Treating chronic pain and breathing disorders with technology

Dr. Steven R. Olmos explores high-tech solutions to treatment problems

Background

My interest in patients suffering from chronic pain originated in dental school. I remember a woman who was being treated by a faculty dentist in the TMJ Department. She was given a nightguard and told to wear it all day. She was on medications for muscle relaxation and anti-anxiety. There was a certainty that these problems were of psychosocial origin at the time, so she was told to take an extended vacation. I was walking by when she tearfully said, "I'm wearing the appliance, taking the medication, and just returned from two months of vacation, and nothing has changed."

In the early 1980s, there were many joint surgeries for these failed patients. Treatment was based on symptom management before, and certainly after, joint surgery. Long-term outcomes were not good.

In the mid-1990s, I sold my dental practice and limited my practice to craniofacial pain (head, face, jaw pain, and headaches). There was always an overlap with pain patients and poor sleep. In 1981, the CPAP was developed as the first nonsurgical and still most frequent treatment for obstructive sleep apnea (OSA). I started to treat patients that had OSA with oral appliances.

I had patients with OSA who suffered from chronic craniofacial pain and vice versa. Current literature demonstrates a high comorbidity.[1,2,3,4]

My dental education focused on the orthopedic function of the jaw and occlusion. In my search for an easy and noninvasive way to know the health of the joints, I investigated Joint Vibration Analysis (JVA) (BioRESEARCH Inc.). It dynamically measures the vibration of soft and hard tissues to determine perforations — when and where the TMJ disc is recaptured or displaced.[5,6,7,8]

My search for novel ways of using technology to treat chronic pain and breathing disorders continues.

Educational aims and objectives

This clinical article aims to discuss how to treat chronic pain and breathing disorders with technology.

Expected outcomes

Orthodontic Practice US subscribers can answer the CE questions on page 52 to earn 2 hours of CE from reading this article. Correctly answering the questions will demonstrate the reader can:

- Recognize how 3D imaging can be beneficial for evaluation of chronic pain and breathing disorders.
- Realize the role that low-level laser therapy can play in chronic pain treatment.
- Realize how orthodontic appliance therapy can help in treatment of chronic pain, sleep-breathing disorders, and orthopedic/orthodontic therapy.
- Identify some testing methods for these chronic pain and breathing disorder issues.

Figure 1

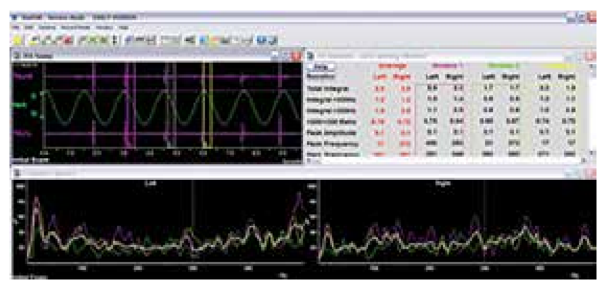

Figure 2

3D imaging

3D imaging of the head is essential when evaluating for chronic pain and dysfunctional breathing. An article published in *The Journal of the American Dental Association* (2013) recommends "the need for complete and proper review of the entire image, regardless of field of view or region of interest."

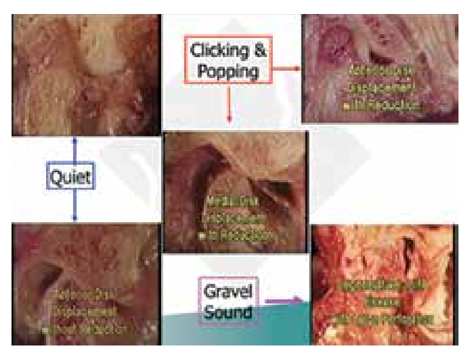

Figure 3

The reason is that incidental findings (IFs) "are detected relatively frequently in CBCT imaging, and considerable variation is evident in their frequency and nature."[9]

Case example

One example of how 3D imaging can make a difference in diagnosis is the case of a 12-year-old boy, whose mother brought him in for his chronic face and jaw pain and severe fatigue. A dentist had recommended a bite splint, and a physician had prescribed

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Disclosure: Aqualizer, Mute, and Max-Air are sponsors for Dr. Olmos' courses.

