The Temporomandibular Joint and Related Orofacial Disorders

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Conservative Treatment

Opinions about the treatment of TMD are as controversial as beliefs about the etiology of TMD and the technical aids used to diagnose this disorder. Traditional methods have focused on correcting functional bite disharmonies or anatomic malalignments. Present trends favor TMD as a musculoskeletal disorder that is treatable with simple procedures.

By and large, there are insufficient data to permit comparison of different therapies and thus to establish a priority for their use. Many treatments routinely prescribed today for musculoskeletal disorders have never been tested clinically for safety or effectiveness. Therefore, the management of TMD should begin with conservative, reversible measures and escalate slowly to irreversible procedures if necessary (Table 9-1).

A sampling of 472 dentists of the American Equilibration Society showed that the most common treatments for TMD were intraoral appliance (84%), occlusal adjustment (45%), nutrition (40%), relaxation and stress management (40%), physiotherapy (37%), and counseling (36%). Differences existed between general dentists and dental specialists for some lesser used treatments.

Another survey of dentists' knowledge and beliefs indicates the lack of uniformity about the kind of treatment needed (Table 9-2). Using the opinions of a selected panel of TMD "experts", a higher percentage of dental specialists concurred with the experts than did general dentists. Usually, the percentages for the specialists were lower than for the experts. This trend existed among responses for which no statistical differences were found between generalists and specialists (Table 9-3). The authors attributed some differences to outright disagreement with expert opinion or to the uncertainty of specialists and general dentists about specific issues.

Treatment or Referral?

Practitioners face the problem of treating or referring patients with TMD. There is no ready solution about the direction to take. If initial management is directed to control of pain, improved function can be expected to follow. For successful management of pain, the practitioner needs to know a spectrum of pharmacologic, anesthetic, psychiatric, noninvasive, and psychological approaches. Few solo practitioners possess this expertise.

With the best interest of the patient in mind, several guidelines are recommended for practitioners. If the patient can be treated more effectively by someone else, referral should be the choice. If the clinician elects to manage acute pain, mild to moderate improvement can

be expected within 1 week to 10 days. For treatment of chronic complaints, if no improvement occurs by 2 months, a change in treatment strategy or a referral is in order.

The next question is to whom you should refer the patient. If health problems other than TMD compromise treatment, these should be managed by the patient's primary care physician. For confusing clinical findings, other specialists may be consulted. If the magnitude of the patient's problem is vast, pain management should be handled in a multidisciplinary pain center. These centers have sufficient equipment and the personnel with skills to diagnose and treat complex head and neck complaints. Comprehensive care can be achieved with optional modalities unavailable to many solo practitioners.

Letter of Referral

A letter of referral to another clinician should precede the initial visit made by the patient. The following information is helpful to the receiving clinician:

- The patient's name, address, and phone number should be identified.

- A brief statement should be made about the patient's primary complaint and about the duration and possible etiology.

- Clinical findings should be addressed. Remarks should be made about previous diagnoses and treatments for the condition.-

- The clinician's name, address, and phone number should be identified.

For referral to a physical therapist, a prescription with at least a minimum of information is necessary.

- Identification of the patient.

- Written instructions with the clinician's signature.

- Diagnostic impression.

- Identification of the anatomic areas to be treated.

- Kind of treatment.

- Number and duration of treatment.

- Expectation of a written post-treatment report sent to the clinician.

Treatment Guidelines and Goals

In treating the TMD patient, the primary goals are to:

1. Achieve normal jaw function.

2. Reduce or eliminate pain.

3. Encourage a return to normal activities of daily living.

4. Reduce long-term health care use.

Other important goals are to:

5. Improve the patients' understanding of the complaint.

6. Improve the patients' management of the complaint.

7. Eliminate unhelpful thinking about the complaint.

8. Increase the patients' confidence in his or her ability to function and cope.

9. Reduce or eliminate powerful medications.

Clinician-Patient Relationship

Success in managing TMD requires an ongoing assessment of the patient's complaint. Patients need to form a healing partnership with the clinician. Once management begins, the clinician should discuss treatment issues with the patient.

Clinicians should ensure patients a place in the "communications loop". They should encourage patients to ask questions and voice concerns. Each question, complaint, or request requires consideration and an appropriate response. Clinicians should educate patients about the most appropriate means of meeting their needs rather than dictating to them. Family members may request information about the patient's diagnosis or condition; if these requests are made, the patient should be present to maintain the bounds of privacy. Patients or family members may also ask about appropriate credentials of the practitioner and other health care workers.

It may be necessary to offer specific explanations about certain symptoms. With acute complaints, the clinician should pay attention to sensory components of the patient's pain. For example, patients want to know if the intensity or frequency of the pain will increase or decrease. They may ask if the pain will move to another location. With chronic complaints, the clinician should address psychosocial and behavioral factors that affect the patient.

Frequently, patients want to know about the long-term progression of their disorder. Conclusions drawn about the progression of painful conditions are informative. An account of 55 untreated patients suffering with TMJ osteoarthritis showed that joint pain had nearly

disappeared by 9 months. A period of discomfort characterized by joint crepitus burned out by 2 to 3 years. This finding differs from a report of the progression of myofascial pain of the masticatory muscles. Evidence indicates that the condition is not self-limiting, may increase in severity, and may lead to joint problems. An examination conducted by an examiner blind to the status of the masticatory muscles in 25 patients suffering with myofascial pain and in a control sample of 25 healthy subjects showed that muscular tenderness persisted after 3 years. Finally, if the pattern of TMD pain follows the evolution of other chronic musculoskeletal pains, it can be expected to persist in slightly less than two thirds of individuals and disappear in one third. Patients need to be informed that none of the patterns of response is absolute.

The clinician should inform the patient that it is possible to use noninvasive procedures to avoid rather than treat pain. The value of noninvasive management should be explained fully to the patient.

The patient should be given a concise explanation of the recommended procedure. Details should include a discussion of the procedure's purpose (ie, why it is necessary), what is expected of the patient, what the patient might expect, approximate time of response or result, and the patient's right to refuse treatment. Simple diagrams of procedures are often helpful.

The facts about controversial treatments should be provided. The clinician should make an effort to correct any misfortunes, particularly when the procedure's efficacy has not been established. An explanation of the therapy should be based on a consensus of research findings and on the clinical experience of practitioners in the field. Reassurance about treatment safety is a must. Patients should not be subjected to any unnecessary treatment.

The clinician may have to tell patients that successful management requires medication. Although some patients refuse medications, relief can be achieved in a high percentage of patients by dosing "around the clock". The problem for the clinician is in choosing the appropriate medication. The problem for the patient is compliance.

Significance. No one is capable of managing someone else's pain. Patients must learn this early in treatment. Practitioners can only assist patients to come to terms with untoward physiologic and emotional reactions that affect them.

Conservative Program of Home Care

Although patients can receive instructions from the clinician by telephone, they can obtain more useful information by visiting the clinician. Therapy described only in verbal terms frequently limits success. Patients needs a written reminder of what is expected at the office visit. To avoid misinterpretation, this information should be spelled out, in writing, in words that the patient understands. Sticky notes can be placed in convenient areas around the patient's home as reminders.

Patient compliance is a must. Patients should be made aware of the need to take responsibility for treating their complaints. Research findings confirm that most TMD discomfort arises from muscle-based pain. In a study of 295 TMD patients who visited a

private practice, 87% were classified as suffering from myogenous pain. This finding agrees with the occurrence of muscular pain found among patients admitted to TMD clinics around the world. Thus, therapy should focus on obtaining relief of muscular pain.

Home care practices have proved effective in management of TMD. Nearly three fourths of patients managed for 2 years obtained total resolution or improvement in their condition with simple therapies. Some home care practices are discussed below.

Reassurance

Patients should be reassured that most acute TMD symptoms are self-limiting. Self recognition of the physical basis for muscle symptoms is difficult. Typically, acute muscle complaints last 7 to 10 days. Exacerbations may recur periodically, but once pain diminishes, normal function should return.

Placebo Effect

A placebo is a form of therapy given for suggestive effect. Some symptoms may be relieved by rendering harmless therapy to the patient. A healthy physiologic response may result from the patient's enthusiasm and desire for cure, from the clinician's enthusiasm and desire to please the patient, or from an unexpected side reaction.

Rest and Diet

A diet of soft foods can be recommended, particularly if there is acute pain. It should be continued for as long as 2 weeks.

Avoidance of excessive caffeine, sugar, and alcohol may help. These substances change the patient's daily mood. Although not proved convincingly, mood swings tend to intensify pain.

A regular sleep schedule of at least 7 hours a night should be followed. An orthopedic pillow may relieve neck complaints. Sleeping on the back helps if the patient has jaw pain. Placing a sore jaw against a hard surface tends to worsen the pain during sleep.

Relaxation

Patients should be instructed to control excessive oral habits. This awareness of bruxism can be taught by asking patients to "feel" their tight jaw muscles once the teeth are clenched. A conscious effort should be made to keep their teeth apart.

A program involving "deep breathing" may benefit the patient. Clinicians should instruct the patient to practice this exercise for 3 to 5 minutes every hour, particularly during painful episodes.

Avoidance

There should be no "overuse" of the jaw, including excessive talking on the telephone, yawning, choir singing, or playing of wind instruments. Rapid, jerky stretching movements of the jaw should be avoided. Once the acute pain diminishes, a few stretching exercises can be performed.

Active Range of Motion

Individuals with healthy TMJs can achieve "three finger" opening of the mouth. An inability to perform this "check" indicates limitation on opening. Restriction may result from muscle or joint dysfunction, or both.

For this check, the patient is instructed to open the mouth as wide as possible. The index, middle and fourth digits are aligned adjacent to one another and inserted perpendicular to the lips between the upper and lower central incisors. This check, and moving the mandible to the right, left, forward, and backward can be done twice weekly, 6 times for each movement.

