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Abstracts of the

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## Speakers

### S-1. The Transmission and Modulation of Nociceptive Messages. A. Basbaum (University of California San Francisco, San Francisco, California).

This presentation will highlight several aspects of the transmission and modulation of nociceptive messages that bear on the production of pain due to injury to tissue and nerve. In addition to characterizing the properties of afferent fibers that respond to noxious stimulation, the distinction between primary and secondary hyperalgesia will be discussed. Primary hyperalgesia results from the sensitization of primary afferent nociceptive A delta and C fibers, usually in a setting of inflammation. Primary afferents that typically only respond to noxious stimuli can now be activated by non-noxious stimulation. The arachidonic acid cascade and the sympathetic nervous system are major contributors to this form of hyperalgesia. The recent evidence of sprouting of sympathetic postganglionic axons around dorsal root ganglion cells in the setting of nerve injury is of particular interest. Secondary hyperalgesia results from changes in the CNS. As a result of intense and/or persistent C fiber input, trigeminal and spinal dorsal horn nociceptive neurons become sensitized, such that they can now be driven by large diameter afferents. The pharmacology of central sensitization, including the contribution of the NMDA receptor and several peptide neurotransmitters, will be addressed. Finally, this presentation will address the organization of the nociceptive neurons in the dorsal horn, including the analysis of noxious stimulus-evoked molecular changes and the effects of opioids on these changes.

### S-2. Neurotransmitters and Pain. DL Hammond (University of Chicago, Chicago).

Great progress has been made in the past 5 years which respect to our understanding of the neurochemical mediators and modulators of nociception and analgesia. The first part of this lecture will review new information on the neurotransmitters that participate in the central transmission of pain as well as the production of hyperalgesia or hyperesthesia. The role of calcitonin gene-related peptide and substance P in nociceptive transmission will be briefly reviewed. The newly recognized role of excitatory amino acid neurotransmitters, also contained within large and small diameter primary afferent fibers, in the transmission of pain will also be discussed. Evidence supporting a "synergistic" interaction of these excitatory amino acid and peptide neurotransmitters will then be presented as it relates to mechanisms for the exacerbation and prolongation of nociception. The role of inhibitory amino acids, such as  $\gamma$ -aminobutyric acid (GABA), in the production of allodynia, hyperalgesia, and nociception will also be described. In addition, the physiological basis, pharmacological mechanisms, and pathological consequences of "central sensitization" or "wind-up" of central pain pathways, mechanisms that may underlie the exacerbation of pain, will be discussed in detail. The last part of the presentation will focus on the mechanisms by which nociceptive transmission can be inhibited and analgesia produced. The role of monoaminergic neurotransmitters such as serotonin and norepinephrine in descending inhibition will be reviewed. New information on the role of opioid receptors, with an emphasis on the delta opioid receptor(s), will be described. This presentation should provide attendees with an up-to-date summary of the pharmacological bases of pain transmission and the production of analgesia.

### S-3. Sympathetic Pain Syndromes. AJ Belzberg (Johns Hopkins School of Medicine, Baltimore, Maryland).

Sympathetically maintained pain (SMP) refers to a chronic pain disorder in which the pain is dependent on activation of adrenergic receptors. Patients with SMP characteristically have ongoing pain and pain to light touch (hyperalgesia). The diagnosis

of SMP is established when blockade of sympathetic innervation to the painful part results in a significant decrease in the pain with treatment, often including a chemical or surgical sympathectomy. Administration of various adrenergic agents has been employed as both a diagnostic and therapeutic tool in this disorder. Intravenous phentolamine, a short-acting, alpha-adrenergic blocking agent, is particularly useful as a diagnostic tool because it lends itself to placebo control. Investigations into the pathophysiology of SMP have included psychophysical studies with intradermal injections and topical applications of adrenergic agonists as well as electrical stimulation of sympathetic chains. The results suggest that a peripheral alpha-adrenergic mechanism underlies SMP. Development of animal models of neuropathic pain, some of which appear to display features of SMP, have enabled laboratory investigation of this perplexing disorder. Peripheral neuromas have been demonstrated to develop adrenergic sensitivity, and after a rat sciatic nerve is ligated, noradrenergic perivascular axons have been seen to sprout in dorsal root ganglia and form basket-like structures around sensory neurons. These observations suggest that in SMP, sensory nerves may express alpha receptors that when stimulated drive the pain system. We are exploring the molecular basis of SMP using cDNA probes for alpha receptors combined with *in situ* hybridization techniques to determine if there is a phenotypic change in the sensory neurons in an animal model of SMP.

### S-4. Pain Can Kill. JC Liebeskind (University of California, Los Angeles, California).

Specific aims: To review two research topics that are currently the object of intense investigation in my laboratory. These lines of research, involving studies of rats and mice, are yielding results that appear to have important implications for our understanding of human pain problems and the consequences of incorrect or insufficient pain management.

Topic one: Genetic studies of pain inhibitory mechanisms (stress-induced analgesia) in mice suggest that sensitivity to stress, opiate drugs, and brain stimulation analgesia are under a considerable degree of genetic control. Mice bred for high stress-induced analgesia, for example, show vastly enhanced sensitivity to morphine and show significantly more whole brain opiate receptor binding. A Mendelian analysis suggests this phenotype is determined by a single major gene. This finding, in turn, suggests that the gene can be localized and, perhaps, one day soon cloned and subjected to experimental manipulation. Other studies in mice are revealing that nonopioid mechanisms of analgesia importantly involve the NMDA receptor. These studies have implications for the development of a new class of analgesic drugs that are powerful and centrally active but not addictive or subject to tolerance development. Of special interest, we are finding important sex differences in NMDA mediation.

Topic two: Studies of the adverse health consequences of pain and stress in rats show, for example, that when postoperative pain is not properly managed, immune function (natural killer cell cytotoxicity) is compromised and the growth of experimental tumors is, by consequence, greatly enhanced. A role for endogenous opioids in certain forms of stress-induced immune suppression and tumor enhancement has been found. The important implication of results such as these is that pain is not something that people should be expected to bear with grace and stoicism; rather it can be a significant pathogen and an efficient immunosuppressive and tumor enhancing agent — in short, "Pain can kill."

### S-5. Migraine and Muscle Contraction Headache. SD Silberstein (Germantown Hospital, Philadelphia, Pennsylvania).

Migraine: A theory must explain the five phases of migraine: the prodrome, the aura, the headache, the headache termination, and the postdrome. According to Wolff, the aura of migraine is caused by intracerebral vasoconstriction, and the headache pain

is caused by vasodilatation of the external carotid artery. However, (1) it failed to explain the prodromal features of a migraine attack or the associated neurologic features; (2) some of the drugs used to treat migraine have no effect on blood vessels; and (3) the theory has not been supported by evidence from recent blood-flow studies. The Heyck theory that a migraine attack was secondary to the opening of the arteriovenous anastomoses is probably incorrect. The neural theory, which states that migraine is caused by a primary derangement of brain function, is supported by CBF studies, magnetic resonance, spectroscopy, and magnetoencephalography. CBF decreases during migraine with aura but does not change in migraine without aura. While the aura develops, blood flow progressively decreases as a wave of spreading oligemia begins in the occipital cortex and moves forward at a rate of 2 to 3 mm/min. Leaó found that noxious stimulation of the exposed cerebral cortex of a rodent produced a decrease in electrical activity, associated with lowered CBF.

