TMJ Communiqué

THE TMJ ASSOCIATION

Changing the Face of TMJ

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Who Supports the TMJA?

Sue

Shock: my first reaction to the life-altering discovery that I have Temporomandibular Disorders (TMD) due to two different dental procedures within months of each other. Where was I to turn? I could hardly move my head or open my mouth, floss my teeth, chew my food or sleep. I didn't know what to do.

After two weeks of waiting and monitoring my condition, the shock began to subside and I started to look for help—but from whom? A physician, dentist, chiropractor, lawyer, or a physical, occupational, speech, or massage therapist? Who could I trust to help me make the initial decisions at this vulnerable stage?

I gratefully realized that the first order of business was the need for emotional support so that I could make clear decisions without fear or intimidation. Fortunately I was not in a state-of-emergency, though in great discomfort; I was functioning.

I played around in Google and found The TMJ Association (TMJA). I called the Association and spoke to the President, Terrie Cowley. Talk about down to earth and approachable! Her care and concern gave me a "shot in the arm." I called the two support contacts she recommended who had TMD; they also offered understanding and support. I read the TMJA's website and Terrie invited me to participate in a conference call regarding how TMJ patients make their health care decisions. I learned a lot from the others on the call.

As I think about the many ways the TMJA supported me, I wonder...who supports the TMJA? It is easy to forget that those who support us need our support in return. This is the perfect time to show how much we care about the Association. By making a contribution to the TMJA you'll not only be helping the Association, but also yourself and the millions of other TMJ sufferers! *Sue* ♦

TMJA Annual Update

On behalf of Members of The TMJ Association (TMJA) Board and the Scientific Advisory Board I wish you the best holiday season and good health and happiness in 2013. What follows is a brief summary of how the TMJA has moved forward in 2012.

The prominence of pain. As you know from reading our publications, pain related to Temporomandibular Disorders (TMD) has been foremost among our activities for the past several years. This has been intentional, for the vast majority of TMD patients seek care because of pain. As you've also read, many times TMD pain does not exist alone, but is accompanied by other bodily pain conditions, which like TMD, predominantly affect women. This August, the National Institutes of Health held a follow-up meeting to our 2010 TMJ Association meeting focusing on these overlapping pain conditions (page 3) to explore what we know and what research is needed to alleviate these multiple pains.

Joining forces. The TMJA is a member of the Chronic Pain Research Alliance and our mission is to see that research is directed to the conditions that overlap with TMD. We were pleased to be the catalyst for the August NIH meeting and the Senate HELP Committee Hearing on Pain in America: Exploring Challenges to Relief. Most recently, the TMJA along with the CFIDS Association of America and the National Vulvodynia Association submitted a proposal to the Sanofi's *Collaborate|Activate Innovation Challenge.* We were honored to be among the top four finalists out of 280 organization submissions. Though we didn't win we will use our experience and plan for future opportunities.

And the need for drugs. We took the opportunity to advocate for TMD treatments before the FDA. Within the Prescription Drug

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The *TMJ Communiqué*

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TMJA Annual Update

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User Fee, there is a Patient-Focused Drug Development initiative to highlight 20 disease areas in need of therapies by featuring each one in an FDA-sponsored public meeting. We asked the FDA to add TMD to these conditions. These highlighted disease areas will have the attention of drug companies and the public forums will provide a platform calling attention to the need for research leading to the development of treatment options. To date, the FDA has not one drug labeled for use in TM Disorders and in the Device Division, only total joint devices. None of the pain management options currently available are labeled for TM Disorders. We hope to change that!

About TMJ devices. As a TMJ implant patient, this subject will always be one I passionately care about. In two months it will be two years since the FDA issued an order to the TMJ device manufacturers to submit protocols for conducting postmarket surveillance studies to obtain information about the safety of the devices and other measures. To date we have not been informed that any manufacturer has satisfied all requirements of this order. I've met with the FDA on this issue and have voiced our concern that the order has not been satisfied. This year we launched, *TMJExchange*, an on-line TMJ implant patient communication center which provides an avenue for patients to share experiences. Implant patients and those considering a device may join by contacting us at info@tmj.org.