Use of Heat

Moist heat from a heating pad, hot water bottle, Hydrocollator, or hot pack placed on sore muscles of the jaw has proved effective in relieving jaw pain. Moist heat delivered by a heating pad for 6 weeks reduced painful jaw symptoms by about 35% in 19 of 27 TMD patients, whereas a 4% reduction in symptoms occurred in the remaining 8 untreated patients during this period. Application of moist heat on the jaw (20 minutes, 2 to 3 times daily) increased mouth opening up to 9 mm after 12 days of treatment in 55 patients with progressive degeneration of the TMJ. At the final evaluation, 31% required no further treatment.

Moist heat can be delivered according to following recipe:

1. Damp washcloth - next to skin.

2. Plastic wrap.

3. Dry towel - four layers.

4. Heating pad.

5. Duration: 20 minutes, 2 to 3 times a day at temperature tolerance.

Use of Ice

Ice can be applied directly to the skin or applied with a separating medium between the skin and ice. Application of ice directly exceeds the efficacy of an ice pack in reducing skin temperature. Tolerance to ice improves after a few applications.

Ice from water frozen in a paper cup can be applied in a massaging manner across an affected area. If an ice pack is chosen, the following alcohol ice-pack recipe has been recommended.

1. 1/2 cup rubbing alcohol.

2. 1 cup water.

3. Pour into a pint-size reclosable plastic bag and freeze.

4. Place ice pack on top of moist towel against the skin.

5. Duration: 20 minutes, 2 to 3 times a day at temperature tolerance.

Stretching and Massage

Most patients fail to stretch on a regular basis. Muscle flexibility is achieved by stretching the muscle to its normal length. Like muscles of other joints, muscles of the TMJ region shorten if they are not stretched properly. Limited motion of the jaw can ensue. In the presence of pain, the restriction worsens the outcome.

Gentle massage of tender muscles before stretching often aids in relief of pain. Massage and stretching are more tolerable after use of heat and ice. Cold water packs coupled with stretching of the jaw and the neck proved effective as a short-term intervention for relief in 10 TMD patients. Comparison of pre- and post-treatment ratings showed that self-report of pain was significantly reduced after 2 weeks of treatment. No significant effect was found for tenderness of muscles to palpation or for range of motion.

Medications

The patient's history in use of medication provides the clinician more complete understanding of the complaint. Most have some history involving over-the-counter analgesics. Many have discovered that TMD pain responds poorly to these analgesics when no other form of treatment has been rendered.

Significance: This conservative program of home care may have the following results: (1) improvement in symptoms with no other treatment needed; (2) no change in symptoms and continuation of the same treatment; or (3) marked increase in symptoms with other treatment needed.

Optional Therapies

If home care management proves ineffective, the patient may require specific advice and special care other from health care practitioners. To obtain a successful outcome, more complex medications and accessory therapies such as intraoral appliances, physiotherapy, behavioral modification, and occlusal and surgical treatments may be needed. Evidence for and against many common therapies is discussed below.

Medications

Orofacial pain may be severe and require specific medications (Table 9-4). Acute therapy is aimed at stopping the symptoms or reducing the discomfort of an attack. Medication should be given as early as possible as the initial treatment approach. Once selected, the medication should be prescribed in the optimal formulation for each patient. Care is needed to explain the distinction between acute and prophylactic medication to avoid unwarranted side effects.

Once acute relief is obtained, the patient should be given the option of prophylactic management. Some patients assume a cure once mild relief occurs and may stop the medication. If other therapies have failed to provide lasting relief, a program of polymedication may be required.

A recent study of 109 patients treated by medications for chronic pain showed that 56% of compliant patients achieved relief, whereas 75% of noncompliant patients had no change in pain severity. Compliant patients were more satisfied with outcome than noncompliant patients.

Muscular Pain

Acute muscular pain responds poorly to most analgesics, yet they are the medication most frequently prescribed by both general dentists and dental specialists. About 39% of dentists prescribe anti-inflammatory medication. Combination treatment with an anxiolytic agent has been suggested to improve relieve, but no definitive superiority has been demonstrated by taking both simultaneously. If sedation is desired, a low dose of diphenylhydramine may be substituted for the muscle relaxant.

For generalized myofascial pain, a tricyclic antidepressant (eg, amitriptyline) taken at a low dosage produces analgesia. Few dentists prescribe antidepressants. A survey of dentists showed that about 9% prescribe antidepressants for TMD. If prescribed, patients tend to associate the antidepressant with the stigma of having a psychiatric disorder. They may consider it a permanent reminder of a chronic illness that they view as a weakness. Reassurance may be necessary because many patients are reluctant to take even the lowest dose recommended.

Amitriptyline has proved effective in treating patients with widespread myofascial pain, termed *fibromyalgia.* A study of 23 double-blind, randomized, cross-over trials showed that this medication was 74% effective in final management. The effect was evident within 2 weeks of therapy. Conclusions were based on findings of a symptom questionnaire and count of tender points. The medication was so effective that 35% of the cases were able to discontinue its use. Other evidence points to the benefit of this therapy. Four of 8 myofascial pain dysfunction patients who were unresponsive to biofeedback training achieved remission of symptoms by the second week of antidepressant therapy.

For patients suffering from chronic somatoform pain, decreased pain intensity and increased level of activity may result from using amitriptyline. The effects of medication were less predictable if patients required psychotherapy. Side effects of amitriptyline include dry

mouth, weight gain, and sedation. Patients should be encouraged to drink plenty of water and to chew sugarless gum or eat candy. Although improvement may be expected within 2 weeks, up to 8 weeks may be needed for some patients to gain relief.

Schedule: The dosage schedule for amitriptyline is 10 mg/night for 3 days, increasing the dose to 20 mg/night for 3 days, to 25 mg/night for 3 days, and up to 50 mg/night for 3 days, as needed.

Polyarthritic Disease

For treatment of generalized osteoarthritis, nonsteroidal anti-inflammatory drugs (NSAIDs) have proved useful agents despite their possible deleterious effects on joint loading and metabolism of cartilage. NSAIDs may be coupled with an antidepressant, but combining medications makes it difficult to discern individual efficacy.

Ibuprofen appears moderately effective as an antiarthritic for TMD. In a double-blind study of 14 TMD patients treated for 6 weeks with 1600 mg/day of ibuprofen and 14 TMD patients treated by placebo, 64% of those receiving ibuprofen had complete remission of symptoms, whereas 42% of those receiving placebo had a similar result.

Headache

Many medications are available for treating headache. Some are more effective against one form of headache than another. Sumatriptan, a self-injectable, may provide sudden relief for emergency treatment of migraine and cluster headache. Because the side effects include transient elevation in blood pressure and decreased heart rate, the initial dose of 6 mg subcutaneously should be given in the clinician's office. A maximum dose of 2 injections/day with a 1-hour interval between injections is recommended. Sumatriptan may be taken prophylactically. No major side effects were found after use for 11 months. Propranolol is a useful alternative.

A comparative study of 20 patients with headache and TMD pain showed that meclofenamate reduced pain significantly more than placebo treatment. This double-blind, cross-over study with a washout period showed that subjects in pain had fewer painful days, shorter duration of pain, and a lower number of hyperthermic zones while using this medication.

Among 100 patients with chronic headache, 55 had significant TMD pain. The authors hypothesized a relation between headache and pain localized in the masticatory muscles. Half of the patients were treated by a dentist and half by a neurologist. Headache intensity and medication use dropped significantly in the half treated by dentists.

Dental Pain

If routine dental treatment fails to relieve the patient's pain, a medicament strategy devised for the management of acute dental pain may prove helpful. This strategy may aid in the management of other acute forms of orofacial pain. If treatment of mild pain fails, major episodes are managed by more potent and alternate medications. Certain medications

require special consideration and need to be discussed with the patient. Codeine has limited effectiveness in oral pain. About three fourths of patients taking oxycodone experience dizziness, nausea, and drowsiness.

Sinus Inflammation

Symptoms similar to dental pain may result from sinusitis. This complaint is overdiagnosed as a source of orofacial pain. Furthermore, idiopathic headache is often termed *sinus headache.* This latter description has not been classified by the Headache Classification Committee of the International Headache Society. Patients with frank sinusitis may be referred to an ear, nose, and throat specialist, who will most likely prescribe some combination of antibiotics, analgesics, and decongestants.

Trigeminal Neuralgia

Some relief from neuropathic pain may be achieved with baclofen or carbamazepine. Baclofen is the first choice. Treatment with carbamazepine requires initial medical laboratory work, including complete blood count, differential leukocyte count, and sedimentation rate, and liver function tests. Periodic follow-ups are necessary. The treatment of more complex cases should be conducted in a multidisciplinary setting.

Some symptoms of trigeminal neuralgia may be confused with TMD or dental pains. Studies conducted on 61 patients diagnosed with pretrigeminal or trigeminal neuralgia revealed that 61% had initial dental pain before the neuropathy was diagnosed.

Intraoral Appliances

Various intraoral appliances have proved useful for diagnostic and therapeutic purposes.

Diagnosis

Bruxism can be demonstrated to the patient by showing tooth wear on the appliance. The duration of parafunctional contact may reach 4 hours/day with a clench force of up to 975 lb. This biting strength contrasts sharply with the duration of functional contact of the teeth of 4 to 10 minutes/day with a force of 20 to 40 lb. The presence versus absence of jaw pain can be demonstrated by an appliance.

Therapeutic Benefits

The use of appliances has been recommended after surgery of the TMJ and in the treatment of fibromyalgia of the masticatory muscles, arthralgia, and disk placement with or without reduction.