Figure 4

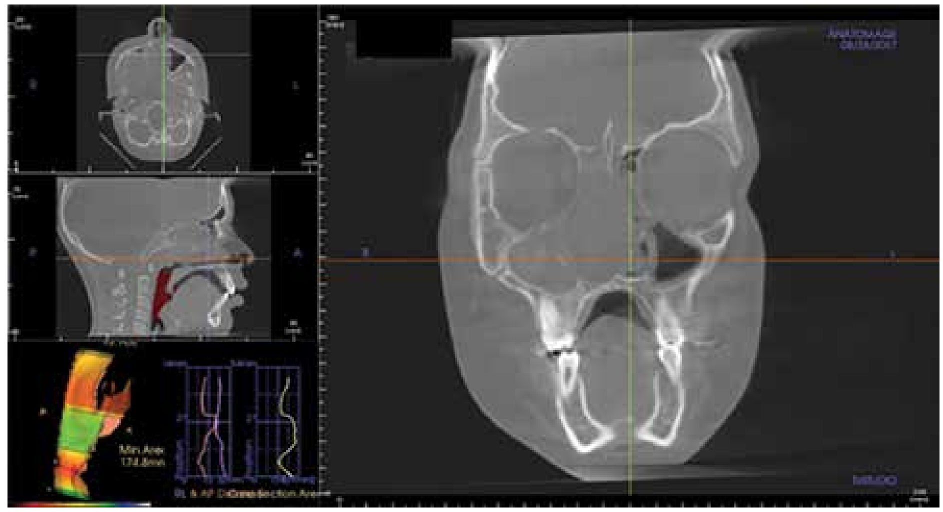


Figure 5

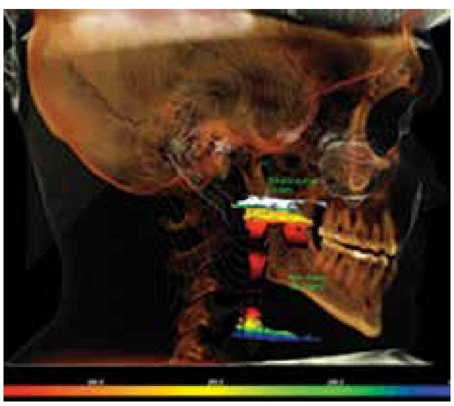


Figure 6

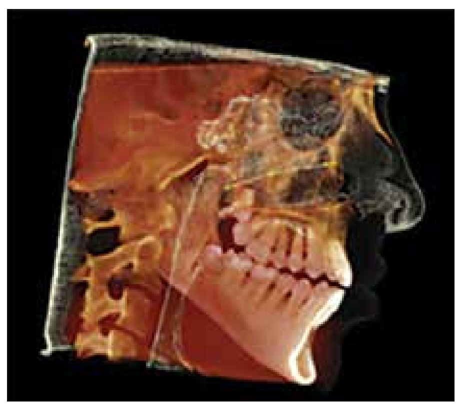


Figure 7

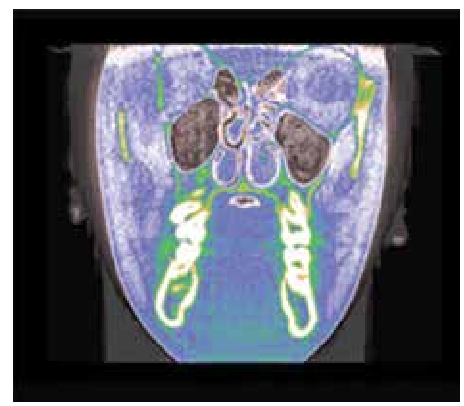


Figure 8

Figures 9 and 10: 9. Start of treatment. 10. 12 weeks MMI

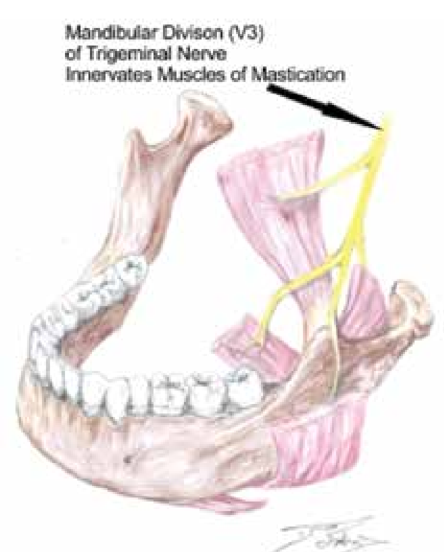


Figure 11

antibiotics and steroid nasal spray for him. Neither practitioner had performed imaging. After my clinical exam, I prescribed a CBCT image only to find an enormous space-occupying lesion that required immediate hospitalization and surgery.

