Chapter 17
Transcutaneous Electrical Nerve Stimulation (TENS) Combined with the T-Scan System: A Case Report

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ABSTRACT
Masticatory muscle hyperactivity has been considered a significant factor in promoting and perpetuating dysfunctional symptoms observed in Temporomandibular Disorder patients. Many therapeutic modalities have evolved within Dental Medicine that attempt to lessen or resolve the varying symptoms frequently reported by dysfunctional patients. One such method, known as Ultra Low Frequency (ULF) Transcutaneous Electrical Neural Stimulation (TENS), has been used to relax the masticatory musculature by applying an electrical stimulus to the efferent motor fibers of the Vth and VIIth cranial nerves, such that TENS can result in pain analgesia and patient sedation, restore compromised muscle physiology, and increase muscle resting length. TENS also aids in establishing a neuromuscular maxillomandibular relationship by inducing a muscually contracted involuntary arc of closure. This chapter discusses TENS as a treatment modality for Temporomandibular Disorders, explains how to employ TENS to obtain a neuromuscular maxillomandibular relationship, and illustrates in a Clinical Case Report the use of TENS in combination with the T-Scan Computerized Occlusal Analysis System to measurably and physiologically balance a removable overlay anatomical acetyl resin orthotic prosthesis.

INTRODUCTION
Masticatory muscle hyperactivity has been considered a significant factor in promoting and perpetuating dysfunctional symptoms observed in Temporomandibular Disorder patients. Muscle hyperactivity leads to facial pain, clenching and grinding habits, temporal headaches, and mandibular fatigue. Suggested muscle relaxation treatments include muscle relaxant medications (Dionne, 1997), biofeedback (Dalen, Ellertsen, Espelid, & Gronningsaeter, 1986), stress reduc-
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In addition to traditional methods such as counseling (Schumann, Zwiener, & Nebrich, 1988), intraoral orthosis (Carr, Christensen, Donegan, & Ziebert, 1991), and therapeutic massage (Wright & Schiffman, 1995), Ultra Low Frequency (ULF) Transcutaneous Electrical Neural Stimulation (TENS) has been shown to cause direct stimulation of motor nerves (Gomez & Christensen, 1991). This stimulatory effect can be used to relax hyperactive masticatory musculature, by applying a once-per-second electrical stimulus to the efferent motor fibers of the Vth and VIIth cranial nerves (Kamyszek, Ketcham, Garcia, & Radke, 2001). After electrodes are properly placed on the patient’s head (Figure 1), brief rhythmic twitch contractions are induced within the musculature, resulting in an increase in circulation and a reduction in posturing electrical activity (Kamyszek, Ketcham, Garcia, & Radke, 2001). Afferent nerve fibers are also stimulated during the pulsing, such that TENS has been used to provide analgesia for patients suffering from facial pain (Holt, Finney, & Wall, 1995), to control the pain response to cavity preparation (Horiuchi, Suda, Hanada, & Suzuki, 1978), and as a method of patient sedation (Shane & Kessler, 1967).

Studies involving ULF-TENS have determined that TENS reduces muscle activity levels on the resting EMG levels of both hyperactive and relaxed muscles (Kamyszek, Ketcham, Garcia, & Radke, 2001). Additionally, TENS has been shown to establish a nonendorphinergic analgesic effect that follows prolonged and continuous muscle pulsing (Pertovaara, Kemppainen, Johansson, & Karonen, 1982; Olausson, Eriksson, Ellmarker, Rydenhag, Shyu, & Andersson, 1986). However, one study revealed that although TENS reduced both pain and EMG activity of the anterior portion of the temporal muscle, it increased the activity of the masseter muscles during Maximum Voluntary Clench (MVC). The study showed that a single

Figure 1. One set of three TENS electrodes are placed over the Left and Right Coronoid notches, with the third electrode placed on the center of the neck below the Nuccal Line. The second set of three TENS electrodes are placed over the Left and Right Scalene muscle groups, between the sternocleidomastoid and Levator Scapulae. A third electrode is centered on the neck beneath the one first placed below the Nuccal Line. Here, the patient is being pulsed into articulating paper to mark the occlusal contacts present on an orthotic.
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