Most appliances delivered by practitioners can help the patient avoid tooth wear and fracture. Clinical evidence shows their value in maintaining the health of teeth. Appliances are indicated when there is a need to:

1. Remove occlusal prematurities temporarily.
2. Reduce traumatic forces from occlusion.
3. Prevent occlusal wear or enamel fracture.
4. Maintain loose teeth in a stable position.
5. Aid in establishment of an optimal occlusal pattern and vertical dimension before definitive restorative and prosthetic procedures.

Management of Pain

Certain orofacial pains are relieved by appliances, although the reason for relief is uncertain. The effects may be central, peripheral, or both. Information is too equivocal to support either hypothesis fully.

The presence of central effects is supported by early and more recent findings. There is a nonspecific placebo effect from wearing an appliance, which suggests that the mind affects outcome. A 25% reduction in symptoms was found in TMD patients who wore a placebo splint that covered only the palate. Efficacy can be measured only after it exceeds this 25% reduction. Recent evidence for a central effect is based on the memory of patients for pain. TMD patients' ratings of pain relief obtained after wearing appliances correlated with rate of change in memory, thus showing a central effect. They did not correlate with either pain intensity or pain unpleasantness.

The argument for peripheral effects relates to relief from muscular or joint complaints. Insertion of an appliance often reduces the abnormal muscle activity associated with bruxism or alters the rhythm of excessive masticatory muscle activity. Another argument is that the "bite-raising" effect allows passive stretching of muscle fibers.

A further opinion is that insertion alters the disk-condyle relation, leading to condylar shift at the most anteroposterior "therapeutic" position within the articular fossae. Presumably, this change reduces resting or functional pain, lessens joints sounds, or unlocks restrictive jaw motions.

Design

Different designs have been developed with the aim of achieving specific outcomes. Appliances have been designed either for full or partial coverage. The latter covers either the anterior or the posterior teeth. Evidence for and against their usefulness is discussed.

Full Arch Appliances. Flat, full arch appliances are referred to as *stabilization appliances.* Several studies show improvement in painful symptoms from 30% to 90% after their use. A recent study showed more than half of 30 TMD patients had complete relief of pain after 1 month of appliance therapy. Joint sounds improved by 78%, and limitation of mandibular movement by 68%. After 13 weeks of wearing the appliance, TMJ pain improved by 70%. Shoulder and neck pain improved by 76% and 52%, respectively.

Electromyographic studies of the anterior temporalis and masseter muscles in 26 myogenous patients showed that wearing a full arch, flat appliance decreased the activity of the temporalis fibers immediately and that this decrease continued for 1 month. Initial

improvement occurred to a lesser extent in the masseter muscle. Some worsening of pain was associated with minor occlusal interferences; it was eliminated by correcting the occlusal surface.

Full arch appliances proved as effective as a combination of biofeedback and stress management in relieving pain and depression in sample of 58 patients. Assessment was made by self-report of pain and by checking pain on palpation of masticatory muscles after 6 weeks of treatment. A 6-month follow-up of treated patients revealed that neither post-treatment depression scores nor pain measures were significantly different from pretreatment scores. Treatment with biofeedback and stress management reduced depression, but no changes were found for pain measures. A combination of appliance, biofeedback, and stress management effectively relieved pain and depression. These findings on improvement in muscle and pain contrast sharply with other studies.

A different outcome was reported among 10 patients treated with a flap appliance and 10 treated with a mandibular repositioning appliance. Based on the Helkimo dysfunction index, no significant change in functional, TMJ, or muscle pain was found after wearing the flap appliance. Reciprocal clicking was not reduced in 8 patients. With the repositioning appliance, TMJ and muscle pain improved significantly. Eight of the subjects had no reciprocal sounds at the end of the 90-day treatment period. Another study of 51 TMD patients found that flap appliances were no better than no treatment for TM disk displacement without reduction.

Pro: When a flat appliance can be shown to reduce symptoms significantly, it should be the appliance of choice. Reduction in temporalis muscle activity can be expected based on findings of two studies. If no improvement occurs within 2 months, another strategy is necessary.

If properly adjusted, full arch, flat appliances prevent the overeruption of teeth. They can be adapted to complete dentures by use of ball clasps. They can be coupled with a biofeedback and stress management program to alleviate pain and depression in some patients.

Con: The timing of appliance use and proper adjustment affect the outcome. Patient compliance is less likely during an acute episode of pain and is poor if the appliance is ill-fitting.

Partial Coverage Appliances. These appliances cover either the anterior or posterior teeth.

An anterior appliance is easy to deliver and adjust, but impressions and mounted dental casts are required for construction. For emergencies, a simple anterior appliance can be constructed by forming uncured acrylic resin into a block. The patient is instructed to retrude the mandible and to open about 10 mm. The "doughy" block is positioned so that about 3 mm of the resin overlaps each of the mandibular and the maxillary incisors. The patient holds this mold with tooth indentations until nearly set. The mold is removed and additional resin is added as needed. The block is cured in warm water, then adjusted and polished. Presumably, tense muscles relax when the patient wears the block. This emergency appliance has been termed an *anterior jig* or *deprogrammer.*

In posterior, partial coverage appliances, a hard acrylic resin covers only the posterior teeth. Some practitioners add excess resin to the bases, thereby increasing the vertical dimension of occlusion.

Pro: Partial coverage appliances are easier to deliver and adjust than flat, full arch appliances.

Con: They can lead to altered occlusions if worn continually. Patients must be warned to wear them either during the night *or* during the day, but never night *and* day. Practitioners should not recommend these appliances routinely.

Mandibular Repositioning. This appliance was designed to produce mandibular protrusion. The claim is that an anteriorly displaced disk can be recaptured to a "therapeutic", concentric position between the condylar head and the articular fossa. Although pain may be reduced and recapture may occur, the outcome is unpredictable. Joint sounds may return. Even in selected patients, the elimination of sounds does not mean successful recapture. Among 72 TMD patients with suspected clicking, only 53 had reducing disks. Just 41 were considered suitable candidates for protrusive appliances.

Furthermore, studies with direct sagittal computed tomography found that 41.8% of disks were not recaptured, even though sounds were eliminated. In another study of 40 patients treated for 2 months with this appliance, 80% had no joint sounds or pain. At a follow-up about 2.5 years later, three fourths were without joint pain, but one third had return of joint sounds.

As a plausible alternative to surgery for diskal displacement, protrusive appliances have been suggested for elimination of joint sounds. Once the therapeutic position is reached, the plan is to restore the occlusion at that position. Some clinicians have considered this form of treatment inappropriate. Mandibular repositioning appliances should not be used to justify other reconstructive therapies.

Attempts to correlate specific diskal disorders with joint pain have been unsuccessful. Clinical and arthrographic evaluation of 222 TM joints showed that neither pain location (front of the ear, temporal region, or neck) nor pain intensity correlated with specific disk disorders. Ear pain was more common among cases with disk disorders without reduction and among otherwise normal individuals than in patients with reducing disk disorders.

Pro: There are scattered reports that repositioning appliances relieve painful symptoms in some patients.

Con: Evidence is insufficient to prove that disks can be recaptured or that joint sounds can be permanently eliminated. One must continually guard against occlusal alterations. Dental intrusion was found in 3 cases and extrusion and intrusion in another 3 cases. Occlusal changes can be managed by gradual modification of the appliance. The modification was done 2 months after the patients wore the appliance. This form of management is too difficult for most clinicians.

Soft Appliance. Improvement in symptoms was found in 84% of 26 TMD patients wearing a water-filled appliance that allowed the muscles to reposition the mandible. A heat-processed latex rubber appliance with a flat occlusal table lessened symptoms in 74% of 19 TMD patients treated for 6 weeks.

Another study found a minor change in joint sounds when a soft appliance was used. Four of 42 TMD patients had no clicking 10 to 20 days after treatment. A few occlusal changes, and intrusion of molars and premolars, were observed in 28 patients. Still other studies have reported occlusal alterations. Nearly all 10 TMD patients lost occlusal contacts after wearing soft splints for as little as 7 hours.

Pro: Soft appliances are just as effective as hard acrylic appliances in reducing symptoms. They can be worn safely for 2 weeks or less in emergencies.

Con: After brief wear, a soft appliance should be replaced with a heat-cured resin appliance to avoid possible occlusal alteration.

Patients should be informed about appropriate wear and care. Recommendations should include:

1. Period of wear - nightly/daily/all the time except to eat.
2. Relief of symptoms may require 2, 4, or 6 weeks/months.
3. Cleaning with a brush after each period of wear.
4. Warning of possible altered occlusion if worn continually.
5. Need for periodic follow-up to check the status of the appliance and the occlusion.

Vapocoolant Spray

A vapocoolant spray (fluoromethane or ethyl chloride) can be prescribed for muscular complaints. It acts as a counterirritant that inhibits the conduction of pain impulses. Relief may occur from brief anesthesia of trigger points, but the complete physiologic effect is unknown. Speculation is that spraying activates A-delta fibers, closing the gate within the spinal cord and thus reducing the C-fiber activity responsible for chronic pain.

Schedule: The spray is delivered from a 4-oz bottle for 2 minutes, 3 times daily. The tissue is allowed to warm to room temperature between applications. Once applied, manual massage of the tissue can be tolerated and provides further relief. No heat should be applied to the sprayed region because the skin remains hypersensitive for nearly an hour afterwards.

Pro: The spray can be used to assist in jaw opening for the short-term.

Con: Long-term effects have not been determined.

Manual Massage, Myofascial Release, and Acupressure

Information is scant about the benefits of massage on the masticatory muscles of TMD patients. There is ample opportunity to test this treatment. Pericranial muscular tenderness was a common finding in 62 patients with myofascial pain, 63 patients with TMJ internal

derangement, and 56 headache patients. Patients in these groups had significantly more pericranial and neck muscular tenderness than asymptomatic individuals. The authors hypothesized that tenderness leads to craniofacial pain and that improvement follows after the tenderness is treated.