The mystery of the jaw joint. The third Temporomandibular Joint Bioengineering Conference was held in September. Once again, the consensus was that, "unlike other joints in the body, we still know very little about the "TMJ"". We hope to change that too. For several years we have asked the Directors of three NIH Institutes: Arthritis and Musculoskeletal and Skin Diseases (NIAMS), Biomedical Imaging and Bioengineering (NIBIB) and Dental and Craniofacial Research (NIDCR), to combine their intellectual and scientific resources toward determining what we know and what we need to know about the temporomandibular joint. Our efforts have paid off. The three Institutes will hold a TMJ workshop in May 2013. We will share details as we learn of them.

Adding bioengineering expertise. We have invited Anthony Ratcliffe, Ph.D., President and CEO of Synthasome, Inc. to join our Scientific Advisory Board. Dr. Ratcliffe's work focuses on musculoskeletal disorders, tissue engineering, and product development, and he is highly respected in his field. I have known Dr. Ratcliffe since 1994 and in addition to respecting his scientific expertise I admire his passion for bringing safe and effective developments to the patient. I've asked Dr. Ratcliffe to take the lead in identifying the best and brightest bioengineers to add to our Scientific Advisory Board.

Listening to patients. This year has been one in which TMJA has been particularly heedful of patients' needs, which we have expressed at a growing number of meetings and with organizations that have asked for our input. I remember it was about 15 years ago after I explained to my husband's colleagues about TMD that he jokingly said, *"The whole world will know about TMJ but only one person at a time!"* That has certainly changed, and with every speaking invitation I accept my only goal is to let the audience know about TM Disorders, how they affect lives and what we need to solve the problem.

So, at last we can say that we have attention being paid to TMJ patients' pain and jaw joint dysfunction by policy makers in the highest quarters. We continue to have champions supporting the needs of the TMJ patients in the US House and Senate and we are cultivating more of them. We've also expanded our advocacy to the FDA Drug Division. We intend to stay on top of the items I've just told you about. They are in addition to what we do daily in helping those in need of support, information or contacts; keeping you informed about the latest science and happenings, and making and taking every opportunity to advance our mission.

YOU are the TMJA. You are the reason the TMJA exists and our goal is to eventually see the end of TM Disorders. When we look back over the years at our successes "doing" TMJ work has been gratifying. However, there is much more still to be done. When we look at the future and how we can bring the patients' needs to fruition, "doing" TMJ work is daunting and challenging. But we are up to the challenge! With your continued moral support, volunteered help, expertise, and financial contributions, we will overcome these challenges and achieve our goal. I thank all the patients and their loved ones, scientists, clinicians, and everyone else who lends their time, effort and prestige for working with us and supporting us in so many ways. *Terrie Cowley, President & Co-Founder* ♦

TMD, Comorbid Pain and Widespread Palpation Tenderness and Multiple Pain Conditions

One of the most active and productive research teams studying TMD is a group at the University of North Carolina at Chapel Hill led by William Maixner. Readers may recognize his name as the principal investigator for the OPPERA study to determine risk factors for the development of TMD. Now, with colleague Luda Diatchenko and co-workers at Chapel Hill, the investigators have conducted a secondary analysis of data collected in a pre-OPPERA study.

In that study women TMD patients in an age range of 18 to 60 years were compared with a matched group of TMD-free women controls. The women were characterized with regard to clinical pain, experimental pain sensitivity (for example, applying a heat stimulus to the forearm and determining at what temperature it becomes painful) and a range of psychological characteristics using a battery of tests. Included in the data were measurements of widespread body palpation tenderness (WPT) in response to a measured force of 3 pounds applied to 18 body sites outside the orofacial region. The aim of the study was to determine the relationship between the presence of WPT and multiple comorbid pain conditions (looking in particular at 7 conditions: fibromyalgia, chronic fatigue, irritable bowel, interstitial cystitis, chronic pelvic pain, frequent headaches and frequent low back pain) in TMD patients and controls.