CBCT is important in evaluating condyle regeneration using appropriate decompression appliance therapy and laser rehabilitation.[10] Oral orthotic treatment for craniofacial pain and sleep-breathing disorders have been demonstrated to be effective.[11,12]

Chronic facial pain and low-level laser therapy

One in six adults who visited a general dentist during 2015 experienced chronic facial pain.[13] Pain in the muscles and temporomandibular joints was reported as frequently as that in the teeth and surrounding tissues in patients visiting general dentists. Pain in the orofacial regions affects 21.7% of the population in the United States and costs more than $32 billion each year.[14] The clinical efficacy of low-level laser therapy (LLT) in the treatment of neuropathic pain is well established in many studies.[15-23] This is a very important tool for the treatment of nerve injuries, as all other treatments are palliative, while the laser therapy is truly therapeutic.

Classical trigeminal neuralgia (TN) is a disease of severe, stabbing neuropathic facial pain of the second and third divisions of the trigeminal nerve.[24] It is estimated that one in 15,000 people suffer from trigeminal neuralgia; however, numbers may be significantly higher due to frequent misdiagnosis.[15] The incidence is greatest in people more than 50 years old, and in women more frequently than men.[25] I authored a case study titled "Chasing Pain: Diagnosing and Treating Trigeminal Neuralgia in General Dentistry."[26] The patient was treated unsuccessfully for 4 years with Tegretol. I found the patient to have OSA and treated with an oral appliance and a cold laser (Mphi 5, BioRESEARCH), which uses two wavelengths of light (808 and 905) with a synchronized delivery of both continuous and pulsed modes. The pain was resolved, and the patient was able to discontinue the Tegretol pain-free in 8 weeks.

LLT therapy has been demonstrated to move teeth between 30% and 50% faster with reducing pain by 50% with either straight wire or Invisalign® techniques.[27,28,29,30]

Figure 12

Figure 13

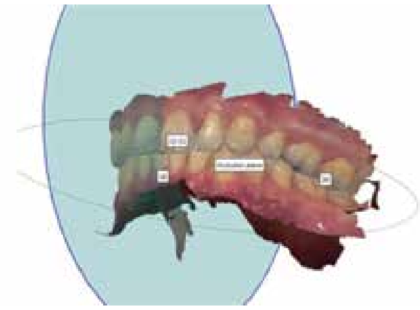


Figure 14

Figure 15

Figure 16

Figures 17 and 18

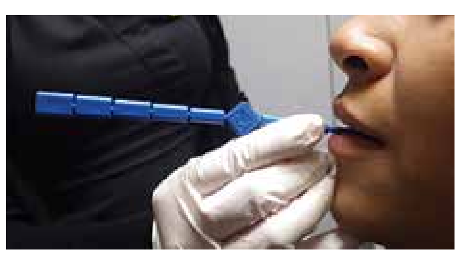


Figure 19

Figure 20

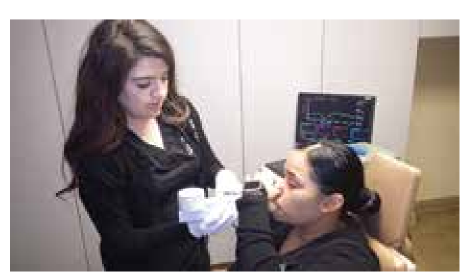


Figure 21. Acoustic pharyngometry

Orthodontic appliance therapy

I reviewed the history of appliance therapy in a previous issue of *Orthodontic Practice US* "Oral appliances — past, present, and future" (July/August 2018).[31] Digital scanning and fabrication of appliances for chronic pain, sleep-breathing disorders, and orthopedic/orthodontic therapy are now done on software in the laboratory. New printed materials (Type 12 Nylon) are crafted from lightweight, flexible, biocompatible materials that are inert and unreactive to soft and hard tissue, in contrast to methyl methacrylate either layered or milled: Both are now available. This technology allows for the first vertical titratable appliance for sleep-breathing disorders (Diamond Digital Sleep Orthotic [DDSO]/Diamond Orthotic Laboratory LLC).[32]

Finding the optimal 3D mandibular position to produce appliances for both orthopedic function and minimizing pharyngeal collapse of the airway for sleep-breathing appliances can be accomplished utilizing the sibilant phoneme registration (SPR) protocol or phonetic bite technique.

Acoustic pharyngometry is used to measure the baseline and collapse of the pharyngeal muscles of the airway in patients with OSA (Figure 21).[33,34] This device allows for evaluation of the bite registration for restoration of tonus. Utilizing the sibilant phoneme registration requires vertical titration as opposed to protrusive for the George Gauge technique. The SPR technique will reduce the chances of TM disc dislocation. (See Figure 22 for airway volume and TM joint position comparisons for the same patient.)

