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The Treatment of Internal Derangement of the Temporomandibular Joint: A Survey of 300 Cases

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In recent years more emphasis has been placed on disk displacement as a cause for temporomandibular dysfunction than on myofascial or psychological causes of this condition.[1-10] Controlled studies have shown that disk displacements are usually anterior and medial to the mandibular condyle.[6] These displacements may be reduced by opening movements of the mandible or they may be of a more chronic nature without reduction. Reduction is a term used to imply that the condyle moves onto the disk and into a more physiological relationship with it. At the moment of reduction, a clicking sound is usually emitted. However, silent reductions may also occur. It is generally documented that joint clicking usually indicates anterior disk displacement while crepitation means that a perforation is present in the disk or peridiskal tissues.[11]

Observations at the time of surgery suggest a number of potential reasons for the displacements. They include stretched lateral and medial ligamental attachments, torn attachments, and stretched or perforated tissues posterior to the disk. Limitation in movement by the patient can be caused by the displaced disk blocking translation of the condyles. In these cases, the normal morphology of the disk is replaced by diskal contortions or folding of the disk upon itself. Consequent pain may be due to the condyles' articulating on the highly vascular and innervated soft tissues adjacent to the disk. Subsequent muscle hypercontraction which often accompanies injuries to the joints in the human body may result in concomitant myofascial pain.

A number of different approaches to the treatment of anterior disk displacement have been advocated including mandibular repositioning splint therapy and surgery. It is the purpose of this paper to present the results of a survey of consecutive, nonsurgically treated patients with internal derangement of the temporomandibular joint. In this paper internal derangement refers to the displacement of the disk from its normal position in juxtaposition to the condyle. This was clinically determined by the presence of joint clicking with mandibular opening and/or lateral movements after the method of Rholin et al.[11] The clicking was determined by stethoscopic auscultation with simultaneous palpation.

Materials and Methods

Three hundred consecutive patients, referred with a chief complaint of temporomandibular pain and/or headache, were selected from the authors' practice. All subjects were judged to have internal derangement of the temporomandibular joint. All were a minimum of three years and a maximum of five years posttreatment and were observed on a recall basis. Initial examination included a complete medical history along with measurement of maximum opening, auscultation, and palpation of the joints and muscles of mastication. Lateral, frontal, and submental vertex cephalometric radiographs were made, along with a panoramic film. Laminagrams were made only when severe degenerative changes were observed on the panoramic film. In a few cases arthrograms were taken prior to treatment. Mounted models were made in each case.

Treatment involved anterior repositioning of the mandible to the point of reduction of the disks, using anterior repositioning splints (ARS). Patients were asked to open to the point at which the click occurred, to retain the mandible in that anterior position, and to close the mandible sufficiently to make tooth contact. An upper ARS was constructed for nighttime wear, and a lower ARS was made for daytime use. The maxillary ARS had a reverse ramp from canine to canine which guided the mandibular anterior teeth into the reduced position, requiring the mandible to remain forward during sleep. The length of the ramp was determined by the resting posture of the mandible, i.e., the lower incisors remained anterior to the ramp when the lower jaw was at rest. The lower posterior teeth made contact with the surface of the splint with only the buccal cusps (**Figure 1**).

The daytime splint was constructed at the same position as the upper but was made on the mandible with definite indentations for the maxillary teeth to close into from the canines distally. The upper incisors only made contact with the anterior of the lower splint. The acrylic extended 1.5 to 2 mm apically on the buccal and lingual of the maxillary posterior teeth. The patient was then required to posture the mandible into the forward position to comfortably occlude (**Figure 2**). Splint construction techniques have been published previously.[12] The subjects were required to wear these appliances full time, including eating, with the lower ARS in the mouth for the first two weeks. The patients were placed on a soft diet and appointed on a two-week basis. At sequential appointments they received ultrasound therapy and electrogalvanic stimulation to the muscles of mastication as needed. If joint noises were still present, the mandible was repositioned to the point of least audible noise, as determined by stethoscope auscultation. As the patients became pain-free, they were asked to discontinue wearing the lower daytime splint but to continue nighttime wear of the upper splint.

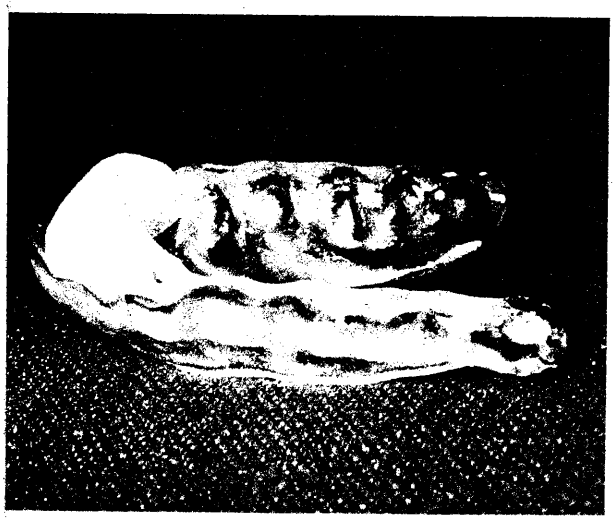

Figure 1
The maxillary ARS. The length of the anterior ramp is determined by the resting posture of the mandible. At rest, the lower incisors should remain anterior to the ramp.

