

AAOP 2006 Annual Conference

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Selected Abstracts

Hierarchical Tree Clustering of Facial Tactile Stimuli: A Magnetoencephalography (MEG) Study. Ioannis Koutlas, DDS, MS; Aurelio Alonso, DDS; Elissaios Karageorgiou, MD; Arthur Leuthold, PhD; Apostolos Georgopoulos, MD, PhD (University of Minnesota, School of Dentistry; University of Minnesota, Medical School; Brain Sciences Center, VA Medical Center, Minneapolis, Minnesota)

Objectives: The brain mechanisms of facial tactile sensibility were investigated. **Background:** Magnetoencephalography (MEG) has been used to study the brain localization of facial tactile stimuli. Here the research team focused on the tactile perception by using different stimulation conditions to elicit distinct percepts, namely perception of discrete versus illusion of tactile motion. **Methods:** MEG data were collected from 248 axial gradiometers (4-D Neuroimaging) from healthy subjects while tactile stimuli were applied to the left cheek using an air-driven elastic membrane. Stimuli were delivered sequentially to 3 adjacent sites either discretely (every 1 to 2 seconds) or continuously and were perceived as isolated or moving stimuli, respectively. Single dipole solutions were derived from artifact-free data. **Results:** Thirteen cortical areas were engaged, mostly (3:1) in the right hemisphere. In both conditions, the right postcentral gyrus was engaged early (at ~ 50 ms from stimulus onset). In the Discrete condition, the left postcentral gyrus was engaged shortly thereafter, followed by areas in the right posterior parietal cortex, notably the parietal operculum; no activation of central sulcus or precentral areas was observed. By contrast, Continuous stimulation resulted in activation in the depth of the central sulcus, the left precentral gyrus and posterior parietal sites, including the supramarginal gyrus. Precuneus was activated late in both conditions. **Conclusion:** Although these brain activation patterns share several common elements in both conditions, the specific involvement of precentral areas in the Continuous condition could underlie the illusion of tactile motion felt. Such experimental designs may play an important role in the study of facial allodynia, where alterations of neural networking are suspected. **Funding:** This study was supported by the MIND Institute.

Salivary and Plasma Substance P Levels in Adults with Chronic Orofacial Pain Syndrome. Min-Wook Chang, Jin-Woo Chung, Hong-Seop Kho, Young-Ku Kim, Sung-Chang Chung (Department of Oral Medicine and Oral Diagnosis, Seoul National University, Seoul, Korea)

Objectives: Substance P is a neuropeptide involved in nociception; it is widespread in the central and peripheral nervous systems. The aims of this study were to investigate substance P levels in human saliva and plasma and the associations between these levels and chronic orofacial pain symptoms. **Methods:** Resting whole saliva and plasma samples were collected from 7 subjects, and substance P levels were measured by enzyme immunoassay. Prevalence of 5 orofacial pain symptoms (jaw joint pain, headache, dental pain, oral sores, and burning mouth) in the past 6 months, along with questions from the Graded

Chronic Pain Scale, were assessed using a structured questionnaire. **Results:** Substance P level was higher in saliva (204.46 ± 108.75 pg/mL) than in the plasma samples (125.98 ± 79.61 pg/mL, $P < .01$) and correlated with each other ($\rho = 0.736$, $P < .01$). Both salivary ($r = 0.567$, $P < .01$) and plasma ($\rho = 0.693$, $P < .05$) substance P levels were increased with age but did not show gender differences. Subjects with headache showed higher plasma substance P levels than subjects without headache ($P < .01$). Subjects with dental pain showed higher salivary ($P < .05$) and plasma ($P < .01$) substance P levels than subjects without dental pain. Plasma substance P level was higher in the subject with at least 1 orofacial pain than in the subject with no orofacial pain during the past 6 months ($P < .01$). Plasma substance P level was correlated with pain intensity level obtained from the Graded Chronic Pain Scale ($\rho = 0.238$, $P < .05$). **Conclusion:** Measurement of salivary and plasma substance P level could provide a valuable tool for the study of patients with chronic orofacial pain.

