Influence of Biased Clinician Statements on Patient Report of Referred Pain

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Aims: *The purpose of this study was to examine the influence of clinician bias on patients' reports of referred pain. Diagnosis of temporomandibular disorders is dependent on subjective reports of pain and referred pain upon manual muscle palpation. The influence of biased clinician statements in such subjective reports has not been previously investigated.* **Methods:** *Forty subjects with pain and who met specific inclusion criteria were randomly assigned to 1 of 2 experimental groups. One group was subjected to a standardized biasing statement, while the other group was not. Tender points in the masseter muscle were then stimulated with a pressure algometer to the pressure-pain threshold. Subjects then recorded the presence or absence, location, intensity, and unpleasantness of any referred pain. State-trait anxiety and social desirability were also assessed to explore the possibility that anxiety levels or subjects' desires to please the experimenter influenced results.* **Results:** *The biased group reported increased presence ($P < 0.01$), intensity ($P < 0.001$), and unpleasantness ($P < 0.003$) of referred pain as compared to the non-biased group. There were no differences between groups on state-trait anxiety or social desirability ($P > 0.05$).* **Conclusion:** *These data suggest that patient reports of pain referral may be subject to clinician bias, and recommendations to control this bias are offered.*

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Key words: bias, referred pain, temporomandibular joint disorders, muscular pain, pain measurement

The effect of bias on subjects' response has been investigated in the field of psychology but has received little attention in the field of dentistry. It is commonly understood that expectations exert a powerful influence on an individual's behavior and/or the behavior of others. Bias is defined as the deviation of results or inferences from the truth or processes leading to such deviations.[1] The term also refers to prejudice leading to the conscious selection of information that departs from the truth in a particular direction. Bias is a function of motivational, cognitive, personality, and learning variables.[2] More than 35 different biases have been catalogued, with findings demonstrating that many diagnostic tests requiring observational assessment and interpretation are easily biased.[3] Since many clinical assessments lack a gold standard of accuracy, bias can frequently be involved in "clinical transactions."

Muscle palpation is a major component of physical examination for a temporomandibular disorder (TMD),[4,5] and positive findings

on palpation of the masseter muscle are a "cardinal symptom."[6] Muscle tenderness on palpation is one of the major factors allowing for the clearest distinction between patients with TMD and controls.[7] Muscle palpation may not be based on objective data, however, and is only an interpretation of a subject's reaction, which may be influenced by the behavior of the clinician.[8]

Pain on palpation contains many subjective variables, including the patient's desire to comply with a positive response.[9] Muscle tenderness is also variable and is a common finding in non-patient populations. Because non-patient groups report muscle tenderness, several authors have suggested that tenderness may be artificially created during muscle palpation.[10,11] False positives can be measured during muscle palpation, even when specific steps are taken to increase objectivity, and may be viewed as an incidental finding unless coupled with corresponding symptoms.[12] Interpretation of responses to muscle palpation may be difficult and can lead to examiner bias.[13] It is not uncommon for false positives and false negatives to occur in muscle palpation evaluations, since parameters for diagnostic specificity and sensitivity have not yet been fully developed.

One area in which specificity and sensitivity are particularly suspect is in regard to referred pain. Referred pain is a "heterotopic pain that is felt in an area that is innervated by a nerve different from the one that mediates the primary pain."[14] Referred pain of muscular origin is considered to be a significant factor in TMD. When a TMD is suspected, a thorough evaluation of referred pain in the masticatory system is essential for correct diagnosis.[15,16]

Although the neuroanatomic basis of referred pain in TMD has been explored, many questions about the phenomenon remain. Chapman[17] has proposed that TMD may illustrate the difficulty distinguishing between the site of pain and the source of pain, because such distinctions are influenced by a number of factors associated with perceptual processes. In an attempt to elucidate some aspects of bias and its relationship to the experience of referred pain, this study examined the influence of clinician bias on the reporting of referred pain from the masseter muscle in patients with TMD. It was hypothesized that the use of biasing statements by the clinician would result in changes in patients' reports of referred pain in the clinical situation.

