

Guidelines for somatosensory evaluation of temporomandibular dysfunction and orofacial pain patients*

Diretrizes para avaliação somatossensorial em pacientes portadores de disfunção temporomandibular e dor orofacial

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SUMMARY

BACKGROUND AND OBJECTIVES: Different stimulations are needed to evaluate the integrity of afferent fibers and to better understand the mechanisms involved in different pain conditions which may affect the orofacial region. This study aimed primarily at reviewing the literature to provide guidelines to the clinical practice.

CONTENTS: PubMed database was searched from 1990 to 2011 using MeSH terms. Mechanical stimulation could be done with Von-Frey monofilaments to test A-beta and A-delta fibers. Pinprick test is a simple way to evaluate A-delta and C fibers. Pressure pain threshold (PPT) tests A-delta and C fibers. Among thermal test modalities one may use ice cubes or a freezing spray to measure the level of central sensitization involved. Electric stimulations applied by the Neurometer/Neurotron[®] device evaluated three major fibers (A-delta, A-beta and C), hyperesthesia and hypoesthesia. In addition, C fibers can also be evaluated by chemical stimulations with capsaicin and/or menthol.

CONCLUSION: Quantitative sensory tests are a reliable way to evaluate nervous fibers sensory function. Sensory deficit may be quantified and data may be used as diagnostic aid or to compare the effectiveness of different treatment approaches.

Keywords: Headache, Miofascial pain syndromes, Pain perception, Pain threshold, Thermal sensitivity.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Diferentes estímulos são necessários para avaliar a integridade das fibras aferentes e compreender melhor os mecanismos envolvidos nas diferentes condições dolorosas que podem afetar a região orofacial. O principal objetivo deste estudo foi realizar uma revisão da literatura, proporcionando diretrizes para a prática clínica.

CONTEÚDO: Foram realizadas buscas na literatura de 1990 a 2011, na base de dados Pubmed utilizando-se termos MeSH. A estimulação mecânica pôde ser realizada mediante o uso de monofilamentos de Von-Frey, para testar as fibras A-beta e A-delta. O teste de picada é uma maneira simples de se avaliar as fibras A-delta e C. O limiar de dor à pressão (LDP) testa as fibras A-delta e C. Dentre as modalidades de ensaios térmicos, pode-se utilizar cubos de gelo ou um *spray* aerossol congelante para medir a nível de sensibilização central envolvido. Os estímulos elétricos, aplicados pelo aparelho Neurometer/Neurotron[®], avaliam os três tipos principais de fibras (A-delta, A-beta e C), hiperestesia e hipoestesia. Além disso, as fibras do tipo C também podem ser avaliadas por estímulos químicos com capsaicina e/ou mentol.

CONCLUSÃO: Os testes quantitativos sensoriais consistem em uma forma confiável para avaliação da função sensorial das fibras nervosas. O déficit sensorial pode ser quantificado e os dados utilizados como auxílio diagnóstico ou para comparações de eficácia entre diferentes modalidades de tratamento.

Descritores: Cefaleia, Limiar da dor, Percepção da dor, Sensibilidade térmica, Síndromes da dor miofascial.

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INTRODUCTION

The clinician wishing to treat pain patients should initially know how nociceptive impulses are produced and how they are processed by the central nervous system (CNS). Primary afferent neurons have axons of different thicknesses, being A fibers the thickest and C fibers the thinnest. Fibers are subdivided into alpha fibers (13-20 μm), beta fibers (6-13 μm), gamma fibers (3-8 μm) and delta fibers (1-5 μm). From these fibers, the thickest ones transmit impulses faster than the thinner ones. C fibers are 0.5-1 μm thick and have a transmission velocity of 0.5 to 2 m/s. The fiber type is also related to the type of impulse it transmits, that is, A alpha, beta and gamma fibers, which are faster, transmit proprioception and touch stimuli. A delta and C fibers, which are slower, transmit painful stimuli. In addition, there are two types of pain stimuli. A pinprick and fast type, transmitted by A delta fibers, and a burning type, transmitted by slower C fibers. A delta fibers also transmit intense hot and cold tactile stimuli. C fibers also transmit chemical stimuli, itching and thermal hot and cold stimulations¹.