The group's findings add weight to the observation that there are distinct subsets among TMD patients. There were 76 TMD patients with WPT and 83 without WPT No control subject met the criteria for WPT. Overall, TMD patients reported an average of 1.7 comorbid pain conditions compared to 0.3 reported for controls. However, when compared to controls, the odds of TMD patients with WPT having multiple pain conditions was much higher (odds ratio of 8.3) than for TMD patients without WPT (odds ratio of 3.3). With regard to the 7 named pain conditions, the researchers found that 22% of participants reported 2 or more comorbid conditions outside the orofacial region. The figures represent 4% of control subjects, 59% of TMD patients with WPT and 27% of TMD patients without WPT. The average age of subjects reporting multiple pains was higher than for those reporting none or 1.

Other findings indicated that TMD patients with WPT were more sensitive to experimental pain produced by applying increasing levels of pressure both in cranial and non-cranial regions than TMD patients without WPT. On the other hand it is of interest that there were no essential differences in the TMD pain characteristics when comparing TMD patients with or without WPT. **As the authors conclude, "These findings are of substantial clinical significance as they emphasize the importance of integrating bodily pain assessment and psychological assessment in the evaluation of TMD patients and may guide the development of individualized management programs for specific TMD groups."**

by Joan Wilentz ♦

Source: Chen H., Slade G., Lim P., Miller V, Maixner, W., Diatchenko, L., Relationship Between Temporomandibular Disorders, Widespread Palpation Tenderness, and Multiple Pain Conditions: A Case-Control Study, J Pain. 2012 Oct;13(10):1016-27. doi: 10.1016/j.jpain.2012.07.011.

NIH Workshop Focused on TMD and Overlapping Conditions

The focus of The TMJ Association's (TMJA) last three scientific meetings has been on Temporomandibular Disorders (TMD) and pain conditions that a patient might get before or after being diagnosed with TMD. The recommendations from these meetings and advocacy action by members of the Chronic Pain Research Alliance (CPRA) have prompted the National Institutes of Health (NIH) to form a trans-NIH committee to address these conditions. On August 13-14, 2012 the trans-NIH committee sponsored A W*orkshop on Chronic Overlapping Pain Conditions*, at the NIH campus in Bethesda, Maryland. The meeting was open to the research community. If you would like information about the meeting, please go to: http://www.nidcr.nih.gov/NewsAndFeatures/Calendar/CalendarListing08132012.htm.

TMJA President, Terrie Cowley, and the other members of the CPRA participated in the panel discussions addressing patients' concerns regarding the state of diagnosis and treatments of these conditions as well as research directions to advance understanding of these complex disorders. Conditions addressed at the workshop include chronic fatigue syndrome, chronic headache, endometriosis, fibromyalgia, interstitial cystitis, irritable bowel syndrome, low back pain, **Temporomandibular Disorders**, and vulvodynia.

The goals of the workshop were to:

1. Determine the state-of-the-science in chronic overlapping pain conditions;
2. Develop a coordinated research strategy in order to identify standard features of chronic overlapping conditions that will drive the development of research diagnostic criteria;
3. Improve and develop new research strategies to identify underlying mechanisms of etiology; trajectories of disease; risk factors for disease onset, progression and reversal; and outcome measures for these conditions.

We will share the formal workshop recommendations with you when we receive them. *by Joan Wilentz* ♦

TMD and Tooth-Grinding: A Surprising Finding

Over the decade researchers studying Temporomandibular Disorders (TMD) have concluded that these conditions are complex in origin. Some combination of genetic, sex, environmental and behavioral factors gives rise to symptoms of jaw pain and dysfunction. But that conclusion contradicts the long held beliefs by many patients and dentists who think that jaw problems are caused by tooth-grinding (bruxism) during sleep. The presumption behind this is that the activity of jaw muscles would stress the muscles and wear on the jaw joint? Wrong!

