of the technique described by Ohnishi.

We choose to do the procedure under general anesthetic for two reasons. It provides total pain relief, at the puncture site and intra-articularly, and it also provides complete relaxation of the temporalis, masseter, medial and lateral pterygoids to allow free and full manipulation of the joint during the operative procedure.

Nasotracheal intubation is chosen in preference to endotracheal intubation for the same reasons, to leave an unimpeded full and free range of motion of the jaw.

The joint to be approached first is prepared by having the anesthetized patient's face turned with the concerned side up. The hair just anterior to the tragus is lightly shaved, and the skin is prepared with Betadine scrub and Betadine prep. Standard disposable drapes are used to expose a field of the cheek area just anterior to the tragus.

The jaw is held in an open-mouth position. A #23ga needle with approximately 5cc of saline in a syringe is inserted at a point just anterior to the tragus and anterior to the palpable superficial temporal artery. The condyle of the temporomandibular joint is palpated and the needle inserted in a supermedial direction, aiming toward the temporal fossa. The saline solution is then used to distend the joint; distending the joint with saline allows easier insertion and manipulation of the arthroscope. Free flow of the saline back-and-forth between the joint and the syringe confirms good needle placement.

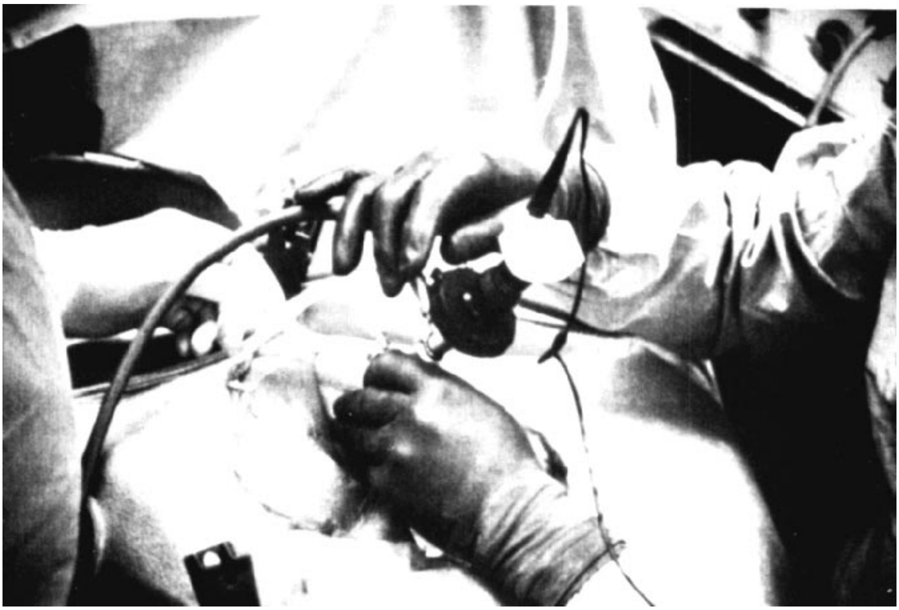


Fig. 1 **Arthroscope inserted in the temporomandibular joint. The TV camera is mounted on the end of the arthroscope.**

The arthroscope which we use is a Wolf scope with a 1.9mm optical system and a 2.2mm outer sleeve. A small vertical stab wound is made to allow this slender scope to enter the skin. A sharp trochar is then used to penetrate through the masseter muscle and pop through the joint capsule. The sharp trochar is then removed and the blunt trochar is used to penetrate the synovial lining and enter the joint. The free flow of the saline, this time through the trochar sleeve, confirms good placement into the joint before the arthroscope is inserted down the sleeve.

We also employ a chip color TV camera mounted onto the arthroscope for the surgical procedure itself (Fig. 1). This serves several purposes.

It magnifies the image so that it is easier to see small detail.

It allows everyone in the room to see, including both operators.

Sterility is better maintained. It is easy to contaminate the field with one's face down close to these small arthroscopic instruments. However, using a fully sterilizable TV camera system, one can operate with minimal fear of contamination. Figure 2 shows the operator positions during surgical debridement while viewing the procedure on the monitor.

When we do this procedure, the surgeon performs the insertion and manipulates

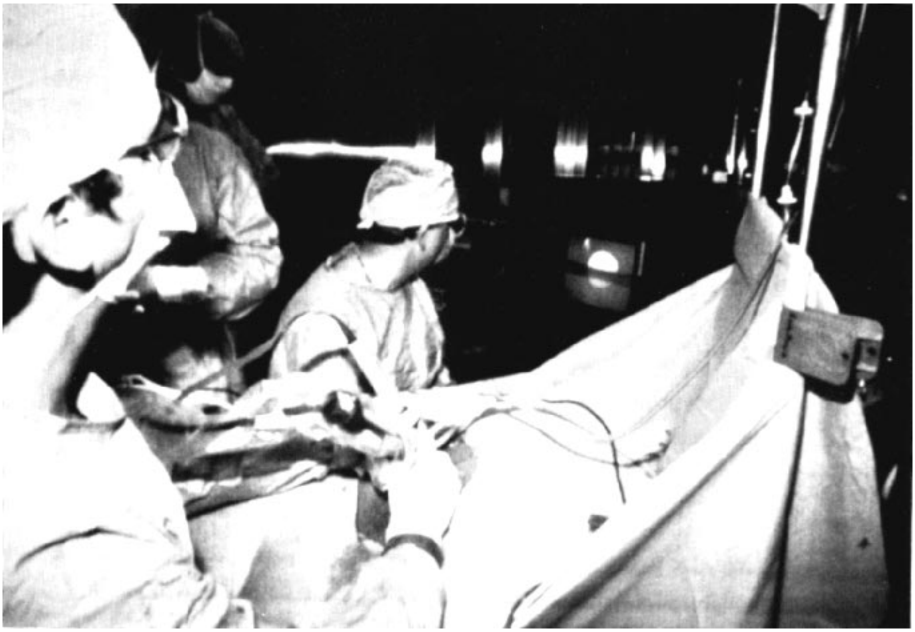


Fig. 2 **Surgical debridement with the instrument in place, with the operators viewing the procedure on the monitor.**

the scope, and the orthodontist, also scrubbed and gowned, slips his hands underneath the drape and puts his fingers into the mouth to manipulate the jaw intra-operatively. This gives us full view and control of the joint.

