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Measuring Pain in the Clinic

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This review identifies common methods used to assess subjective reports of chronic orofacial pain in adults. Several issues in pain assessment are identified which highlight the complexity of the apparently simple task of asking subjects how much they hurt. Recent applications of psychophysical methods to chronic orofacial pain assessment are emphasized since they provide interesting new methods which can be used for analysis of pain and analgesic processes and which can improve the reliability and validity of clinical pain reports.

Chronic orofacial pain can be characterized by its sensory qualities, its intensity, quality, duration, and locus, and by its affective-emotional attributes such as present distress and fear for the future. Pain may be inferred from behavioral observation or psychophysiological assessment, topics covered in separate articles in this issue. Pain also may be inferred from subjective reports of altered cognitive, emotional, social, and vocational functioning.

UNIDIMENSIONAL SCALES OF PAINFULNESS

The simplest measures of chronic orofacial pain treat it as a unitary dimension like weight and volume, requesting the patient to assess amount of pain or pain relief. Patients rate pain magnitude by numerical (e.g. 1–10) or verbal category scales (e.g. none, slight, mild, moderate, severe), or by the commonly-used visual analog scale (VAS) which is usually a 10 cm line labeled at the ends with extreme categories such as "no pain" and "pain as bad as it could be." Patients indicate their pain magnitude by marking the line.

The simplicity of these measures is in part responsible for their widespread use. They are understood by most patients, require little time, and are analyzed easily. Categorical responses usually are evaluated by assuming equidistant categories and responses are converted to integral numbers used directly for analysis. The appropriateness of these assumptions has been questioned, and the use of alternative analyses that determine category boundaries using the same data or values derived from a separate task are well documented.[1–3]

Studies comparing these measures have found general agreement,[4–6] although there is varying evidence for superiority of different methods.[7,8] Many evaluations of scale properties have been based on response distributions resulting from a single assessment without evaluating reliability or sensitivity to a known analgesic manipulation.[9,10] While a uniform distribution of pain responses is desirable, it may not indicate psychometric superiority. For example, categorical or VAS scales of pain relief are generally regarded as the most sensitive measures in clinical trials, yet these measures compress the entire range of experience from no change to any possible pain increase into a single point on the line (the end labeled no relief). The entire remainder of the line is used to rate differing degrees of relief. Without standard psychometric evaluations of reliability (multiple presentations) and validity (correspondence to other measures, sensitivity to standard analgesic intervention), "static" scale comparisons (each scale administered once) may be of limited value.

These simple scales possess other theoretical limitations. They all are bounded scales with a top limit. In comparison to relatively limitless scales (e.g. magnitude estimation, cross-modality matching), they are vulnerable to a number of biases associated with behavior at the end of the scale, spreading responses to cover all possibilities equally, and the relation of scale range to range of the sensory attribute assessed.[11–14] The biasing effect of constrained response range has been demonstrated with experimental pain stimuli[15] but not in any systematic way

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with clinical pain assessment. In addition, these scales deliberately ignore the multi-dimensional nature of pain experience. They yield a single score that presumably provides a weighted (albeit unknown) combination of significant pain dimensions.

MULTIDIMENSIONAL SCALES

Multidimensional scales recognize that pain experience is not a unitary phenomenon but rather varies dramatically in terms of sensory quality, temporal and spatial characteristics, and emotional qualities of aversiveness and distress. The McGill Pain Questionnaire (MPQ) is the most widely used multidimensional pain assessment instrument, providing adjectives describing increasing amounts of sensory qualities such as pressure (constrictive, traction, punctate and shearing pressure), thermal qualities, qualities of movement, spread, dullness, and temporal qualities.[16] The MPQ also presents affective dimensions and an evaluative dimension. For each of 20 dimensions, the MPQ presents 2 to 6 adjectives ordered to describe increasing amounts of the dimension. For example, the temporal dimension contains the adjectives, "flickering, quivering, pulsing, throbbing, beating, and pounding," and the punctate pressure dimension the adjectives, "pricking, boring, drilling, stabbing, and lancinating."

The MPQ and similar scales emphasize the difference between pain syndromes and can be used as an aid to diagnosis. Studies have shown qualitative differences between toothache pains that result from either reversible pulp inflammation or irreversible, necrotic pulp inflammation.[17] Both toothache pain and pain from the "burning mouth syndrome" were found to be equal in magnitude but significantly different in pain quality as assessed by the MPQ.[18] The MPQ has distinguished between atypical facial pain and the pain associated with trigeminal neuralgia with a correct classification rate of 90%.[19] The MPQ has been used in several studies of headache pain. It distinguished between the pain from tension and classical migraine headache, with one discriminate analysis showing that 70.7% of a 74% classification rate was based on quantitative and not qualitative differences between these syndromes.[20,21] In contrast, a recent study showed that the MPQ differentiated between cluster headache and other vascular (mixed and migraine) headache based on quality rather than intensity.[22] Three subclasses (presence of punctate and thermal qualities and absence of dullness) primarily distinguished the cluster headache MPQ responses.