The Effect of Anterior Overbite on the Mandibular Movement Velocities in Young Adults. Ching-Zong Wu,* I-Yen Kuan, Chiu-Jou Wu, Wan-Yu Kao (Taipei Medical University School of Dentistry and TMUH, Department of Dentistry, Taipei, Taiwan)

Purpose: The relationship between morphologic characteristics of the dentofacial skeleton and the function of the masticatory system has been extensively studied. Mandibular movement velocity is 1 of the parameters used to evaluate mandibular function. However, the association between deep overbite and mandibular movement velocity needs to be clarified. The aim of this study was to investigate mandibular movement velocity in young adults with deep overbite and to determine the correlation between steepness of incisal relationship and the velocity of mandibular movement. **Methods:** One hundred twenty-seven young adults (84 males, 43 females, ranging from 21 to 26 years old) were observed using a Myotronics kinesigraph K-6 model for the measurement of jaw motion velocity. Each subject was instructed to open and close the mouth as wide and as fast as possible. Five consecutive open-close strokes were recorded and processed to evaluate the following parameters: (1) the maximal opening and closing velocities, (2) the average opening and closing velocities, and (3) the maximal velocity of terminal tooth contact. Dentofacial morphology was evaluated with conventional lateral cephalometric radiographs and dental casts with the association of the mandibular movement velocity by analysis of variance. **Results:** Data analysis indicated that the maximum and average closing velocity of male subjects had a significant association with the angulations and overbite of the maxillary incisor ($P < .05$). Terminal tooth contact velocity was significantly associated with facial diversity in females and with overbite in males. **Conclusion:** Anterior tooth alignment might have some influence on mandibular movement velocity. **Funding:** Research is supported in part by NSC-90-2815-C-038-007-B.

Correlation and Cluster Analysis of Sensory, Pain, and Reflex Thresholds to Various Stimulus Modalities in Symptom-free Subjects. Osamu Komiya,¹ Kelun Wang,² Peter Svensson,³ Lars Arendt-Nielsen,² Misao Kawara,¹ Antoon De Laat⁴ (¹Nihon University, Japan, ²Aalborg University, Denmark, ³University of Aarhus, Denmark, ⁴Catholic University of Leuven, Belgium)

Objectives: The present study evaluated the correlation between psychophysical responses to various sensory stimuli and with the appearance threshold of the late masseteric exteroceptive suppression (ES2) period. A cluster analysis was also performed with these variables. **Methods:** Twenty males and 20 females (age range, 20 to 33 years) participated. The tactile detection threshold (TDT) and the filament-prick pain detection threshold were measured on the cheek skin overlying the left masseter muscles. The pressure pain threshold and pressure pain tolerance threshold were measured at the left masseter muscle. The surface EMG was recorded from the left masseter muscle, while electrical stimuli with 13 fixed intensities (from 5 to 35 mA) were applied to the skin above the left mental nerve. The stimulation intensity at which the ES2 appeared for the first time and the lowest stimulus intensity that the subjects reported to be painful were defined as the ES2 and pain threshold, respectively. **Results:** There were significant correlations between the TDT and the pain thresholds determined using the different stimulus modalities ($P < .05$). In addition, the ES2 threshold was significantly correlated with the pain thresholds ($P < .05$). Cluster analysis could significantly discriminate 2 distinct groups with high versus low tactile, pain and ES2 thresholds ($P < .05$). **Conclusion:** The present findings suggest that the ES2 reflex response may have a relation with the individual sensory and pain sensitivity, and that complementary information on the pathophysiology underlying orofacial pain may be obtained by combined examination of sensory, pain, and ES2 thresholds.

