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REVIEW ARTICLE

Transcutaneous electrical nerve stimulation for temporomandibular joint disorder*

O uso da estimulação elétrica nervosa transcutânea na disfunção temporomandibular

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SUMMARY

BACKGROUND AND OBJECTIVES: Temporomandibular joint disorder (TMD) is a term to describe a group of diseases functionally affecting the masticatory system, especially masticatory muscles and the temporomandibular joint (TMJ). It has different etiologies and specific treatments, among them the transcutaneous electrical nerve stimulation (TENS). This article aimed at reviewing the scientific literature on the use of TENS in TMD patients.

CONTENTS: Epidemiological studies show that approximately 75% of people have some TMD sign, while 33% have at least one symptom. Whenever possible, one should treat the cause of pain. When it is impossible to determine its etiology, one should start with less invasive and reversible procedures, especially for pain and muscle dysfunction. TENS therapy consists of administering electrical current to the skin surface, to relax hyperactive muscles and promote pain relief.

CONCLUSION: Although there are controversies about the use of TENS to control chronic pain, its use for masticatory muscle pain is still relevant. However, an accurate diagnosis is needed to prevent its inadequate use. We still need controlled randomized studies including selected samples to homogenize the use of TENS in TMD patients.

Keywords: Miofascial pain, Orofacial pain, Temporomandibular joint disorder, Transcutaneous electrical nerve stimulation, Trigger-points.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A disfunção temporomandibular (DTM) é um termo que descreve um grupo de doenças que afetam funcionalmente o aparelho mastigatório, particularmente a musculatura mastigatória e a articulação temporomandibular (ATM). Tem etiologias múltiplas e tratamentos específicos, entre os quais a estimulação elétrica nervosa transcutânea (TENS). O objetivo deste artigo é o de revisar a literatura científica sobre o uso da TENS em pacientes com DTM.

CONTEÚDO: Estudos epidemiológicos mostram que aproximadamente 75% da população apresentam algum sinal de DTM, enquanto 33% possuem ao menos um sintoma. Sempre que possível deve-se tratar a causa da dor, caso não se consiga estabelecer a sua etiologia, inicia-se com procedimentos menos invasivos e reversíveis, especialmente nos casos de dor e disfunção muscular. A terapia com TENS consiste na administração de corrente elétrica na superfície cutânea, de modo a relaxar os músculos hiperativos e promover o alívio da dor.

CONCLUSÃO: Embora existam controvérsias quanto ao uso de TENS para o controle da dor crônica, seu uso na dor muscular mastigatória continua relevante. Entretanto, é fundamental o diagnóstico preciso para evitar uso inadequado. São necessários ainda estudos randomizados controlados que incluam amostras selecionadas para homogeneizar o uso de TENS em pacientes com DTM.

Descritores: Disfunção temporomandibular, Estimulação

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INTRODUCTION

Temporomandibular joint disorder (TMD) is a generic term to describe a group of disorders or diseases affecting masticatory muscles, the temporomandibular joint (TMJ) and associated structures[1].

Epidemiologic studies show that approximately 75% of the population have some TMD sign, while 33% have at least one symptom[2]. Only part of the population has severe enough problems to look for clinical treatment.

The combination of different signs and symptoms in an adequate TMD classification helps the achievement of adequate diagnosis. Widely used classifications for clinical investigations are proposed by the American Academy of Orofacial Pain (AAOP) and by Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)[3], although other classifications are suggested and used.

Several symptoms may be present in TMD, being pain, predominantly in masticatory muscles, one of the most common symptom[4]. Clinical presentation suggestive of TMD in general includes jaw movement changes or limitations, face, head or cervical pain and joint noises. Symptoms such as headache or earache, dizziness and hearing problems may be associated to TMD[5]. In addition, chronic TMD patients often report depression, poor sleep quality and low morale[6].

Early TMD handling assumes that systemic and life threatening diseases are discarded. For such a thorough differential diagnosis is necessary, in addition to the accurate determination of etiologic agents involved with each specific group.

Many studies have shown the effect of some therapeutic resources which may decrease pain and reestablish masticatory muscles function[7]. Among them, transcutaneous electrical nerve stimulation (TENS) deserves special attention, because it is safe and provides decreased pain and electromyographic activity (EMG) of masticatory muscles at rest in TMD patients[7]. There are several studies on the effects of TENS therapy[8-10].

This study is a literature review on the application of TENS to TMD.

To find adequate and relevant articles for this literature review, the following terms were combined: "dor miofascial", "trigger points", "TENS", "transcutaneous electrical nerve stimulation", "orofacial pain", and "estimulação elétrica nervosa transcutânea".

BBO, Cochrane, LILACS and Medline databases were queried from 1989 to 2011 and were supplemented by manual search in journals and chapters of books. This research was carried out with humans and animals and was limited to publications in Portuguese and English.

ETIOPATHOGENESIS OF TEMPOROMANDIBULAR DISORDERS

Several factors may influence TMD evolution, such as muscle hyperactivity, trauma, emotional stress and malocclusion, together with several predisposing factors which may trigger or perpetuate the disorder[11].