The MPQ may be used also to assess the mechanism of action of interventions that relieve distress by changing pain qualities or by reducing the affective consequences to a minimally reduced pain sensation. The MPQ also has been useful as a single overall measure of pain magnitude in studies of pain mechanisms and efficacy of pain interventions.[23,24]

While the MPQ emphasizes the difference between different pain syndromes, other multidimensional scales assess dimensions common to all pain perceptions. These measures assess two primary dimensions identified repeatedly in philosophical[11] and early investigations[25] of pain perception. These dimensions are the intensity of the perceived sensation and the amount of unpleasantness or distress associated with the sensation. Verbal and VAS scales of these dimensions have been validated and used to assess acute and chronic orofacial pain.[11,26–30] These methods provide information about the relative distress associated with equivalent pain sensations among different syndromes[31,32] and about the efficacy and mechanisms of both pharmacological and nonpharmacological pain control interventions.[27,33,34]

ISSUES IN UNI- AND MULTIDIMENSIONAL VERBAL PAIN ASSESSMENT

Simple, unidimensional scales are readily understood by patient populations and have produced significant results in many studies of chronic orofacial pain. Proponents of multidimensional scales, however, emphasize the complexity and rich variety of pain experience and question the adequacy and validity of evaluating this experience with these simple scales. Although there is no general consensus on the proper scale, there is increasing appreciation that the scale choice depends on the intellectual ability of the patient population, the time allotted for assessment, the type of pain, the type of experimental design and purpose of the assessment. For example, paroxysmal, intermittent pains such as trigeminal neuralgia vary little in quality, and in the absence of detailed diary records, may be best assessed not by multidimensional measures but by global subjective judgments of severity which incorporate these factors.[35] The choice of simple scale (VAS, numerical or verbal) or multidimensional scale may likewise depend on patient ability and experimental design. Any scale may adequately assess the efficacy of a fast-acting analgesic intervention, in which the dependent measure is the change in pain. Comparing the level of pain in two diagnostic groups in the absence of an intervention places greater psychometric demands. Scales useful for this purpose must equate pain levels within individuals. Although pain levels are ultimately private and cannot be independently verified, certain methods may be theoretically or empirically superior to others. For example spatial (VAS) or numerical scales must assume that two-fifths of the space or the number 4 mean the same level of pain in each individual. These assumptions may be less tenuous, and the face validity greater, in measures with verbal descriptions which anchor responses to subjective standards that may be relatively uniform within the language.[36] Recent studies suggest that magnitude matching methods also may improve validity of pain comparison between groups.[37] Rather than rely on verbal anchors, these methods anchor judgments to another sensory dimension (e.g. visual brightness) which is assumed invariant across the population. Another method, described briefly below, requires subjects to rate both clinical pain and experimental pain by the same scale, and in addition, to determine the stimulus intensity that evokes an experimental sensation equal in magnitude to the clinical pain.[11,12,28] This method provides both face and construct validity, increasing the confidence that the resulting measure is representative of perceived pain sensation.

USE OF PSYCHOPHYSICAL METHODOLOGY

Psychophysical methodology is increasingly being applied to the evaluation of chronic orofacial pain syndromes. For example, several independent investigators have used pressure algometers to assess pressure pain sensitivity of head and neck musculature in patients suffering from myofascial pain syndromes,[38–42] or headache.[43] Muscle pressure pain thresholds have been shown to be reliable, to correlate with verbal reports of myofascial pain, and to increase (lower pain sensitivity) after treatment interventions. These results suggest that this method provides an objective correlate of the presence of painful trigger points and of treatment efficacy. Continued improvement in the design and application of these stimulators should result in threshold, and possibly suprathreshold, measures consistent over different individuals and treatment centers. This method thus may result in a degree of standardization presently associated with pain syndromes with motoric or other physical correlates (e.g. the facial tic in trigeminal neuralgia).

Other investigators have found that chronic orofacial syndromes can influence the perception of experimentally evoked pain sensations. A comparison of patients with burning mouth syndrome and age matched controls on several tactile and thermal psychophysical measures showed decreased heat pain tolerance on the tongue tip, providing evidence for a physiological mechanism and identifying a potentially useful marker for this syndrome.[44] Improvement in chronic facial pain following administration of amitriptyline was not accompanied by analgesia to experimentally-evoked thermal pain sensations, suggesting that the clinical analgesia was not mediated by opioid systems that putatively alter thermal pain sensation.[24] Myofascial pain dysfunction has been associated with increased pain threshold and decreased discriminability of cutaneous pressure-evoked sensations.[45] In addition, patients with myofascial pain dysfunction scoring high on neuroticism rated equivalent intensities of either their clinical pain or pain produced by a thermal stimulus as more unpleasant in comparison to patients scoring low on neuroticism.[26]