**Muscle contraction headache:** Wolff said that the sustained contraction of skeletal muscles of the head and neck was a major cause of headache and other head sensations. Now, TTH is postulated to be a clinical manifestation of a state of abnormal neuronal sensitivity and pain facilitation and not a state of abnormal muscle contraction: pain sensitivity is increased; EMG is increased in some pericranial muscles, independent of headache; and increased EMG activity and tenderness vary independently. Olesen proposed a "vascular-supraspinal-myogenic" model for migraine and TTH. The nucleus caudalis (NC) is the major relay nucleus for head and face pain. In both migraine and TTH, there may be increased supraspinal facilitation of the NC neurons. In migraine, the vascular nociceptor may be hypersensitive; in TTH associated with a disorder of pericranial muscles, the myofascial nociceptor may be more hypersensitive; in TTH not associated with disorder of pericranial muscles, there may be less myofascial nociceptor hypersensitivity and a general increase in nociception.

#### S-6. Is There Such a Thing as TMJ Headache? *JK Campbell* (Department of Neurology, Mayo Clinic, Rochester, Minnesota).

To most neurologists, temporomandibular dysfunction (TMD) simplistically causes pain on opening the mouth, chewing, and talking, and that pain is in the jaw joint and muscles of mastication. Many patients with these symptoms are never even seen by neurologists. In the absence of the above symptoms, most of us probably hardly even consider TMD in the evaluation of a patient with headache. The training of physicians in general pays scant attention to the jaw and dentition. Are we missing the cause of many headaches? It seems unlikely, but warrants a review along two lines. Firstly, can TMD itself be responsible for head pain with or without pain on chewing, etc? And, secondly, can TMD act as a trigger for the primary headaches, migraine, cluster, and tension-type headache? Noxious impulses from the teeth, jaw, TMJ, and muscles of mastication enter the brain through the trigeminal nerve. Could they induce an axon reflex or other activation of the trigemino-vascular system and produce the vasodilation and sterile inflammation of the meningeal vessels so eloquently demonstrated in animals by Moskowitz? This hypothesis and others will be discussed in trying to answer the question — Is there a TMJ headache?

#### S-7. Practical Management of Headache. *JR Saper* (Michigan Head-Pain & Neurological Institute, Ann Arbor, Michigan).

**Specific Aims:** This presentation will review current concepts and management strategies regarding the cause and treatment of chronic headache disorders. This review will consider current

symptomatic and preventive approaches, with an emphasis on the practical aspects of treatment application and the relevance to TMD.

**Methods:** The foundation for treatment will be established by a review of current and accepted theories of chronic headache pathophysiology. Strategies of effective management of headache will include a review of current pharmacotherapy, identifying and treating toxic headache disorders (analgesic and ergotamine rebound states), the presence of co-morbid disease, the identification of compulsive medication taking patterns, a review of the impact of hormones upon the headache mechanism of women, and the basis and criteria for inpatient vs outpatient management.

**Conclusion:** The attendee should obtain from this presentation an understanding of the basis of current, practical management of headache; an understanding of the most relevant theories that relate to the cause of primary headaches; and a general overview for approaching the patient with intractable headache states.

#### S-8. The Magic of Placebo. *RH Gracely* (Neuropathic Pain and Pain Measurement Section, Neurobiology and Anesthesiology Branch, National Institute of Dental Research, National Institutes of Health, Bethesda, Maryland).

The placebo effect is a ubiquitous and mysterious variable in treatment. Patients can improve dramatically after a placebo treatment, with an efficacy equal to the most potent active intervention. The placebo effect is regarded often as a nuisance in research studies, necessitating the use of placebo control groups and strict double-blind administration of treatments. For the practicing clinician, however, the therapeutic magic of placebo can be harnessed to increase the efficacy of proven treatments. The presentation will provide the basic foundation for effective use of the placebo effect, including a discussion of the biological mechanisms underlying placebo responses and the relation between the potency of the "real" treatment and that of a similar placebo treatment. The obvious role of the patient's cognitions will be presented, including expectancies and demand characteristics. The often over-looked role of the care-giver also will be discussed, including evidence that the expectancies of the placebo administrator may be as important as those of the placebo recipient. Finally, the concept of "placebo responder" will be addressed. Is placebo response a trait characteristic related to specific personality variables or merely a situational state characteristic?

#### S-9. Differential Blockade — Neural and Pharmacological. *JD Haddox* (The Emory Clinic Center for Pain Medicine, Atlanta, Georgia).

The concept of differential blockade, that is, determining the mechanism of a particular pain complaint by blocking neural conduction or some other pathophysiologic process, will be explored during this session. Local anesthetic blocks have been employed in the past, and the newest tools in this arena are specific pharmacologic "receptor blocks." Local anesthetic blocks have the potential to be misleading based on placebo effects, systemic effects of the drug, inherent specificity of the block, and operator errors. These pitfalls will be discussed and illustrated. Intravenous drugs, such as local anesthetics and alpha adrenergic antagonists, are also employed in a diagnostic or prognostic fashion. Errors in interpretation of these techniques may occur due to placebo effect and dosage dependent responses. After a general review of these considerations, the appropriate use, performance, and interpretation of these techniques will be discussed in detail.

**S-10. Psychometrics — Why? When? How?** BD Naliboff (Sepulveda Veteran's Administration Medical Center and UCLA, Los Angeles, California).

**Specific Aims:** A variety of psychometric instruments have been used for assessment of patients with orofacial pain. The purpose of this session is to outline a model that includes multiple levels of assessment and to provide empirical data on instruments appropriate for each level.

**Methods:** Psychological and psychosocial assessment of orofacial pain patients can be used for patient screening, treatment planning, and decisions regarding use of invasive and rehabilitation procedures. Information regarding specific instruments for these uses comes from a variety of sources, including studies comparing clinical judgement with testing, studies of prediction of outcome from questionnaire data, and research on psychometric issues of validity, response bias, and conscious positive or negative distortions. Data from each of these spheres will be reviewed in the context of practical assessment in orofacial pain practice.

**Conclusions:** There is no single best assessment technique for all situations. The empirical data clearly supports use of psychometric techniques in addition to clinical information for assessment of complicated and chronic pain patients. Attention to choice of specific assessment questions and issues of validity can make evaluation more accurate, easier, and more productive.

**S-11. Clinical Pain Psychology.** JL Reeves, II (The Pain Center, Department of Anesthesiology, Cedars-Sinai Medical Center and Department of Orofacial Pain, UCLA School of Dentistry, Los Angeles, California).

**Specific Aims:** Psychological evaluation should be a standard part of any chronic pain assessment, even when an organic basis of pain can be documented. It is known that psychosocial and behavioral factors may influence the nature, severity, and persistence of chronic pain and disability. The purpose of this presentation is to detail the essentials of a "physician friendly" psychological evaluation that will result in specific recommendations for medical, dental, and behavioral medicine treatments of orofacial pain.

**Methods:** Psychological evaluations, including appropriate psychometric testing, provide information and recommendations that can guide the medical and dental treatment of chronic orofacial pain. The problem is that traditional psychological evaluations are not usually "physician friendly" and fail to provide information directly relevant to the medical and dental treatment of pain. The assessment of five critical factors that will directly impact the medical and dental treatment of chronic orofacial pain will be detailed. These factors are (1) Behavioral and operant factors; (2) Emotional factors; (3) Side-effects potential to medications and procedures; (4) Medication abuse and use; and (5) Compliance to physical and behavioral medicine interventions. Incorporating these factors into the decision-making process through treatment planning and patient contracting will be described. Data will be provided showing that clinical judgements about the degree of psychological factors impacting treatment is limited without an appropriate psychological evaluation.

**Conclusions:** The psychological evaluation is a critical part of any chronic pain assessment. This presentation will show how such an assessment can directly impact the medical and dental treatment of chronic orofacial pain.