A definitive study conducted by researchers at New York University (NYU) College of Dentistry, Weill Cornell Medical College, New York and the University of Montreal led by NYU investigator Karen Raphael refutes the idea that bruxism causes TMD. To begin with, the team noted that the bruxism theory was largely based on patients' believing that they bruxed in their sleep (often reinforced by dentists telling them so). For that reason the researchers designed a study using polysomnographic recordings (PSG) of patients and controls in the setting of a sleep laboratory. PSG recordings include audio and video data along with measures of jaw muscle activity to determine how many episodes of sleep bruxism (SB) occur during the night, distinguishing them from other muscle activity such as yawning, talking or chewing. Over two consecutive nights they compared TMD patients with matched controls. Wanting to get the best data, the researchers scheduled the first night of the study to enable the participants to get familiar with the lab setting and instrumentation, thus allowing the experimenters to concentrate on the second night for data analysis. The team recruited 124 women patients diagnosed with myofascial (muscle-based) TMD from NYU's dental school clinics and compared them with a control group of 46 women who were either acquaintances of the patients or recruited from other NYU clinics and well-matched in age and other demographics. Neither group was initially recruited based on whether they believed that they bruxed or not. Here's what the investigators found:

- In follow-up interviews 55.3% of the TMD group said they were told that they were sleep bruxers (SB) compared to 15.2% of controls.
- But actual PSG measurements showed much lower and very similar rates of SB in both groups: patients 9.7%; controls 10.9%.
- Grinding noises (but not meeting SB criteria) were common in both groups: 78.3% for patients; 59.7% for controls.
- Overall, both groups spent an average of less than one minute per night in SB episodes and less than 5 minutes in total activity involving the chewing muscles.
- Within the patient group those found to be bruxers reported less pain and less interferences with daily activities than the non-bruxing patients.

The authors conclude: "Our study should lay to rest any remaining beliefs regarding a relationship between SB and the course of myofascial TMD. Although there may be other reasons for treating SB (for example, tooth wear) the treatment decision should not be based on a concern for maintaining or exacerbating a chronic, painful myofascial TMD condition."

We asked Dr. Raphael to comment on her study. Her response: **"When your dentist tells you that your facial pain is somehow 'your fault' because you are grinding your teeth, you now know that it is simply not true. Many people grind their teeth a little bit at night, but that activity cannot account for your pain. If anything, people who suffer from the most severe TMD pain are actually the least likely to grind their teeth at night. If you are thinking about getting treatment for sleep grinding to help reduce your pain, think again: It is likely to be a waste of time, energy and money."**

by Joan Wilentz ♦

Source: Raphael K., Sirois D., Janal M., Wiegren P., Dubrovsky B., Nemelivsky L., Klausner J., Krieger A., Lavigne G., Sleep bruxism and myofascial temporomandibular disorders: A laboratory-based polysomnographic investigation, JADA 2012; 143(11):1223-1231.

DeCODE-ing TMD

According to the New York Times, on December 10, 2012 the biotechnology giant, Amgen, said it was acquiring deCODE Genetics, a gene-hunting business known for its "headline grabbing discoveries linking genetic variations to disease. DeCODE, a privately held company in Iceland has studied the local population to identify genetic variations linked to schizophrenia, cancer and numerous other diseases." Dr. Kari Stefanson, a neurologist who had taught at the University of Chicago and Harvard, realized that Iceland, his native country, would be an ideal place to perform studies in an attempt to detect genetic variants that raise or lower the risk of various diseases. "Iceland has good medical and genealogical records and a population that is not very diverse genetically." The National Institutes of Dental and Craniofacial Research has awarded a grant to Dr. Jeffrey Gulcher of deCODE to investigate pain syndromes including TMD. We are extremely happy that the deCODE team has taken up the TMD challenge!

The following information is from the abstract that accompanied the grant application submitted by deCODE.

Abstract: This project proposes to generate new knowledge on the basic pathophysiology of chronic neuropathic pain by determining the genetic differences between patients who develop chronic neuropathic pain after initial tissue injury versus those who do not despite having the same acute tissue injury. The researchers will use the unique genetic resources gathered and developed at deCODE Genetics for whole genome sequence-based human pain genetics studies to uncover high risk variants of low frequency significantly associated to conversion

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TMJ Bioengineering Conference: Facilitating a Multidisciplinary Approach to TMD

We thank Meghan K. Murphy, Ph.D. Candidate and Boaz Arzi, DVM, DAVDC at Department of Biomedical Engineering and Veterinary Surgical and Radiological Sciences University of Education, University of California, Davis for writing this summary article for the TMJ Communique.

