

Psychophysiological and Psychological Correlates of Pericranial Allodynia and Affective Distress

Kathleen M. Romanek, M.S.
Ohio University

Acknowledgments

Kenneth Holroyd, Ph.D.
Dissertation Advisor

Katey Foster, B.S.
Research Assistant

Kara Carson, B.S.
Research Assistant

Jamie Huckins, B.S.
Research Assistant

Pericranial Allodynia

- Pericranial allodynia is the most reliable clinical finding in very frequent or chronic tension-type headache (CTTH).
- Allodynia- defined as a pain response to a stimulus which does not normally evoke a pain response (Merskey & Bogduk, 1994).
- Assumed to be “key” in the pathophysiology of CTTH (Jensen, 1999; Bendtsen, 2000).

Merskey, H., & Bogduk, N. (1994). *Classification of Chronic Pain*, 2nd Ed, (pp. 209-214). Seattle: IASP Press.

Jensen, R. (1999). Pathophysiological mechanisms of tension-type headache: A review of epidemiological and experimental studies. *Cephalalgia*, 19, 602-621.

Bendtsen, L. (2000). Central sensitization in tension-type headache: Possible pathophysiological mechanisms. *Cephalalgia*, 20, 486-508.

Pericranial Allodynia

3 hypothesized processes:

1. Peripheral abnormalities.

- a) Muscular activity
- b) Local ischemia
- c) Local inflammation

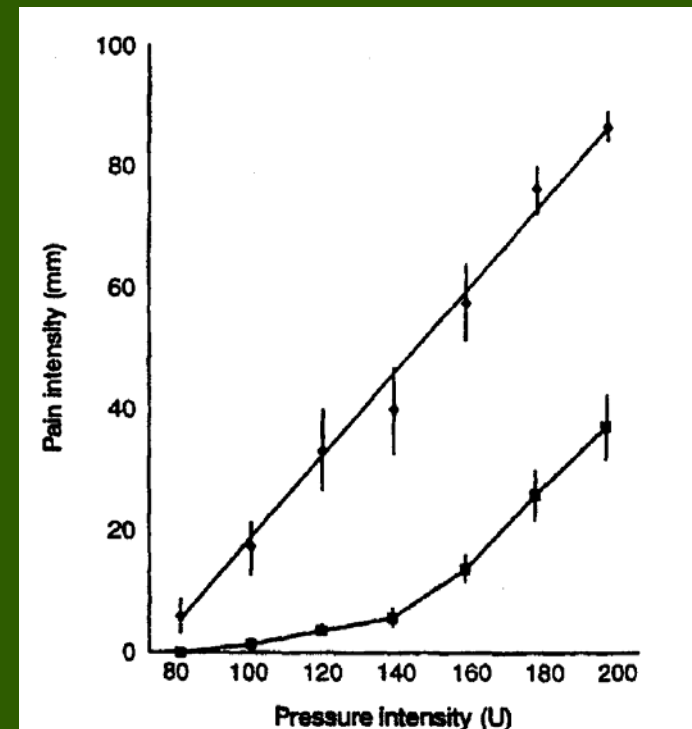
2. Local sensitization at the level of the trigeminal nucleus.

3. Higher-ordered central pain processing/modulation

Pericranial Allodynia

- Current beliefs is that allodynia reflects central pain processing abnormalities.
 - Tender muscles exhibit different stimulus response curves (Bendtsen et al, 1996).
 - Allodynia associated with decreased extra-cephalic pressure pain thresholds

Stimulus-response function in tender versus non-tender muscle.



Note: From Bendtsen, 1996

Pericranial Allodynia

- Pericranial allodynia has only been examined within a chronic tension-type headache.
- Unclear whether allodynia is associated with multimodal pain sensitivity.

Affective Distress

- Psychological processes may influence pain processing at the cortical level.
- Affective distress is consistently associated with headache and other chronic pain disorders.
- Depression found to be associated with allodynia and decreased extra-cephalic pressure pain thresholds (Janke et al, 2004).

Affective Distress

- However, no studies have considered how affective distress may affect pain sensitivity.
- Other psychological factors (stress, pain catastrophizing) thought to influence CTTH. Unclear if allodynia is associated with these factors.

Objectives

- To examine the association between pericranial allodynia and affective distress on formal diagnoses of headache and other persistent pain problems.
- To examine the association between pericranial allodynia and affective distress on multimodal cephalic and extra-cephalic pain sensitivity.
- To explore roles of pericranial allodynia and affective distress on other psychosocial correlates of headache.

Methods

Screening/Diagnosis (N=368)

Allodynia

- PMT+ (TTS \geq 6, \geq 2 sites)
- PMT- (TTS=0)



- Headache Disorders/Pain Complaints

Affective Distress

- Mood and Anxiety Symptoms Questionnaire

- Psychological Assessment

- Prime MD
- Undergraduate Stress Questionnaire

Pericranial Allodynia

- Manual standardized pressure (500 g/c)
- 5 bilateral muscles:
 - Temporalis
 - Masseter
 - Suboccipital
 - Cervical
 - Trapezius
- Rated on 0-3 verbal+ behavioral scale and summed (0-30)



Methods

Psychophysiological Assessment

Mechanical Stimuli

- Pressure Pain Thresholds
 - Temporalis
 - Finger
- Manual Tender Point Survey

Thermal Stimuli

- Thermal Thresholds
 - Heat Pain Thresholds
 - Heat Pain Tolerance
- Temporal Summation
 - Pain Catastrophizing Scale
 - McGill Pain Questionnaire

Methods: Pressure Pain Thresholds

- Examined at temporalis and finger.
- Pressure applied at a constant rate of 1.0 kg/sec.
- Participants indicate point pressure first becomes painful.