Materials and Methods

Forty subjects were recruited from patients seeking care in the Orofacial Pain Center at the University of Kentucky. Inclusion criteria were: *(1)* age between 18 and 65, *(2)* report of persistent facial pain of at least 3 months duration, *(3)* report of focal masseter pain on manual palpation with an intensity greater than 3 out of 10 on a verbal rating scale, and *(4)* presence of a TMD (Type I and Type II) as indicated by the Research Diagnostic Criteria proposed by LeResche and Von Korff.[4] Since the primary focus of interest was on determining to what extent biased statements from clinicians would influence patient reports, we chose to use a broad spectrum of clinical pain patients so as to improve the generalizability of results to the TMD population at large. However, we were careful to insure that the patients recruited for this study were in fact experiencing significant levels of pain and had been for at least 3 months. Exclusion criteria included: *(1)* pregnancy, *(2)* previous trigger point injections, or *(3)* need for immediate dental treatment. The final subject population consisted of 36 females and 4 males with a mean age of 31.8 years and a range of 18 to 57 years.

Single focal sites of maximum masseter muscle tenderness identified by manual palpation were marked as the experimental sites. After a demonstration of the use of the pressure algometer on the subject's hand, the experimental site was stimulated with the Somedic pressure algometer at a rate of 30 kPa/sec, with a maximum of 400 kPa. The patient was instructed to indicate when the feeling of pressure changed to pain. This value was determined to be the pressure-pain threshold (PPT). The pressure algometer has been shown to have greater interrater reliability than manual muscle palpation in evaluation of TMD and has also been shown to have good validity and reliability in the assessment of muscle tenderness in both normal subjects[18] and pain patients,[19] including those with myofascial pain and TMD.[10] Three PPT measurements were accomplished with a 15-second rest between successive stimulations, and the mean of 3 trials was established as the stimulation pressure for the subsequent stimulation.

The experimental site was stimulated with the Somedic pressure algometer at a rate of 30 kPa/sec to within ± 5 kPa of the previously determined PPT and held for 15 seconds. Data was collected via standardized facial form drawings, on which the subject recorded the location, intensity, and unpleasantness of any referred pain. This form is shown in Fig 1. Intensity (VAS intensity) and

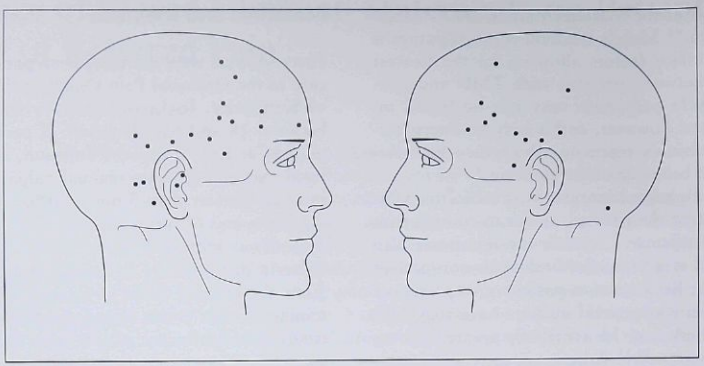

Fig 1 Anatomic distribution of referred pain. • = sites of pain referral.

Biased

When we push on this sore spot on your jaw muscle you will feel pain in an area from your temple running above the ear to the back of the head (designating area of expected referral by manually outlining the area on the patient's head from an anterior temporalis area running directly superior to the ear to an area about on the nuchal line). We are going to push on this sore spot in the muscle. When you feel pain in this other area of your head away from where we push, mark an X on the drawing of the face where you feel the pain. Then rate the intensity of the pain (how much it hurts) and the unpleasantness of the sensation using the lines below as a scale to rate the pain. You can mark as many boxes as you wish.

Non-biased

Sometimes when we push on sore spots in jaw muscles you may feel pain somewhere else. We are going to push on a sore spot in the muscle. If you feel pain in an area of your head away from where we push, mark it with an X on the drawing of the face where you feel the pain. If you feel pain in an area away from where we push, rate the intensity (how much it hurts), rating it from "no pain at all" to "the worst pain possible." Also rate the unpleasantness (how much you don't like it) of the sensation using the lines below as a scale from "not unpleasant at all" to "the most unpleasant feeling possible." You can mark as many places as you wish or no places at all if there is no pain in an area away from where we push.