A massage therapy widely practiced around the world is termed *myofascial release.* The assumption is that the fascia forms a web connecting the cranium and sacrum to the brain and spinal cord. Fascia invests every structure that connects to the spinal dura. Presumably, restriction of fascial mobility exerts deleterious effects on the dura, disrupting the craniosacral rhythm. A disturbance of rhythm results in somatic pain and dysfunction. Treatment is aimed at restoring rhythm and normal fascial mobility. The patient dictates which direction the therapist pushes and pulls the muscle.

The general opinion is that pressure to specific points reduces fatigue and stimulates production of endorphins, which block pain. Sufficient pressure must be applied to loosen tense muscles. Lack of pressure is one of the most common faults hindering successful outcome. Pressure can be applied in several different ways.

Straight-on pressure is applied with a single finger or knuckle (comparable to shiatsu massage). For localized tenderness around the TMJ, the rubber eraser (the flatter the better) of a pencil can be applied in a straight-on manner and the rotated in a circular motion, moving the muscle beneath the skin.

For tenderness in the temporal region, straight-on pressure is applied with the one or two fingers or knuckles flat against the head and moving in small circles.

For tenderness in the neck, shoulder, or upper back, pressure from the thumb or finger is applied in a straight-on manner. Sustained pressure to a localized area can be done by placing a tennis or golf ball between the tender area and a hard surface such as the floor.

In the *compass maneuver,* the affected area is visualized as a compass. Pressure is applied with he finger beginning at the center and pushing in north, east, south, and west directions.

Roller technique therapy consists of forming a fist and rolling the knuckles along tender areas. The latter procedure is particularly useful for tenderness of the head, where curved contours of the skull limit therapy.

The flexibility of tissue in some regions allows for kneading of the muscles. For generalized tenderness in the neck, shoulder, or upper back, the muscles can be kneaded.

Schedule: Any of these procedures are done for 3 to 5 minutes once or twice daily.

Pro: Because frequent treatment is required to effect improvement, myofascial release or manual manipulation most likely helps only in the short term.

Con: The concept remains speculative. Practitioners have termed outcomes as successful based on patient testimonials.

Exercises and Muscle Strengthening

To strengthen a muscle, one must exercise it regularly. Muscle endurance is accomplished by adding repetition and frequently to an exercise. Muscle integrity is maintained by keeping the muscle strengthened throughout its arc of motion. To strengthen a muscle to its full capacity on demand, resistance must be added to exercise to add power to the muscle.

A program of appropriately planned exercises may provide symptomatic relief. Active and passive range of jaw motion exercises were used successfully to reduce pain intensity and improve mouth opening in 6 TMD patients. Patients were instructed in exercises twice a week for 6 weeks.

Other claims support the usefulness of exercises as part of a multidisciplinary program. One such study of 30 patients with mixed forms of head and neck pain found an 87% recovery rate at the time of discharge and 83% at a 6-month follow-up.

Improvement has been found even among more debilitated patients with TMD. Among 29 patients with rheumatoid arthritis and 34 patients with ankylosing spondylitis, short-term effects were obtained with a stomatognathic physical training program. Joint mobility improved in both groups after 3 weeks of training, and the clinical scores improved in patients with rheumatoid arthritis. Measures exceeded scores of controls. Recommended forms of exercise are discussed below.

Jaw Exercises

Strengthening of the jaw muscles can be accomplished by isometric or isotonic exercise. Examples of isometric exercise are rhythmic stabilization and massed practice therapy.

Rhythmic Stabilization (or Reflexive Inhibition). The patient attempts mandibular movement as the therapist resists the force with a hand beneath. The patient opens about 10 mm, and the force is applied. Lateral and protrusive motions are done in the same way. This exercise can be done solely by the patient. The patient places one hand behind the head and pushes the jaw against an opposing fist beneath the chin.

This exercise produced a 30% reduction of pain intensity in 11 TMD patients treated at two sessions with an interval of 21 days between sessions.

Massed Practice Therapy. The patient clenches tightly for 5 seconds and then relaxes the jaw for 5 seconds. This exercise proved useful in management of bruxism in 33 individuals with almost 80% success.

Schedule: 5 repetitions 6 times daily for 2 to 4 weeks.

Examples of isotonic jaw exercises are active stretch and retrusion exercises.

Active Stretch. The patient is taught with the aid of a hand mirror to open symmetrically and then to translate the mandible in a straight pattern.

Retrusion. The patient is taught with the aid of a hand mirror to pull the jaw posteriorly. The patient learns to flex and relax the suprahyoid muscles by feeling changes along the throat.

Mobilization

Tongue depressors can be used to improve the jaw opening in patients with limited function. With extreme care under emergency conditions, a mouth gag retractor may be substituted to prop the jaws open gradually.

Tongue Depressor. The patient's opening is measured at the central incisors. Several depressors are bound with masking tape to fit the opening. Then single depressors are added to tolerance. As the stretch improves the opening, more depressors can be added. The patient holds the depressors in the mouth for about 5 minutes. The depressors are removed and the mandible is stretched in all directions.

Schedule: The exercise is performed 5 to 10 minutes daily in the morning and evening until normal opening is attained.

For patients who have experienced recent TMJ surgery, two other forms of mobilization have been recommended.

Long-Axis Distraction. The therapist stabilizes the chin of the patient with an index or middle finger, then presses inferiorly with the thumb on the lower molars distracting the mandible in a forward direction.

Schedule: 10 seconds, 3 to 5 times each session.

Overpressure With Opening. The patient is asked to open the mouth as wide as possible. The therapist presses inferiorly again in the lower molar region, stabilizing the chin with an index or middle finger.

Schedule: 10 seconds, 1 to 3 times each session.

Head and Neck Exercises

Several head and neck exercises have been recommended.

Chin Tuck. The patient is instructed to keep the ears over the shoulders and obtain a neutral position for the head and neck. Practice of this postural routine helps the patient avoid strained neck muscles that may develop when the head is protruded.

Extension-Flexion. The patient touches the chin to the chest and then pulls the head backwards. An *axial extension* can be done by having the patient place their hands flat across the back of the neck and gently pulling the neck forward while nodding the head in a forward direction.

Lateral. The patient touches the chin to each shoulder without raising the shoulder.

Tilt. The patient moves the right ear towards the right shoulder and then moves the left ear towards the left shoulder.

Shrug. The patient submerges the head down into the shoulders.

Schedule: Each exercise can be done 5 to 6 times daily for 6 repetitions at the most convenient time.

Pro: These stretching exercises probably improve and maintain short-term flexibility.

Con: Further research with matched controls is needed to verify long-term efficacy.

Cervical Traction

Because neck pain frequently accompanies jaw pain, therapists often apply traction to the occipital region to reduce neck pain or relax the cervical musculature.

Selected studies fail to confirm the efficacy of this modality. No relaxation was found after study of the myoelectric activity of the upper trapezius muscle in 12 patients treated with traction for cervical pain disorders. Traction used as part of an active program of physical therapy was less beneficial than a molded collar with slight flexion in the treatment of 135 adults with soft tissue neck injuries caused from motor vehicle accidents. Another report was unable to establish efficacy of traction in the management of neck pain.

If used in conjunction with other treatment for a jaw disorder, care must be taken to avoid excess force on the joint. Mechanical force applied to the mandible that is delivered vertically by some units may irritate a painful jaw. The recommended head strap angle is 45° to 60° to the horizontal plane, with the patient's body in a supine position. This position reduces the pressure on the chin strap and thus the force against the jaw.

Schedule: 5 to 10 lb for 15 minutes daily initially, increased to tolerance.

Pro: This stretching exercise may be mildly useful for treating neck pain in the short-term. The effect may be no greater than the placebo response.

Con: A long-term program needs to be conducted to fully evaluate efficacy.

Physiotherapy

Physiotherapy includes a host of special therapies with the purpose of reducing musculoskeletal pain and improve function. An enlightening review of procedures that may assist in management of specific TMD complaints is available.

Electrical Stimulation

Many forms of electrical stimulation have been used in the treatment of TMD. The efficacy of some therapies, namely ultrasound (US) and transcutaneous electrical nerve stimulation (TENS), has not been proven. A summary reported that convincing evidence is lacking about the efficacy of US in the treatment of musculoskeletal disorders. Some studies have been criticized for a tendency to overinterpret clinical success and specific therapeutic effects, partly as a result of technical difficulties and lack of appropriate controls. There is also difficulty in determining whether an effect is a therapeutic or placebo response. Despite these limitations, some clinicians have been unable to conclude that physiotherapy has no beneficial effect.

Ultrasound

Ultrasound is based on a piezo electrical effect that produces acoustic energy at an ultrasonic range. Effects are thermal and mechanical vibration (cavitation). Deep heating occurs quickly, presumably leading to increases in blood flow, metabolism, and permeability of the cell membrane. Because circulation is increased, these changes decrease inflammation, increase soft tissue extensibility, and promote healing. Some pain relief occurs from the heating of peripheral nerves and free nerve endings.

Studies reflecting clinical improvement in the range of 20% to 30% can be explained by a placebo effect. The placebo response has been documented in other studies. From a double-blind, cross-over study of 93 patients with different forms of musculoskeletal pain, actual US stimulation produced 46% improvement, whereas the response with placebo was 32%.

Information exists on the treatment of TMD patients with US. Evaluation of 100 TMD patients divided into four equal groups showed that subjects obtained more relief when treated with US combined with an intraoral appliance than when US or appliance was used separately or when both were combined with another therapy.