Methods: Manual Tender Point Survey

- Manual standardized pressure (4kg)
- 9 bilateral muscles:
 - Knee
 - Lateral epicondyle
 - Greater trochanter
 - Second rib
 - Supraspinatus
 - Gluteal
 - Low cervical*
 - Trapezius*
 - Occiput*
- Rated on 0-10 scale and summed (0-180)



*Removed prior to analyses

Methods: Thermal Thresholds

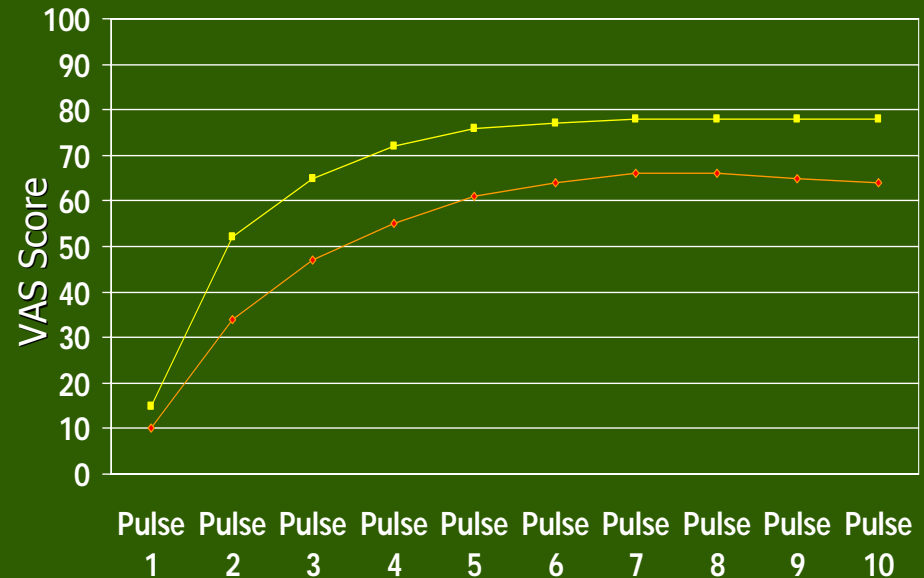
- 2.5 cm² thermode with a baseline temperature of 32° C delivers standardized increase at a rate of 0.3° C /sec to a maximum temperature 50° C
- *Stimulus Thresholds*= point at which participants notice temperature change.
- *Pain Thresholds*= point at which stimulus first becomes painful.
- *Pain Tolerance*= point at which participant can no longer tolerate the temperature increase.



Methods: Temporal Summation

- 15 51° C to delivered to palm on non-dominant hand.
- 40° C base with pulse duration of 1.5 seconds and 1.5 ISI.
- Participants rate intensity of each pulse from 0-100.

Example temporal summation data:



Study 2: Methods

Demographic Characteristics

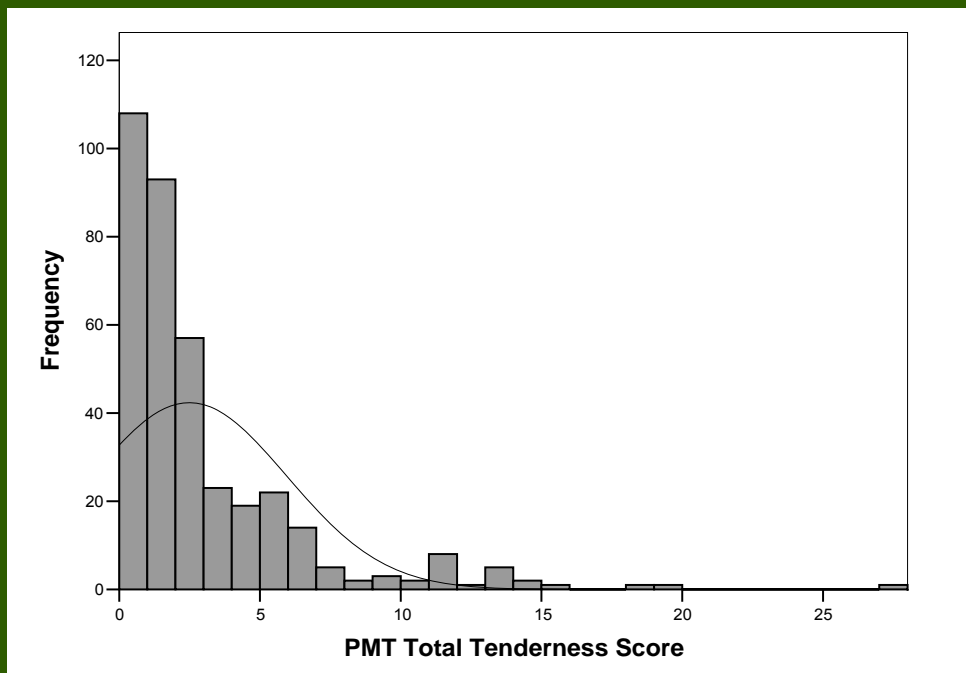
	PMT + (N=45)	PMT- (N=108)
Age	18.89 (1.15)	19.13 (1.62)
Identified Race		
Caucasian	91.1% (41)	90.7% (98)
African American	2.2% (1)	3.7% (4)
Hispanic/Non-white	-	1.9% (2)
Asian	4.4% (2)	3.7% (4)
Multi-racial	2.2% (1)	-
Year in School		
Freshman	68.9% (31)	74.1% (80)
Sophomore	17.8% (8)	13.9% (15)
Junior	2.2% (1)	5.6% (6)
Senior	4.4% (2)	4.6% (5)
Graduate	-	1.9% (2)
Menstrual Stage	13.64 (8.00)	15.79 (12.48)
Total Tenderness Scores****	9.96 (4.30)	0.0 (0.0)
Mood and Anxiety Symptoms Questionnaire****	157.40 (35.16)	134.05 (26.55)