Fig 2 Statements read to subjects prior to experimental stimulation.

Table 1 Summary Data: Reported Presence, Intensity, and Unpleasantness of Referred Pain in Biased and Non-biased Groups

	Referred pain?		VAS	VAS		Marlowe-	STAI (SD)	
	Yes	No	intensity (SD)	affect (SD)	PPT (SD)	Crowne (SD)	Y-1	Y-2
Biased (n = 20)	17	3	4.13 (2.24)	3.72 (2.65)	85.2 (29.1)	18.4 (5.2)	40.6 (12.6)	39.8 (10.0)
Non-biased (n = 20)	9	11	1.73 (2.12)	1.49 (2.05)	87.5 (32.7)	18.7 (4.43)	33.9 (10.5)	34.9 (6.1)
P value	0.01		0.001	0.003	NS	NS	NS	NS

VAS intensity = intensity of referred pain as measured on VAS; VAS affect = unpleasantness of referred pain as measured on VAS; PPT = pressure-pain threshold; Marlowe-Crowne = score on the Marlowe-Crowne Social Desirability Scale; STAI Y-1 and Y-2 = scores on the Spielberger State-Trait Anxiety Inventory representing state (Y-1) and trait (Y-2) anxiety; NS = not significant ($P > 0.05$).

unpleasantness (VAS affect) were recorded on visual analog scales (VAS) in a manner suggested by Price and Harkins,[19] with endpoints "no pain" and "the worst (strongest) pain possible," or "not bad at all" and "the most unpleasant feeling possible," respectively. The 2 separate VAS have been previously shown to be valid, reliable measures of the intensity and unpleasantness of both experimentally induced and chronic pain.[19] The subject marked with an X on the facial illustration all sites of referred pain and rated the intensity and unpleasantness of the pain in any referral sites with the VAS.

Following experimental stimulation and recording, subjects completed the Marlowe-Crowne Social Desirability Scale (MC) and the Spielberger State-Trait Anxiety Inventory (STAI). The STAI is commonly used to evaluate the effects of anxiety on pain[20,21] and in TMD.[22,23] The MC is a standardized measure of the degree to which a subject's response style represents a desire to please the clinician.[24] These instruments were included primarily to rule out the possibility that the results obtained in the present study were linked to either subjects' tendencies to please the experimenter or their ongoing emotional states.

The study was a randomized clinical trial in which participants experienced the pressure stimulation with or without biasing information. Patients were randomly assigned to 1 of 2 experimental groups (biased, n = 20; non-biased, n = 20). The biased (experimental) group underwent a standardized pressure stimulation protocol after being read a biasing statement (Fig 2). The non-biased (control) group underwent the standardized pressure stimulation protocol after hearing a statement that was designated as non-biased (Fig 2). The mean ages of the biased and non-biased groups were 34.7 years (± 7.5 years) and 28.9 years (± 10.3 years), respectively, with no significant differences between the groups ($P > 0.05$). Furthermore, to control for the expectancy effects that may be imparted by a clinician that would be independent of the experimental manipulation itself, 1 group of subjects (n = 20; both biased and non-biased) was read the statements by a clinician who did not participate in the muscle palpation procedure. The other group (n = 20; both biased and non-biased) was read the statements by the clinician who conducted the palpation procedure. Recordings of the following were used as dependent measures: *(1)* PPT, *(2)* presence or absence of referred pain, *(3)* location of referred pain, *(4)* intensity of referred pain (VAS intensity), *(5)* unpleasantness of referred pain (VAS affect), and *(6)* summary scores on psychometric tests.

Data are reported as group means plus or minus standard deviations. Data were analyzed with Student's t test for comparison of groups with the level of significance set at $P < 0.05$. Presence or absence of referred pain was analyzed by the Chi-square test (χ^2). Correlation between dependent variables was assessed with Pearson's correlation coefficients (r).

Results

There was a significant increase in the presence ($\chi^2(39) = 63.4$, $P < 0.01$); intensity (4.13 ± 2.24 versus 1.73 ± 2.12, $t(38)$, $P < 0.001$); and unpleasantness (3.72 ± 2.65 versus 1.49 ± 2.05, $t(38)$, $P < 0.003$) of referred pain in the biased versus the non-biased group (Table 1). Locations identified by the patients as sites of pain referral are noted in Fig 1.