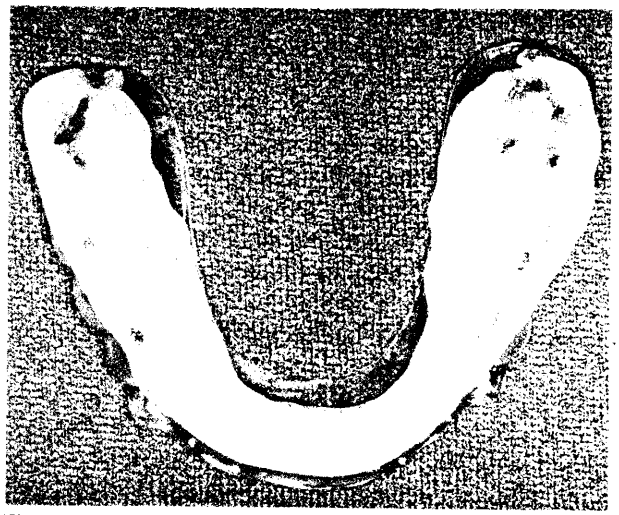

Figure 2
The mandibular ARS. The definite indentations into which the maxillary teeth fit provide a positive anterior position for the mandible.

If the patients remained symptom-free until the following appointment, the ARS therapy was discontinued and the maxillary splint changed to allow the mandible to reseat fully into the glenoid fossa. This was achieved by removing the acrylic from the ARS until it was flat. New autocuring acrylic was then added in a roll to the occlusal surface and the patient asked to close into it with gentle pressure placed downward on the chin by the operator to give the closing muscles light resistance. After the acrylic had been cured, the splint was adjusted to allow the buccal cusps of the lower posterior teeth to occlude with the splint surface. A slight overbite of the acrylic from canine to canine allowed disclusion of the posterior teeth by the lower incisors and canines which made light contact with the maxillary acrylic. This splint has been described previously and is called a superior repositioning splint (SRS).[13] It is intended to allow the mandible to seat superiorly on the posterior slope of the eminence and to be placed

there by the patient's own healthy musculature. At sequential appointments a leaf gauge was used[14] while the patient closed lightly, and the SRS was adjusted until tooth contacts occurred as previously described. When no change occurred between appointments, the patient was observed for another month to ensure stability, and records were made to reassess the occlusion. If the patient's dislocation relapsed after changing to the SRS, he was given the choice of returning to the ARS for an indefinite period or an arthrogram and probable arthroplasty.[15] All of these potential sequelae were explained carefully to the patient prior to beginning treatment.

In order to assess the degree of success or failure, the patients were graded at follow-up examinations by palpation and auscultation and by subjectively asking the subject to grade himself on a scale of pain and restoration of function from 0 to 10 with 10 representing total remission of symptoms and 0 no improvement.

Results

Two hundred and thirty eight patients (79%) described themselves as eight or better (**Table 1**). Of these, 24% rated 10, 31% were 9, and 24% were eight. All of the patients who indicated their improvement at 6 or better, considered themselves successfully treated to the comfortable and satisfactorily functional state (270 patients, or 90%). The mean pain improvement rating was 8.19 ± 1.96. The average improvement in joint noise was also 8 on the scale (80% improvement). The mean time for remission of symptoms was 32 months. Thirty subjects (10%) were judged unsuccessful. Twenty-eight of the 30 unsuccessful people (5 or less on the scale) were symptom-free until removed from the ARS and placed on the SRS. Two of these 30 patients did not improve at all with therapy.

Table 1
Distribution of Patients by Self-Assessed Reduction in Pain and Improvement in Function

Score	Number	Percentage
10	72	24
9	94	31
8	72	24
7	24	8
6	8	3
5	6	2
4	6	2
3	12	4
2	4	1.3
1	0	0
0	2	0.7

Discussion

This study has demonstrated a high degree of success in the treatment of internal derangement by first reducing the displacement, allowing time for healing, and then testing the repair by encouraging the muscular seating of the mandible into the glenoid fossa. Treating to the seated position instead of the initial forward one was felt to be important since it has been shown that the seated position is used by the patient when chewing hard foods on the working side.[16,17] The mandibular musculature seems to propel the lower jaw through its border movements on the chewing side when resistance is great. It is significant to note the high proportion of patients with internal derangements.

In selecting the 300 consecutive cases, only 27 (9%) were discarded due to the absence of joint noises. It is also interesting that complete remission of clicking was not necessary in order to successfully treat the patient's chief complaint. Westesson[18] seldom observed structural hard tissue changes in patients where reduction of displacements occurred. He used serial tomography and double contrast arthrography in 128 patients with anterior disk displacements. This tends to support the successful rating in cases where complete remission of clicking was not attained, particularly since these subjects were a minimum of three years and a maximum of five years posttreatment.