****p<.001

Results: Pericranial Muscle Tenderness and Affective Distress

- One-third of participants no tenderness and more than ½ indicated no tenderness or mild tenderness at one site ($TTS \leq 1$).
- Only 12% exhibited tenderness of 6 or greater across 2 or more sites.
- PMT and AD were significantly associated ($\rho = .26, p < .001$).

Distribution of PMT Total Tenderness Scores



Results: Headache Diagnoses/Other Pain Complaints

% Headache Diagnoses/ Persistent Pain Complaints for PMT groups.

	PMT + (N=45)	PMT- (N=108)	Total (N=153)
Tension-Type Headache			
1-14 headache days/month	28.3% (13)	25.5% (27)	26.1% (40)
≥ 15 headache days/month	6.7% (3)	2.8% (3)	4.0% (6)
Migraine	24.4% (11)	10.2% (11)	14.4% (22)
Any Headache Disorder	44.4% (20)	34.6% (37)	37.3% (57)
Persistent Pain Complaints	17.8% (8)	10.2% (11)	12.4% (19)

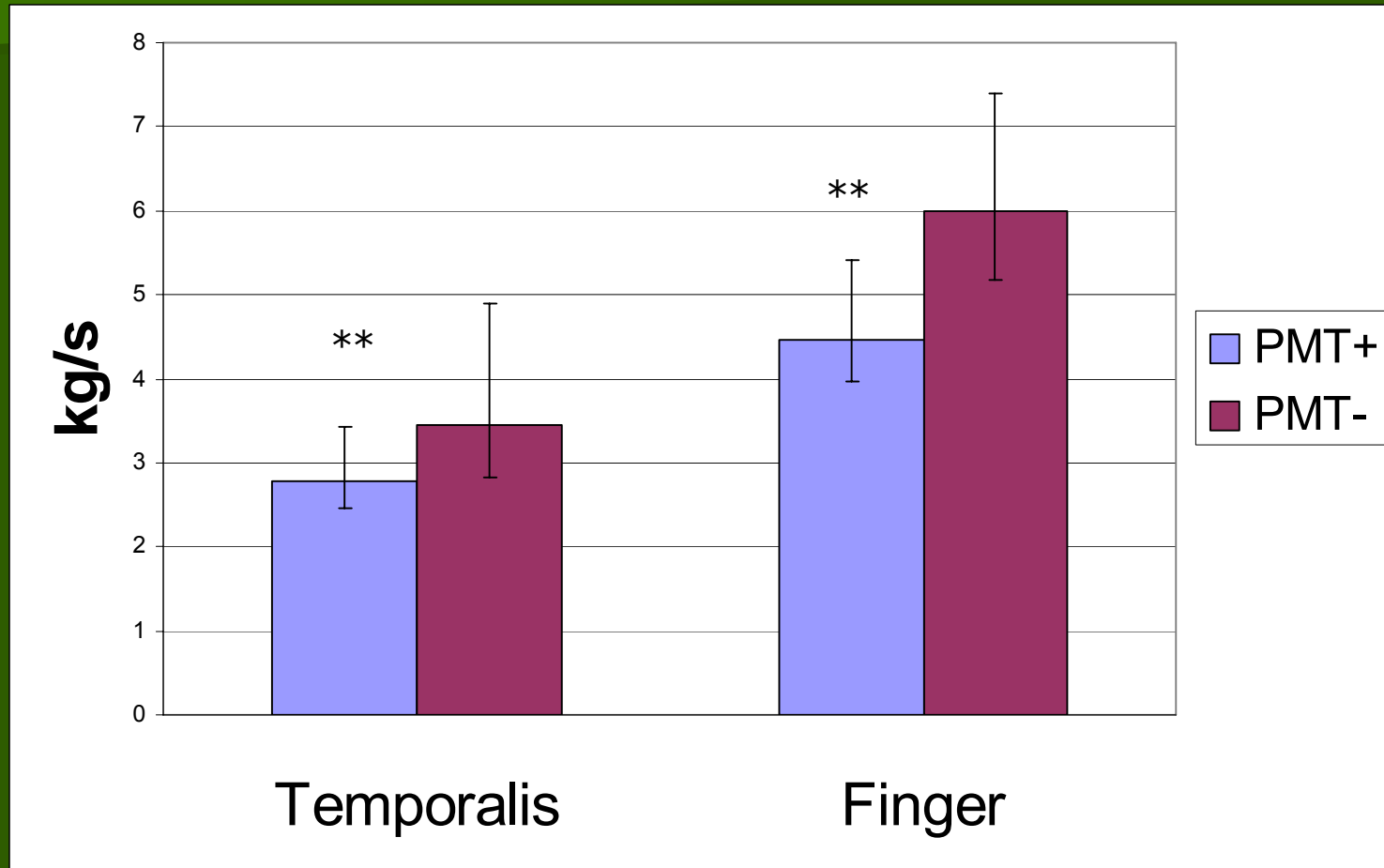
% Headache Diagnoses/ Persistent Pain Complaints for AD.