Muscle pain dysfunction (MPD) symptoms were reduced in 23 of 28 patients. Of 19 patients treated with muscle and diskal dysfunction, 18 improved. Of 9 patients treated for diskal dysfunction, 5 improved. In another study, 6 patients reported less pain after twice weekly sessions for 6 weeks.

Ultrasound produced greater relief of pain and tenderness on palpation of the masticatory MPD patients than did muscle relaxers or short wave diathermy. Three groups of 40 patients each received US, short wave diathermy, or muscle relaxers for 2 weeks. Follow-up occurred from 6 to 12 months. Based on a four-point scale for pain, the reduction

was US 46%, diathermy 40%, and muscle relaxers 5%. For tenderness on a four-point scale, reduction was US 34%, diathermy 35%, and muscle relaxers 5%.

Ultrasound, superficial heat, and jaw exercises were used to treat half of 58 patients after TMJ surgery. Compared with patients not receiving physical therapy, treated patients had more pain and less voluntary opening during the treatment period. One year later, no difference was found between groups in subjective report or by clinical examination. Statistical analysis showed patients with opening of less than 30 mm postoperatively were more likely to achieve 40 mm opening if they had physical therapy than if they did not. Patients with 30 mm or more opening likewise showed increased tendency to achieve 40 mm if physical therapy was done.

Schedule: 1.0 to 1.5 W/cm^2 for 3 to 5 minutes in the TMJ region and 7 minutes in the cervical region, 2 to 4 times a week for 3 to 4 weeks.

Pro: Benefits are minimal (about 14% improvement) and are probably of short duration.

Con: More frequent and widespread application may be required to overcome the placebo response.

Transcutaneous Electrical Nerve Stimulation

This modality has been used to control pain. TENS has been described as working by two different mechanisms. In the first mechanism, electrical energy from a TENS unit alters the gate control of pain transfer. Presumably, stimulation of large fibers that transmit sensations of touch and vibration can close the "gate" in the spinal cord and block the painful signals that travel in smaller and slower fibers. A second mechanism is that TENS promotes the release of brain endorphins that reduce pain.

Recent findings on low back pain reveals the complexity in establishing efficacy. TENS reduced both the ratings for pain intensity and pain unpleasantness and motivational-affective aspects in the short term. However, it is likely that most reduction in the affective dimension is a placebo response.

A claim has been made that TENS treatment of neck and shoulder trigger points significantly reduced myofascial discomfort. Recomputation of the data from this study failed to reveal a statistically significant effect between treated and untreated subjects. This corrected finding agrees with the results of another study in patients treated for head, neck, or facial pain. Only 20% to 25% of these patients obtained good to excellent relief. In one third of patients with facial pain, needle stimulation was more effective than surface stimulation. The needles were inserted paraspinally at the C_1 to C_2 transverse processes.

The efficacy of standard TENS or high-frequency neural modulation in the treatment of TMD has been reported to range between 30% to 100%.

Based on a double-blind design, four models of TENS versus no stimulation were compared in 60 subjects (12 in each group) suffering from myofascial pain, including pain

of the temporalis and masseter muscles. Significant pain reduction was attained in the group receiving 100 Hz/250 ms for 10 minutes followed by 100 Hz/50 ms and pain suppressor TENS. No pain reduction occurred at 2 Hz/250 ms TENS or for the controls. Tests with a pressure algometer showed no significant difference in trigger-point sensitivity between groups. The authors concluded that high-frequency, high-intensity TENS reduced myofascial pain but had no effect on trigger-point sensitivity.

A double-blind, cross-over study of 19 patients with TMJ rheumatoid arthritis revealed that high-frequency TENS reduced functional pain but had no significant effect on resting pain or tenderness of the masticatory muscles or TMJs. Cathodes were placed over the auriculotemporal nerve and the temporalis muscle. No significant effect was found between low-frequency TENS and placebo treatment.

TENS treatment proved effective in patients with postherpetic neuralgia. Good to excellent relief was obtained in 60% of chronic cases treated with TENS. In another study, a 70% decrease in pain was found in 33 of 97 patients after one or two treatments.

TENS was valuable in reducing pain produced by venipuncture in children. A double-blind study with untreated and placebo controls showed that VAS pain intensity and unpleasantness were lowest for the TENS group (200 Hz/5 ms) and highest for the untreated controls.

Pro: Based on these studies, the effect of TENS probably exceeds the 30% to 40% placebo response for the short term. A high frequency of 100 Hz or greater is more effective than a lower frequency.

Con: Choosing the best site for electrode placement appears to be crucial. Because myofascial pain presents in a diffuse pattern, many muscles may need to be treated over a longer period.

High-Voltage Electrogalvanic Stimulations (HVGS)

Present HVGS units deliver currents of positive and negative polarities. Positive polarity produces a vasoconstrictive effect, whereas negative polarity produces a vasodilatory effect. Typically, positive polarity reduces nerve irritability and negative polarity enhances it. Negative polarity tends to soft tissue and thus seems to reduce regions of muscular tension and trigger points.

Treatment with HVGS relieved pain intensity and improved mouth opening in 8 TMD patients. Patients were treated twice weekly for 6 weeks. HVGS was used in the rehabilitation of 1 patient after TMJ arthroscopy. *Schedule:* 100 pulses per second for 10 to 20 minutes, twice weekly.

An alternate form of this stimulation is inferential current stimulation (ICS), which produce biphasic pulses within the tissue but no skin irritation. Two different currents are applied simultaneously and superimpose as a modified current deep within the tissue. A study using ICS treatment of subjects with recurrent jaw pain did not prove helpful. No significant

difference was found in decreasing jaw pain or increasing vertical opening in 20 patients receiving ICS compared with 20 subjects receiving placebo treatment.

Pro: A few studies suggest that HVGS may be valuable for improving mandibular motion.

Con: Because of the lack of appropriate controls and because no effect exceeds placebo response, efficacy must be viewed cautiously.

Laser Therapy

Laser therapy has been widely publicized for as a treatment for acute and chronic musculoskeletal pain syndromes. Analysis of 36 randomized clinical trials of 1704 patients suggests that the efficacy of laser therapy for these disorders seems only slightly greater than placebo treatment. There may be too many technical variables to confirm benefits.

Other assessments of pain showed no significant difference between 62 patients with chronic fibromyalgia treated at acupuncture points with low-output helium-neon laser therapy than was found for an untreated placebo group. Six treatments of tender points in the neck and the shoulder girdle of 47 female laboratory technicians with low-level laser therapy was not significantly different from six placebo treatments of the same regions. In fact, subjects of a double-blind, cross-over study rated the placebo best. No significant difference was found in the use of analgesics between treated and untreated sessions.

A double-blind, cross-cover study of MPD patients treated with infrared laser therapy at 31 active trigger points (including the infraspinatus, levator scapulae, trapezius, extensor carpi radialis, and tibialis anterior) showed an increased pain threshold immediately after treatment. At nonactive trigger points, the effect occurred 15 minutes after laser therapy.

Pro: If masticatory muscles of TMD patients respond to laser therapy as do other bodily muscles, immediate relief can be expected at active trigger points. The effect will likely be of short-term benefit.

Con: The overwhelming difficulty is in treating enough of the active trigger points that refer pain.

Iontophoresis

Iontophoresis transfers ions from a solution through intact skin by passing a DC electrical current between two electrodes. Negative ions are transmitted at the anode and positive ions at the catode. Examples of negatively ionizing drugs are methylprednisolone and dexamethasone sodium phosphate. These corticosteroids have been indicated for use in reversing acute inflammations of the tendons, ligaments, trigger points, and joints.

Iontophoresis was suggested as a method of treatment for TMD and for postherpetic neuralgia in 1982. Five patients with different forms of TMD obtained some relief from pain after iontophoresis treatment with corticosteroid.

In a double-blind study of 27 TMD patients with capsulitis and diskal derangement without reduction, dexamethasone sodium and lidocaine delivered by iontophoresis to the TMJ region proved more effective in improving jaw motions than lidocaine only or buffered saline. Jaw opening improved 6 mm, and lateral motion to the nonaffected side improved 1.2 mm. Treatment was 3 times every other day for about 2 weeks.

Schedule: The medicament solution consists of 25 mg methylprednisolone (Solu-Medrol), 2.5 mL 4% lidocaine, 0.5 mL 1/1000 epinephrine. Two to 3 mL of solution delivered with an Iontophor unit (Life Tech, Houston, Texas) are applied to an electrode (Meditrode, Life Tech) over the affected region at a setting of 1.5 mA for 5 to 6 minutes positive and 10 to 12 minutes negative at 3 to 7 day intervals for 2 to 5 weeks. A return electrode is attached to the arm of the same side.

Pro: Clinical evidence shows iontophoresis to be useful for improving jaw function.

Con: More information is needed to confirm long-term effects on pain.

Supportive Counseling and Psychotherapy

Many patients recognize the stress affects their complaints. Among risk factors are major life changes and multiple daily confrontations that trigger unhealthy responses. Some patients have an inadequate support system or are engaged in activities that could undermine treatment. Social support and the learning of coping skills are vital resources for managing physical illness evoked by stress.

Supportive therapy may be given in various ways. The initial focus should center on sympathetic attention and encouragement with regard for physical symptoms and the effects produced by medication or physical modalities. In a multidisciplinary setting, this program proved helpful in management of patients with chronic somatoform pain. Although the average pain intensity or level of productivity did not change, the amount of time patients were in pain decreased significantly.

Often, improvement requires that patients modify their current life study. The practitioner can initiate an awareness of underlying problems. Brief discourse can focus on abrupt emotional reactions or changes in daily living activities that might trigger more muscular tension. Simply having the patient make a list of stressful events and then placing a priority on those that produce the most distress may help. This exercise may identify situations which many individuals take on, but over which they have no control. Most stresses can be managed some of the time. Problems develop when too many stresses overcome the capacity for management.