If an additional instrument is necessary, we have developed a two-puncture technique using the principle of triangulation. Approximately 1cm anterior to the first puncture site a second puncture wound is made with a 22ga spinal needle. The needle is inserted into the joint in such a way in that it can be seen in the arthroscope (Fig. 3). This small needle shows the path necessary to perform the triangulation with minimal trauma.

When the second instrument is inserted, a stab wound is again made with a #11 blade, directly into the puncture site alongside the spinal needle. The needle is then removed and the arthrotome is inserted along the same path. We have used a 3.2mm diameter Hall arthrotome with a blunt cartilage-cutter tip.

After the diagnostic arthroscopy and any arthroscopic surgical procedure have been performed, the joint is thoroughly irrigated with free-flowing sterile saline and insufflated through the arthroscopic tubes, using 1cc of Marcaine. If an arthritic condition and significant synovitis are present, 20mg of Depo-Medrol is likewise used. The instruments are then all removed, and the two puncture sites are closed with a 4-0 Nylon suture, and dressed with a single "band-aid."

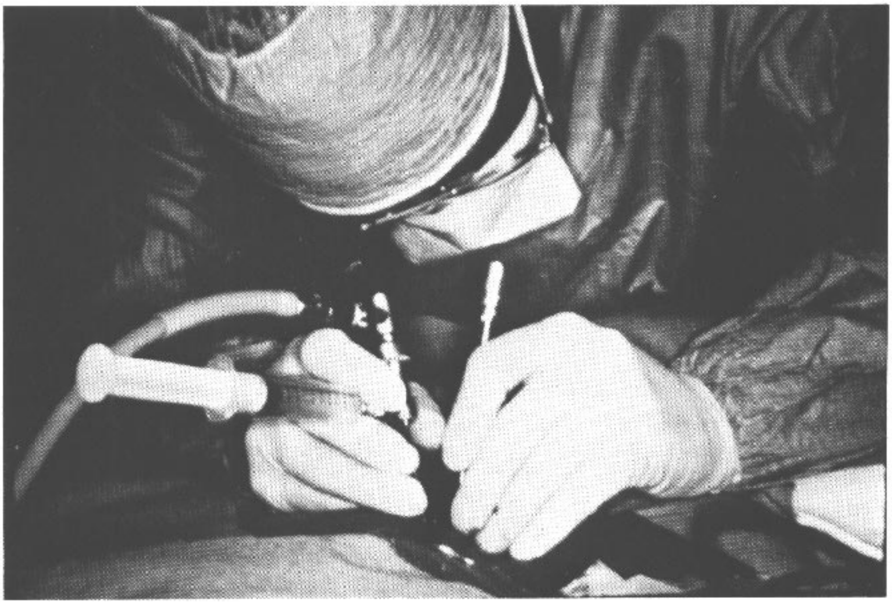


Fig. 3 **Surgeon inserting the secondary operative instrument under visual control through the arthroscope.**

— Case Presentations —

Live video presents the most vivid picture of the intra-articular activities and findings, but that is obviously impossible in a print medium. The illustrations that follow are still frames from the videotapes made at the time of surgery on three patients (Cases 1, 2 and 3). A short case history, the CT scans, and the intra-operative findings are also presented.

In viewing the video images, the most difficult part is orientation to the internal perspective of the joint. You are not an outsider looking in; your eye is actually inside the joint. You are literally looking out of a 1.9mm porthole as you wander through the joint space itself, so only small segments of the condyle and other joint structures are seen in any one view.

Figures 4-6 show placement of the arthroscope and the second surgical instrument.

Case 1
Figures 7-13

This is an 11yr-old white female whose chief complaint was "crooked teeth." Her initial examination revealed no apparent slides in mandibular function. Clicking of the left TMJ was noted on opening and closing. The diagnosis was a skeletal and dental Class I, well-related vertically, but with crowded lower incisors and a 4mm overjet. The mandibular right second bicuspid was missing, with deciduous molar retained and impacted under

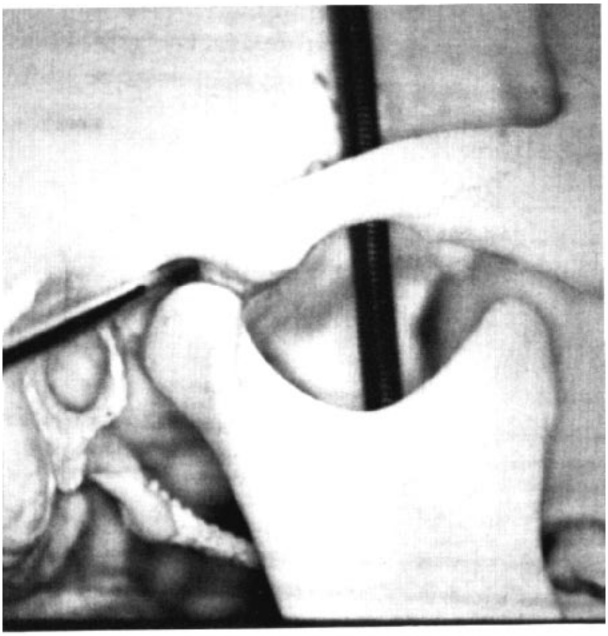


Fig. 4 Arthroscope inserted, with the jaw closed.