	High AD (N=77)	Low AD (N=76)	Total (N=153)
Tension-Type Headache			
1-14 headache days/month	27.3% (21)	25.3% (19)	26.1% (40)
≥ 15 headache days/month*	7.8% (6)	0.0% (0)	4.0% (6)
Migraine*	23.4% (18)	5.3% (4)	14.4% (22)
Any Headache Disorder*	48.1% (37)	26.3% (20)	37.3% (57)
Persistent Pain Complaints*	16.9% (13)	7.9% (6)	12.4% (19)

*p<.05

Results: Psychophysiological Findings

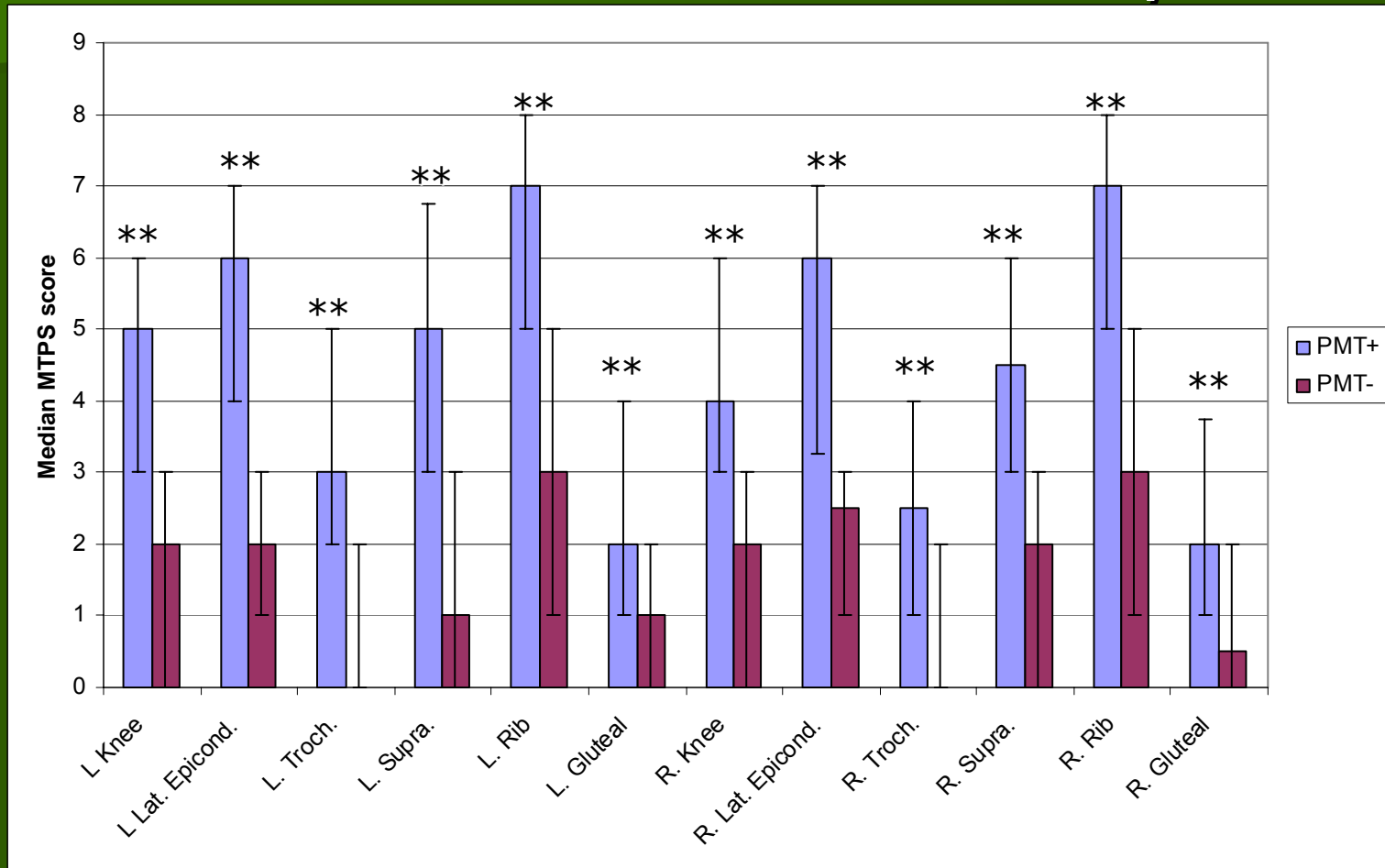
