Surface Electromyographic Characteristics of a Myofascial Trigger Point of the Temporalis Muscle: A Case Report

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Myofascial pain is a condition associated with regional pain and muscle tenderness characterized by the presence of myofascial trigger points. In this case report, a subject complaining of nighttime bruxism was clinically assessed, and a latent trigger point of the anterior temporalis muscle was identified with manual palpation. A surface electromyographic (SEMG) exam of the anterior temporalis muscle harboring the latent trigger point demonstrated several SEMG features, including post-contraction irritability, delayed relaxation following contraction and accelerated muscle fatigue. It was concluded that a SEMG exam may detect abnormal masticatory muscle function and, therefore, assist in the evaluation of myogenous temporomandibular disorders.

Key words : Myofascial pain, Trigger points, Masticatory muscles, Surface electromyography.

I. INTRODUCTION

Myofascial pain is a condition associated with regional pain and muscle tenderness characterized by the presence of hypersensitive nodules, called myofascial trigger points.[1)] An active trigger point causes spontaneous pain at rest, and the pain increases on contraction or stretching of the involved muscle. A latent trigger point is a focal tender area in a muscle without spontaneous pain. To date, there are no validated diagnostic tests or criteria for the identification of trigger points. The diagnosis of myofascial pain mostly relies on careful manual palpation.[2,3)] Surface electromyography (SEMG) of muscles harboring active myofascial trigger points seldom records electrical activity at rest, but tends to exhibit increased motor activity during contraction,[4)] and discloses several functional problems such as increased responsiveness, delayed relaxation, and increased fatigability.[1)] Needle EMG studies have revealed spontaneous electrical activity (SEA) generated at myofascial trigger point loci[5)]

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although much controversy exists as to whether SEA represents normal muscle endplate activity. The SEMG characteristics of the masticatory muscles with myofascial trigger points seldom have been reported in the literature. The purpose of this case report is to present SEMG findings for a patient diagnosed with myofascial pain of the temporalis muscle with a latent trigger point.

II. CASE PRESENTATION

A 26-year-old woman presented to the Department of Oral Medicine at Chonnam National University Dental Hospital with a complaint of nighttime tooth grinding and intermittent noise of the temporomandibular joint (TMJ). The clinical examination revealed a good dentition and occlusion. The mandibular range of motion was within normal range. There was no audible or palpable sound on both TMJs. The palpation of the TMJ and extraoral masticatory muscles revealed a tender, palpable nodule on the left anterior temporalis site, which was indicative of a latent trigger point of myofascial pain. There was no significant pathologic finding in the panoramic and transcranial radiographs.

For the SEMG exam, the subject was seated upright in a dental chair with her head unsupported and the Frankfurt horizontal plane parallel to the floor. Self-adhesive pre-gelled disposable bipolar Ag/AgCl surface electrodes (Duotrode; Myotronics-Noromed, Inc., Seattle, WA, USA) were placed along the fibers of the anterior temporalis and superficial masseter muscles bilaterally. The reference electrode was placed over the spinous process of the seventh cervical vertebra. Resting muscle activity was recorded for 15 s with both eyes of the subject closed. Next, the subject was instructed to clench her jaw as strongly as possible (maximum voluntary contraction, MVC) in the intercuspal position and to maintain the same level of contraction for 2 or 3 s several times. Finally, sustained clenching for 50 s with 100% MVC was performed to induce muscle fatigue and to analyze the frequency power spectrum. SEMG signals from

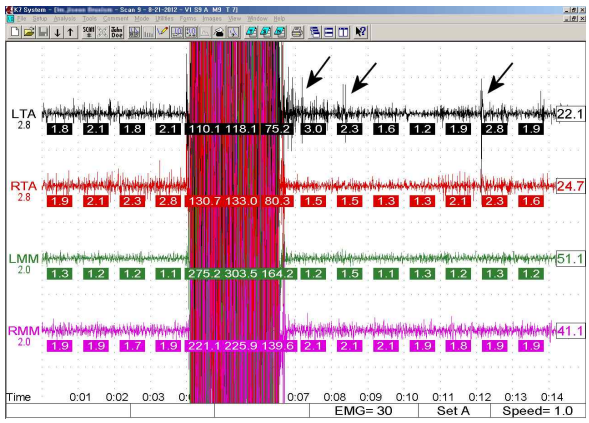

Fig. 1. Raw SEMG tracing of the anterior temporalis and superficial masseter muscles, including one clenching task during the 15 s recording time. The arrows of the left anterior temporalis tracing indicate hair-like myoelectric signals following the cessation of the clenching task, revealing post-contraction muscle irritability. LTA: left anterior temporalis; RTA: right temporalis anterior; LMM: left superficial masseter; RMM: right superficial masseter; EMG amplitude unit: μV