The third Temporomandibular Joint Bioengineering Conference (TMJ3) was held this past September at the University of Pittsburgh. Conference chair, Dr. Alejandro Almarza, and organizers, Dr. Michael Detamore, Dr. Kyriacos Athanasiou, and Dr. Jeremy Mao, composed a meeting seeking to advance the field of Temporomandibular Joint (TMJ) research while strengthening the continuity among clinicians, scientists, and bioengineers. The conference drew an array of national and international experts and facilitated exciting discussions regarding degeneration and regeneration of the TMJ. Keynote lectures by Dr. Louis Mercuri, Dr. Marcus Teschke, and Dr. Mark Wong provided a review of the status of current therapies, the progress of Temporomandibular Disorders (TMD) research, and future directions aiming to improve therapies for TMD patients.

TMJ3 attendees ranged from TMD researchers, general dentists, oral and maxillofacial surgeons, basic biologists, and even included a veterinary oral specialist. The diversity of knowledge present at the conference facilitated multidisciplinary discussions regarding many aspects of TMD. Discussion topics included the role of tissue engineering in treating TMD and whether a replacement disc is strategically necessary for restoring function and reducing patient pain once the disc has lost function. Researchers discussed whether a scaffold-based or scaffoldless approach would be ideal for engineered joint components. Additionally, attendees discussed the role of imaging in diagnostics and treatment planning for TMD patients, and the need for further efforts in modeling and understanding the biomechanics of the joint.

Attendees joined from all over the world to present state of the art TMJ research and treatment planning. Presentation topics included possible molecular mediators in TMJ pathogenesis, TMJ modeling in health and in disease, surgical approaches intended to restore joint function, and the role of stem cells and tissue engineering in developing therapies. Topics extended to animal models for disease progression and pain, and comparative pathological aspects of TMD.

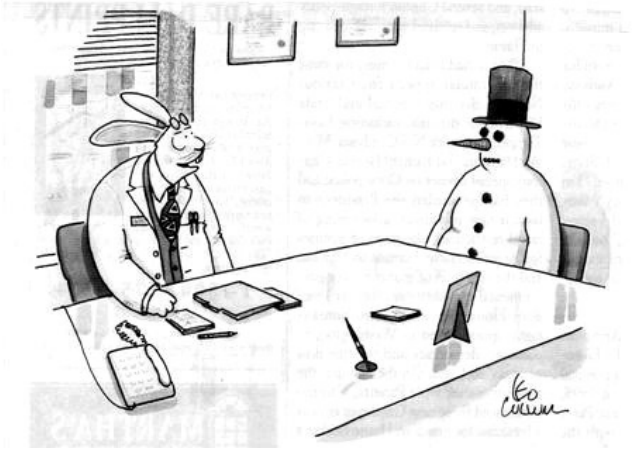
In concluding the meeting, attendees agreed that unlike other joints in the body, we still know very little about the TMJ. There remains a great deal of basic information about the makeup of TMJ tissues and their functions that needs to be elucidated. This basic information is invaluable to understanding etiologies and helping patients cope with these debilitating disorders. For example, we are just beginning to characterize the joint capsule and discal attachments, shedding light on the contribution of these structures to mechanical stability and joint motion, but also to pain. Moving forward in our research efforts, it would be extremely helpful if the National Institute of Health could place the TMJ high on its list and provide funds for basic TMJ studies.

The TMJ Bioengineering Conference, yet again, facilitated a productive cross-disciplinary approach to understanding disorders of the TMJ toward its objective of providing the best possible therapies for TMD patients. The union and synergy of TMJ researchers, biologists, and clinicians appropriately guides future directions for the field, keeping in mind all aspects of the disorder from form and function to mechanisms of pain. We look forward to TMJ4 and invite all individuals with an interest in the TMJ to participate. ♦

Free TMJA Brochure

Our brochure, *A Resource Guide for Temporomandibular Disorders* is available as a downloadable PDF on our website. You may also request hard copies by mail. We encourage you to share this brochure with your friends, health care professionals and family as it is a great educational resource for everyone.

Our thanks to Drs. Daniel Laskin, Sharon Gordon, and William Maixner and to Joan Wilentz and our volunteers for their contributions to this brochure. Last but not least, we thank Purdue Pharma L.P. for making the production of this publication possible through an education grant of $5,000 and the National Institute of Dental and Craniofacial Research, grant #R13DE019079. ♦



"We could reshape your nose with conventional surgery, but I'm going to suggest something radical."