Psychophysical methods also have been used to elucidate the mechanisms of trigeminal neuralgia.[46] A patient with a one year history of trigeminal neuralgia received psychophysical testing by innocuous pressure (von Frey hairs, air puff), vibratory (tuning fork) and pin-prick tactile stimuli, by graded electrical stimuli applied to the teeth, and by thermal warmth, cooling and noxious heat applied to the skin. Only the mechanical stimuli by von Frey hairs elicited the paroxysmal pain of trigeminal neuralgia. Using a cross-modality matching psychophysical technique, the patient rate the pressure and pain sensations evoked by a constant pressure (2.0 g) stimulus presented at varying intervals to a tooth that could trigger the paroxysmal pain, and to a control tooth. One of several findings was the observation that stimulation of the trigger tooth resulted in summation of throbbing pain at intervals of 2–10 sec while stimulation of the control tooth did not produce pain and resulted in summation of pressure sensation at only the 2-sec interval. This result and the finding of temporal summation resulting from stimulation of a single eyebrow guard hair at 2-sec intervals provides important psychophysical evidence supporting the overall conclusion that the pain was mediated by A-beta afferents usually conveying only nonpainful sensations.

In addition to the studies in which chronic pain influenced the perception of an experimental stimulus, psychophysical assessment of painful experimental stimuli have been used to directly assess orofacial pain magnitude. In these designs clinical pain magnitude is assessed in two different but theoretically equivalent ways. The first method assesses clinical magnitude directly in the conventional manner, for example by verbal descriptor scales of intensity or unpleasantness. The second method requires subjects to match the intensity or unpleasantness of their clinical pain to that produced by an experimental stimulus such as electrical toothpulp stimulation. They also use the verbal descriptors (or the same response measure used to assess clinical pain) to rate the intensity or unpleasantness of the sensations evoked by a series of the electrical toothpulp stimuli. The verbal responses to the magnitude of the experimental pain stimulus that the subject matched to their clinical pain provides the second measure of the clinical magnitude in the same units as the first. These two measures are directly comparable and should be similar if subjects correctly assess and match the clinical and experimental pain sensations. These measures have been shown to be similar for both acute[28] and chronic (myofascial pain dysfunction syndrome) orofacial pain.[11,12]

The comparison of the two measures of clinical pain both provides a second measure of pain magnitude, increasing validity and sensitivity, and in addition, provides a measure of scaling ability for each patient. It identifies patients who, by ability or performance, do not consistently scale their clinical pain magnitude. This information can be used to evaluate the confidence in a patient's clinical pain report, and used in research to select subjects who can appropriately judge and report their clinical pain magnitude.

Clinical scaling performance also may be assessed without the use of experimental pain stimulation. In this method, subjects are presented multiple verbal descriptors of sensory intensity, unpleasantness or other pain dimensions and asked to rate their pain in relation to each word. The Descriptor Differential Scale (DDS) presents a digital graphic scale for this comparison, allowing subjects to indicate if their pain is equal to that implied by the descriptor or how much lesser or greater on a 10-point scale.[47] Like the MPQ, this method provides multiple measures of a pain dimension, decreasing random scaling error. In addition, each subscale covers a different portion of the pain range, resulting in measurement unaffected by category-end effects that influence commonly used verbal, numerical and VAS scales of pain magnitude. The method also provides several measures of scaling consistency which are uncorrelated with pain magnitude. Like the experimental pain matching method, these measures can be used to identify patients who by ability or choice do not reliably judge and report pain magnitude.

The DDS also appears useful for the problem of assessing pain over time in the same individuals. When asked for a series of pain reports, subjects may remember their last verbal assessment and simply give it again, resulting in artifactually high reliability. This is particularly problematic for evaluations of pain memory since these studies require patients to recall a previous pain magnitude and not a previous pain response. The DDS directly addresses this issue since it can be divided into equivalent alternative forms with different descriptors on each form. These alternative forms have been shown to be reliable,[48] have been cross-validated,[49] and have been used to assess the memory of postoperative dental pain.[50] Contrary to anecdotal evidence of poor memory for pain sensations, this study supported a previous study[51] showing that the memory for the pain following extraction of third molars is accurate after one week. Pain memory was not influenced by expected pain sensation assessed prior to surgery or by rating pain immediately after oral surgery.[50]

PSYCHOSOCIAL ASSESSMENT

The task of chronic orofacial pain evaluation and treatment would be simplified greatly if the clinician could concentrate on a few succinct indicators of pain to assess the effects of treatment. Unfortunately, these patients are people with a private, hidden primary symptom, with normal adaptive reactions of depression and irritability, with unique personalities and differing family, work and social environments. Interpretation of pain indicators, diagnosis and treatment choice all depend on factors other than pain complaints or behavior. The evaluation of psychosocial functioning of patients with chronic orofacial pain is an area that by size and importance requires a review dedicated exclusively to the topic.

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