each electrode arrangement were amplified using an eight-channel differential amplifier (K7 EMG PRE-AMP; Myotronics-Noromed, Inc.) and were analyzed using K7 software (Myotronics-Noromed, Inc.). The average rectified value (in microvolts) served as the amplitude variable for the resting condition. The integral average value (in microvolts) was calculated during 2-3 s maximum clenching tasks. The percent change of median power frequency from the initial 1.42 s to the last 1.42 s time windows were calculated for the 50 s sustained clenching task.

The SEMG tests revealed that the raw amplitude of the temporalis and masseter muscles under the resting condition was generally 1.0-2.0 μV and did not exceed 3.0 μV. During the 2-3 s maximum clenching periods, the masseter muscle showed higher raw amplitude than the temporalis, and the amplitude of the left temporalis was ~15% lower than that of the right. The left anterior temporalis

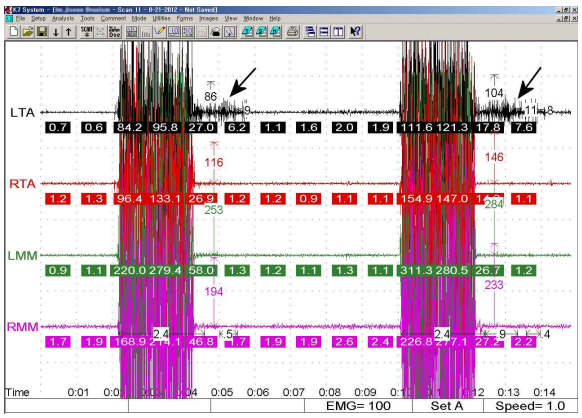

Fig. 2. Raw SEMG tracing of the anterior temporalis and superficial masseter muscles, including two successive clenching tasks during the 15 s recording time. The arrows of the left anterior temporalis tracing indicate incomplete and delayed muscle relaxation for ~1.5 s following each contraction task. LTA: left anterior temporalis; RTA: right temporalis anterior; LMM: left superficial masseter; RMM: right superficial masseter; EMG amplitude unit: μV

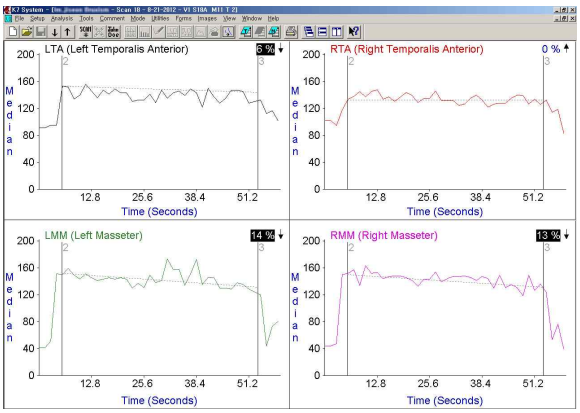

Fig. 3. Frequency spectrum analysis of the anterior temporalis and superficial masseter muscles for the sustained clenching task of 100% MVC lasting ~50 s. The median frequency of the left anterior temporalis muscle decreased by 6% at the end of the muscle contraction period, but there was no change for that of the right anterior temporalis. The right and left superficial masseter muscles showed symmetrical decrease in the median frequency, and were more susceptible to fatigue than the temporalis muscle for sustained contraction.
LTA: left anterior temporalis; RTA: right temporalis anterior; LMM: left superficial masseter; RMM: right superficial masseter; EMG frequency unit: Hz

showed post-contraction irritability, with hair-like myoelectric signals (Fig 1) and, in addition, incomplete, delayed muscle relaxation (Fig 2), following cessation of the clenching tasks. Frequency spectrum analysis for the 50 s sustained clenching task revealed a 6% decrease in the median frequency of the left anterior temporalis muscle at the end of contraction, and in contrast, no change in that of the right anterior temporalis. The median frequency of both sides of the superficial masseter muscle decreased symmetrically (right side 13% and left side 14%, respectively).