Pressure Pain Thresholds



**p<.001

Results: Psychophysiological Findings

Manual Tender Point Survey

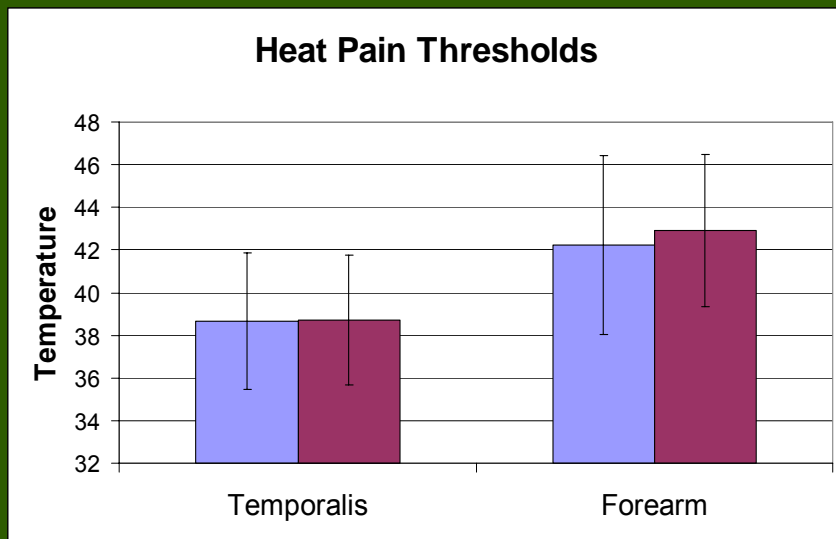


**p<.001

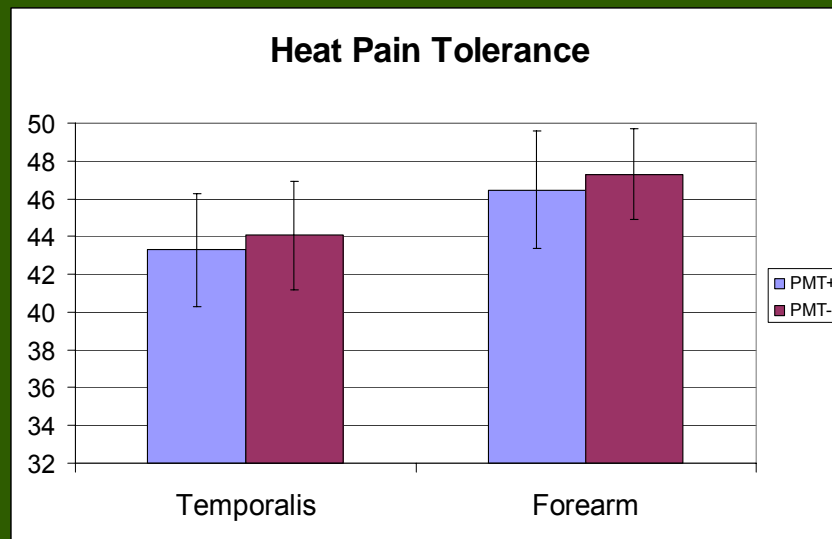
Results: Psychophysiological Findings

Thermal Assessment

Heat Pain Thresholds



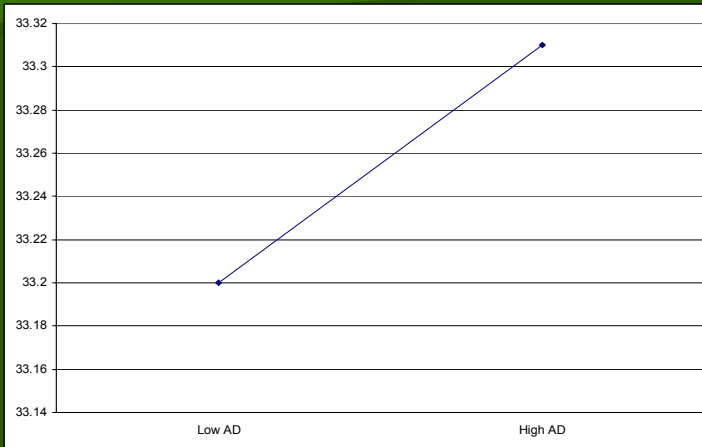
Heat Pain Tolerance



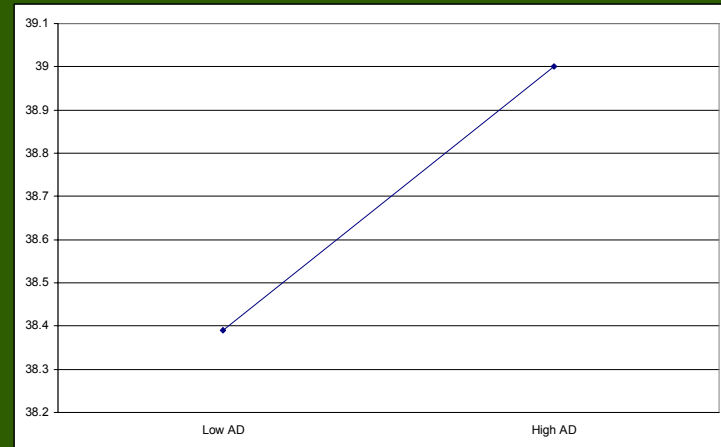