**S-12. Failed Temporomandibular Joint Surgery.** B Sanders (Santa Monica, California).

In 1992, the American Association of Oral and Maxillofacial Surgeons published Parameters of Care for Temporomandibular

Joint Surgery including: Indications for Care, Therapeutic Goals, Factors Affecting Risk, Standard of Care, and Specialty Performance Assessment Indices. These guidelines can be used to establish criteria for success/failure. The reasons for surgical failure include: patient selection, misdiagnosis, surgical procedure selection, intra-operative technical problems, post-operative complications, and post-operative care. There are problems with specific surgical procedures. The management of failed arthroscopy, diskoplasty, and diskectomy patients will be discussed. Management of patients who have had silastic or proplast/Teflon implants will be covered. The multiply operated patient requires a team approach for successful management. Several cases will be presented and treatment options discussed.

**S-13. Medical Management of the Failed Temporomandibular Joint Patient.** SB Graff-Radford (The Pain Center, Department of Anesthesiology, Cedars-Sinai Medical Center and Department of Orofacial Pain, UCLA School of Dentistry, Los Angeles, California).

The problem of failed temporomandibular joint surgery (FTMJS) is perplexing and poses a challenge to clinicians dealing with pain. This lecture will attempt to provide a starting point for clinicians who are faced with these overwhelming problems. There are three groups of FTMJS patients: (1) Technically sound surgery but incorrect diagnoses, (2) Technically failed surgery, and (3) Failed technology. Each group will be addressed describing the medical management strategies. Management may be in the form of (A) Surgery, which will be covered by Dr Bruce Sanders; (B) Neurosurgery, which will be covered by Dr Ronald Young; and (C) Medical management. The medical management depends on the state of function of the patients. Are they working or not and what is the goal of treatment in this regard. The treatments will be discussed in terms of patients needs for additional surgery and their pre and post operative management. Personality profiles will also be reviewed. The review of medical management will include the physical and psychological workup, medications and physical medicine techniques utilized. An emphasis will be placed on pharmacology.

**S-14. Neurosurgical Procedures for Management of Orofacial Pain.** RF Young (Northwest Hospital Gamma Knife Center, Seattle, Washington).

**Objective:** To review the indications and results of newer neurosurgical treatments of orofacial pain. Emphasis will be placed on three approaches: (1) trigeminal ganglion/nerve root stimulation; (2) brain stimulation; and (3) stereotactic radiosurgical thalamotomy with the Leksell Gamma Knife.

**Methods:** Excellent pain relief was achieved in 16/23 patients with orofacial pain of a variety of causes (eg, facial trauma, TMJ, anesthesia dolorosa) by percutaneous implantation of a unipolar electrical stimulation lead on the trigeminal ganglion or posterior nerve root. Follow-up periods ranged from 6-46 months (mean 26 months). These patients had failed to respond to prior less invasive techniques. An additional 24 patients with intractable orofacial pain underwent placement of stimulating electrodes in the periaqueductal grey and/or ventroposteromedial thalamic nuclei. When pain was nociceptive in type, 65% achieved pain relief, whereas when pain was of neuropathic origin, only 40% were successfully relieved. Recently, two patients with intractable orofacial pain have been treated by a non-invasive technique, ie, medial thalamotomy with the Leksell Gamma Knife radiosurgical system, with encouraging results.

**Conclusions:** Several new neuro-surgical techniques are available to treat orofacial pain which is severe and unresponsive to less invasive techniques. These procedures carry low complication rates, which will be discussed.

## Poster Presentations

### P-1. An Epidemiological Study of Headache in Dental College Students. S-C Chung, Y-K Kim, H-S Kim, S-Y Lee (Seoul National University, Seoul, Korea).

**Specific Aims:** Headache is one of the oldest and most frequent ailments known to mankind. A number of people suffer from headache in their daily lives. Our knowledge of the epidemiology as well as in the clinical aspect of headache is very limited. The purpose of this study is to investigate the characteristic features of headache in dental college students of Korea.

**Methods:** We classified headaches of students in relation to the criteria of the International Headache Society (IHS). All of the subjects were dental college students and the number of subjects was 690 (male: 435, female: 255).

**Results:** The prevalence of headache was 40.6% (34.5% in males, 51.0% in females). Among headache sufferers, 69.6% suffered from tension-type headache, 15.6% suffered from mixed (overlap) type headache, and 14.9% suffered from migraine. Twelve percent of headache sufferers had sought professional help, but no one was taking medication regularly. It can be seen that students experiencing headache were predominantly in their 2nd year of study. Headache appeared more frequently in female than in male students.

**Conclusion:** The authors present the epidemiologic data of headache in dental college students. According to this study, approximately 40% of dental college students suffered from headache, and the most frequent type was tension-type headache. Headache seemed to appear in association with psychological stress.

### P-2. Predictors of Treatment Outcome of Patients With Chronic Facial Pain. B Hinderstein, A Korszun, MEK Wong (University of Texas Houston, Health Science Center-Dental Branch, Houston, Texas).

**Specific Aims:** The multifactorial etiology of temporomandibular disorders, especially those associated with chronic pain, can make it difficult to establish diagnoses and develop treatment plans with predictable outcomes. Multidisciplinary clinical studies are needed to identify predictors of treatment outcome.

**Methods:** Chronic pain patients have been seen at the Facial Pain Research Clinic since 1989. A data base was established to ascertain predictors of treatment outcome. All patients had been evaluated by a general dentist, oral surgeon, and psychiatrist. History, examination, and psychiatric interview were recorded with each patient.

**Results:** Preliminary data show a strong correlation between the incidence of depression in patients and their first degree relatives, and successful treatment with anti-depressant medication. In addition, the presence of sleep disturbances characteristic of persons with major depression was associated with an analgesic response to anti-depressants. Other possible predictors of treatment outcome included a history of narcotic analgesic use, substance abuse, bruxism, and eating disorders.

**Conclusion:** A multidisciplinary team with psychiatric/psychological, TMJ, and TMD experience can help identify predictors of treatment outcome.

### P-3. Relation Between Tongue Position in TMJ Internal Derangements. J Mendez, M Saavedra, M Aquino (Universidad Latinoamericana and Universidad Nacional Autonoma de Mexico, Mexico).

Clinical observations indicate that the understanding of the physiology of buccal components is necessary to know the effect on facial bones caused by the direction and type of force generated by the tongue and muscular system. This force can modify TMJ function by inducement of rhythmic discharges in the lateral pterygoid and anterior temporalis muscles, which can cause abnormal mandibular position. The objective of this investigation was to observe tongue position in normal occlusion (C1)

G1) and malocclusion (C1 G2) and evaluate its association with TMJ internal derangements.

**Method:** 220 subjects were studied in two groups by clinical analysis, craniomandibular questionnaire, linear tomography of the TMJ, and placement of a colorant paste on the tip of the tongue while the tongue was at rest and in the swallowing position.

**Results:** In G2 there were statistically significant differences ( $t = 2.78, P < .01$ ) in swallowing position among subjects having TMJ internal derangements with abnormal tongue position, but not in G1. Bow occlusal plane, unilateral mastication, mandibular deviation, and articular overload were observed in 71% of the subjects. In rest position there were no differences, but there was a tendency to place the tongue in an abnormal position. Using TMJ linear tomography, we observed structural modifications, such as erosion and calcification, in the TMJ and the glenoid cavity. In G2 there were differences ( $t = 1.9, P < .05$ ) in vertical condylar changes. There were no changes between vertical right and left condyles in G1.

**Conclusions:** The abnormal tongue position modifies mandibular function, TMJ, jaw, and tooth relationships, as well as muscle activities. This is due to the weak pressure stimulation on the pharyngomandibular reflex from trigger areas for swallowing in the soft palate, root of the tongue, and lateral parts of the palatoglossal and posterior wall of the pharynx.