The importance of occlusal factors as etiologic or risk factors for TMD has been widely investigated in recent years. Occlusal treatments, such as occlusal adjustment of natural teeth, orthodontic treatment and occlusal splints were widely used based on the principle that unfavorable occlusal contacts could lead to neuromuscular changes[12]. Cause and effect relationship between occlusion and TMD is considered poor or inexistent, based on epidemiologic data and systematic reviews[13].

It is known that skeletal muscles are major sources of generally diffuse and underdiagnosed pain, varying from pain after exercises to painful myofascial syndrome. In this latter case, there may be areas of hyperirritability, called myofascial trigger points (MTP), which are sensitive sites in muscle bands, tendons or ligaments[14], which may generate local or referred pain with a typical pattern[15]. These points, when present in masticatory muscles, are directly related to TMD manifestations, as observed in a systematic review[16] where myofascial pain was the most common diagnosis among studied patients. In a series of 86 patients with bruxism, authors[17] have found 898.6% with TMD symptoms. So, it is inferred that bruxism may also contribute to the development of TMD[18,19].

Currently, most authors advocate the idea of a multifactorial etiology for most TMD. Especially in muscle pain, considering that its etiology has not been yet totally explained, conservative and reversible treatments are recommended as the standard to decrease pain and muscle tension in these patients[20].

MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS

Investigators agree that invasive and irreversible approaches should be recommended with care, especially during early TMD handling[21]. There are several noninvasive and reversible therapies which, in those cases, are useful to control pain of most patients with such disorder[22], especially functional or idiopathic disorders.

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Pain relief is the primary reason why patients look for professional care. In the absence of a clear understanding of the significance of TMD, it has been treated as a syndrome affecting the masticatory system and this limits management to common, very often iatrogenic procedures[23].

TMD handling may be simple or may require a multidisciplinary approach. Dentists, physicians, psychologists and physical therapists work together to cope with such condition afflicting patients. Clinical treatment is considered the first choice[24]. Numerous physical therapy methods are effective to treat TMD, such as moist heat, ultrasound, TENS, microwaves, laser, exercises and manual therapy techniques[6]. These methods aim at decreasing musculoskeletal load and pain effects, at decreasing inflammation, at restoring normal joint function (strength, movement and resistance) and at helping return to daily activities[25].

In addition to interocclusion devices (IOD), TMD patients may use medication, acupuncture, chiropractic, physical therapy techniques, such as relaxation, TENS and biofeedback, among other modalities. A considerable subgroup of patients with chronic TMD does not respond to IOD, and there is also no broad professional consensus with regard to most treatments that are effective for these patients[26]. In addition, TMD patients do not look for a single treatment modality and, in general, are more prone than TMD-free people to receive several types of medical and dental care[27].

TENS TO HANDLE PAIN

TENS therapy is basically the use of a device administering low voltage, pulsed electrical current as a two-phase, symmetric or asymmetric wave, balanced as a positive square semi-wave and a negative peak[28]. When applied to the skin surface through electrodes, its objective is to relax hyperactive muscles and promote pain relief[29]. There are different devices available in the Brazilian market and it is not known whether they are standardized.

There are different pulse frequencies, intensities and durations. They are classified in two groups: high frequency, higher than 50 Hz and low frequency, lower than 10 Hz. Those used in dentistry are in general mixed, with low and high frequency currents. In case of high frequency (50 to 150 Hz) and low intensity, the action seems to be essentially central, although studies are controversial about its action on chronic pain. Low frequency has essentially peripheral action being indicated for muscle relaxation. When intensity is being adjusted, one should avoid muscle contractions, trying to obtain hypoesthesia or paresthesia of the treated region, regulating the device according to patients' sensitivity. Studies indicate that intensities varying from 10 to 30 milliamps are the most adequate, producing few fasciculations. Values between 40 and 75 microseconds are recommended as pulse time[30].

TENS applied to dentistry aims at controlling chronic pain in selected cases[31] and at relaxing masticatory muscles[32]. Some authors[7] have observed that, at rest, muscular TMD patients have higher myoelectric activity of jaw elevator muscles as compared to control groups, being more evident in the anterior portion of the temporal muscle. TENS application has promoted pain relief with simultaneous decrease of myoelectric activity in the anterior portion of these muscles at rest. The same authors[7] postulate that increased electromyographic amplitude of jaw elevator muscles at rest is probably due to sensorymotor interactions of the craniofacial segment which may modify action potentials generation and, finally, myoelectric activity amplitude.

TENS effects, however, are based on different theoretical bases: direct stimulation of motor nerves lead masticatory muscles to execute rhythmic contractions. These repetitive skeletal muscles movement, together with its mild rhythmic movement, increases local blood flow thus decreasing interstitial edema and tissue build up of noxious metabolites. This way pain is decreased, increasing energetic availability of phosphate radicals, decreasing muscle hypoxia and masticatory muscles fatigue[33].