Results: Psychophysiological Findings

Thermal Assessment

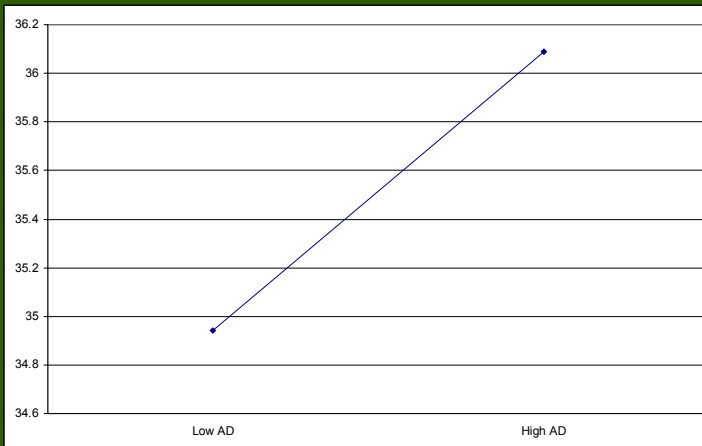
Cephalic Sensory Thresholds



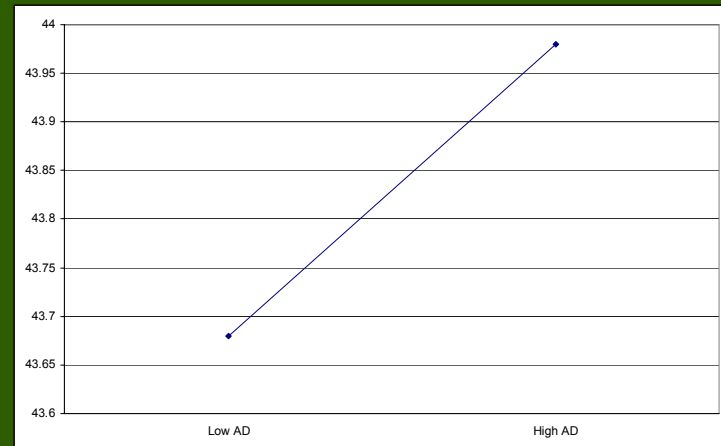
Cephalic Heat Pain Thresholds



Extra-cephalic Sensory Thresholds

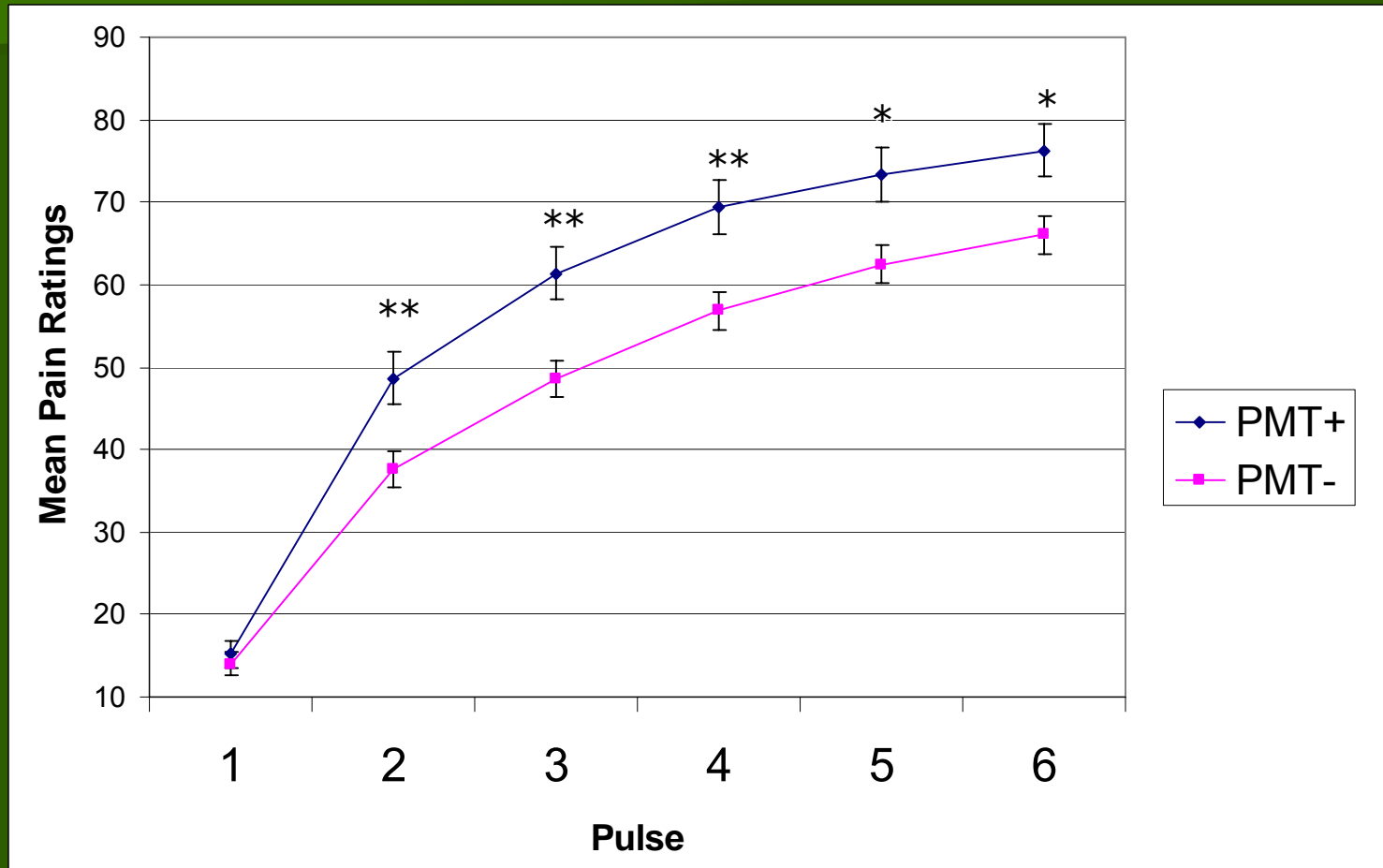


Cephalic Heat Tolerance



Results: Psychophysiological Findings

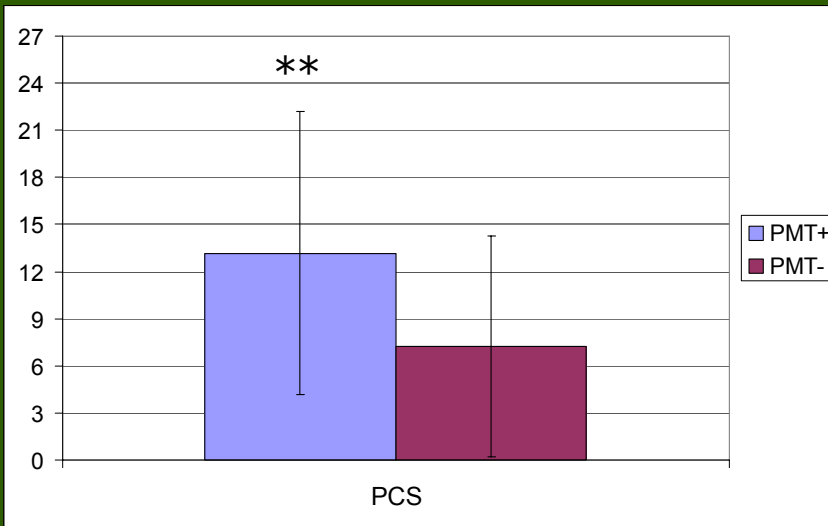
Temporal Summation