### P-4. Relationships Between Anterior Tooth Contacts and Cephalometric Profiles in Patients With Craniomandibular Disorders. K-S Han, B-W Kim (Wonkwang University, Iri, Jeonbuk, Republic of Korea).

**Specific Aims:** Many patients with craniomandibular disorders (CMD) have shown anterior open bite with a variable degree at the time of first presentation, but few studies have investigated its nature and/or character; for example, whether the anterior open bite has resulted from temporomandibular joint disturbances or the people who have anterior open bite are more likely to develop CMD. The purpose of this study was to investigate the relationship between existing anterior open bite and craniofacial profile at pretreatment by cephalometric analysis.

**Methods:** 80 patients diagnosed with CMD were collected. To observe occlusal contact pattern, such as contact number, force, and presence or absence of anterior contact, a computerized T-Scan system was used. Also, lateral cephalograms were taken and analyzed for growth pattern, jaw bone relationship, and denture pattern by routine method. The obtained data were statistically processed with SPSS/PC+ program about anterior contact pattern and its correlation to craniofacial profile.

**Result:** Patients who have no anterior tooth contacts revealed a tendency of indicating downward and backward growth pattern with regard to growth pattern and jaw bone relationship, but as to denture pattern, there was no statistically significant difference between the presence and absence of anterior tooth contact.

**Conclusion:** From this study, it could be suggested that the CMD patient with anterior open bite at pretreatment time may have skeletal discrepancy rather than dental discrepancy, and they are also likely to develop more increased anterior open bite during or after occlusal splint therapy, because occlusal splint therapy increases vertical dimension.

### P-5. Quick Pain Palpation Test Sites for the TMD Screening and Monitoring. Y Hatano, Y Marumo, E Hashiguchi, S Yokozuka (Crown & Bridge, The Nippon Dental University School of Dentistry at Tokyo, Japan).

**Specific Aims:** The purpose of this study was to determine a combination of a relatively small number of sites useful in evaluation of TMD patients in screening and in monitoring throughout treatment.

**Methods:** 75 TMD patients (age range 16-73 years, 61 female and 14 male) who visited our Department at NDU Hospital were used in this study. We examined 34 palpation sites. Tenderness was classified 0 to 3 according to the severity of response. Non-

parametric statistics were used to compare pain levels before treatment and at the end of the stabilization-type splint therapy. The z values from the one-sample Wilcoxon test before-after treatment, the Spearman's rank correlation coefficient from between pain levels of each site before and after reduction of pain, and the sum of various sites before and after treatment were calculated, and the total sum of the z value in each site and difference between sites were examined. Several combinations of sites were made with those two results. Correlation between the results from all sites and selected sites were compared.

**Results:** Correlations between total sum and sum of 5 sites, 7 sites, and 13 sites before treatment were 0.86, 0.89, and 0.94. Correlations between total sum and sum of 5, 7, and 13 sites in reduction of pain were 0.71, 0.76, and 0.80. Correlations between total sum and sum of 5, 7, and 13 sites in difference between sides were 0.66, 0.78, and 0.87.

**Conclusion:** A relatively small number of sites can give information about patients' TMD status. Those sites would be useful in screening and monitoring of the patient.

**P-6. Characteristics of Temporomandibular Joint Disorder in Edentulous Patients.** L Hongchen, L Ning, Z Jilin, et al (General Hospital of Chinese PLA, Beijing, China).

The edentulous jaw is in a special occlusion before or after the complete denture is in place. The purpose of this study was to determine the characteristics of temporomandibular joint disorder (TMD) in edentulous patients. 123 edentulous patients, 91 in both jaws and 32 in the maxillary or mandibular jaw, were studied to complete a questionnaire and all were subjected to clinical examination of the function of the masticatory system. The result shows that the incidence of TMD is 28.6% in patients edentulous in both jaws and 31.3% with dentia or mandibular jaw patients. It is different from the TMD with dentia in the order and degree of symptoms. In the edentulous temporomandibular joint disorder (ETMD) patient, the most common symptom is TMJ noise. Others are deviation of mandible rather than limited opening and sensitivity in the lateral pterygoid muscle rather than pain in temporomandibular joint (TMJ) area. There is no obvious relationship between the symptoms of headache, earache, eye pain, and nose or throat disturbance and TMD in this group of patients. The Schuller's position radiographs on both sides of the TMJ were made for 20 ETMD patients to observe the condyle position copaired with normal result. It indicates that the condyle is in a retruded position in the glenoid fossa and the position of bilateral condyles is asymmetric in the ETMD patient. According to this study, the occlusion is not an important cause for TMD only, but there are some relationships with the symptoms of TMD, especially for the sign of pain in the TMJ area. As the result of this study, the treatment of the ETMD patient is also different from that of the TMD patient with natural teeth in place.

**P-7. Primary Fibromyalgia Syndrome in TMD Patients.** GA Kaspo, RA Pertes (University of Medicine and Dentistry of New Jersey).

**Specific Aims:** Patients seeking help for TMD problems come with more than one problem. Often times they present when the pain is severe or becomes chronic. Very few studies have used statistical procedures to identify if any relationships exist between TMD patients and primary fibromyalgia syndrome patients. The purpose of this study is to determine the number of patients with symptoms related to TMDs who might also have coexisting primary fibromyalgia syndromes (PFS).

**Methods:** 460 patients (age range 11 to 90 years) were diagnosed with TMDs according to specific criteria. A one-page Patient Health Assessment Questionnaire (PFAQ) was reviewed, and 20 questions were asked to determine any correlation between patients suffering from TMD and PFS. The questions were divided into various groups that related to PFS and could be answered never, sometimes, often, or almost always. Three additional questions were asked: the first was about the length of

TMD symptoms; the second was about changes in weight; and the last addressed whether the symptoms related to accident, surgery, stress, or had no apparent cause.

**Results:** Results revealed that 78.5% of TMD patients were female and 21.5% were male. The duration of pain was 19.5 ± 21.5 months. 5.6% of the TMD patients were suspected of being PFS patients. The results also indicated that there is no relationship between the pain level, the associated cause of pain, and the total symptoms of PFAQ; this holds for each of the sexes. Additionally, the study indicated that there is a relationship between the level of age, total symptoms, and pain duration in months for female patients between 30 and 39 years old and for male patients between 40 and 49 years old.

**Conclusion:** A definitive diagnosis for each patient was not available. These results suggest that there may be a relationship between TMD and PFS.

**P-8. Thermographic Assessment of Neuropathic Facial Pain: A Pilot Study.** SB Graff-Radford, MC Ketelaer, BM Gratt, WK Solberg (UCLA School of Dentistry, Los Angeles, California).

**Specific Aims:** The purpose of this study was to determine if electronic thermography (ET) was able to differentiate neuropathic facial pain.

**Methods:** Patients diagnosed with atypical odontalgia (AO), traumatic neuralgia (TN), trigeminal neuralgia (TIC), pre-trigeminal neuralgia (PTIC), and those with pulpal pain without periapical pathology (TA) were compared with normals using ET. Inclusion criteria used are described by Graff-Radford and Solberg.

**Result:**

Diagnosis	(n)	Age	Thermal result	Sensitivity/specificity
AO	10	58	Hot	100/100
TN	14	55	Hot	100/100
TN	15	51	Cold	80/100
TIC	6	42	Normal	0/100
PTIC	4	51	Normal	0/100
TA	9	40	Normal	89/100
Normals	22	47	Normal	100/100

Normal ET: Change T ± 0.2°C; Abnormal ET: Change T ± 0.4°C or greater.

**Discussion:** It appears from this data that ET is helpful in the differentiation of neuropathic facial pain. In the TN group there is a significant finding of these patients falling into either a hot or cold group. The possible pathophysiological and treatment differences will be discussed. Future research to better define the pathophysiology will also be described.