Eye Study Suggests Autonomic Nervous System Dysfunction in TMD

It's common knowledge that the pupils of your eyes dilate in darkness—to absorb as much light as is available—while they contract in bright light so as not to overwhelm the system. Pupils also dilate in response to various stressors, including the muscle activity involved in clenching your teeth. These eye responses are regulated by branches of the autonomous (also called the autonomic) nervous system (ANS). The sympathetic branch dominates in "fright or flight" stress responses, while the parasympathetic branch dominates in vegetative states, for example, when you are digesting your dinner. "Dominates" is the key verb here, since in the case of the eyes, the two branches interact through complex excitatory and inhibitory pathways to the nerves controlling pupillary muscles. Based on reports that some TMD patients suffer deregulation of the ANS, particularly the sympathetic branch, a team of Italian scientists led by Annalisa Monaco at the University of l'Aquila, conducted a pilot study comparing eye responses of Temporomandibular Disorders (TMD) patients and controls in response to various conditions of light and darkness.

The scientists recruited 20 TMD women patients under 30 and matched them with 20 healthy controls also under 30. Their study used a pupillometer to measure pupil size in the volunteers under four conditions, tested in random order: 1) when the jaw was at rest and the eyes were exposed to infrared light (simulating darkness); 2) when the jaw was at rest and the eyes were exposed to yellow-green light; 3) when the teeth were put into forced occlusion (simulating clenching) and the eyes exposed to infrared light and 4) when teeth were clenched and eyes exposed to yellow-green light.

The results showed some interesting differences between TMD patients and controls. Under infrared conditions, the control group showed significantly larger pupil sizes when teeth were clenched compared to when their jaws were at rest, while TMD patients showed just the opposite: their pupil sizes were significantly smaller when teeth were clenched compared to when their jaws were at rest. Under infrared conditions the scientists also found a significant difference in the ratio of clenched-to-resting position pupil sizes between the groups, again illustrating that controls respond to the forced muscle condition by enlarging pupil size while the TMD patients' pupils decreased in size.

The scientists also found significant differences under resting conditions when they looked at the ratio of pupil sizes in light compared to dark conditions. The figure was 0.662 for the control group (the pupil was about 2/3 as large for the controls in light conditions compared to darkness) while for the patients the light/dark ratio was 0.485 (their pupils under light conditions were less than half the size they were in darkness.

The Interpretation. The authors speculate that TMD subjects show greater activation (or less inhibition) of pupillary muscles under conditions of specific stimulation (presence or absence of light) and less activation or greater inhibition of contraction under the stressful condition of teeth clenching. They suggest that this could mean an impairment of the sympathetic branch of the ANS under conditions of stress. Bolstering this speculation are findings that some TMD symptoms (including pain) are improved by drugs aimed at stimulating selective parts of the sympathetic branch. The authors readily admit that their study was small and should be replicated along with further research. If additional studies confirm these results, pupillometry testing could emerge as a safe non-invasive means of diagnosing dysregulation of the ANS. *by Joan Wilentz* ♦

Source: Monaco A., Cattaneo R., Mesin L, Ciarrocchi I., Sgolastra F., et al. (2012) Dysregulation of the Autonomous Nervous System in Patients with Temporomandibular Disorders: A Pupillometric Study. PloS ONE 7(9): e45424. doi:10.1371/journal.pone.0045424.

DeCODE-ing TMD

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from acute to chronic pain. The project will extensively re-phenotype large cohorts (groups of patients) with chronic neuropathic pain, including common forms of craniofacial pain. There are already over 12,000 Icelandic patients who have or are likely to have certain chronic neuropathic pain syndromes such as phantom tooth pain (persistent dento-alveolar pain (PDAP)), **Temporomandibular Disorders (TMD)**, and post-mastectomy pain syndrome. The investigators will also screen a large cohort of Icelanders taking gabapentin or pregabalin for common chronic pain syndromes, including diabetic neuropathy and post-herpetic neuralgia. The extra phenotyping will give them additional dimensions beyond the basic pain symptomology on which to base the genetic analysis. It will also make it easier to replicate findings in outside pain cohorts that have already been well-phenotyped by their collaborators.