Pressure-pain thresholds, scores on the MC, and scores on both scales of the STAI (state anxiety, or Y-1, and trait anxiety, or Y-2) were not significantly different between the biased and non-biased groups (Table 1). When grouped on the basis of presence or absence of referred pain, subjects who reported referred pain (n = 26) exhibited higher levels of state anxiety (39.8 ± 13.1 versus 32.5 ± 8.6, $t(38)$, $P < 0.04$) than the subjects who reported no pain referral (Table 2). There were no significant differences between the pain referral and no pain referral groups in PPT, social desirability, or trait anxiety ($P > 0.05$). The latter 2 findings regarding trait anxiety and social desirability indicate the likelihood that the obtained results for reports of pain referral were a result of the experimental manipulation, and not the result of a desire to please the experimenter or trait emotional state. The results for all dependent measures were not affected by whether the study was conducted with or without the knowledge of biasing by the clinician performing the palpation ($P > 0.05$).

For the entire sample, intensity and unpleasantness of referred pain were not significantly correlated ($P > 0.05$) with PPTs, state/trait anxiety, or social desirability based on the presence of referred pain (Table 3). The only significant positive correlations were between the intensity (VAS intensity) and unpleasantness (VAS affect) of referred pain ($r(39) = 0.946$, $P < 0.01$), and, as expected, between state (STAI Y-1) and trait (STAI Y-2) anxiety ($r(39) = 0.773$, $P < 0.01$). A significant negative correlation was also found between trait anxiety and social desirability ($r(39) = -0.389$, $P < 0.02$).

The use of the MC and STAI enabled the identification of a specific subgroup of subjects who

Table 2 Relationship of Pressure Sensitivity, Social Desirability, and Anxiety to Pain Referral

	PPT (SD)	Marlowe-Crowne (SD)	STAI (SD) Y-1	STAI (SD) Y-2	Age (SD)
Referral of pain (n = 26)	82.0 (28.4)	18.7 (4.2)	39.8 (13.1)	39.0 (10.7)	31.8 (9.7)
No referral of pain (n = 14)	94.4 (30.2)	18.2 (6.1)	32.5 (8.6)	34.4 (6.7)	31.7 (9.1)
P value	NS	NS	0.04	NS	NS

PPT = pressure-pain threshold; Marlowe-Crowne = score on the Marlowe-Crowne Social Desirability Scale; STAI Y-1 and Y-2 = scores on the Spielberger State-Trait Anxiety Inventory representing state (Y-1) and trait (Y-2) anxiety; NS = not significant ($P > 0.05$).

Table 3 Correlations Among Measured Variables

	VAS affect	PPT	MC	STAI Y-1	STAI Y-2	Age
VAS intensity	0.946†	−0.139	0.036	0.231	0.253	0.060
VAS affect		−0.054	−0.030	0.198	0.243	0.054
PPT			−0.193	0.160	0.232	−0.004
MC				−0.208	−0.389*	0.164
STAI Y-1					0.773†	0.080
STAI Y-2						0.050

Pearson correlation coefficients (*r*); *$P < 0.02$; †$P < 0.01$; VAS intensity = intensity of referred pain as measured on VAS; VAS affect = unpleasantness of referred pain as measured on VAS; PPT = pressure-pain threshold; MC = score on the Marlowe-Crowne Social Desirability Scale; STAI Y-1 and Y-2 = scores on the Spielberger State-Trait Anxiety Inventory representing state (Y-1) and trait (Y-2) anxiety.

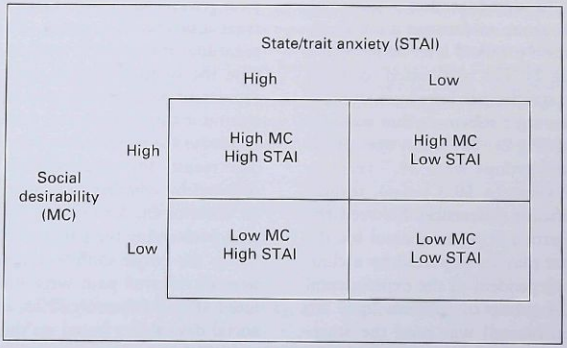

Fig 3 Distribution of patient reports of anxiety and social desirability. The median split method was used to group patients according to scores on the Marlowe-Crowne Social Desirability Scale (MC) and the Spielberger State-Trait Anxiety Inventory (STAI).