**P-9. Clinical Presentation of Traumatic Neuralgia.** SB Graff-Radford, YJ Kim (UCLA School of Dentistry, Cedars Sinai Medical Center, Los Angeles, California).

Traumatic neuralgia has been described by Graff-Radford and Solberg as a continuous, burning numbness and often pulling pain that is blockable with local somatic block. The trauma is usually quite obvious, eg, post wisdom tooth removal or post implant placement. The discomfort can be self limiting, depending on nerve regeneration.

**Aims:** This study reviews the demographic and clinical presentation of patients diagnosed with traumatic neuralgia attending The Pain Center, Cedars-Sinai Medical Center.

**Methods:** 44 consecutive patients diagnosed with TN were reviewed following history and physical and diagnostic workup.

**Results:** n = 44; age: 54.2 ± 17.4; sex: female = 32 (72.2%), male = 12 (27.3%); duration: 45.4 ± 33.7 months (n = 41); trauma type: extraction 5 (13.9%), fracture 4 (11.1%), crown or bridge 4 (11.1%), surgery 5 (13.9%), root canal 8 (22.2%), others 5 (13.9%); location V1 0%, V2 (18) 50%, V3 (18) 50% (n = 36); hyperesthesia 33 (97.1%) (n = 34); sensory change (pin-prick): 4 (23.5%) increased, 13 (76.5%) decreased; thermogram:

hot 14 (48.3%), cold 15 (51.7%); block somatic (>60% reduction) 100%; treatment response 9 (81.8%) improved by self report.

**Conclusion:** Traumatic neuralgia is characterized by a continuous, blockable pain with associated hyperesthesia and an asymmetrical thermogram. Further evaluation of this disorder is needed.

**P-10. Clinical Evaluation of Pressure Pain Threshold (PPT) on Masticatory Muscles and Temporomandibular Joint Tenderness.** S. Masumi, M. Ozamoto, GT Clark, M. Morikawa (Kyushu Dental College, Japan and UCLA Dental Research Institute).

**Specific Aims:** The purpose of this study was to determine the normal range of PPT in normal subjects and to evaluate whether PPT changes occur in subjects with and without temporomandibular disorders (TMD).

**Methods:** 10 TMD patients, who were diagnosed at Kyushu Dental College Hospital, volunteered for this research. 10 normal subjects were derived from staff and students at Kyushu Dental College. An eight-item questionnaire was used to assess the level of jaw pain. The highest possible score is 32 points. A total score of the patient (P) group was more than 9. Tenderness of superficial masseter (MM), anterior temporalis muscle (TM), and lateral capsule (LC) was measured. A pressure algometer was used for determination of the pressure level necessary to reach pain threshold with a constantly increasing rate of pressure 0.5 kg/s until the subject experienced the first occurrence of pain. The resulting data was evaluated using *t* test at the 1% level.

**Results:**

	P Group (N = 10)		C Group (N = 10)		P Value ( <i>t</i> test)
	Mean	SD	Mean	SD	
PPT (kg/s)					
MM	1.67	0.54	2.14	0.85	.0982
TM	1.99	0.48	2.38	0.76	.0955
LC	2.08	0.46	2.59	0.81	.0469

**Conclusion:** Results showed relatively small and non-significant differences in PPT between two groups and indicated that PPT was influenced by other factors.

**P-11. Cough Headache Presenting as a Toothache: A Case Report.** E. Moncada, SB Graff-Radford (UCLA School of Dentistry).

Benign cough headache (BCH) presents as an intermittent, usually bilateral, severe bursting or explosive pain brought on by coughing. Some known conditions that can mimic the pain experienced in BCH are subarachnoid hemorrhage, increased intracranial pressure, intracranial tumors, and even toothache. Careful evaluation must be carried out to differentiate between these conditions. A case of a 45-year-old physician suffering from an intermittent pain located in the right maxillary region with radiating patterns to the ipsilateral temporal region as well as the ear and back of the head presented to The Pain Center, Cedars-Sinai Medical Center. He had described the pain as occurring up to 20 times per day. Treatments had included root canal therapy on two teeth as well as an extensive imaging workup. After careful evaluation he was diagnosed with BCH. He was treated with indomethacin at 75 mg per day with complete relief. Although BCH is usually benign, it is of particular importance to rule out other possible intracranial causes for this pain.

**P-12. Frequency in Migraineurs of: Various Headache Trigger Factors, Depression, Anxiety, Insomnia, Cold Extremities, and Efficacy of Biofeedback.** L. Robbins (Robbins Headache Clinic, Northbrook, Illinois).

The purpose of this study was to assess the impact of various headache triggers on migraine patients. Headache questionnaire reviews were reviewed in 494 randomly selected migraine patients, 393 women and 101 men, aged 16 to 65. The following

table summarizes the percentage of patients affected by various trigger factors. These will be discussed at the meeting.

Trigger Factor of Clinical Characteristic	Female (n = 393)	Male (n = 101)	Combined (n = 494)
During stress	64%	54%	62%
Weather changes	47%	32%	43%
Increase perimenstrually (women only)	50%	—	—
Missing a meal	43%	31%	40%
Sunlight	40%	31%	38%
Undersleeping	33%	23%	31%
Foods	31%	28%	30%
Perfume	34%	10%	29%
Cigarette smoke	29%	13%	26%
After stress is over	25%	22%	24%
Oversleeping	26%	19%	24%
Exercise	14%	16%	15%
Sexual activity	4%	9%	5%
Spring	15%	8%	14%
Summer	13%	3%	11%
Fall	15%	4%	13%
Winter	8%	5%	7%
Significantly colder hands and feet than normal	65%	33%	58%
Biofeedback helped	14 of 81	1 of 11	15 of 92
Biofeedback was of no help	67 of 81	10 of 11	77 of 92
Anxiety — mild	59%	55%	58%
Anxiety — moderate	45%	50%	46%
Anxiety — severe	43%	43%	43%
Patients are often depressed	12%	5%	11%
Insomnia — difficulty going to sleep	21%	12%	19%
Insomnia — difficulty staying asleep	28%	23%	27%
History of asthma	6%	6%	6%

**P-13. Psychometric Profiles and Related Disorder Characteristics of TMD Patients.** K. Wajima, T. Nanami, H. Kogai, H. Nakagawa (University of Keio, Tokyo, Japan).

**Specific Aims:** Psychologic factors have been considered as important contributors to TMD. However, few studies have analyzed how psychologic factors contribute to the etiology and maintenance of TMD. The purpose of this study was to examine subject groups identified with psychometric profiles for differences in TMD symptoms and sleep disturbance.

**Methods:** A group of 100 consecutive patients, presenting with complaints of masticatory disorders, received a complete physical examination that included assessment of muscle tenderness and joint soreness. The degrees of physical symptoms were represented by scores, and the myogenic disorder ratio was calculated by dividing muscular symptom score by total score. In addition, each patient was administered the Japanese version of The General Health Questionnaire (DP Goldberg, 1972), and two psychologically discrete groups were established. Sleep disturbance was also analyzed. The groups were compared as to their myogenic disorder ratio and their scores on the sleep disturbance analysis.

**Results:** The results revealed that patients with abnormal psychologic profiles scored significantly higher on the physical examination of TMD and on the sleep disturbance analysis, and this group also showed higher myogenic disorder than the normal psychologic profile group. In the abnormal psychologic profile group, the patients who were mainly suffering from myogenic disorders scored significantly higher on the sleep disturbance than the patients who were suffering from arthrogenic disorders.

**Conclusion:** It was suggested that the prevalence of myogenic disorders is greater in patients with abnormal psychologic profile. In these patients, sleep disturbance may act as the principal factor of etiology and maintenance of myogenic disorders.