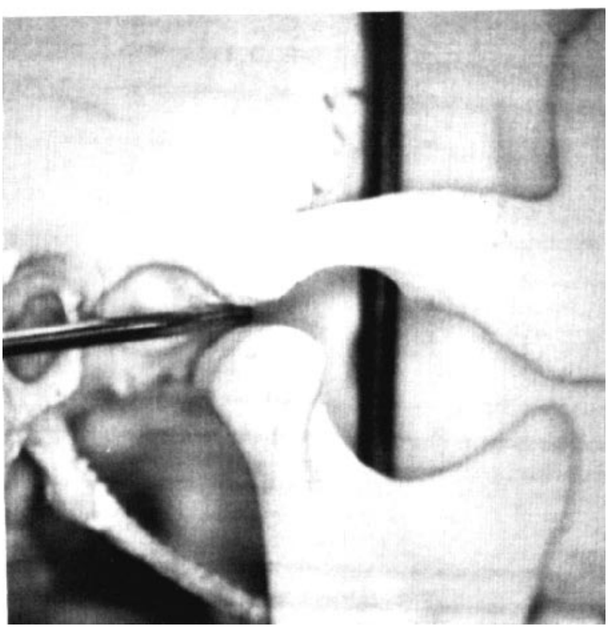


Fig. 5 Arthroscope inserted, with the jaw open.

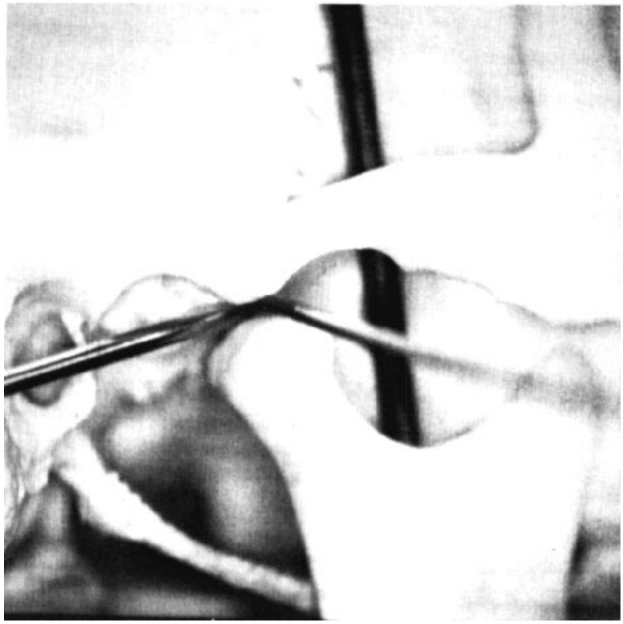


Fig. 6 Arthroscope and second instrument in position in the joint, with the jaw open.

the mesial contour of the first molar. This deciduous molar was also trapping the first bicuspid under its mesial contour. The mandibular left second bicuspid was erupting distally toward the first molar. All four third molars were impacted.

The soft tissue profile was considered normal. Her mother stated that when she was 4 or 5yrs of age, she was hit "full force by a horse in the jaw, and then at age 9, fell off a bike and hit the pavement on the left side of the jaw."

Treatment involved the extraction of the remaining second bicuspids and second deciduous molars. Edgewise orthodontic appliances were used in an attempt to hold the position of the maxillary incisor and advance the mandibular incisor. Treatment required 2½ years, and proceeded without problems other than oral hygiene. Care was taken to not retract the maxillary incisors, and a 3mm overjet was left to assure that the condyle was not distally displaced.

Progress and retention cephalometric radiographs revealed apparent marked vertical growth of the mandible. This was hard to understand, since the patient originally had a normally divergent pattern, and one would expect vertical closure following second bicuspid extraction and intraoral mechanics.

During retention, the patient began to complain of pain and severe clicking of the right TMJ. Her initial clicking had been on the left, and the right TMJ had been normal. A prescription was written requesting CT scans of both the right and left TMJ's in centric occlusion and at the first click.

Figures 7 and 8 demonstrate coronal sections through the left and right TMJ, showing marked degenerative changes on the right. Figures 9 and 10 are direct

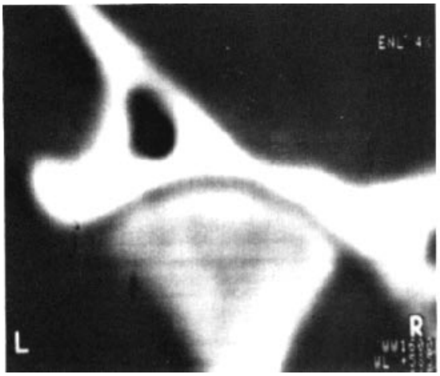


Fig. 7 Case 1
Coronal CT section through the left joint, which appears normal

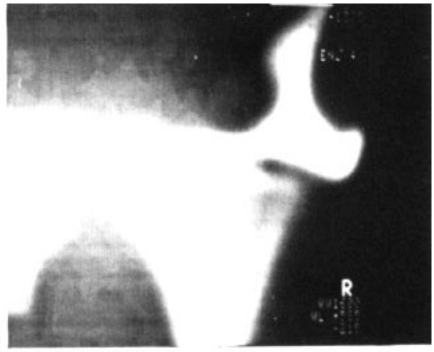


Fig. 8 Case 1
Coronal CT section through the right joint, showing marked pathologic changes.