Table 4 Examination of Pain Reports and Repressive Coping Style*

	VAS intensity (SD)	VAS affect (SD)	PPT (SD)
High MC/Low STAI (n = 13)	1.95 (2.37)	1.58 (1.61)	72.7 (30.6)
Others (n = 27)	3.42 (2.54)	3.10 (2.65)	92.9 (29.6)
P value	0.05	0.04	0.04

*Repressive coping style refers to subjects reporting high social desirability and low state anxiety (High MC/Low STAI) as compared to groups reporting other combinations of social desirability and anxiety (Others).
VAS intensity = intensity of referred pain as measured on VAS; VAS affect = unpleasantness of referred pain as measured on VAS; PPT = pressure-pain threshold.

characteristically score high on social desirability and report low levels of anxiety. These individuals are often referred to as persons with a repressive coping style. When subjects were divided into groups by median splits, as diagrammed in Fig 3, subjects exhibiting high social desirability and low trait anxiety exhibited referred pain that was less intense (1.95 ± 1.1 cm versus 3.42 ± 2.1 cm, $t(38) = 2.05$, $P < 0.05$) and less unpleasant (1.58 ± 1.4 cm versus 3.10 ± 2.8 cm, $t(38) = 2.17$, $P < 0.04$), despite their lower pain thresholds (72.7 ± 24.8 kPa versus 92.9 ± 31.8 kPa, $t(38) = 2.17$, $P < 0.04$) versus the other patients in this experimental cohort (Table 4).

Subjects were also retrospectively grouped on the basis of their use of medication, with 12 subjects identified as taking no drugs, 16 using NSAIDs, 7 using tricyclic antidepressants, 7 using muscle relaxants, and 2 using benzodiazepines. In the no drug group, bias resulted in a significant increase in the report of referred pain ($\chi^2(11) = 23.7$, $P < 0.014$), its intensity ($t(11) = 3.3 \pm 1.85$, $P < 0.007$), and its unpleasantness ($t(11) = 3.7 \pm 2.05$, $P < 0.003$), as compared to those persons who were not given the biasing statements. When grouped according to use of medication, there were no significant differences between the groups ($P > 0.05$) in the report of intensity or unpleasantness of referred pain.

Discussion

In the present study, bias resulted in increased reports of the presence, intensity, and unpleasantness of referred pain in a population of TMD patients, as compared to persons who were not given biasing statements prior to the examination. These findings have important clinical significance, because in TMD, and particularly myofascial pain, subjective reports of referred pain may be the primary finding. Diagnosis of these conditions may be dependent on the presence of referred pain and its characteristic referral pattern.[14,25,26] Often, the subjective finding of pain on muscle palpation is viewed as an "objective" finding from a diagnostic test,[27] but in reality it may be subjective and thus susceptible to a myriad of influencing factors. Clinician expectation of pain referral and the resulting bias can affect patient reports of pain referral. If the diagnosis of a specific condition such as myofascial pain dysfunction is dependent on the finding of such referred pain, there are substantial possibilities for misdiagnosis and subsequent mismanagement. The present study provides data supporting the contention that bias can lead to finding an increased report of referred pain that could result in possible over-recognition or false positives in the diagnosis of TMD and myofascial pain. It is important to keep in mind, however, that even though biasing resulted in an increase in the report of referred pain, such referred pain is a common finding in TMD and may have been present in patients who participated in the study prior to the introduction of the biasing statement.

Based on the results of other studies,[25,28–31] attention can be effectively manipulated and redirected with experimental instructions that result in increased pain report. An example is the "nocebo" response, in which pain report was induced by experimental instructions, even in the absence of any noxious stimulation.[31] The "nocebo" response was attributed to the effects of attention and expectation. The biasing results obtained in the present study could have been the result of deliberately redirecting the focus of the subjects' attention.