**P-14. Study on the Activity Patterns of Masticatory Muscles According to the Levels of Occlusal Force During Unilateral Chewing.** BG Kim, WC Kee (Chonnam National University, Kwangju, Korea).

**Specific Aims:** Many studies have evaluated electromyographic activities of the masticatory muscles during chewing, but they have not fully investigated the muscle activity patterns of masticatory muscles according to the levels of occlusal force during function, especially during unilateral chewing. The purpose of this study is to evaluate masticatory muscle activity patterns during unilateral chewing.

**Methods:** We examined 21 individuals ranging from 23 to 27 years of age. They were selected according to the following criteria: (1) no symptoms of temporomandibular disorders, (2) complete dentition except third molars, (3) normal or Angle's class I molar relationship, and (4) no experience of dental treatment. The electromyographic amplitudes were measured on the masseter and anterior temporalis muscles during unilateral clenching at the levels of 10%, 20%, 30%, 40%, and 50% of the maximum occlusal force by use of electromyogram (EM2, Myotronic, USA) and bite force meter (MPM-3000, Nihon Kohden, Japan). The muscle activity index and muscle asymmetry index were calculated from the muscle activities of the masseter and temporalis anterior muscles.

**Results:** (1) In the muscle activity indices of masticatory muscles of the clenching side at the levels of 10%, 20%, and 30% of the maximum occlusal force, the activity of the anterior temporal muscle dominated the activity of the masseter muscle, but at the levels of 40% and 50%, the masseter was dominant over the anterior temporal muscle ( $P < .001$ ). In the non-clenching side, the activity of the masseter was dominant at all levels. (2) In the masseter muscle, asymmetry indices of muscular activity at the levels of 10% and 20% of maximum occlusal force were showing that the muscular activities of the non-clenching side were dominant. At the levels of 30%, 40%, and 50%, muscular activity was dominant on the clenching side ( $P < .001$ ). In the anterior temporal muscle, asymmetry indices were showing that the activity of the clenching side dominated the activity of the non-clenching side at all levels ( $P < .001$ ).

**Conclusion:** The muscle activity index and muscle asymmetry index were changed according to the clenching level during unilateral chewing.

**P-15. Some Postural Changes of the Mandible During Mastication.** A Lewin (Witwatersrand University, Republic of South Africa), J Booth (USA), W Evans (Witwatersrand University).

**Specific Aims:** Clinical studies of relatively unconstrained movements of the jaws during masticatory function have, in the main, been confined to the observation of the movements of isolated points, most commonly one in the region of the lower incisors. These investigations provide information on the point being observed and not the rolling, pitching, and yawning motions (posturing) expected of the mandible, which has the potential to rotate about all 3 axes.

**Methods:** It is possible to measure rotations about vertical and anteroposterior axes passing through the magnet used by some electrogoniographs. Since the magnet is attached to the mandible and the axes of rotation of any two base points in a body are parallel and the angles formed about them are the same (EJ Routh, Dynamics of a System of Rigid Bodies, New York: Dover, 1905), it follows that the postures of the magnet are an acceptable reflection of those of the mandible. Data on these parameters have been collected from at least three independent sources (20 x 18 records minimum), one set being derived from patients with orofacial pain (OFP). The age- and sex-discriminated data are examined by computer for the prevalence of 8 distinctive postures.

**Results:** Mandibular postures in space vary from moment to moment during mastication and infrequently, if ever, substantiate

the notion of condyles tracking back and forth along defined paths in unyielding joint environments.

**Conclusions:** The jaw postures that occur when subjects with or without OFP are instructed to make simple open/close or lateral movements do not reflect their range of natural postures.

**P-16. Elevated Serum Peripheral Nerve Anti-Myelin Antibody Titers in Atypical Facial Pain Patients with NICO.** R McMahan, J Bouqurot, J Griep (Merrillville, Indiana).

**Specific Aims:** Immunologic studies have shown that many myelin components become antigenic when their protective endoneurial sheath is damaged or torn. These "exposed" myelin elements bind to IgM antibodies and trigger an immunological reaction that activates complement, thereby generating inflammatory mediators and membrane-attack complexes capable of causing further destruction of myelin and contributing to an ongoing inflammation in the alveolar bone. The purpose of this study is to measure serum anti-myelin antibody titers in patients suffering from Atypical Facial Pain (AFP) who subsequently were diagnosed with NICO — Neuralgia inducing Cavitation Osteonecrosis of the alveolar bone of the jaws.

**Methods:** Serum samples from 60 patients with chronic facial pain of unknown origin were evaluated for circulating anti-myelin antibodies using indirect immunofluorescence as a screening test. In addition, sera from Group I (15 cases) were then subjected to enzyme-linked immunosorbent assay (ELISA) to determine which myelin fraction was demonstrating immunoreactivity; while Group II's sera (10 cases) was analyzed by using the complement component -1- fixation and transfer (C1FT) assay to determine specific antibodies to Peripheral Nerve Myelin (PNM). Group III (10 cases) consisted of pain-free healthy controls.

**Results:** The proportion of patients having circulating anti-myelin antibodies using indirect immunofluorescence was normal for the IgG (80%) and IgA (20%) subtypes but deviated significantly from the general population with regard to IgM. Instead of an expected 20%, we found that 60% of these patients had detectable levels of IgM anti-myelin antibodies circulating in the serum. 2 of the 15 patients from Group II demonstrated some immunoreactivity with GM and AGM gangliosides, while 8 out of 10 patients in Group III had elevated (> 7) anti-PNM antibody titers.

**Conclusion:** Preliminary data suggest that patients with AFP have a chronic neuritis of the dental and/or alveolar nerves of the jaws and that auto-immune disease mechanisms at the site of peripheral nerve injury further contributes to their demyelination, sensitization, and algisia.

**P-17. A SPECT Study of Functional Brain Activity During Nonpainful and Painful Stimuli.** E Moncada, BD Naliboff, RR Lake, AG Pullinger (UCLA School of Dentistry, Palo Alto, California).

The purpose of this study was to validate single photon emission computerized tomography (SPECT) as a functional brain imaging method to study central pain processes and to determine the correspondence of areas active during painful versus nonpainful stimuli with those previously found using Positron Emission Tomography (PET). Eight right-handed, healthy males, ages 31 to 55, served as subjects for this study. During one session, (randomized) subjects received 6.5 minutes of an intermittent (5 sec) painful thermal stimulus, which was applied to the underside of the right forearm, and during the other session (more than two days separation), a nonpainful warm stimulus was applied. After each stimulation period, a Visual Analogue Scale (VAS) for the intensity and the unpleasantness of the sensation and a Spielberg state anxiety questionnaire were completed. Significantly greater activation for the painful versus the nonpainful condition was found in the areas which correspond to the anterior cingulate gyrus and the contralateral primary somatosensory (SII) cortex. There were no significant differences found in the thalamus, lenticular nuclei, frontal cor-



tices, motor cortices, or the ipsilateral SI cortex. The VAS ratings for the intensity and unpleasantness were significantly greater for the painful stimulus period versus the nonpainful stimulus period. There were no significant differences between the two conditions for the Spielberger state anxiety. Activation in the contralateral motor cortex was dependent on the order in which the conditions were applied. The results indicate significant increased activity in specific cortical and subcortical structures involved in pain processes, as assessed by SPECT, when a noxious heat stimulus was compared to a nonpainful warm stimulus. The results of this SPECT study are similar to past PET studies that utilized transient stimuli. SPECT is supported as a method with which to continue studies of central pain processes. Areas of future investigation might include fibromyalgia, myofascial pain, headache, and chronic orofacial pain conditions.