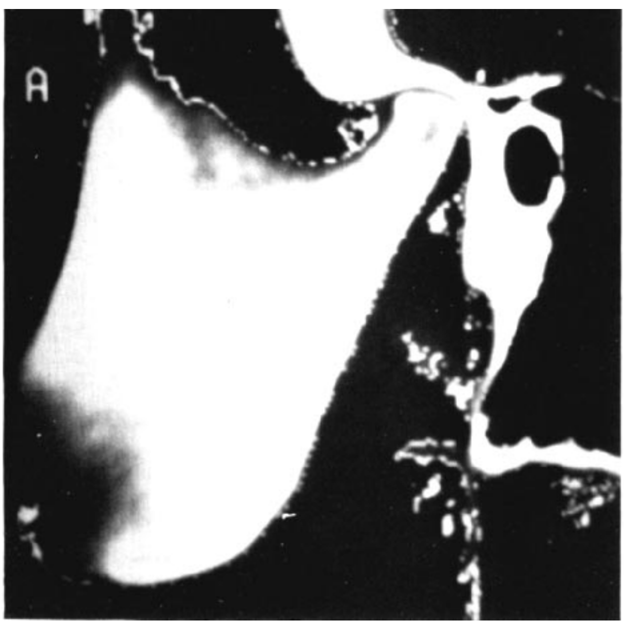


Fig. 9 Case 1
Direct parasagittal CT scan of the right joint with teeth in occlusion

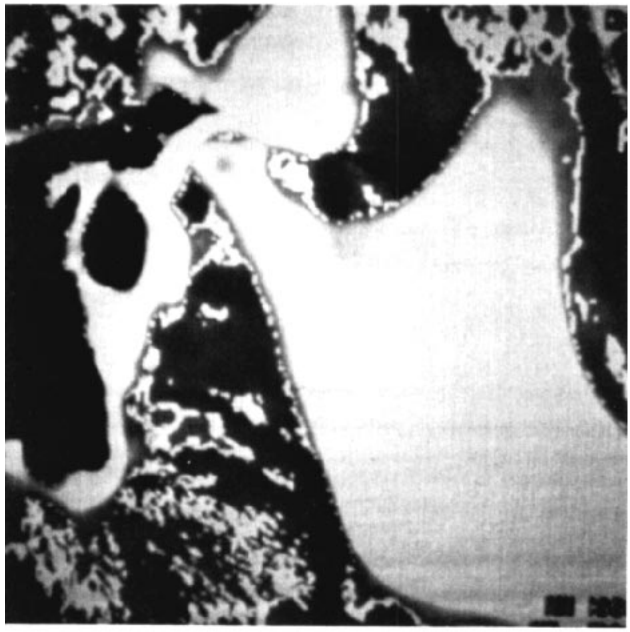


Fig. 10 Case 1
Direct parasagittal CT scan of the left joint with teeth in occlusion

Fig. 11 Case 1
Direct parasagittal CT scan of the right joint with the jaw open

Fig. 12 Case 1
Direct parasagittal CT scan of the left joint with the jaw open

parasagittal CT scans of the TMJ with the teeth in occlusion, and Figs. 11 and 12 show open-mouth views. Precondylar soft tissue density is seen on the left side, suggesting, according to existing knowledge, an anteriorly displaced disk. Marked degenerative changes are also noted on the right side, suggesting an anteriorly displaced disk.

Figure 13 shows arthroscopic views of the joints. The superior joint space of the apparently normal left joint is shown above. On the upper left, we see the open-mouth view, and on the right the closed-mouth view. The temporal eminence in the upper right quadrant of these views is seen to be a rather sharp, well defined white structure. Below, one sees the surface of the articular disk. There is no evidence of an anteriorly-displaced disk.

The lower views show the superior joint space on the right, demonstrating an adhesive band attaching the articular disk to the skull at the temporal eminence. Intra-operatively, this was surgically resected, as were other adhesions and adhesive bands that were seen in the joint that were interfering with normal gliding functions of the superior joint space. Post-operatively, all of the patient's clicking and pain were already gone in the recovery room, and the patient has remained asymptomatic.

Case 2
Figures 14-21

This 22yr-old white male described his chief complaint as "... my jaw feels dislocated, and it hurts all the time." He was involved in an auto accident two years before, but he had "always" had a clicking jaw joint.

Occlusion was a skeletal and dental class II, with a slightly vertical pattern, a marked deep bite, and peg-shaped and

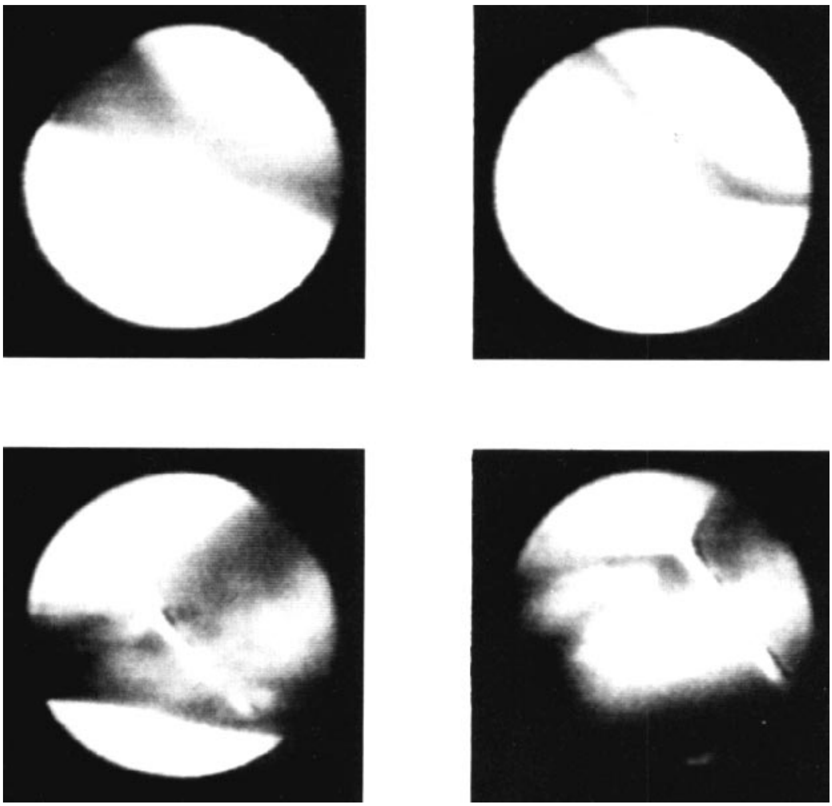


Fig. 13 Case 1

Arthroscopic views of the superior joint space. The temporal eminence appears at the top of each view, and the superior surface of the disk below.