Another theoretical basis for electroanalgesia was published in 1965 through the gate of pain theory[34]. This theory proposes that there is a gate in spinal cord dorsal horn which regulates the nociceptive entrance through small diameter afferent nervous fibers. This may be counterbalanced, or even canceled, by tactile or pressure stimulations and / or through electric current[30] on large diameter fibers, resulting in inhibition of nociceptive stimulations to spinal and supraspinal structures and the gate may be effectively closed. So, TENS would act by involving peripheral and central mechanisms[34].

TENS is a relatively economic, safe and noninvasive therapeutic modality and may be used to treat several painful conditions[29]. Electrodes may be made of silicone with gel application between them and the skin, or may be self-adhesive. They are positioned at the origin of pain or as close as possible to the highest pain site; within the same dermatome, myotome and on myofascial trigger points or acupuncture points. There is also the option of placing them on the pathway of peripheral nerves involved with

pain genesis and / or maintenance. Results obtained with regard to pain will determine their positioning[35].

Some studies have shown the effectiveness of TENS to treat TMD, both combined with other therapies and to improve stomatognathic system functionality. In this sense, some studies[36] report that TMD patients have hyperactivity of masticatory muscles with the jaw at rest and this may cause ischemia, muscle fatigue, functional disorders and pain. It has also been emphasized that myalgia would be caused by connective tissue aseptic local inflammatory reaction.

This condition, which adds muscle hyperactivity and pain, may resolve spontaneously or may become chronic, resulting in increased muscle tension and, consequently, in loss of functionality. This has been shown by a research[21] which has evaluated jaw movement amplitude in TMD patients, submitting them to treatments such as low frequency laser therapy or TENS. It has been observed that both treatments have improved mouth opening immediately after therapy and TENS has presented significant improvement ($p < 0.01$). Authors[21] then suggest that both therapies may be used as adjuvants for some types of TMD.

Decreased myoelectric activity of jaw elevator muscles at rest as result of TENS has been previously described[8-10]. A pilot study was designed[21] to compare electromyographic biofeedback and TENS in patients with bruxism. In this study, both treatments have led to local relaxation of masticatory muscles and there has been statistically significant decrease in electromyographic levels for the group involving the masseter muscle after using TENS.

A study[15] has observed that 95.3% of persistent idiopathic facial pain patients have at least one muscle with tone changes at rest, determined by electromyographic exam. These values returned to normal 45 minutes after TENS. This same study has concluded that TENS together with IOD leads the jaw to a new spatial position. This new occlusion determines significant improvement in bite quality and strength, revealing at least 25% better muscle function efficiency ($p < 0.05$) for most evaluated muscles, in addition to the efficacy of such device to decrease pain[15].

Other authors[37] have also evaluated combined therapy with occlusal splint and TENS in patients with TMD and bruxism. Results have indicated a strong association between bruxism and TMD, in line with other studies[38]. Of all patients with bruxism, 60% had TMD. However, it has been observed that occlusal splints and TENS did not improve TMD signs and symptoms, differently from other studies which consider the use of occlusal splints in bruxism[39] and non-bruxism[40] patients as the best treatment for TMD patients.

An investigation was carried out[41] about the influence of occlusal splint therapy and physical therapy combined with TENS on craniomandibular disorders through the Craniomandibular Index (CMI). This index objectively measures the severity of jaw movement problems, joint noise, muscle and joint sensitivity. In this study, the observation of signs and symptoms of craniomandibular disorders has significantly decreased ($p < 0.001$) during six weeks of using occlusal splints, physical therapy and TENS in 83% of evaluated patients. The conclusion was that this combination may be a reversible treatment choice.

A systematic review[29] was carried out to evaluate the analgesic efficacy of TENS. Conclusions question its efficacy as single treatment for acute pain in adults. Data of this study are not sufficient due to the incomplete filling of treatment modalities by many rejected studies, making replication of interpretation and analysis impossible.

A research[35] was carried out between 1975 and 1990 with a review of 25 studies about TENS efficacy to relieve different types of pain. The conclusion was that such therapy may be used as adjuvant to control pain. They also mention that it is difficult to compare studies involving TENS since there are major differences in experimental models and methodology; in addition, mean number of patients was smaller in studies considered as effective, which in theory would decrease their significance.

Due to specific masticatory system characteristics, TENS for pain and temporomandibular disorder should also be used aiming at such uniqueness. In this sense, further controlled studies with homogeneous samples of TMD patients are needed to confirm the beneficial aspects of this therapy to control craniofacial pain.

CONCLUSION

TENS is a treatment alternative for pain and TMD in duly selected patients. Due to the variability of TMD groups, controlled randomized studies are needed in specific populations to identify patients and diseases responsive to this type of treatment. In addition, it is also necessary to identify facial pain syndromes where adjuvant TENS therapy may be beneficial. Currently, the option to use TENS largely depends on clinical experience and its handling by health professionals.

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