Inhibition of Calcitonin Gene-Related Peptide Expression In Vitro and In Vivo Models of Trigeminal Inflammation by a Cocoa Bean Extract. M. J. Abbey, V. Patil, P.L. Durham (Department of Biology, Missouri State University, Springfield, Missouri)

Objective: Release of calcitonin gene-related peptide (CGRP) from trigeminal sensory nerves contributes to neurogenic inflammation in migraine and temporomandibular disorders (TMD). Cocoa flavonoids are reported to suppress inflammation. The goal of this study was to determine the mechanisms by which cocoa bean extracts could inhibit CGRP gene expression. **Methods:** Rat primary trigeminal ganglia cultures, a human neuronal cell line (DMS 153), and an in vivo model of temporomandibular joint (TMJ) inflammation were utilized. The amount of CGRP was measured by radioimmunoassay. CGRP promoter activity and signaling pathway reporter genes were studied using transient transfection, and luciferase activity was measured. **Results:** Treatment of primary cultures with KCl or capsaicin caused a significant increase in CGRP release. These stimulatory effects were repressed by pretreatment with a cocoa extract. Overnight treatment with cocoa repressed human CGRP promoter activity and CREB reporter activity stimulated by PKA. In addition, cocoa inhibited basal CHOP activity as well as activation of ATF-2 by MEKK. To determine whether cocoa could inhibit CGRP expression in trigeminal ganglion, an in vivo model of TMJ inflammation was used. Injection of mustard oil or capsaicin into the TMJ capsule caused an ipsilateral decrease in CGRP levels in the posterior third of the ganglion. This decrease was attenuated by overnight pretreatment with cocoa extract. **Conclusion:** The results provide evidence that cocoa extract can inhibit CGRP gene expression and secretion as well as key inflammatory signaling pathways. Thus, cocoa extracts may prove useful in treating TMJ inflammation. **Funding:** This research was supported by NIH (1 RO1 DE 015385-01).

Temporomandibular Disorder Symptoms as Associated Factors for Self-reported Headache in Female Thai Adolescents. Somsak Mitirattanakul, DDS, PhD; Panupee Sitthisomwong, DDS, MS; Touch Itthikul, DDS, MDSc; Suneepongrojpaio, DDS; Nattaya Asawaworarit, DDS (Faculty of Dentistry, Mahidol University, Bangkok, Thailand)

Objectives: To identify symptoms of temporomandibular disorders (TMD) as associated factors for self-reported headache in female Thai adolescents. **Methods:** A total of 1,695 female Thai adolescents ranging from 14 to 19 years old (mean age, 17.44 ± 0.55 years) were asked to complete questionnaires regarding the headache as well as pain and dysfunction related to TMD symptoms in the past 3 months. Logistic regression was used to identify and calculate the odds ratio (OR) for TMD symptoms associated with self-reported headache. **Results:** Headache was reported in 1,569 (92.6%) of the female adolescents who participated in this study. The ORs for pain and dysfunction related to TMD symptoms that were significantly ($P < .05$) related to self-reported headache were 6.04 for pain in the temple area, 3.09 for pain in the teeth, 2.58 for hurt when chewing, 2.36 for pain in front of the ear, and 1.90 for uncomfortable bite. **Conclusion:** Five TMD symptoms were found to be related to self-reported headache in female Thai adolescents. The majority of these symptoms were pain related. The findings indicated a closed relationship between headache and TMD. Further study should be conducted to identify which factors play a major role in the headache population.

Neuropathic Pain Scale for Orofacial Pain. Naif Bindayel, Ronald Kulich, Noshir Mehta, Steven Scrivani (The Craniofacial Pain Center, Tufts University, Boston, Massachusetts)