Top, left — The normal left joint with jaw open

Top, right —Left joint with jaw closed

Bottom —Pathologic right joint, showing adhesive band between the temporal eminence and articular disk undersized maxillary lateral incisors. The mandible was asymmetric, with a marked midline shift on opening and a marked anterior thrust in function. Severe clicking was noted in the right TMJ. Complete orthodontic records were taken, and CT scans were performed.

Figures 14 and 15 show coronal sections of the left and right joints. The left is relatively normal in appearance; the right shows significant condyle degeneration with apparent osteophytic spurring medially.

Figures 16 and 17 show left joint images in a bone detail and in a contrast enhancement mode. The bone detail image shows a normal-appearing joint space; however, the contrast-enhanced view (Fig. 17) shows a gray area anterior to the condyle that, according to existing knowledge, represents an anteriorly-displaced and crumpled disk anterior to the condyle. We found this joint to be a normal TMJ on arthroscopic examination.

Figures 18 and 19 show the right TMJ in the closed- and open-mouth positions, demonstrating marked degenerative changes of the condyle surface and also of the condylar fossa.

Figure 20 shows representative arthroscopic views of the same joints, with the normal right joint shown in the two upper views and the degenerated left joint in the center and lower views.

The upper left view is inside the normal left TMJ, looking directly at the tip of the temporal eminence, above, and the upper surface of the articular disk below. To the right of the image would be the fossa; to the left is an extension of the area seen as gray, anterior to the temporal eminence. The critical thing to note here is that the articular surfaces themselves are crisp and white, with no significant fibrillation changes.

The upper right view is inside the same normal left TMJ, with the mouth open. This pulls the disk into the space anterior to the temporal eminence (to the left in this view). Again, the surfaces are seen to be sharp and crisp at the junction between the gray and white areas.

The center views are the right temporomandibular joint in the same patient. Note the considerable differences from the upper views; again, the temporal eminence is above, and the articular disk below. The sharp, crisp lines observed in the left joint are not seen. Instead, one sees a roughening of the surface, which is fraying in fibrillation of the articular cartilage on both the disk and the temporal eminence. In the right center view, one is looking almost directly at the temporal eminence. The large white area is a residual island of articular cartilage. The gray and darker areas are blood and granulation tissue which are covering exposed bone and severe degenerative arthritic condition in this patient's joint.

This disk was stuck to the surface of the skull; these pictures were taken after the disk had been peeled away from the skull itself. In the operating room, all of these details are visualized in real time, in motion on a full-color video monitor.

The lower views demonstrate the inferior joint space on the same patient. In these views, the underside of the articular disk is seen as the white area in the upper part of the picture, with the condyle below. The curved C-shaped structure traversing the center of the picture in both views is the anterior band on the inferior surface of the disk.

On the condyle itself on both pictures, one can see a transverse dark line which is much more prominent in the lower right view. This transverse line was an erosion in the surface of the condyle that

Fig. 14 Case 2
Coronal CT section of left joint

Fig. 15 Case 2
Coronal CT section of right joint, showing significant condyle degeneration and apparent medial osteophytic spurring