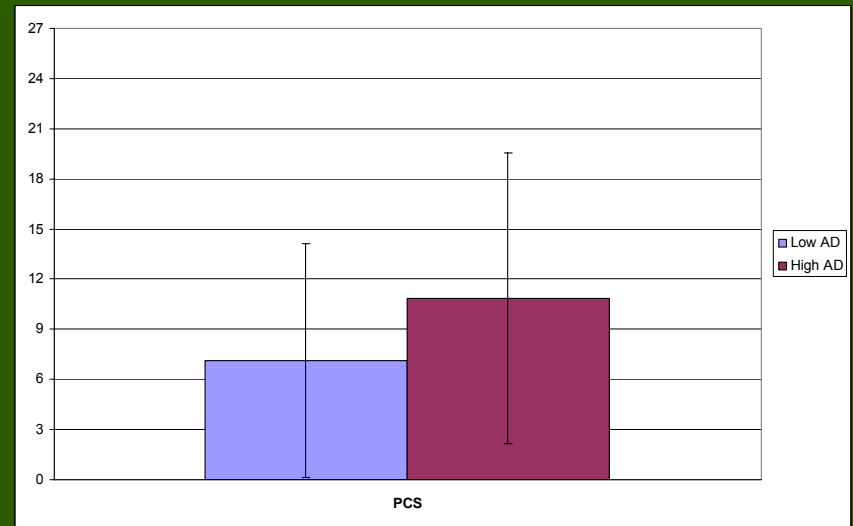
**p < .001; *p < .05

Results: Pain Catastrophizing

PCS scores for each PMT group.



PCS scores by AD.



**p<.01

Results: Psychiatric Disorders

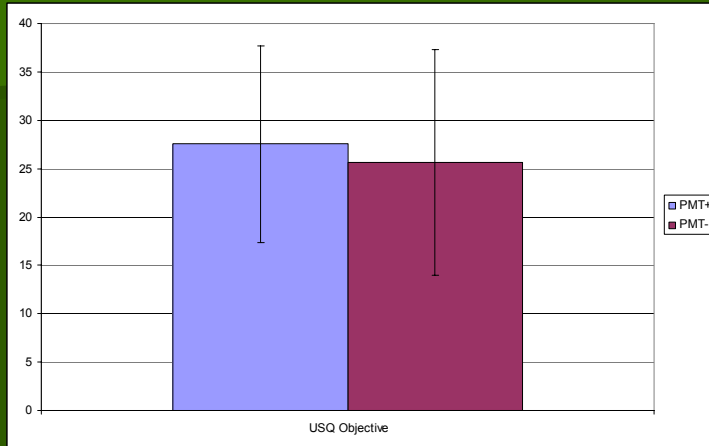
% Mood and/or Anxiety Disorder

	PMT + (N=45)	PMT- (N=108)
Prime MD		
Mood or Anxiety Disorder	28.9% (13)	16.7% (18)
Mood Disorder*	28.9% (13)	12.0% (13)
Anxiety Disorder	8.9% (4)	5.6% (6)