Objectives: (1) Establish a base Neuropathic Pain Scale (NPS) score for the orofacial pain population; (2) correlate the result of each NPS item; and (3) compare the quality and quantity of pain among different neuropathic pain groups and clinics. **Methods:** A quality assurance investigation was performed to determine the pain characteristics of the orofacial pain population. The NPS was administered to 145 consecutive patients. All patients were instructed to respond to the NPS items for their average pain levels prior to their consultation. The data then were subjected to statistical tests utilizing the SPSS statistical computer program. Descriptive statistics and correlation significance were calculated for the values of each item. The present study means were compared to other means for different neuropathic pain groups. **Results:** The study revealed the mean value for each item of the NPS for the study's population. The unpleasant and intense neuropathic pain characteristics had the 2 highest scores (4.58 and 4.35, respectively), while the cold and itchy items of the NPS presented the lowest means (0.70 and 0.44, respectively). Almost all the items of the NPS were found to be correlated significantly with each other at the .05 level. The findings were found to be comparable to other neuropathic pain groups (postherpetic neuralgia). **Conclusion:** Specific factors in the NPS were found to be specific for orofacial pain. These findings could serve as control data for testing the efficiency of new treatment methods or for comparison purposes with other pain disorders.

Evaluation of Maximal Bite Force in Temporomandibular Disorder Patients. Gabriela Modesti Vedolin, Evelyn Mikaela Kogawa, Patricia dos Santos Calderon, Jose Roberto Pereira Lauris, Carlos dos Reis, Pereira de Araujo, Paulo Cesar Rodrigues Conti (Department of Prosthodontics, Bauru School of Dentistry, University of Sao Paulo, Bauru, Brazil)

Objectives: The aim of this study was to evaluate the maximum bite force in temporomandibular disorder (TMD) patients. **Methods:** Two hundred women were divided into 4 equal groups: myogenic TMD, articular TMD, mixed TMD, and control. The maximum bite force was measured in the first molar area on both sides in 2 sessions, using an IDDK (Kratos) Model digital dynamometer adapted to oral conditions. Three-way ANOVA, Tukey, and Pearson correlation tests were used for statistical analysis. The level of statistical significance was given when $P \leq .05$. **Results:** The maximal bite force values were significantly higher in the control group than in the experimental ones ($P < .001$), with no significant differences between sides. Higher values were obtained in the second session ($P = .001$). Indeed, moderate negative correlation was found between age and bite force, when articular group, the mixed group, and the entire sample were evaluated. A moderate negative correlation was also detected between TMD severity and the maximal bite force values for myogenic TMD, mixed TMD, and the entire sample. **Conclusion:** It was concluded that the presence of masticatory muscle pain and/or TMJ inflammation can play a role in maximum bite force. The mechanisms involved in this process, however, are not well understood and deserve further investigation.

The Influence of Nocturnal Bruxism on the Human Maximum Bite Force. Patricia dos Santos Calderon, Evelyn Mikaela Kogawa, Jose Roberto Pereira Lauris, Accacio Lins do Valle, Paulo Cesar Rodrigues Conti (Department of Prosthodontics, Bauru School of Dentistry, University of Sao Paulo, Brazil)

Objectives: The objective of this research was to evaluate the influence of bruxism on the human maximum bite force. The concordance between examiners for the physical finding of bruxism was also evaluated. **Methods:** One hundred eighteen individuals from both genders, bruxers and nonbruxers, with an average age of 20.46 years were selected for these propose. For group establishment, every individual was submitted to a specific physical examination for bruxism performed by 3 different examiners. The maximum bite force was measured using a gnathodynamometer at the first molar, 3 times on each side. Measurement was performed twice. The 2 measurements were separated by an interval of 10 days. The highest value found among the 12 records was recorded. The data were then statistically analyzed using a 2-way analysis of variance, with a level of significance of 5%. For the concordance between examiners the kappa statistical test was applied. **Results:** The maximum bite force values were statistically higher for males ($P < .001$), regardless of the group analyzed. The presence of bruxism did not influence the maximum bite force ($P > .05$). The concordance between examiners for physical examination of bruxism was considered optimal. **Conclusion:** Authors concluded that the voluntary maximum bite force is not influenced by the presence of nocturnal bruxism. **Financial support:** Brazilian Government (CNPq).