**P-18. Treatment of Dysesthesia of the Face Following Neural Trauma.** D. Canavan, SB Graff-Radford (Department of Orofacial Pain, UCLA, Los Angeles, California).

This abstract describes the treatment of facial dysesthesia following neural trauma secondary to surgery. It is not uncommon for patients to have an altered sensation in the distribution of the trigeminal nerve following surgery. This has been reported in response to orthognathic surgery, extraction, root canal therapy, and plastic surgery and even following crown preparation. The sensation is usually described as a continuous uncomfortable prickling or burning that begins immediately following trauma. The sensation is limited to the dermatomal distribution of the injured nerve. When uncomfortable, the sensation is called a dysesthesia, when present without discomfort it is called a paraesthesia. Three cases are described, all of whom had a dysesthesia following trauma. The workup of each patient included a history and physical examination, appropriate x-rays to rule out local pathology, thermography, and nerve blocks. Treatment included topical application of zoxtrix (capsaicin) 5 times per day for 1 week and 3 times per day following this. Desipramine or nortriptyline were used for their pain modulating effects. All three patients reported excellent benefit. The pathophysiology of dysesthesia and differential diagnosis will be described.

**P-19. Stereotactic Neurosurgery With Implantation of Deep Brain Stimulator for Failed TMJ.** J. Chodakiewitz, P Rinaldi (University of California, Irvine).

**Specific Aims:** Just as there are failed backs, there are other parts of the body that not infrequently fail. We want to present the clinical case of a 44-year-old female who had her first TMJ operation in January of 1971. Since then, until the time she presented for neurosurgical consultation for the management of pain, she underwent a total of 24 TMJ surgeries and was in the process of being scheduled for more TMJ procedures. In spite of all these procedures, the patient presented with severe headaches, depression, limited opening of the mouth, and extreme pain on eating and talking. On an analog scale of 0 to 10 (0 = no pain, 10 = worst pain), she was at a constant 9, with exacerbations to 10. The patient was unable to work, on Demerol with tolerance, and had tried "all" other alternatives; she reports having been seen by more than 100 doctors. She was told to live with her pain and had even tried to overdose on medication.

**Method:** The patient underwent neuropsychological testing and was considered a good candidate for DBS. Under local anesthesia, the Leksell frame was used. A stereotactic MRI was obtained preoperatively, and a CT was obtained postoperatively. Coordinates were selected for periventricular gray (PVG) target. The procedure was done through a bur hole with stereotactic precision, using the patient's cooperation while doing microelectrode recording and stimulation of the target site. A Medtronic DBS electrode was implanted. A trial of 6 to 7 days

was used to assess the effect of stimulation on pain. At a second-stage surgery, under general anesthesia, the electrode was internalized and connected to an INTREL II unit (Medtronic neuropacemaker, all internalized).

**Results:** The patient reported initially more than 50% of analgesia. With further fine tuning of the stimulation programming, it has improved to a point where the patient is 80% to 90% free of pain, on no medication, and without depression. In a letter she stated, "I am pain free as long as I have the Medtronic portable programmer on."

**Conclusion:** In severe cases of "failed TMJ" and before patients are at this extreme, consideration should be given to the various neurosurgical alternatives for the control of pain, which probably lead to less patient suffering and more cost effective treatment.

**P-20. Chairside Fabrication of Occlusal Bitesplints Using Visible Light-Cured Material.** J. Dos Santos, M Gurklis (University of Texas Health Science Center at San Antonio, San Antonio, Texas).

**Specific Aims:** As an alternative for immediate occlusal bite-splint construction, clear TRIAD VLC Trans-sheet material (Dentsply/York Division Tab Products, York, PA 17405-0872), can be used when the appliance is needed urgently.

**Methods:** Construction of a maxillary occlusal bite-splint (stabilization type). A plate of the material is adapted to the cast to produce a thin splint coverage area and cured in the light-cure unit. It is removed from the cast and placed in the patient's mouth for fitting and retention adjustment. With the plate in position, separators are placed on each side of the posterior segments of the arch to assess the thickness of the appliance. Once the vertical dimension is determined, uncured material is applied to the anterior portion of the plate. The patient closes the jaw to contact the soft material with the separators in position. The mass of material can be smoothed and cured using a light wand. Fresh material is applied to both sides of the posterior segments of the plate with the anterior part providing the stop. With the appliance in the mouth, gross imperfections are removed and the freshly added material is cured using a light wand. All incisal edges and supporting cusps of the opposing arch will have at least one stop in centric. Excursive guidance can then be incorporated. Finally, the material is left to cure in the unit for 20 minutes.

**Advantages:** Because it is light activated, this material can be nearly perfected prior to the polymerization. Appliance may be fabricated and delivered in the same appointment. Minimal exposure to free monomer is encountered. Expense is reduced due to limited involvement of laboratory work.

**Disadvantages:** TRIAD VLC material not completely cured may produce a bad taste. In cases of limited mouth opening due to dysfunctions, the obtention of a cast may present some difficulties. The temporary use of an anterior "jig" which can be fabricated directly in the patient's mouth can be necessary.

**Efficacy:** Our limited experience in the use of appliances fabricated with this material presents no problem, although it seems to be less resilient than the regular acrylic. There is good patient compliance with its use.

**P-21. Masticatory Function in Growing Subjects With Malocclusion Before and After Treatment.** W. Schmid, A. Felisio, F Mongini (Center for Craniofacial Pathophysiology, University of Turin, Italy).

**Specific Aims:** This study examines whether and how during growth masticatory function is affected by malocclusion and its treatment.

**Methods:** Jaw movements and EMG masseter activity were recorded with a Syrognathograph and surface electrodes in 20 growing subjects with malocclusion and 28 normal subjects matched for age and sex. The following parameters were examined: the number of times the intercuspal position (ICP) was

reached, the mean displacement from ICP at the end of closing, and the pattern of masseter contraction (isometric vs isotonic) in the last phase of closure. This was calculated by comparing mean EMG activity in the 2nd stage of closure with that of the 3rd stage (2nd > 3rd = more isotonic; 2nd < 3rd = more isometric). Data of the patient group were compared with those of the normals (student *t* test). The patients were then treated (repositioning splint and orthodontic treatment, as needed) and mastication was examined after treatment and again after a further mean interval of 19.2 months.

**Results:** Compared to the normals ( $P < .05$ ) before treatment the patient group showed a lower number of closures in ICP, a higher mean distance from ICP at the end of closure, and a lower masseter isometric contraction. After treatment data showed a gradual normalization (ANOVA and Bonferroni).

**Conclusion:** It is concluded that malocclusion may alter masticatory function, and that its treatment may have beneficial effects.

#### **P-22. Multiple Operated Patient.** D. Hoffman (Staten Island, New York).

Patients who have undergone multiple surgical procedures on the TMJ are otherwise known as multiple operated patients. These patients have increased in number and are not uncommon to the active clinician. This problem has been further complicated by the unfortunate Vitek/Proplast incident. The multiple operated patient presents as a difficult challenge for the surgeon and TMJ clinician alike. This paper will review over thirty patients who have each undergone more than four surgical procedures per joint and some of the common problems experienced by these patients. The study has looked at the multiple operated patient population from several different aspects. Etiology has been evaluated and grouped according to MVA, trauma, degenerative joint disease, or other related problems. The group was further divided into Proplast and non-Proplast patients. Several cases presented in this study illustrate the variety of surgical problems encountered. The incidence of true surgical complications was evaluated and is shown to be low compared to the incidence of chronic pain in the multiple operated patient. One of the more interesting aspects of this study showed that each patient initially presented with a single chief complaint and evolved into a multiple complaint group which, as a rule, included drug dependency and the diagnosis of a chronic pain patient. The use of total joint prostheses in the treatment of these patients will be evaluated and discussed as part of their overall care. Conclusions drawn from this study are as follows:

1. It is difficult to predict from the onset which patients will have multiple procedures.
2. The surgeon and non-surgeon must have a strategy in approaching any TMJ surgical patient and subsequently avoid multiple joint procedures.
3. It is best to recognize chronic pain patients and treat the incidence of these problems.
4. RSD is a common diagnosis for these patients and this must be recognized early and treated.
5. The use of total joint prostheses and limiting the number of TMJ surgeries should be inherent in treatment planning from the onset.