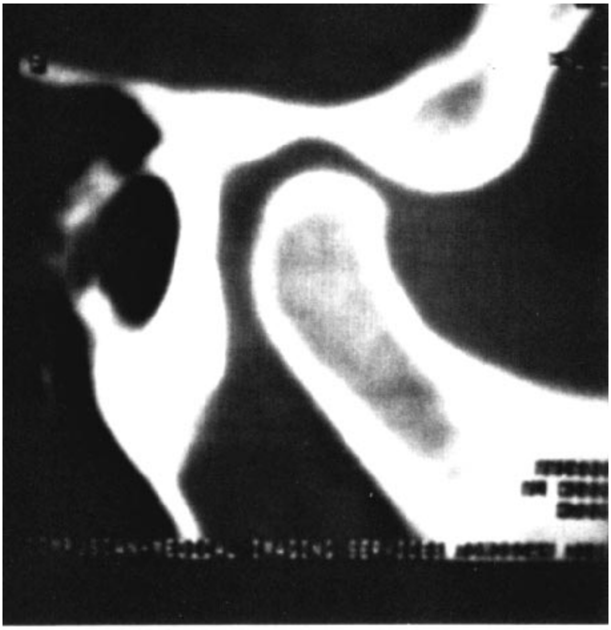


Fig. 16 **Case 2**
Left joint in bone detail mode

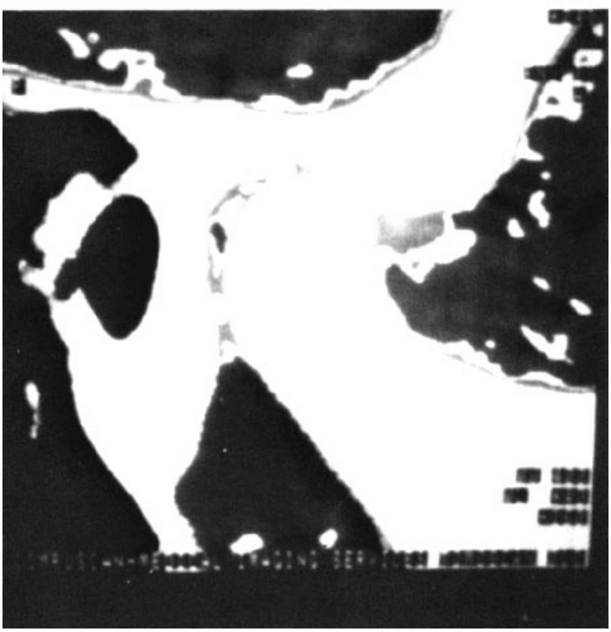
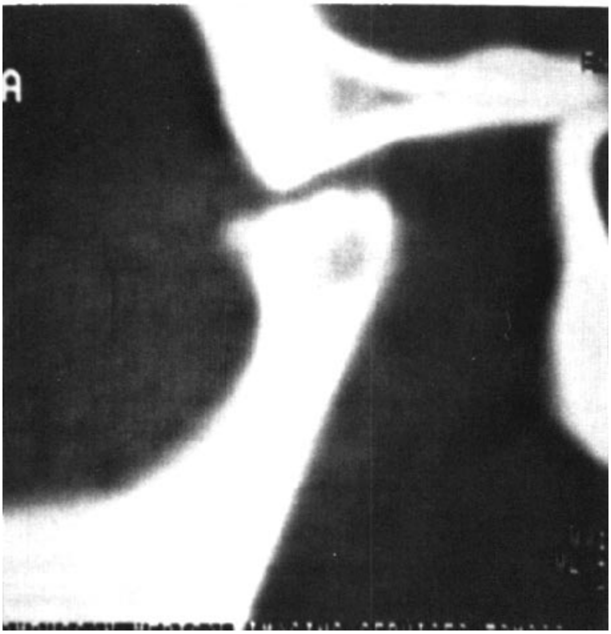


Fig. 17 **Case 2**
Left joint in enhanced contrast mode, showing a gray catrilage-density mass anterior to the condyle

Fig. 18 Case 2
Right joint with jaw closed

Fig. 19 Case 2
Right joint with jaw open



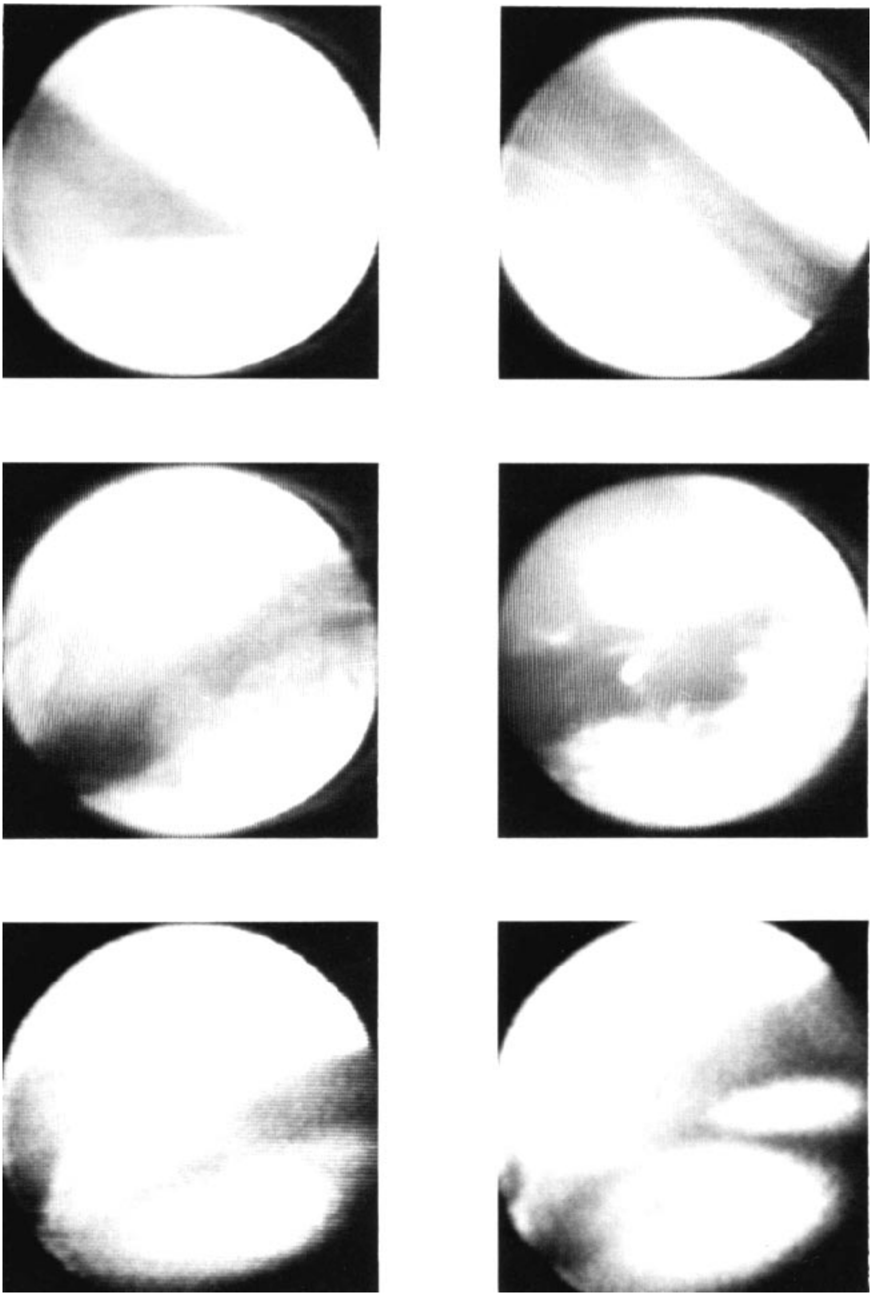


Fig. 20 **Case 2** *Legend on opposite page*

Fig. 20 Case 2 *(opposite page)*

Representative arthroscopic views

Top —The normal left joint, looking toward the temporal eminence, which appears at the top. The disk is seen at the bottom of each view. The glenoid fossa is outside the pictures to the right.

The jaw is closed in the left view, and open on the right, where the disk is seen to have glided forward (left) on the eminence.

Center —Right joint, comparable views, showing rough, frayed, fibrillated surfaces of temporal eminence above, and disk below.