Along with attention, anxiety may also result in an increased report of pain.[2,32] Significantly higher levels of state anxiety in subjects who reported referred pain could be a reflection of anxiety that was induced by the biasing instructions. Since anxiety was assessed following the experimental exposure, the instructions given to the biased group could have induced anxiety as a result of redirecting attentional focus. Thus, the higher level of state anxiety could have resulted in increased pain referral, but the

present design does not enable the testing of that hypothesis. However, it is important to note that state-trait anxiety and social desirability were equivalent in the biased and non-biased groups. Differences in reports of referred pain between these experimental conditions could not therefore be attributed to those psychologic domains.

Expectancy effects have been termed interpersonal self-fulfilling prophecies and refer to the effect of one person's expectations on the performance of another person.[33] Such effects could have also accounted for the experimental results. Expectations of the experimenter can be conveyed to the subject on both conscious and unconscious levels, which can lead to the expected results being obtained. Concurrently, there are expectancy effects on the part of the subject. Subjects engage in active problem-solving aimed at deducing the scientific intent of the experiment and have a strong desire to comply with the experiment and yield the expected results.[34,35] Subjects are also responsive to the situational demand characteristics and to the subject role cues involved in experimental settings. It is entirely reasonable that the differential response in the bias group could be influenced by interpersonal expectancy effects.

Closely related to attention and expectancy effects is the concept of response bias, which is the tendency of subjects or patients to report a sensation as painful. This is the result of attitudinal, motivational, judgmental, and learning variables.[36] In agreement with findings from myofascial pain dysfunction patients[37] and others,[38] the present findings indicate that the subjects who were read the biased statements exhibited response bias. This is reflected in the increased reported presence, intensity, and unpleasantness of referred pain in the biased subject group.

When bias was introduced formally, the resulting referred pain was more intense and unpleasant. The effect on the intensity reflects the sensory/discriminative aspect of pain, whereas the effect on unpleasantness reflects the affective/motivational aspect of pain. The experimental findings tend to support the theory that the effect of bias influences not only the affective aspect of pain, but also has some influence over the sensory dimension of pain. The possibility that a psychologic manipulation can influence both sensory and affective dimensions contrasts with previous work,[19] where there were differential effects on the sensory and affective dimensions of pain, with effects seen only in the affective dimension.

Previously it had been reported that bias effects were especially prevalent in subjects who had high levels of social desirability and low levels of trait anxiety. This response style has often been described as a repressive coping style.[39] In the present sample, the subjects who exhibited this repressive coping style presented with fewer pain reports than the other subjects in the study. Recognition of this response style in the clinical environment may be particularly important because this subset of patients might be prone to under-reporting their pain.

Shortcomings of the present study include the lack of direct assessment of the focus of attention or relation of the report of referred pain to pre-existing pain level, chronicity of pain, TMD diagnostic subgroups, or current medication usage. While it was recognized that there was potential for effects from medication usage, these effects were expected to be controlled through randomization, which would evenly distribute medication usage among the experimental conditions. When patients taking no drugs were retrospectively examined, bias still resulted in a significant increase in pain report. When patients were grouped with respect to medication use or not, there were no significant differences between the groups with respect to report of referred pain. It is possible that the use of centrally acting medications had some effect in central processing that resulted in the report of referred pain, but this effect was not evident in the data on PPTs and pain referral. The experimental situation approximated clinical conditions, where there was no attempt to change exam procedures on the basis of the patient's medication use or other variables, and reflected standard clinical practice.

This study indicates that bias induced by instructions from the clinician can result in a significant increase in reports of the presence, intensity, and unpleasantness of referred pain in TMD patients. The effects of biasing can be attributed to influencing factors such as attention, expectancy, or response bias. The effect does not appear to be a result of differences in pressure-pain thresholds or social desirability, but there may be some influence exerted by a patient's current anxiety level. The fact that pain report can be significantly altered by the presence of bias can have important clinical implications. Bias could lead to an over-report of referred pain upon muscle palpation during routine physical examinations. The report of referred pain may then be due more to expectancy effects and response bias than to physiologic causes. There must also be recognition that a specific subset of patients—those exhibiting high social desirability and low trait anxiety—may under-report pain. The present findings suggest

that clinicians should become much more circumspect in their interactions with patients, to avoid possible bias, and keep in mind the multiple factors influencing pain report.

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