Studies have shown that the two biggest factors in mandibular advancement device (MAD) treatment success are body mass index (BMI) and nasal airway resistance (NAR).[35] Nasal dilators have become a very important part of OSA therapy. Nasal valve dilation has been shown to decrease intraluminal pressures in the oropharynx, which reduces apneic events, via the Starling resistor model (Figure 23).[36]

The volume of the nose can be measured using acoustic rhinometry (Figures 24-26), and the flow rate of the nose can be measured by acoustic rhinomanometry (Figures 27-29).[37,38] This allows for evaluation of normalization of the airway using OTC nasal sprays (Xlear®), nasal dilators (Mute, Max-Air nose cones), and nasal surgery.

Changes to occlusion can occur with or without the use of oral appliances when treating sleep-breathing disorders and/or chronic pain. A study using only nasal CPAP for greater than 2 years produced the same

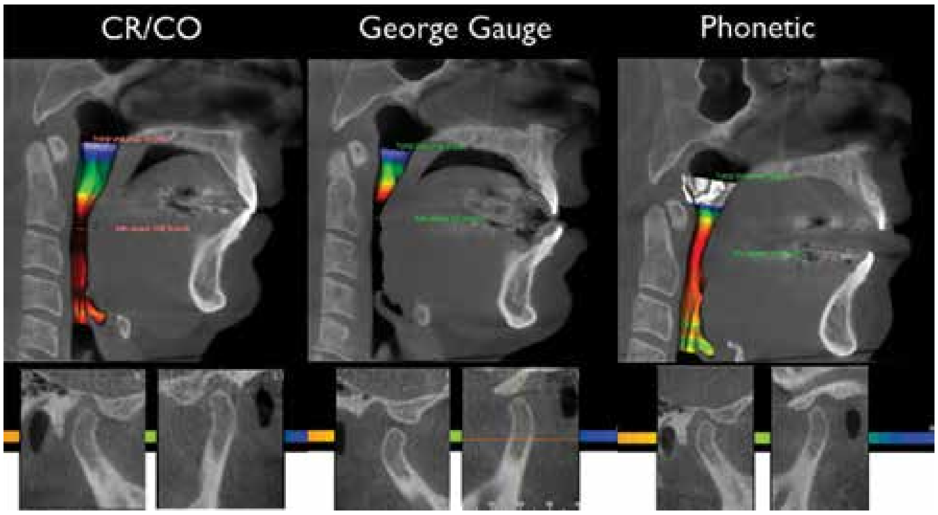


Figure 22: Airway volume/TM joint position comparison in same patient

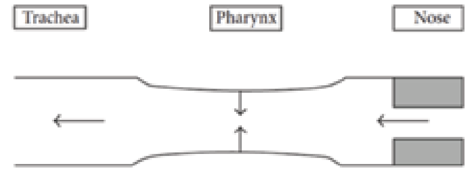


Figure 23: Starling resistor model.

Figure 24: Acoustic rhinometry (volume of the nose)

Figure 25

Figure 26

Figure 27: Acoustic rhinomanometry

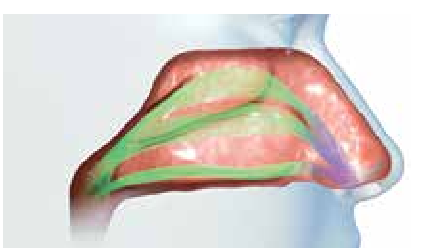


Figure 28: Volume of the nose

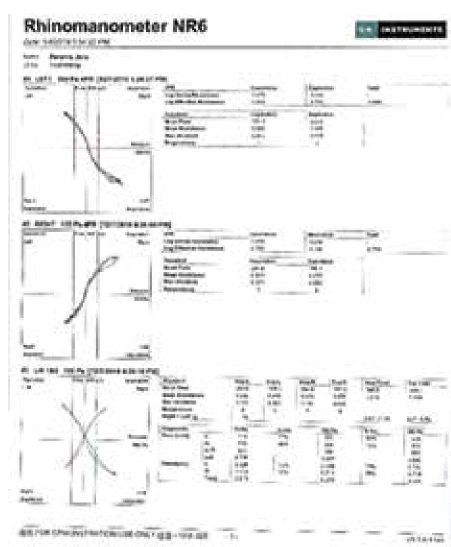


Figure 29

Figure 30

Figure 31

Figure 32

changes as using oral appliances in studies evaluating these appliances changes over 10 years. The changes are correction of anterior rotations, reductions of open bite and overjet (Class II patients), and increase in canine width.[39,40,41,42]