Bottom —Inferior joint space on the right side. The dark line traversing the condyle at the bottom of these pictures is a groove caused by repeated pressure from sliding under the anterior band of the disk, which is the large curved structure seen directly above. This is evidence of conversion of the lower hinged joint to a gliding joint because of fixation of the superior joint space by adhesive capsulitis.

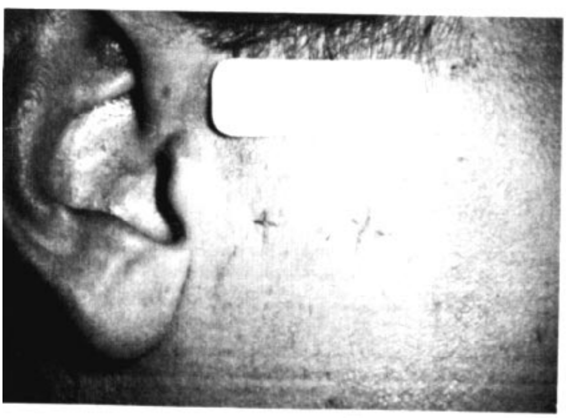


Fig. 21 Case 2
The surgical wounds three days post-operatively. The anterior wound on the patient's right side is the entry for the second operative instrument.

was caused by the condyle passing under the anterior band of this pathologically fixed disk. This is evidence of conversion of the lower hinged joint to a gliding joint because of fixation of the superior joint space by adhesive capsulitis.

The clicking that occurred in this patient was visualized arthroscopically as the condyle passing underneath the very rigid anterior band of the disk. As the condyle moved forward along the inferior surface of the disk, the band would snap from being in front of the condyle into the groove that it had created in the surface of the condyle. The groove is very dark in the lower right view because of a pool of blood lying in the groove; this was washed out just before the image seen on the left.

Figure 21 shows the patient's surgical wounds three days post-operatively. Note the second wound on the right side, where the chondrotome was inserted to perform the surgical procedure. He could not be reached by phone for follow-up the second day following surgery because he was out playing 9 holes of golf. His pain symptoms were completely relieved at the time of surgery, and have remained so for several months.

Case 3
Figures 22-24

The chief complaint of this 32yr-old white male was "extreme overbite causing a slight lisp," and "constant temporal headaches and a jaw that has clicked all my life." He presented with a skeletal and dental class II, Division I malocclusion with mandibular asymmetry and maxillary width deficiency. Crossbites were noted on the right molars. The mandibular left first molar was missing, with mesioangular collapse of the left second molar. The mandibular path from initial tooth contact to centric occlusion was an anterior and left lateral thrusting movement. Full orthodontic records were taken and appropriate CT scans were prescribed.

Figures 22 and 23 show the CT scans of the patient's right joint. Figure 22 shows the condyle in the closed-mouth position, and Fig. 23 in the open-mouth position. These two CT scans demonstrate what traditional wisdom has referred to as an anteriorly-displaced disk with reduction. The condylar soft tissue density is visualized in Fig. 22, and seems to disappear as the condyle centers itself in that mass in Fig. 23.

In reality, when viewed arthroscopically, this patient's right temporomandibular joint had what we believe to be the first reported case of a congenital band tethering the disk somewhat anteriorly in the superior joint space. Figure 24 shows intra-articular arthroscopic video frames of this congenital band. This picture does not really show the disk or the skull due to the field of view. The skull is above the darker space, which is anterior to the temporal eminence. The congenital band is the large triangular white structure, which arose from the surface of the skull and the anterior joint capsule and was attached to the disk in its anterior portion. When this congenital band was surgically removed arthroscopically, the clicking disappeared immediately. In the recovery room, the patient's pain and clicking were gone, and they have remained so for four months.

Findings in cases 4 through 7 are summarized below without illustrations.

Case 4

This is a 68yr old female with pain and clicking secondary to trauma. At surgery, we found a degenerative and fragmented disk, which was surgically debrided arthroscopically. She has been asymptomatic for eight months, since awakening in the recovery room after surgery.

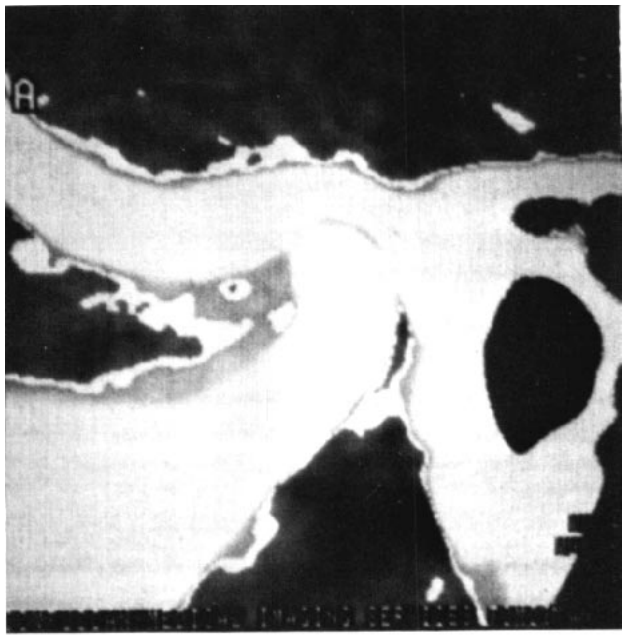


Fig. 22 Case 3
CT scan of right joint with jaw closed. Note the soft-tissue density anterior to the condyle.