Palpation of the Lateral Pterygoid Area in the Detection of Myofascial Pain (RDC/TMD): Sensitivity and Specificity. Paulo Cesar Rodrigues Conti, Leylha Maria Oliveira Nunes, Renato Oliveira Ferreira da Silva, Milton Carlos G. Salvador, Rafael Santos Silva, Mariana Gelmini (Department of Prosthodontics, Bauru School of Dentistry, University of Sao Paulo, Bauru, Brazil)

Objectives: The aim of this study was to evaluate the validity of intraoral palpation of the lateral pterygoid area as part of the physical examination to detect myofascial pain disorders,

according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). **Methods:** Seventy-seven consecutive women, matched for age, were divided into 2 groups: 44 in the myofascial pain (RDC/TMD) group and 33 without signs and symptoms of TMD. One previously calibrated examiner, blinded to group assignment performed 2 intraoral palpations of the lateral pterygoid area on each side, with a time interval of 5 minutes. Positive pain responses received a score of 0, and negative responses received a score of 1. Any intra-examiner disagreement was corrected in a third assessment. The sensitivity, specificity, and negative and positive predictive values were calculated. **Results:** The results of the test were 45.45% true positives, 9.74% false positives, 33.12% true negatives, and 11.69% false negatives. Sensitivity and specificity were calculated as 79.55% and 77.27%, respectively. The specificity level remained below the 90% recommended by the literature, indicating a higher number of false-positive results. Positive and negative predictive values were 82.35% and 73.91%, respectively. **Conclusion:** The low level of specificity observed in this study should be considered, when using the RDC/TMD criteria to establish a myofascial pain diagnosis based on the 3 muscle points tenderness to palpation. **Financial support:** FAPESP- Brazil- GRANT # 04/13160-7.

Pain on Biting, Chewing, and Opening: A Subjective Assessment of Patients with Musculoskeletal and Other Orofacial Pain Diagnoses. Raashi Khatri, Mythili Kalladka, Riva Touger-Decker, Eli Eliav, Archana Viswanath, Julyana Gomes, Sowmya Ananthan, Gary Heir

Objectives: To determine the relationships between orofacial pain (OFP) diagnosis and self-reported pain and difficulty with biting, chewing, and opening of the mouth; dietary habits; and body mass index (BMI). **Methods:** This retrospective descriptive study explored patient-perceived difficulty biting, chewing, and opening of the mouth; pain as rated on a visual analog scale (VAS); and BMI in relation to orofacial pain diagnoses. A convenience sample of 76 patients seen in an OFP clinic between June 2005 and February 1, 2006 was used. The subjects completed a nutrition screening evaluation form. SPSS version 13.0 was used for data entry and analysis; alpha was set at .05. Independent samples *t* tests and point biserial correlation coefficients were used to determine the relationships between OFP diagnosis and pain VAS; difficulty with biting, chewing, and opening of the mouth; and BMI. The patients had to self-evaluate their level of pain on the VAS from 0 to 10, with 0 being no pain and 10 representing the worst pain imaginable. A similar scale was constructed for subjective assessment of difficulty biting, chewing, and opening the mouth. **Results:** The mean age of the patients was 43.6 years (range, 14 to 60 years); 3 individuals were 14 to 18 years old. The majority were women ($n = 66$, 88.2%). OFP diagnoses were grouped into 1 of 2 categories, functional pain (myofascial pain or temporomandibular joint pain) ($n = 54$, 71.1%) and neuropathic pain (including trigeminal neuralgia) ($n = 22$, 28.9%). Patients with a diagnosis associated with functional pain were significantly more likely to have a higher pain VAS ($r = -.305$, $P = .008$), higher biting pain ($r = -.368$, $P = .001$), higher chewing pain ($r = -.276$, $P = .017$), and greater pain opening their mouths ($r = -.500$, $P = .0001$) than patients with neuropathic pain diagnoses. Those with nonfunctional diagnoses had a significantly ($r = .231$, $P = 0.045$) higher BMI (mean = 28.06 kg/m²) than those with functional diagnoses (mean = 24.8 kg/m²). **Conclusion:** Type of OFP diagnosis (functional versus neuropathic) was significantly related to patient-perceived pain on biting, chewing, and opening the mouth; pain VAS; and BMI. The significant relationship between BMI and neuropathic pain may be related to other comorbidities or to diet and/or lifestyle habits. This pilot study supports the need for further research using semiquantitative dietary assessment, quality-of-life tools, and a larger study sample.