A program of didactic education relating stress to increased muscle tension and pain coupled with training in cognitive coping skills to control pain has been used successfully with some TMD patients.

Unlike supportive therapy, psychotherapy deals with painful situations and interpersonal experiences. When properly managed, psychotherapy tends to alter the patient's response to pain and level of activity. Treatment of patients suffering with chronic

somatoform disorder showed that psychotherapy raised the intensity of pain but improved the overall level of activity. Interventions focused on relating the pain to experience in medical care or interpersonal conflicts (eg, anger, separation, or abandonment).

Pro: Programs designed to deal with the interpersonal problems of patients are available at multidisciplinary pain centers in university health centers across the USA. Referral should be made to these centers. Additional information about supportive care may be obtained through The TMJ Network, a support system for TMD patients established in 1993 by Ann-Marie C DePalma (36 Meacham St, Somerville, MA 02145).

Con: Most clinicians lack enough savvy and time to effect significant changes of this sort. Patients should be directed to health professionals capable of managing burdensome daily problems or emotional features involved with pain and suffering. Referral for counseling of TMD patients is not common among dental practitioners. According to a survey of 302 dentists of the American Equilibration Society, one fourth of their patients suffering with MPD were referred for counseling.

Behavioral Modification

Changes in certain behaviors may assist in management of pain and suffering. Methods that have been suggested to lessen anxiety and allow coping with pain include information, distraction, and modeling.

Information: The clinician provides a well-defined description of a given therapy to be used on the patient.

Distraction: The aim is to preoccupy patients with another form of activity. Audio and video programs are examples suitable for diverting attention.

Modeling: Patients are urged to observe the treatment that they will receive being done on a peer individual.

Physiologic Arousal Reduction

Relaxation

Although relaxation therapy is widely extolled as useful for the management of stress, few publications describe its use for TMD pain. Coupled with oral appliance therapy, relaxation therapy led to reduced tenderness of masticatory muscles and a lower level of pain in MPD patients. Palpation and pain scores decreased significantly by 12 weeks in patients wearing oral appliances and receiving instructions to keep the teeth apart and relax the neck. No similar effect was found in 8 TMD patients receiving only appliance therapy.

Progressive Muscle Relaxation

One program of progressive relaxation therapy consists of 20-minute practice sessions in which the therapist instructs the patient to tense the muscles and relax them slowly. Taped

instructions about muscular relaxation given to 27 TMD patients showed results comparable to patients treated with biofeedback training.

The benefit of relaxation tapes in the home setting is doubtful. Using tape-recorded instructions, no additional improvement was found in 19 TMD patients treated simultaneously with biofeedback treatment compared with 32 patients receiving only biofeedback therapy.

Paced Respiration

This exercise involves inhaling or exhaling at a predetermined rate. Breathing may be coordinated with repetitive flashing light or sound. Eight inspiratory-expiratory cycles per minute proved more effective than greater cycles. This therapy has been referred to as *autogenous relaxation.* Sessions of 20 minutes focus on an aura of comfort and relaxation.

Stress-Coping Training

This training promotes coping by teaching patients to identify and modulate maladaptive attitudes and expectations that contribute to stress. Comparison of stress-coping training with relaxation training showed that both were equally effective in producing immediate improvement with migraine. After the 3-year follow-up study was completed, stress-coping was recommended for patients who demanded complex solutions.

Pro: Biobehavioral training has potential for relieving TMD suffering. The frequency and intensity of pain during treatment should be recorded daily in the patient's symptom diary.

Con: Repetition is a necessity. Typical length of treatment is at least 6 to 8 sessions. More studies with double-blind design need to be completed to judge individual efficacy.

Hypnosis

The aim of hypnosis is to achieve relaxation and control of physiologic response through increased suggestibility. Hypnotizability implies the capacity to dissociate. Individuals have high or low hypnotic susceptibility. Those with high susceptibility are at significant risk to symptom formation, whereas resistant individuals often delay seeking help until complaints are difficult to manage.

Hypnosis is achieved by induction, either through verbalization or ideo-motor signaling. *Rapid induction* may involve the clinician asking the patient to visualize descending a stairway with several steps. At each step, a suggestion is made to relax. Posthypnotic suggestions are made to continue relaxation. The patient is then asked to describe the experience. *Eye rolling* is a form of self-hypnosis. The patient focuses on a point while holding the chin parallel to the floor. The patient counts to ten and thinks about relaxing at the same time.

Chronic tension headache has been treated successfully with hypnotherapy. A single, blind, time-controlled study revealed significant reduction in the number of headache days, hours, and intensity in 11 headache patients compared with 15 controls. The treatment period

was for 3 months. Patients followed a flow-off maneuver in which the headache was expressed as a visual image changed by suggestions.

Few papers describe treating TMD pain with hypnotherapy. Most detailed methodology or mention its use with a few cases unresponsive to other forms of therapy. A study revealed no significant relation between hypnotizability and weekly pain ratings. No changes were found in prediction of pain reduction when scores were adjusted for other factors.

Pro: If TMD pain mimics tension headache, it may respond successfully to hypnosis.

Con: One problem is in locating qualified hypnotherapists who can effect relaxation in the patient.

Biofeedback

Basically, biofeedback is a form of instrument-aided psychotherapy. The aim is to achieve psychological self-regulation. The procedure involves attaching an electrode to the skin over the muscle and detecting changes in tension. A polygraph is used to record muscular activity, which is displayed on a monitor visible to the patient. Most systems can be adapted for auditory control. Patients are asked to contract then relax the muscle and at the same time to be aware of reactions in the muscle. Increased muscular tension raises the number on the monitor or produces tone of a higher pitch, whereas decreased tension lowers one or the other. By repetitive training, patients are made aware of the relation between muscular tension and pain.

Several TMD studies before 1989 have been criticized because patients were not permitted an adequate period of adaptation or because inappropriate statistical analyses were used. The authors concluded that more research was needed to ascertain if TMD patients evinced symptom-specific psychophysiologic responses.

Review of the literature showed that biofeedback training proved successful in relieving MPD symptoms in 15 of 23 patients. It was effective in reducing mean masseter electromyographic (EMG) levels and symptoms in 16 MPD patients. Compared with 8 MPD subjects not receiving training, 75% of treated patients improved enough that no further treated was needed after 1 year. Improvement occurred in the amount of mandibular opening, complaint of pain, and tenderness on palpation.

Biofeedback training was used successfully in combination with jaw posturing and with a prosthetic guide to decrease masticatory muscle activity in women with myofascial pain. Holding the mandible at rest position or separating it with a 6.8-mm prosthetic bar augmented the effect of biofeedback treatment.

Comparison of 30 patients with chronic TMD pain versus 90 patients with chronic back pain found that TMD patients were more responsive to biofeedback treatment than back pain patients. Patients completed eight training sessions.

As an add-on therapy, EMG biofeedback has been used successfully to treat subjects with low back complaints. Compared with 30 control subjects, 30 patients with myofascial pain improved the strength of their trunk extensor muscles. The level of pain was not significantly different between treated and untreated subjects after eight sessions over a month.

Biofeedback may be coupled with relaxation training. Long-term efficacy with both has been proved in patients with chronic headache. A study of 12 patients treated by relaxation, 10 by relaxation and EMG biofeedback, and 12 by relaxation and temperature biofeedback showed that less headache activity occurred in the group with EMG treatment than in the other groups when evaluated at 6- and 12-month follow-ups.

The age of the adult patient is not a limiting factor in treatment. Assessment conducted 3 months after frontal biofeedback revealed a reduction in tension headache among 8 sufferers who were 62 years or older. The training program involved 12 sessions. EMG measures for the upper trapezius muscle in patients with cervical neck pain found that patients between 55 and 78 years of age responded similarly to patients between 29 and 48 years of age.

Schedule: 5 minutes no-feedback resting baseline: 20 minutes of biofeedback with a 5 minute no-feedback period, weekly for 6 weeks.

Pro: The more sophisticated systems are adapted to handle eight channels (two EMG panels, two temperature channels, electrodermal response, heart rate, respiratory rate, and continuous blood pressure), so more information can be derived.

Biofeedback is not considered curative for TMD. Opinions of leading clinicians at the 1982 American Dental Association President's Conference on Temporomandibular Disorders described biofeedback as having reasonable scientific support for TMD patients suffering from complaints of the masticatory muscles and for certain patients with chronic discomfort unresponsive to other therapies.

Con: The benefits tend to be transitory. The chief difficulty is an inability to motivate patients. Reinforcement is necessary to achieve an enduring result.

Acupuncture, Needling, and Auriculotherapy

Acupuncture

The lay literature abounds with success stories about acupuncture treatment of generalized muscular and joint pains. The use of acupuncture in treating TMD is limited. Analysis of clinical measures showed that acupuncture performed 3 times over 1 month on 25 TMD patients produced no greater relief of symptoms than 25 patients treated by counseling, occlusal adjustment, muscular exercises for the mandible, or intraoral appliances. A 3-month follow-up showed that neither modality proved superior to the other.

Another study of 110 TMD patients compared the effects of acupuncture to appliance therapy. Nearly equal-sized groups of patients were treated either by acupuncture or by appliance, and a similar number of controls received neither treatment. Relief of pain

improved immediately in treated subjects, but no change was found for controls. A 1-year follow-up showed 57% improvement in patients receiving acupuncture and 68% improvement in patients treated with appliances. Muscular tenderness decreased immediately after treatment and remained lower 6 months later. The authors concluded that both therapies produced the same outcome in patients suffering myogenic complaints.

Dry needling has proved effective in the relief of a few patients with postherpetic neuralgia and in other selected patients with localized myofascial pain of the neck. A follow-up 6 months later showed no return of the neck pain.