Ⅲ. DISCUSSION

In this case report, the SEMG exam on the temporalis muscle harboring a myofascial trigger point demonstrated several abnormal characteristics of muscle function including post-contraction irritability, delayed relaxation following contraction and accelerated muscle fatigue. The abnormal pattern of muscle activity could be identified even though the trigger point was latent in nature. Latent trigger points share clinical characteristics in common with active trigger points except that they do not produce spontaneous pain. Both active and latent trigger points can cause motor dysfunction.[1)]

In the present case, raw SEMG tracings clearly depicted such features as hair-like myoelectric signals, indicating post-contraction muscle irritability, and incomplete delayed muscle relaxation, following the cessation of the clenching tasks. Post-movement irritability in a muscle that harbors a trigger point was also described.[6)] The lack of a return to pre-movement baseline levels, as well as the hair-like elements seen in the post-recruitment pattern, may represent a

disturbance in the muscle spindle secondary to the presence of a trigger point.[6] Ibarra[7] explained that myofascial trigger points are associated with reduced efficiency of reciprocal inhibition, which may contribute to delayed and incomplete muscle relaxation following exercise, disordered fine movement control, and unbalanced muscle activation.

Localized muscle fatigue has been defined as a failure to maintain the expected force.[8] Merletti[9] showed negative trends of spectral variables and conduction velocity, and positive trends of amplitude variables, as myoelectric manifestations of muscle fatigue. Naeije[10] suggested the rate of frequency shift to lower frequencies of the power spectrum as a valuable parameter to quantify the masseter muscle's susceptibility to fatigue. Among the several power frequency parameters, the median frequency is preferred because it is the least sensitive to noise,[11] and it appears to reflect reliably the changes in the shape of the power spectra during fatigue.[12] The median frequency of the power spectrum from the masseter muscle is lower than that from the temporalis muscle,[12-14] and the median frequency moves to a lower frequency during sustained masticatory muscle contraction.[12,14]

The sustained contraction time of 50 s in this case is considered sufficient for fatigue induction because muscle fatigue appears after about 30 s of 100% MVC clenching.[15,16] In the present case, the superficial masseter muscle was more susceptible to fatigue than the temporalis muscle for sustained contraction. This finding corresponds well with other studies[12,17] reporting that the masseter muscle shows a relatively fast decrease of the median frequency of the power spectrum, whereas the other facial muscles show a much slower decrease. Hagberg[17] showed that the slope of regression for the force level 0-100% MVC was steeper for the masseter muscle than for the anterior temporalis muscle. Van Boxtel[12] found relatively high endurance in orbicularis oris, frontalis, and corrugator supercilii muscles; intermediate endurance in zygomaticus major, buccinator, and temporalis muscles; and low endurance in the masseter muscle.

In this case, the median frequency of the anterior temporalis muscle on the involved side, which had a trigger point, decreased 6% at the end of sustained maximum clenching, whereas there was no decrease on the other side, which is consistent with previous studies.[18,19] These findings may support the clinical value of SEMG in the assessment of jaw and neck muscles of patients with temporomandibular disorders (TMD). Gay[19] compared the properties of muscle fatigue in the masseter and temporalis muscles of normal individuals and those with myofascial pain, and revealed accelerated fatigue of the muscles of myofascial pain patients. Decreases in median power frequency over time were significantly greater for the myofascial pain patients than normal subjects, and increases in RMS power were significantly greater over time for the patients. Castroflorio[20] showed that the initial values of mean frequency and averaged rectified value were lower in patients with muscle-related TMD. Hagberg[18] found accelerated fatigability electromyographically and in terms of work tolerance of the trapezius muscle that had myofascial trigger points as compared to a contralateral muscle that was pain-free.

In conclusion, with a bruxism patient, a latent trigger point of the temporalis muscle which had been identified clinically with manual palpation displayed several abnormal SEMG characteristics related to altered muscle function. This case report showed that a SEMG exam might assist in the evaluation of masticatory muscles of TMD patients.

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국문초록

측두근의 근막동통 발통점의 표면 근전도 특성: 증례 보고

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근막동통은 국소적인 통증과 촉진시 근 압통을 보이면서 근막 발통점이 존재하는 것이 특징인 근육질환이다. 본 증례에서는 야간 이갈이를 호소하는 환자의 임상검사에서 촉진을 통해 측두근 전방 부위의 잠재성 발통점을 확인하였고, 양측의 측두근과 교근에 대해 표면 근전도 검사를 시행한 결과, 이환된 측두근에서 수축 후 근과민성, 이완 지연 및 근피로 가속과 같은 소견을 얻을 수 있었다. 표면근전도 검사는 저작근의 비정상적인 기능을 확인할 수 있으므로 근육성 측두하악장애의 평가에 도움이 될 수 있다.

주제어: 근막동통, 발통점, 저작근, 표면근전도