Although costs are dropping rapidly, it is still very expensive to fully sequence the genomes of the thousands of individuals that are required for well-powered disease association studies. These investigators can generate whole genome sequences for large cohorts of pain syndromes and controls in Iceland more quickly and cost-effectively than in other populations. By using their already existing genealogy database and high density DNA chip data they expect to find many new genetic associations that will increase our understanding of the conversion from acute to chronic neuropathic pain syndromes. The primary data generated in this grant will be made widely available for others to build on. ♦

Your Brain on TMD

We thank David A. Seminowicz, Ph.D., Assistant Professor, Department of Neural & Pain Sciences, University of Maryland School of Dentistry, for writing this summary article.

Temporomandibular Disorders (TMD) and other chronic pain disorders are associated with altered brain anatomy. A recent paper by Moayedi and colleagues expands knowledge in this area by describing the changes in white matter tract anatomy in TMD patients compared with healthy controls (healthy people without TMD). White matter tracts consist of the neuronal connections between different parts of the brain. MRI scans can indicate a loss or gain of these connections, local swelling or shrinkage of the nerve fibers, as well as the connections between different regions.

Moayedi et al. first examined changes in the trigeminal nerve, which contains the fibers responsible for transmitting pain and non-pain signals from the face to areas of the trigeminal brainstem complex, from which point signals are transmitted to the thalamus and other regions of the brain. They found that people with TMD had decreased white matter signals in the trigeminal nerve and that this decrease depended upon how long a patient had TMD—the longer one had suffered from TMD, the less white matter was in the nerve. It not is clear whether and how this finding is directly related to the TMD pain experience.

It's possible that the abnormality is important for the development and maintenance of pain, but that mechanisms higher up in the brain are responsible for the pain TMD patients experience. Moayedi et al. examined white matter changes in the brain and found decreased white matter across the whole brain, particularly near areas known to be involved in the experience of pain, including the brainstem, thalamus, insula, and somatosensory and cingulate cortices, as well as prefrontal cortical areas. White matter changes in some of these regions correlated with patients' TMD pain or unpleasantness ratings, thus suggesting a link between altered anatomy and symptoms. Previous work from the same group of researchers showed altered gray matter in similar parts of the brain in people with TMD; the current study provides more details on the structural brain changes that occur with TMD.

Finally, Moayedi and colleagues reported altered connectivity to prefrontal regions, including a decrease in connectivity to the dorsolateral prefrontal cortex (DLPFC) and increased connectivity to the frontopolar cortex (FPC) in TMD patients compared to controls. The DLPFC and FPC are both implicated in various aspects of cognitive function (all aspects of perception, thinking, reasoning, and remembering), and these structural abnormalities could be related to the difficulty that some people with TMD have in performing a cognitive task, a finding the same laboratory previously reported.

While this study advances our understanding of structural brain abnormalities associated with TMD, future research will need to clarify the relationship of brain function and structure and TMD symptoms, as well as the effect of treatment on these brain alterations. ♦

Source: Moayedi M, Weissman-Fogel I, Salomons TV, Crawley AP, Goldberg MB, Freeman BV, Tenenbaum HC, Davis KD, White matter brain and trigeminal nerve abnormalities in temporomandibular disorder, Pain. 2012 Jul;153(7):1467-77. doi: 10.1016/j.

A New Engineering Initiative at Cornell University

Our thanks to Dr. Jonathan Black for providing our readers with the following update.

In 2011, the Board of Directors of The TMJ Association (TMJA) entered into an agreement with Prof. Jonathan Black, Cornell University, to provide advisory support to a new education and research program focusing on engineering opportunities in the treatment of TM Joint Disorders (TMJD). Prof. Black, Adj. Professor of Biomedical Engineering, observed: "It seemed like a good idea to take a new look at TMJD, from an engineering perspective, and see if there are any overlooked opportunities." Under his direction, design teams of students, as part of their studies for the degree of Master of Engineering in Biomedical Engineering, have been addressing issues associated with restoration of function and management of acute and chronic pain in the TM Joint.