Method: For treatment of myofascial pain, the muscle is palpated for trigger points. Once the "jump sign" is demonstrated, the area is probed with a 25- to 30-gauge needle, which is rotated every few minutes to achieve the desired effect. Spraying the area with vapocoolant mist before needling makes the procedure more comfortable.

Auriculotherapy

There are many anecdotal reports that stimulation of the external ear with a needle or microcurrent alleviates pain at distant sites. The claim is that the therapy elevates the pain threshold and reduces sympathetic tone.

Success with auriculotherapy is doubtful. A comparison of 36 patients with chronic pain showed that the effect was no greater than found in placebo controls. Furthermore, auriculotherapy coupled with TENS failed to produce a significant effect on autonomic functions and on an experimental threshold for pain in other patients.

Pro: Acupuncture and needling appear to offer some benefit in relieving localized regions of pain.

Con: The failure to demonstrate acupuncture as more successful than appliance therapy may relate to the diffuse pattern of pain originating from different sites. The problem is where to begin treatment. Needling an ear is not rational unless one wants an earring.

Chemical Injections

Local Anesthesia

Injection of a local anesthetic into one or more regions of the muscle may produce relief of pain. The procedure for injection of muscle trigger points is to locate the taut band by finger pressure. The patient is asked if "1, 2, or 3" areas hurts the most. The most sensitive area is sprayed with vapocoolant spray because a concentration of local anesthetic even less than used to obtain nerve block tends to increase pain. Either chloroprocaine (3%) or procaine (5%) without vasoconstrictors, 0.1 to 0.5 mL, has been recommended.

Most dental pain can be blocked effectively after injection of a local anesthetic. Using an intraligamentary syringe, single teeth can be anesthetized, enhancing exact identification of the pain.

Pro: Localized dental pain can be treated effectively once an offending tooth is anesthetized. For diffuse muscle pain, repeated injection may be required to obtain lasting results.

Con: A single injection produces necrosis of muscle. Regeneration may require at least 1 month.

Corticosteroid

Injection of corticosteroids and other agents into joints has produced only short-term results in patients with generalized osteoarthritis. Few studies demonstrate that patients with osteoarthritis improved significantly after injections compared with patients receiving placebo agents.

Other findings are mixed. Improvement has been related to reduced synovitis in the joint. Within a day after injection, 79% of 19 joints in 10 patients with hemophilic arthropathy showed improvement. Two months later, 58% of the patients obtained relief. On the other hand, injections into the synovial fluid of the knee produced no significant benefit in 18% of 102 cases of patients with rheumatoid arthritis, osteoarthritis, or traumatic osteoarthritis.

Long-term follow-up (3 to 15 years) of 93 patients with stenosing tenovaginitis injected with methylprednisolone at 3-week intervals showed that 76% obtained complete relief.

Collectively, these dissimilar findings tend to support the findings obtained with the few TMD patients treated similarly. Recommendation was made that 40 mg of hydrocortisone injected into the upper compartment would afford rapid relief in cases of severe, acute TMJ arthralgia. Single injections of corticosteroid into the TM joint provided complete symptomatic relief in 65% of 46 patients with osteoarthrosis. No additional treatment was required at a follow-up less than 6 months later. Another study showed that intra-articular injections of hydrocortisone into the TMJs of 8 patients provided 2 months relief of pain. In a 2-year parallel study of 15 patients treated with intra-articular injunctions of corticosteroid and of 18 patients managed with occlusal therapy, injections proved more effective in improving maximum voluntary opening than did the occlusal therapy.

Schedule: 0.5 mL betamethasone (0.6 mg/mL), 0.5 mL lidocaine (10 mg/mL), 1 injection weekly for 3 weeks in the TMJ. No more than 2 to 4 injections per year has been recommended. Based on studies of 50 patients with low back pain, injections are effective only if done by the intra-articular route.

Pro: The few studies on TMD patients suggest that patients receiving corticosteroids within the joints may improve in the short-term.

Con: Side effects can be expected. Corticosteroids tend to remain in connective tissue at the injection site. Among 12 patients, 6 showed a mild reaction, and the attendant tissue was avascular.

Hyaluronate

Presumably because synovial fluid contains sodium hyaluronate, it functions as an intra-articular lubricant. This property offers an opportunity to discover if hyaluronate injections can be used to free intra-articular adhesions. Thus, disk incoordination, particularly in cases of disk displacement without reduction, might improve.

Report of short-term and long-term improvement following intra-articular injections of hyaluronate into the superior joint space has been shown. Comparison of 33 patients with TMJ pain and dysfunction and 24 patients with TMJ arthritis showed decreased symptoms and signs after injection. Findings did not differ significantly from patients receiving injections of corticosteroids. A short-term effect was found after pressurized infusion of hyaluronate in 1 patient who had restricted mouth opening.

A study of 121 patients with degenerative joint disease (DJD), displaced disk without reduction (DDN), and displaced disk with reduction (DDR) revealed that the DDR patients received the greatest benefit. Compared with subjects receiving placebo saline solution, about twice as many DDR patients (90% versus 50%) improved after 1% sodium hyaluronate treatment. Few DDR patients treated with hyaluronate relapsed, but 31% relapsed with placebo solution. Patients with DJD did not improve.

The effect of sodium hyaluronate and corticosteroid on papain-induced joint lesions has been studied in the guinea pig knee. Findings showed less deviation in form and granulation tissue after injection, but no overall change in joint severity.

Pro: Injection of hyaluronate may improve early-developing incoordination of the disk.

Con: The disparate findings between patients with different forms of disk derangements suggests that benefit may accrue only to those patients with disks that do no reduce.

Trigeminal Glycerol Gangliolysis

Recalcitrant trigeminal pain, unresponsive to medications, may respond to treatment with glycerol gangliolysis. Effectiveness with this procedure has been estimated to range from 89% to 96%. About 7% to 10% of those treated have early recurrence of pain and up to 21% have recurrence later.

The technique requires the expertise of a trained practitioner. After intravenous injection of appropriate sedative, an opaque dye viewed radiographically is used to position a needle in the fluid surrounding the trigeminal nerve. Glycerol (0.5 mL) is injected into the fluid. Some patients obtain relief of pain by 1 day. Relief in others may not occur for 3 weeks. Side effects may include loss of feeling in the face, which usually returns within 3 months.

Other procedures for relief of trigeminal neuralgia are alcohol block, alcohol gangliolysis, neurectomy, radiofrequency gangliolysis, microvascular decompression, rhizotomy, and trigeminal tractotomy. Some are either less predictable or require surgery

compared with glycerol gangliolysis. Microvascular decompression involves the surgical removal of dilated vessels surrounding the nerve. Among 40 patients undergoing microvascular decompression, 75% rated the relief as excellent and 15% as good about 11 years later.

Pro: After an unsuccessful trial with medication, glycerol rhizolysis may offer the patient relief. Success relies on appropriate diagnosis of neuropathic pain.

Con: Side effects may develop. Posterior fossa exploration with microvascular decompression is the recommended procedure if rhizolysis fails.

Occlusal Rehabilitation

There is widespread use of occlusal adjustment in the treatment of TMD. Adjustment is listed as the second most common form of treatment (30%) for MPD in a survey of 2143 general practitioners belonging to the American Dental Association. Traditional practitioners argue that adjustment reduces or ultimately eliminates symptoms of TMD. Unfortunately, clinical judgments made without appropriate controls are often misleading. Even worse is the neglect of reading the literature on the part of some practitioners.

Results with adjustment procedures fail to validate the need for reduction of prematurities to relieve pain. There is a strong placebo response. Mock adjustment completed on 25 MPD patients showed that 16 reported almost total relief of symptoms. Thirteen patients remained free of symptoms for 29 months.

Recently, a double blind study of 51 patients treated by adjustment of mediotrusive interferences and significant slides between retruded contact position and intercuspal position failed to confirm that this procedure differed from the placebo effect obtained by mock adjustment.

Although there is no reason to adjust teeth for relief of tenderness in the masticatory muscles of patients with TMD, this procedure has been done with that purpose in mind. The removal of prematurities during a period of variable muscular activity is questionable.

Pro: The primary reason for adjustment is to prevent, reduce, or eliminate lateral stresses on teeth. Improvements can be made in directing occlusal loading along the long axis of teeth. If one joint degenerates so severely that no occlusal contact occurs on the contralateral side, adjustment may stabilize the occlusion on the affected side. Restoration of teeth on the contralateral side is an alternative. If unilateral surgery is required, adjustment may be needed on the affected side to improve the final occlusal contacting relation.

Con: Adjustment should not be made with an anticipation of pain relief.

Protocols of Simulated Patients

A few examples are described so that the practitioner may gain experience int he clinical management of selected cases of head and neck complaints. The treatment sequences

begin with patients suffering from a primary complaint and build to management of patients having multiple complaints. No modality should be considered definitive.

Muscular Symptoms of the Jaw

Patient: #1

Chief complaint: Preauricular pain radiating along the left mandible.

Past history: Fatigue and soreness in the jaw over the past 2 weeks.

Examination: Localized tenderness of the masseter muscle with pain on palpation, absence of joint tenderness and sounds, voluntary opening and lateral mandibular motions within normal limits, TMJ radiograph within normal limits.

Diagnosis: Localized myalgia.

Treatment: Home care program as described above.

Follow-up: Office visit after 1 week, interview and palpation of the area for tenderness, continued home care therapy for at least 1 weeks as required.

Patient: #2

Chief complaint: Generalized bilateral orofacial pain, occasional neck pain.

Past history: Period soreness and stiffness widely scattered over the face, neck, and shoulders for the past 5 years. Pain diffuse and aching in character, no history of joint sounds.

Examination: Palpable tenderness of masticatory, neck, and shoulder muscles, voluntary opening > 30 mm, lateral jaw movements > 7 mm, TMJ radiograph within normal limits.