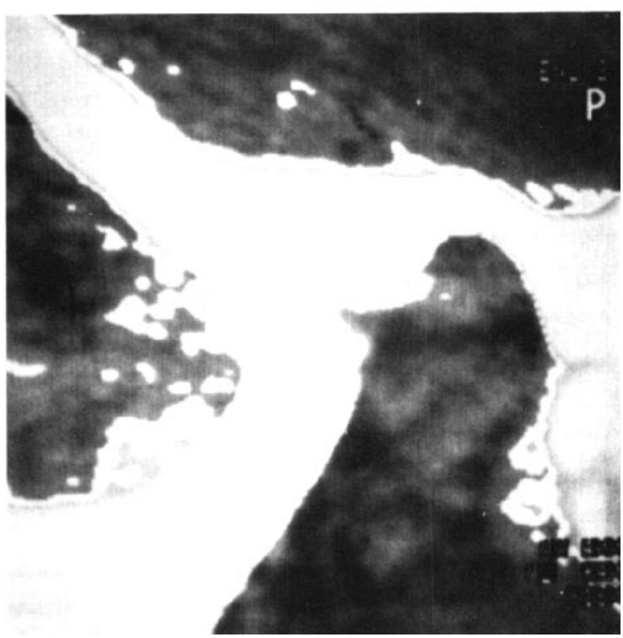


Fig. 23 Case 3
CT scan of right joint with jaw open. The material seen in Fig. 22 is no longer seen as the condyle is centered in the mass, suggesting "recapture" of an anteriorly-displaced disk. Arthroscopic inspection revealed that this was not the case.

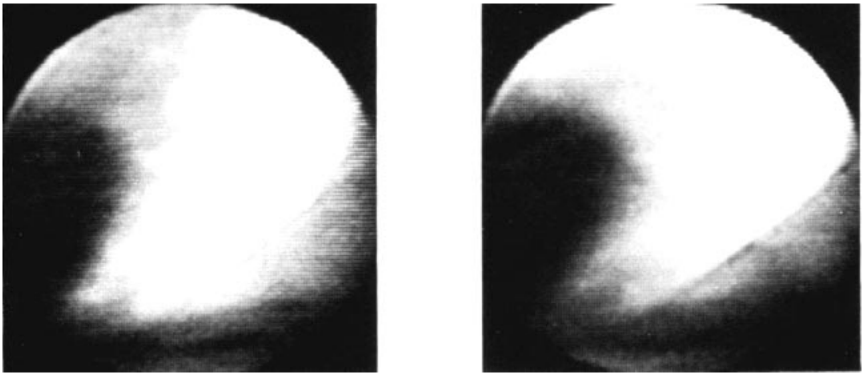


Fig. 24 Case 3
Arthroscopic views showing a heavy congenital band tethering the disk to the eminence. The entire white diagonal mass is this fibrous band; the skull and disk are outside the picture, above and below the field of view.

Case 5

This 66yr old female experienced pain on eating, and night pain, secondary to malocclusion. At surgery, we found significant degenerative arthritis and adhesive capsulitis. Her disk was freed and adhesions debrided. She was still asymptomatic after six months.

Case 6

A 32yr old female with a painful clunking in her joint, also secondary to malocclusion. At surgery we found an intraarticular cartilagenous flap and adhesions, which were debrided. Correction of her malocclusion was begun with rapid palatal expansion. At four months after surgery she remains totally asymptomatic.

Case 7

This 28yr old female presented with painful clunking and deviation of her jaw secondary to malocclusion. At surgery, we found adhesive capsulitis which was debrided and released. Rapid palatal expansion was again a significant part of the necessary orthodontic correction. She has been asymptomatic since surgery.

All of these patients experienced immediate elimination of their clicking. Even in the recovery room they could move their jaws freely with only a little soreness from extravasation of saline into the masseter muscle during the procedure. They are instructed to ingest only liquids for the first day, then eat what they want to from then on. Most patients are chewing soft foods 2 or 3 days after surgery, with no pain or symptoms.

— Complications —

Arthroscopic surgery of the TMJ is not without its potential complications. The smallness of the incision and the dressing, along with the rapid and quick recovery of successful cases, tend to overshadow the serious pitfalls that await the arthroscopic surgeon who approaches the temporal mandibular joint.

The first and most obvious potential complication is injury to the facial nerve. By careful selection of the direction of the incisions and manipulation of the arthroscope, the branches of the facial nerve can be avoided.

In addition, the outer capsule of this joint is very dense, while the inner capsule is very soft and thin. the pressure required to "pop" the arthroscope into the joint is so great that if care is not taken, the scope can advance on into the pterygoid plexus, the carotid artery, and perhaps even more critical neurological structures at the base of the brain. Copious bleeding may also result from injury to the superficial temporal vessels which lie directly against the posterior aspect of the joint capsule.

Visualization of this joint, from an arthroscopic point of view, is one of the most difficult that the author (D.G.N.) has encountered. The volume of the superior joint space is only 5cc when fully distended. Only a drop or two of blood mixed with the saline in the joint can completely obscure your view. The inferior joint space volume is approximately 1½cc, making it very difficult to enter and explore.

Because of the above potential complications and the difficulty in inserting, orienting, and visualizing the intra-articular structures, we feel strongly that extensive experience with the arthroscope in larger joints is necessary before attempting insertion of the arthroscope into this small joint. Considerable practice on cadavers or other teaching aids can also provide valuable training before attempting arthroscopic surgery of the temporomandibular joint.

— Conclusions —

Our experience with this approach to arthroscopic surgery of the TMJ leads us to the following conclusions.

- Diagnostic arthroscopy is possible. With proper training, it could be a standard part of a workup where conservative treatment fails to arrest temporomandibular joint disease.
- Arthroscopic surgery of the temporomandibular joint is possible and beneficial for some conditions.
- Not all popping and clicking in the temporomandibular joint is caused by disk rupture. Other pathologic conditions can produce these sounds, and some may be easily treated arthroscopically.
- Removal of a fragmented disk with arthroscopic surgery is possible.
- Treatment of intra-articular pathology arthroscopically is only a portion of the treatment of the whole patient. Treatment of the extra-articular cause of the intra-articular pathology must also be done to avoid recurrence of symptoms from the same cause.
- This is a preliminary report presenting short-term results, so it should be viewed with some caution. A long-term study is under way to follow up on these early successes. A/O

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