Differences in Psychological Factors, Pain Intensity Level, and Associated Characteristics in Myofascial Pain Patients with and Without Migraine. Rafael dos Santos Silva, DDS, MS^{1,2}; Somsak Mitrirattanukul, DDS, PhD^{2,3}; Masakazu Okubo, DDS, PhD⁴; Paulo Cesar Rodrigues Conti, DDS, PhD¹; Robert L. Merrill, DDS, MS² (1Department of Prosthodontics, Bauru School of Dentistry, University of Sao Paulo, Bauru, Brazil; 2Orofacial Pain, University of California at Los Angeles (UCLA) School of Dentistry, Los Angeles, California; 3Faculty of Dentistry, Mahidol University, Bangkok, Thailand; 4TMD/OFP Clinic, Nihon University School of Dentistry, Matsudo, Chiba, Japan)

Objectives: To compare the differences in psychological factors, pain level, and associated characteristics in myofascial pain (MFP) patients with and without migraine. **Methods:** A total of 229 orofacial pain patients from UCLA Graduate Orofacial Pain Clinic with primary diagnoses of MFP were asked to complete the Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) as well as questionnaires regarding pain intensity levels (present pain, highest, usual, lowest), moodiness levels, disability levels due to the pain, degree of pain interference with jaw function, and quality of rest. All measurements except BAI and BDI scores were obtained using visual analog scales (VAS). **Results:** Of the 229 MFP patients, 86% (197) were female and 32 (14%) were male. Of the total sample, 31% (71) had an additional diagnosis of migraine (MFP + migraine group). This group included 65 (91.5%) females and 6 (8.5%) males. The following table shows the statistical differences between the MFP-only and MFP + migraine groups. Only anxiety (11.78 versus 15.55; $P = .04$), high pain intensity (62.27 versus 74.44, $P = .01$), and quality of rest (52.95 versus 65.02, $P = .01$), respectively, for MFP only versus MFP + Migraine reached statistical significance. **Conclusion:** MFP patients with migraine had higher levels of anxiety, pain, and poor rest. Further study is needed to clarify these differences.

	Mean	Standard error	P
BAI score			
MFP only	11.78	12.02	.04*
MFP + migraine	15.55	11.51	
BDI score			
MFP only	10.34	9.61	.12
MFP + migraine	12.70	9.73	
Pain intensity (now)			
MFP only	40.15	27.85	.16
MFP + migraine	46.25	26.30	
High pain intensity			
MFP only	62.27	28.45	.01
MFP + migraine	74.44	22.74	
Usual pain intensity			
MFP only	48.41	26.39	.16
MFP + migraine	54.14	24.68	
Low pain intensity			
MFP only	27.87	24.85	.32
MFP + migraine	31.98	28.48	
Moodiness level			
MFP only	49.17	25.91	.21
MFP + migraine	54.15	22.96	
Disability level			
MFP only	46.58	32.22	.59
MFP + migraine	49.29	31.20	
Interfere with jaw function			
MFP only	62.00	30.06	.54
MFP + migraine	64.98	31.64	
Level of poor rest			
MFP only	52.95	31.39	.01
MFP + migraine	65.02	27.78	



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- To enhance the clinician's ability to diagnose and manage patients with orofacial pain
- To enable the clinician to interact with medical colleagues on a knowledgeable basis
- To help the participants prepare for orofacial pain board examinations

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Co-Directors: Sheldon G. Gross, DDS
Harold V. Cohen, DDS

For Information Contact:

Richard A. Pertes, DDS-Course Director
UMDNJ – New Jersey Dental School
Division of Oral Medicine, Room D881
110 Bergen Street-D881
Newark, NJ 07103
Phone: (973) 972-0214
E-mail: rpertes@aol.com
Website: ccoe.umdj.edu/dental