Postural changes such as leg length discrepancy can result in changes to occlusion.[43,44]

Inflammation (capsulitis), osteoarthritis, and disc displacement also can result in changes to occlusion. The T-Scan (Tekscan) (Figure 33) — a device that measures the timing, force, and distribution of tooth contact in real time utilizing a digitized wafer and software — is useful in quantifying occlusion. Figures 34 and 35 show scan of a seated patient with and without foot orthotics. Note the heavy occlusal forces on the left side without and the normalized occlusion with the foot orthotics in place. It is necessary to quantify the efficacy of treatment for OSA via an at home sleep testing (HST) device during treatment. The MediTouch is an effective tool for adult and pediatric OSA patients.[45,46]

Conclusion

Quantifying each step of treatment is the bridge between clinical practice and science (reproducible steps). I am certain that due to our increase in knowledge of the comorbidity

Figure 33: T-Scan connects to computer for real-time occlusal analysis

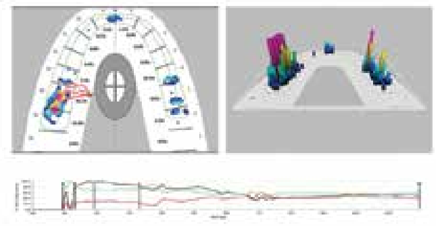


Figure 34: Heavy occlusion left without foot orthotic

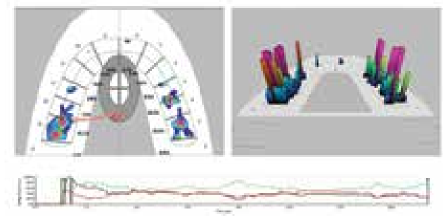
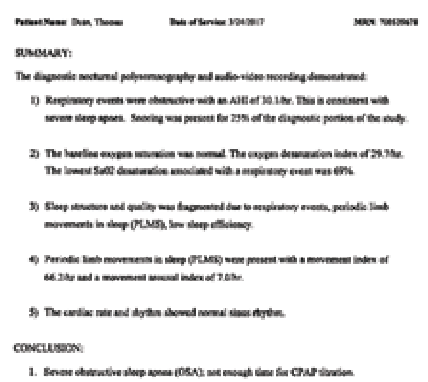


Figure 35: Balanced occlusion with foot orthotic



Patient Name: Dean, Thomas   Date of Service: 3/24/2017   MRN: [illegible]

SUMMARY:

The diagnostic nocturnal polysomnography and audio-video recording demonstrated:

1) Respiratory events were obstructive with an AHI of 30.1/hr. This is consistent with severe sleep apnea. Snoring was present for 25% of the diagnostic portion of the study.

2) The baseline oxygen saturation was normal. The oxygen desaturation index of 29.7/hr. The lowest SaO2 desaturation associated with a respiratory event was 69%.

3) Sleep structure and quality was fragmented due to respiratory events, periodic limb movements in sleep (PLMS), low sleep efficiency.

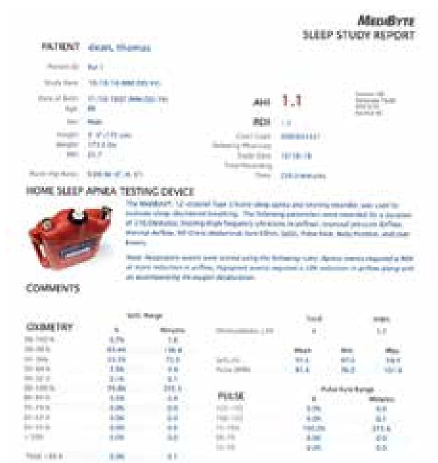
4) Periodic limb movements in sleep (PLMS) were present with a movement index of 66.2/hr and a movement arousal index of 7.0/hr.

5) The cardiac rate and rhythm showed normal sinus rhythm.

CONCLUSION:

1. Severe obstructive sleep apnea (OSA); not enough time for CPAP titration.

Figure 36: Diagnostic PSG (severe sleep apnea)



MEDIBYTE
SLEEP STUDY REPORT

PATIENT

AHI 1.1

HOME SLEEP APNEA TESTING DEVICE

COMMENTS

OXIMETRY

PULSE

Figure 37: Titration HST titration study with hybrid therapy (normal respiration)

Figure 38: Level 3 HST setup

of chronic face pain and sleep-breathing disorders and the technology that exists, I would now be able to help that woman who was suffering way back in my dental school education. OP

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