Terrie Cowley, TMJA President, recently visited Cornell's Ithaca, NY campus and took part, as a member of a panel, in one of a series of periodic design reviews. She remarked: "It is amazing how far and fast these highly motivated students have advanced in understanding the problems of TMJ patients." This program, strongly driven and self-directed by the students involved, is physically housed in the McGovern Family Center for Venture Development in the Life Sciences, an endowed new business incubator.

The director of the McGovern Center, Louis Walcer, hopes that ideas from this design effort may become bases for new business ventures in his program. Of the design projects currently underway, one, utilizing a new non-pharmacological approach to patient-directed management of acute pain, is now moving into the prototype construction and proof of principle stage. If pre-clinical evaluation proves promising, this may be the first fruit of this new engineering initiative. For further information, please contact Prof. Jonathan Black at jb2245@cornell.edu. ♦

Standing Together for TMD

STANDING BY YOU, AND TAKING A STAND

Since 1986, The TMJ Association (TMJA) has stood by you—the patients and families affected by Temporomandibular Disorders (TMD), friends, scientists, and medical professionals. We've addressed your concerns and listened to stories of hope as well as despair. From our beginning, we knew that supporting our patients also required taking a stand to advocate for research and greater awareness of TMD. You want answers, and so do we. You want a cure, and so do we.

Donate to help The TMJ Association continue to stand strong for YOU.

MAKING A DIFFERENCE FOR OVER 25 YEARS

The "road to recognition" is long and arduous, but The TMJ Association has and continues to pave the way, serving as the essential link between patients and the research and policies that impact lives. And we're making headway for you!

We lead the nation in providing the most up-to-date information for you about TMD and fight tirelessly for policies that will positively impact you or your loved ones' quality of life. We share the latest research with you, have petitioned the Food and Drug Administration to ensure the safety and efficacy of the devices you receive, and work closely with the National Institutes of Health so the best science this country has will be directed towards TMD.

Two messages we recently received from patients illuminate why we do what we do…

> *Dear TMJA, Thank you for the excellent recent newsletters online and in print. I want to thank you again for everything I have learned from you about TMD and all the support over the years. I don't want to imagine what my life would have been like without it. Keep up the fantastic work and congratulations on all your achievements." Kristina, St. Paul, MN*

…and why we must continue…

> *"I am writing to you because I can no longer take this pain. My entire family is in limbo as I try to suffer through. The issue being that it is considered cosmetic surgery and not an issue that will change my life. I am eating nothing healthy at this point only things I can swallow whole. The pain is keeping me up at night and furthermore I am eating about 40 Tylenol every 2-3 days. PLEASE HELP ME!" Erin, Joplin, MO*

YOU CAN BE PART OF THE SOLUTION

We have stood beside you, and we have taken a stand. But you deserve more—more answers, more research towards a cure and treatment. We are committed to improve the quality of health care and lives of everyone affected by TMD, but we simply cannot accomplish our mission without your generous support.

- **Make a financial contribution**
  100% of your donation goes towards advocacy efforts for TMD patients. Send us a check, money-order on line or via US mail.
- **Corporate Match Program**
  Does your company offer to match your charitable contributions? Check with the Human Resources department at your workplace today!
- **Raise money for the TMJA by using the internet!**
  GoodSearch is a search engine (akin to Google or Yahoo) that donates one penny every time you search. Visit their website and choose "The TMJ Association" as the cause you would like to help! Happy searching!
- **Share our mission with a friend**
  Help your friends/family understand what you're going through by inviting them to join us on Facebook, Twitter, and even register to receive the TMJA's e-newsletter, *TMJ News Bites*.
- **Donate your time and talents**
  Do you (or someone you know) have experience in marketing, fundraising? Do you know someone who understands TMD and is interested in helping us achieve our mission? Would you be willing to offer your expertise pro bono? We'd love to have you on board! Send us an e-mail at info@tmj.org indicating your interest.
- **Honor, memorial and legacy gifts**
  In lieu of gifts for special occasions give a gift to the TMJA in honor or memory of someone in your life. Please also consider a planned gift to the TMJA in your Will or Trust. This gift will enhance our capacity to continue to *change the face of TMJ!*
- **Donate your vehicle**
  Give your well loved vehicle a new home. Contact the TMJA for more details. ♦