In summary, this abstract should acquaint its audience with an understanding of the multiple operated patient. Recognition will hopefully initiate the process of elimination of the multiple operated patient, also known as a surgical misadventure.

#### **P-23. Stellate Ganglion Block for Temporomandibular Disorders.** Y. Imamura, S Masumi, M Nishi, M Morikawa (Kyushu Dental College, Kitakyushu, Fukuoka, Japan).

**Specific Aims:** Temporomandibular disorders (TMD) display various symptoms. This study is designed to assess the effect of stellate ganglion block (SGB) on the following symptoms of TMD: masticatory muscle pain, joint pain, and mouth opening disturbance.

**Methods:** Seventy-one patients diagnosed with TMD were examined in this study. Thirty-one patients were treated with stabilization type splints (Splint group), forty with SGB plus stabilization type splints (SGB group). In the SGB group, SGB was performed from the first day of treatment until the treatment was completed, splint therapy was introduced from the second day of treatment. Pain relief scores were used for determining the degree of pain. The pain degree was defined as 10 at the first visit, then indicated as an integer by the patients themselves on every visit, from 0 to 9 when there was pain relief and from 11 when exacerbated. Mouth opening distance without pain was also measured on every visit.

**Results:** Both in the Splint group and the SGB group, muscle pain relief, joint pain relief, and improvement of jaw movement were all observed. Masticatory muscle pain on function showed greater improvement in the SGB group than in the Splint group. SGB improved the degree of relief from all of the examined symptoms from the first day of treatment; splint therapy, however, took several days before any improvement was observable.

**Conclusion:** SGB is useful for the treatment of TMD by its immediate effect on muscle pain and joint pain.

#### **P-24. Rehabilitation of the Temporomandibular Joint Through the Application of Motion.** W.L. McCarty Jr., M Darnel (Montgomery, Alabama and Atlanta, Georgia).

**Specific Aims:** The application of motion to specific intra-articular disorders was used as both post-operative rehabilitation and as definitive/adjunctive type therapy. Post-operatively, the addition of a continuous passive motion device was compared to exhaustive physical therapy incorporating primarily active motion in addition to standard physical therapy modalities such as ice, heat, ultrasound, and galvanic stimulation.

**Methods:** 162 patients were used in the study, 60 patients were initial open joint surgery with 30 used for the control, 40 patients had undergone multiple surgical procedures with 20 used for control. 18 patients had undergone bilateral total joint replacements with a like number used for control. 26 patients were studied in the category of definitive/adjunctive therapy. No control group was used in this category, as the failures either abandon therapy or received other types of therapy such as surgery, arthroscopy, etc.

**Results:** Results showed an improvement in range of motion in all three surgical categories utilizing the CPM device. The most favorable category was the initial surgery group.

**Conclusions:** It is highly likely that surgical failure and lack of adequate post-operative rehabilitation are closely linked. A major objective of any invasive procedure is to insure that the first procedure is successful, otherwise with each repeat procedure the success rate drops dramatically. The rehabilitation also has application in treatment of intra-articular disorders as definitive/adjunctive type therapy.

#### **P-25. The Conservative Treatment of Disc Displacement Without Reduction. Short- and Long-Term Results.** E. Monzini, F Ibertis, A Manfredi (Center for Craniofacial Pathophysiology, University of Turin, Italy).

**Specific Aims:** Our purpose was to explore the extent to which disc displacement without reduction can be successfully treated without surgery.

**Methods:** The patient group consisted of 97 patients (11 men, 86 women, mean age 28.8, range 11–61) consecutively treated in the last five years with a modified mandibular manipulation, orthopedic splint, and physical treatment, as needed. Maximum mouth opening (mm) and the presence of pain (score 0 to 5) were recorded before treatment and after treatment (short-term, that is, after a mean period of 12.44 months since the onset of treatment). In 55 patients, long-term data could be also obtained (after a mean period of 50.53 months since the end of

treatment). Statistical analysis was performed with paired *t* test and ANOVA.

**Results:** Mean mouth opening increased from 29.81 before treatment to 42.67 at short term ( $P < .001$ ) and pain went from 2.59 to 1.2 ( $P < .001$ ). The patients in whom long-term data were collected showed the same trend; no significant difference was found between short- and long-term data.

**Conclusion:** Disc displacement without reduction can be successfully and permanently treated by conservative means in most cases.

#### **P-26. Surgical Management of Refractory Craniomandibular Pain Using Radiofrequency Thermolysis. S Wilk (Center for Headache and TMJ Disorders, Denver, Colorado).**

**Specific Aims:** Radiofrequency thermolysis (RFTN) has traditionally been used, with favorable results, to treat pain disorders primarily in the low back and cervical areas. The purpose of this study is to show the application and efficacy of RFTN treatment of temporal tendonitis, stylomandibular ligamentitis, and occipital myalgia-neuralgia when conservative, nonsurgical attempts have failed.

**Methods:** Thirty patients were used in this study. Following a history, examination, imaging, and results of previous treatment, 21 patients were diagnosed with temporal tendonitis, 14 with occipital myalgia-neuralgia, and 4 with stylomandibular ligamentitis. Criteria for selection in this study included the following: prior nonsurgical care was unsatisfactory, and, on a scale of 1 to 10, the patients rated their pain greater than 7 for at least 7 months. The diagnosis was confirmed following total pain relief after anesthetic injection into the specific sites. Clinical technique included visualizing the tendon or ligament insertion under fluoroscopy, placement of the radiofrequency neuroprobe, electrical stimulation to avoid motor nerves, and thermolysis, which

causes selective denaturation of A delta and C nerve fibers and decreases trigger points.

**Results:** 96.6% of patients had 75% to 100% pain relief at the 1 to 3 year follow-up; 3.4% had 50% relief; and none had the same or worse pain following RFTN.

**Conclusion:** RFTN was found to be safe, effective, and predictable for management of chronic pain disorders following proper case selection criteria.

#### **P-27. Relative Efficacy of Orthotic Therapy, Physical Therapy, and a Combination of the Two in the Treatment of Non-Derangement Temporomandibular Disorders. J Colt, S Winber (Denver, Colorado).**

**Specific Aims:** Controversy continues regarding the efficacy of splint therapy, need for physical therapy as an adjunct to orthosis, and possible benefits of combined therapy. The purpose of this study was to determine the relative efficacy of all three of the above alternatives on symptom resolution and duration of therapy.

**Methods:** 150 patients diagnosed with non-derangement temporomandibular joint and associated myofascial complaints were treated by (a) orthosis with no or minor physical therapy modes, (b) physical therapy exclusively, (c) a program of orthotic therapy coupled with a comprehensive regimen of associated physical therapy. Criteria utilized were total time of treatment and resolution of symptoms, based on recorded patient history.

**Results:** None of the three treatment protocols produced clearly superior results, in terms of rapidity of reaching maximum medical improvement. However, the combined method appeared to produce a higher level of improvement, as well as more positive patient input.

**Conclusion:** Coordinated orthotic and physical therapy appears to offer the most comprehensive and satisfactory resolution of orofacial symptoms, although speed of recovery may not be materially affected.

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