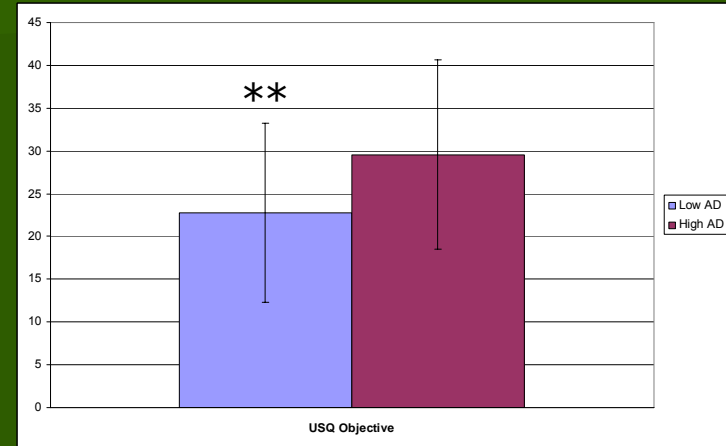
*p<.05

Results: Stress

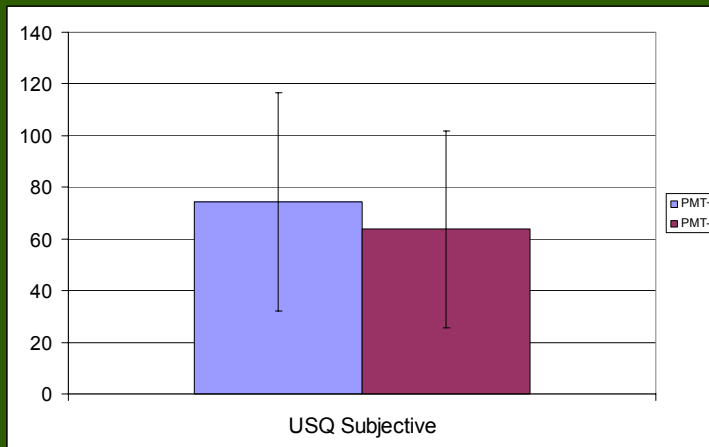
Objective Stress Scores for each PMT group.



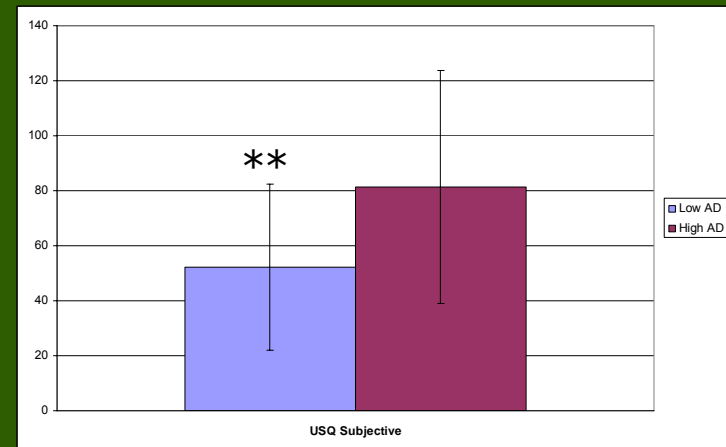
Objective Stress Scores by AD.



Subjective Stress Scores for each PMT group.



Subjective Stress Scores by AD.



**p<.001

Conclusions: Association with Headache Disorders and Pain Complaints?

- Allodynia in general population is not associated with headache.
- However, individuals with CTTH did exhibit higher PMT scores.
- Allodynia may be a sensitive, but not specific measure of abnormal pain processing in CTTH.
- Allodynia may also serve as a risk factor for headache or other pain problems.

Conclusions: Association with Multimodal Pain Sensitivity?

- Allodynia is associated with widespread and multimodal pain sensitivity, including:
 - pressure pain thresholds
 - widespread mechanical pain sensitivity
 - temporal summation
- Indicates a general disruption in pain involving higher-ordered processes rather than peripheral abnormalities or local sensitization.

Conclusions: Role in Psychological Correlates of Headache?

- Allodynia is associated affective distress and the presence of a mood disorder.
- Allodynia is also associated with pain catastrophizing following the temporal summation task.
- Because these variables are associated with abnormal pain processing, they may play a role in the development/ maintenance of chronic pain disorders.

Conclusions: Limitations of Study

- Sample may not be representative of community populations.
- Retrospective nature of pain complaints and headache reports.
- Association between allodynia and affective distress may have contributed to lack of findings regarding any interactions. A large-scale study may detect interactions.

Conclusions: Future Directions

- Allodynia in young women appears to be associated with multimodal pain sensitivity but not associated with headache or a persistent pain problem.
 - Future prospective studies should examine abnormal pain processing as a predictor of pain disorders.
- Allodynia is also associated with affective distress and pain catastrophizing.
 - Future studies should focus on how these variables influence pain processing and the development/maintenance of chronic pain disorders.