A few patients in this study had arthrograms prior to splint therapy which revealed perforations by dye exuding into the superior recess of the joint. If relapse of the dislocation occurred following anterior repositioning therapy, another arthrogram was made prior to arthroplasty. Some of these subjects showed arthrographic evidence of healed perforations. One subject had an arthrogram prior to splint therapy indicating a perforation and then received splint treatment, but dislocated subsequently. A second arthrogram was made and the surgery completed. At surgery an area of obvious healing was observed in the retrodiskal tissue. In performing the plication surgery, this area was excised and the retrodiskal tissues sutured. The excised tissue was submitted for histologic examination and revealed repair initiated by generous synovial cell proliferation[19] (**Figure 3**).

Figure 4 shows a histologic section from the perforated disk of a monkey. Investigators observed a similar healing process in the animal study. Repositioning the condyle away from the perforated area may have allowed the synovial cells to begin the repair process on the periphery of the perforation.

Of the 270 patients in this study treated nonsurgically, 261 (96%) received some form of orthodontic therapy following repositioning splint treatment. This was usually associated with posterior open bite and coupling of anterior teeth. Of the 30 patients considered as surgical candidates, 28 elected to have the surgery performed. Twenty-seven of them received some type of orthodontic therapy following surgery. Two subjects decided to continue with indefinite anterior repositioning splint therapy without further treatment. It is possible that some of the 261 patients treated orthodontically could have continued asymptomatically without treatment. However, they were given the option and elected to have treatment.

Figure 3
The gross specimen was excised from the retrodiskal tissues. The rolled periphery indicates the edges of the original perforation. The specimen was submitted for histological examination which showed the center to consist of synovial cells and the periphery to be of connective tissue as seen in the peridiskal tissue and disk itself.

Summary

Three hundred consecutively treated patients with internal derangement of the temporomandibular joint were assessed for success or failure. Two hundred seventy considered themselves successfully treated to a generally pain-free and functionally satisfactory state (90% success rate). They rated themselves on a 0 to 10 basis with 10 being completely pain-free. The average improvement was 8.1 for pain and 8 for joint noises. Twenty-eight of the 30 subjects who considered themselves unsuccessfully treated were pain-free while on anterior repositioning appliances. When allowed to function in a seated position, they dislocated again and were given the option of

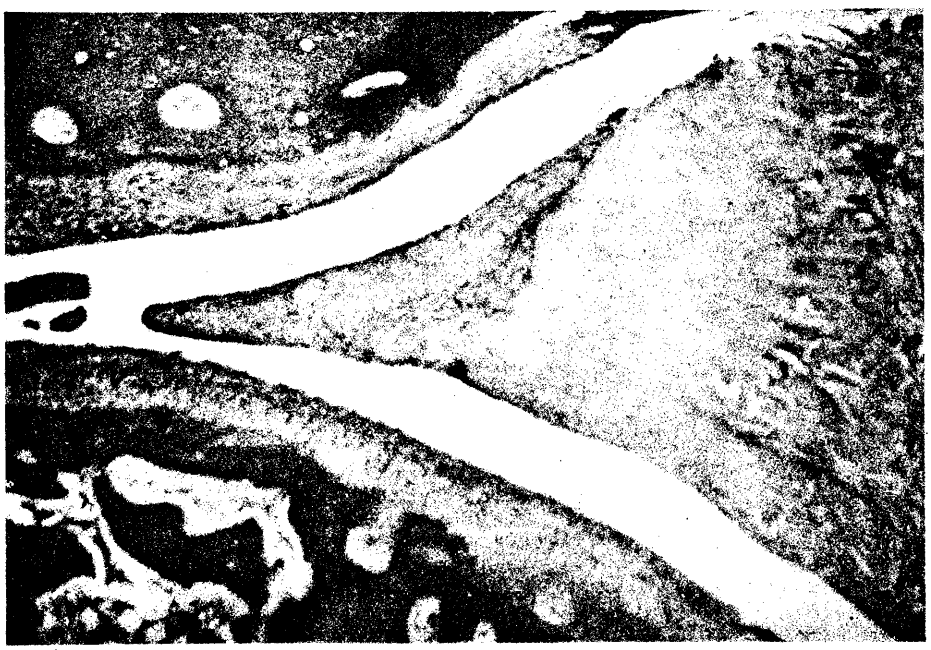

Figure 4
Histologic section from the surgically perforated disk of a monkey. The wound was closed and the monkey allowed to function normally. The animal was later sacrificed and the joint structures examined. In this cross section the articulating surface of the temporal bone is presented superiorly. The central tissue represents the fibrous connective tissue disk. The inferior structure is the articulating surface of the condyle. Note the proliferation of the synovial cells on the extreme right edge of the disk. This was the location of the perforation which the proliferating synovial cells are apparently attempting to close. (Courtesy of Dr. Robert A. Bays) The histological animal section is taken from the Masters Thesis of Dr. Emad Helme, Medical College of Georgia, School of Dentistry.

arthroplasty or indefinite splint therapy. Twenty-eight chose the surgical procedure. A large percentage of subjects elected to have orthodontic treatment following their earlier therapy.

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