Although a lot has been studied about temporomandibular dysfunctions (TMD), little was explained and defined about their etiology, mechanism and treatment². They are multifactorial and their treatment is usually multidisciplinary. In addition, TMDs may be acute or chronic with different characteristics and behaviors influencing diagnosis and treatment. As already described, chronic TMDs in general involve more complex generation processes and may be maintained for long periods if not adequately treated. Chronic pain reported in these cases is often related to emotional and mood disorders, depression and central pain maintenance mechanisms, such as the neuroplasticity process³. In addition, many chronic pain patients are refractory to different types of treatment⁴, which brings about the suspicion that in a way they are not totally effective and that probably some chronic pain generation and/or maintenance mechanism is still unknown.

Chronic pain is not biological and persists after the cause is removed, does not respond to conventional therapies and needs a multidisciplinary approach, as opposed to acute pain which is physiological and protective, ends after healing, is self-limiting and responds to conventional therapies^{5,6}. It is started by a strong and/or provoked stimulus causing central sensitization when an electric trigger is generated even in the absence of stimu-

lus. This is caused by changes in NMDA receptors, is stimulated by aminoacids, aspartate and glutamate, may be reversible or permanent and has central afferent excitatory (referred pain, trigger points), efferent and/or autonomic excitatory effects⁶⁻⁸.

This mechanism is called central sensitization and is caused by central neurons neuroplasticity, which alters their function temporarily or definitively^{7,9}. These changes are responsible for pain chronification, for changing acute into chronic and persistent pain⁸. Major features of this process are: chronic sensitization of peripheral nociceptors; vicious cycles of stimuli at spinal level or wind-up; central secondary afferent neurons sensitization and, as a consequence, descending analgesic mechanism disorders responsible for the endogenous opioid system able to block pain stimuli and grade them using serotonin and norepinephrine as primary neurotransmitters^{1,8}.

To prevent these changes and the neuroplasticity mechanism it is important to thoroughly treat primary hyperalgesia or acute pain to prevent their chronification.

Different stimuli are needed to evaluate the physical integrity of afferent fibers and to better understand the mechanisms involved in different pain conditions which may affect the orofacial region. The set of quantitative sensory tests (QST) is a tool to evaluate positive and negative sensory signs which help identifying neural mechanisms and somatosensory changes behind different pathological conditions involving the pain mechanism, helping the diagnosis and guiding the treatment approach. Pain may be inflammatory or neuropathic, acute or chronic, with more peripheral or central involvement^{1,8}.

This study aimed primarily at reviewing the literature on orofacial region somatosensory evaluation to provide basic orientations to the clinical practice and research in the area, with no intention of being a systematic review.

CONTENT

PubMed database was searched from 1990 to 2011 using the following keywords (DeCS/MeSH) crossed with each other: orofacial pain, trigeminal, pain threshold, pain measurement, somatosensory function, neurosensory test, sensory quantitative test and pain perception. Stimuli modalities test different types of peripheral fibers (Table 1). Some modalities are easy to apply and provide better understanding of each patient's pain mechanisms, helping the diagnosis and the choice of the best treatment approach, as well as the follow up of its effectiveness¹⁰.

Table 1 – Stimulation Modalities (Adapted from Svensson et al.)¹⁰

Stimulation Modalities	Peripheral Fibers
Mechanical	
Touch (Monofilaments)	A-beta
Distinction between two points	A-beta
Vibration	A-beta
Pinprick	A-beta
Pinch	A-delta, C
Deep pressure (Algometry)	A-delta, C
Thermal	
Cold	A-delta
Heat	C
Pain at heat	C, A-delta
Pain at cold	C, A-delta
Electrical	
	A-beta, A-delta, C
Chemical	
Capsaicin	C
Menthol	C

Tactile sensitivity test with monofilaments

Monofilaments adapted by Semmes-Weinstein are used to determine the tactile threshold. The kit has nylon monofilaments of different diameters gauged to exert specific forces which increase as the monofilament diameter increases. Each monofilament is applied until the filament bends. Initially, filament 12 is applied¹¹.

If the patient responds positively to the stimulus, the next thinner filament is applied, and so on, until the patient no longer feels the stimulus. This is considered a negative stimulus (“-”). Then, the next thicker filament is applied, and so on, until the patient feels the stimulus and this is considered a positive stimulus (“+”).