Diagnosis: Generalized myofascial pain.

Treatment: Home care program as described above.

Follow-up: Office visit after 1 week, interview, palpation of tenderness; if no improvement, intraoral appliance, medication (antidepressant or diazepam), physical therapy.

TM Joint Symptoms

Patient: #1

Chief complaint: Annoying clicking in the joints.

Past history: Bilateral joint sounds for more than 2 years, which are bothersome during eating, no history of pain.

Examination: Voluntary opening of 48 mm, lateral mandibular movements exceed 7 mm, minor tenderness on palpation of the temporalis tendons, bilateral reciprocal clicking, TMJ radiograph within normal limits.

Diagnosis: Bilateral disk disorder with reduction.

Treatment: Restriction of mandible on opening, yawning, and eating; chew small food portions bilaterally.

Follow-up: If the patient is severely impaired, consider diagnostic arthroscopy including lavaging of the TMJ with irrigation solutions.

Patient: #2

Chief complaint: Inability to open the mouth wide.

Past history: Noise in the right joint for the past 6 weeks which disappeared suddenly during yawning; sharp pain on locking as voluntary opening decreased; present pain dull, aching.

Examination: Restricted opening < 30 mm, left lateral movement 4 mm, right lateral movement 8 mm, deviation of the mandible to the right on opening, localized tenderness on palpation of the right joint.

Diagnosis: Right-side disk disorder without reduction.

Treatment: Home care program with emphasis on stretching of the jaw.

Follow-up: Office visit if no improvement within 1 week, measurements of voluntary opening and lateral motions, vapocoolant spray and manual manipulation of the mandible if opening < 30 mm. Continuation of home care program with emphasis on stretching of the jaw. Stretching can be achieved with tongue depressors. Repeat office visit 1 week later using some treatment if minimal progress. Recommend physical therapy (moist heat, ultrasound, and manual manipulation), consider diagnostic arthroscopy with irrigation if condition become chronic.

Patient: #3

Chief complaint: Limited voluntary opening, chronic pain in the left joint, recurrent headache.

Past history: Grating sound in the left joint over the past year, mandible tends to hang during opening, recurrent dull pain that wakes the patient at night.

Examination: Palpable tenderness in the left shoulder, neck, and masticatory muscles with a rating of 2 or more on a scale of 0 to 3, left joint with crepitus on opening and lateral movements, jaw deviates to left on opening, TMJ radiograph positive for joint erosion.

Diagnosis: Left TMJ arthritis with arthralgia, headache, myofascial pain.

Treatment: Initiate home care program, medication (antidepressant, medication to induce sleep, or both), begin fabrication of intraoral appliance.

Follow-up: Office examination after 1 week for palpable pain and tenderness. Delivery of intraoral appliance. Another follow-up in 1 to 2 weeks to check on health of patient and status of appliance.

Patient: #4

Chief complaint: Mouth locks open and jaw cannot close, sharp pain in left TMJ.

Past history: Frequent subluxation over the past year occasionally requiring assistance to reduce opening, recurred pain on locking.

Examination: Maximum voluntary opening 60 mm, right lateral movement 17 mm, left lateral movement 8 mm, tenderness of left TMJ and temporalis tendon, TMJ radiograph with possible flattened eminence of the left TMJ.

Diagnosis: Left TMJ hypermobility.

Treatment: Referral to an oral surgeon for TMJ surgery, likely arthroscopic cauterization of the posterior attachment to restrict movement.

TMJ Arthrotomy

Chief complaint: Recurrent pain and extreme restriction of mouth opening following surgery for ankylosed left condyle.

Past history: Ankylosis developed after trauma to the mandible resulting from a motor vehicle accident, loss of voluntary opening to 15 mm, left lateral mandibular movement 6 mm, right lateral movement 1 mm, no prior history of pain or limitation of mandibular movement.

Examination: Moth opening immediately after surgery 34 mm, left lateral movement 7 mm, right lateral movement 5 mm.

Diagnosis: Bony ankylosis of left condyle.

Treatment: Analgesics, diet instructions for soft or semisolid foods, program of physical therapy to maintain or improve voluntary opening and mandibular movement produced by surgery. Daily program of moist heat and ultrasound followed by active and passive exercises to facilitate protrusive, lateral and full opening activities. Home exercises with emphasis on compliance to reinforce instructions from physical therapist.

Follow-up: Assessment of condition, restoration of joint and occlusal therapy as needed.

Dentofacial Deformity and TMD Symptoms

Chief complaint: Upper jaw too large and lower jaw too small, pain around the right ear, and sounds in the right jaw joint.

Past history: Congenital growth problems of face, preauricular pain radiating to the neck, joint sounds present for 5 years, no history of trauma.

Examination: Voluntary opening of 44 mm, right and left lateral mandibular motions of 8 mm, generalized, muscular tenderness on palpation in neck and jaw bilateral in nature, unilateral popping in the right TMJ on opening but no functional pain, occlusion class II, TMJ radiograph within normal limit.

Diagnosis: Myofascial pain, disk disorder with reduction, and class II skeletal and dental malocclusion.

Treatment: Program of home care.

Referral: Oral surgeon, orthodontist, and counseling for pain and esthetic changes in profile.

Follow-up: Office visit following interviews by referral clinicians, continued treatment of pain by intraoral appliance and medication as needed.

Confusing Symptoms

Patient: #1

Chief complaint: Limited voluntary opening, feeling of swelling and slight numbness in the right mandible.

Past history: Opening and lateral jaw motions had decreased slowly within the past 2 months, perception of swelling along the angle of the mandible appeared with loss of opening, diffuse pain localized within the area of the lower second molar.

Examination: Voluntary opening of 22 mm, left lateral movement 3 mm, right lateral movement 10 mm, tenderness on palpation along the ramus and angle of the mandible, absence of tenderness in masticatory muscles, gingiva surrounding the second molar healthy, tooth slightly tender to percussion, but no decay or restorations present determined clinically and radiologically, pulp test within normal limits, tooth not sensitive to ice or heat, TMJ radiograph with questionable radiolucency present near angle of the right mandible.

Diagnosis: Because history reveals no record of recent fracture, recommend bone scan of the mandible to rule out possible tumor; if positive bone scan, plain film of the mandible and bone biopsy.

Treatment: If tumor confirmed, localized radiation or surgical excision.

Follow-up: Program of physical therapy program to improve mouth opening and lateral jaw functions, monitoring or oral hygiene.

Patient: #2

Chief complain: Inability to open wide, persistent pain of the left mandible.

Past history: Visited dentist 1 week ago for toothache, report of three shots in the lower left jaw, some numbness lasting over 2 hours, sharp pain presence once anesthesia disappeared, no history of joint sounds.

Examination: Maximum voluntary opening of 15 mm, left lateral movement 6 mm, right lateral movement 2 mm, well-defined tenderness on palpation along the angle of the left mandible and in the anterior fibers of the temporalis, no joint sounds, radiographs within normal limits.

Diagnosis: Postinjection trismus.

Treatment: Vapocoolant spray to left TMJ and masticatory muscles followed by manual manipulation of the mandible, analgesics.

Follow-up: Office visit after 1 week; if no improvement repeat spray and manipulation, program of physical therapy to improve opening and lateral jaw motions.

Patient: #3

Chief complaint: Generalized head and neck pain.

Past history: Series of 12 root canals on upper and lower teeth with residual tooth pain inconsistent with pattern of decay and periodontal status; brain scans and magnetic resonance imaging of head and neck within normal limits; overconcern with minor aches; family problems.

Examination: Absence of joint sounds and tenderness of TMJs, masticatory, neck, and shoulder muscles on palpation; treated teeth slightly sensitive to percussion; voluntary opening and mandibular movements within normal limits; radiographs and bone scan within normal limits.

Diagnosis: Possible somatoform pain disorder.

Treatment: Referral to psychologist or psychiatrist for evaluation and behavioral management.

Follow-up: Office visit to reevaluate patient outcome once diagnosis is confirmed by psychological testing.

Patient: #4

Chief complaint: Localized continuous pain in the region of lower second molar.

Past history: Pain present for longer than 4 months, associated hyperesthesia localized to site of pain, unsuccessful root canal therapy including apicoectomy followed by extraction.

Examination: Gingiva within normal limits, hyperesthesia at extraction site evoked by palpation, anesthesia block equivocal, radiographs within normal limits.

Diagnosis: Atypical odontalgia.

Treatment: Medication (antidepressant).

Follow-up: Interview for compliance with medication.

Neuropathic Symptoms

Chief complaint: Short bursts of pain, unilateral in mandible.

Past history: Health history unremarkable until 60 years of age, then pain localized to the molar area of the right mandible lasting for 10 seconds; rubbing the lower lip evokes pain.

Examination: Absence of tenderness on palpation of TMJ, masticatory, and neck muscles, teeth with minor fillings and negative to testing, gingiva healthy, radiographs within normal limits, pressure on trigger points of lip causes repeated painful episodes, diagnostic anesthesia confirms referral of trigeminal pain.

Diagnosis: Trigeminal neuralgia.

Treatment: Baclofen or carbamazepine; if no relief, glycerol neurolysis or microvascular decompression.

Headache

Chief complaint: Severe unilateral orbital or temporal pain or both lasting 15 to 180 minutes if untreated.

Past history: Headache with pulsating quality, pain moderate to severe intensity, frequency from 1 every other day to 8 each day, aggravated by routine physical activity; nausea or vomiting, accompanied by lacrimation, nasal congestion, forehead and facial sweating, ptosis.

Examination: Brain scan and physical symptoms within normal limits, no obvious pathology, oxygen inhalation aborts pain.

Diagnosis: Cluster headache.

Treatment: Oxygen inhalation, prophylactic regimen of sumatriptan or subcutaneous injection in emergencies.