This is done until 8 negative and 8 positive stimuli are obtained and mean is then calculated. Between the 5th and 8th peaks, a “blind” stimulus is applied without touching patient’s skin. If patient does not respond to the stimulus, the test proceeds. If patient perceives some stimulation, the test is interrupted, explained and restarted¹². Time for such is protocolled in 1.5 seconds. The stimulus is maintained for 1.5 seconds and then removed for 1.5 seconds¹³. All patients are instructed to say “yes” as soon as they feel a minor touch and monofilament diameter is recorded.

Pinprick

This test may be carried out with a clinical exploratory probe or a Von-Frey monofilament (e.g., 5,46). This test helps detecting the presence or absence of hyperalgesia¹⁰.

Pressure pain threshold (PPT)

PPT test is performed with a Kratos[®] algometer with a

circular, flat end with area of 1 cm², which is used to apply pressure to the desired muscle¹⁴. As control to determine PPT, the Achilles tendon may also be the target to determine PPT¹⁵.

The algometer is positioned perpendicular to the point to be tested and an increasing and constant pressure of approximately 0.5 kg/cm²/second is applied until the patient pressures the manual pressure-recording device when the sensation becomes painful. At this moment, pressure is no longer applied and the algometer records the value corresponding to PPT. While algometry is performed with one hand, the other supports patient’s head to prevent it from moving and impairing data collection¹⁴.

Thermal tests

Cold test is easily applied with a freezing spray on a swab tip during 3 seconds in different desired regions. After 3 seconds, patient shall respond to a numerical pain scale (zero to 10). Then the time in seconds in which the patient no longer feels cold in the painful area is recorded. This post-stimuli sensation, when very prolonged, may be an indirect sign of central sensitization^{10,16}.

There are electronic devices, such as TSA-II – Neuro-Sensory Analyzer (MEDOC[®]), which are able to produce a constant increasing or decreasing heat sensation, allowing the automated detection of the pain threshold to heat or cold in different areas^{10,17}.

Ischemic pain

Ischemic pain may be evaluated by the cold pressor test, with the immersion of the non-dominant hand in a container with water and ice at 0°–1° C and keeping it there for as long as possible. During immersion, patients report the sensation according to a predetermined scale: wet, lightly fresh, fresh, mild pain (pain threshold), moderate pain, and severe pain from zero to 10. Times at every reported sensation are recorded in seconds. Threshold and tolerance records are statistically evaluated¹⁷. Immediately after ice water immersion, a warm water (32° C) immersion may be done to improve patient’s comfort.

Electrical test

This may be performed with the Neurometer CPT/C (Neurometer/Neurotron[®] Painless Electrodiagnostic Sensory Nerve Testing Equipment) device, which measures neural transmission threshold, especially the minimum electrical stimulus needed by a nerve to induce a response. This device has high specificity and sensitivity to evaluate the presence of hypoesthesia/neuropathy, hyperesthesia/neuritis and checks the presence of

increased pain perception. The device evaluates well the three major sensory fibers, A beta (2000 Hz), A delta (250 Hz) and C (5Hz)²⁵ using small surface electrodes which are placed on the area to be examined^{10,18-20}.

Temporal Summation and conditioned pain modulation

This test uses the 5,86 (26 g) filament in a sequence of four applications. Each application is continuous and repeated during 30 seconds and patient is asked to respond to a numerical visual scale for the pain sensation felt in each moment. The first measurement is done in the first second, the second at 10 seconds, the third at 20 seconds and the fourth at 30 seconds.

Then, the non-dominant hand is immersed in a container equipped with a thermostat with water at 46° C during 31 seconds. Still with the hand immersed, patient is again submitted to the previous test with the four measurements within the 30-second interval.

The Temporal Summation test checks increased pain intensity as noxious stimuli are repeatedly applied with constant intensity. It is related to the Wind-up psychophysical mechanism, which is the increase in magnitude and frequency of central nervous system response when nociceptive neurons receive a constant strength noxious stimulus.

Studies indicate that temporal summation is increasing in women with chronic TMD, indicating generalized central hyperexcitability faced to the processing of noxious stimuli. Conditioned Pain Modulation-CPM, on the other hand, checks the modulator capacity, that is, the descending analgesic mechanism of chronic pain patients. Chronic pain patients in general have a deficiency in such mechanisms which very often explains pain maintenance or perpetuation^{10,21-23}.

CONCLUSION

Sensory quantitative tests are a reliable way to evaluate nervous fibers. Sensory deficits may be quantified and used as diagnostic aid, as a reference to check the effectiveness of a certain treatment approach and for evaluation in scientific studies.

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