Test of Memory Malingering Performance is unaffected by laboratory-induced pain: implications for clinical use

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Abstract

The Test of Memory Malingering (TOMM) is a well-validated and widely used forced-choice symptom validity test. However, little is known about how TOMM performance is affected by pain. The present study evaluated the sensitivity of the TOMM to pain induced in healthy participants via the cold-presser test. Participants (\(n = 20\) per group) were administered the TOMM under one of three conditions: (1) standard instructions; (2) instructions to simulate pain-related memory deficit in pursuit of personal injury litigation; (3) while experiencing cold-induced pain. Results indicate that TOMM performance was unaffected by laboratory-induced moderate to severe pain and support the TOMM’s use in evaluating clinical patients with pain.

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Clinicians have used forced-choice symptom validity tests (SVTs) for decades to detect exaggeration of cognitive and perceptual symptoms in neuropsychological evaluations (for a review, see Bianchini, Mathias, & Greve, 2001). Most SVTs are two-alternative forced-choice tests that serve ostensibly as measures of cognitive or perceptual ability. Research has demonstrated that SVTs are relatively insensitive to memory impairment caused by...
brain damage (e.g., Bianchini, Mathias, Greve, Houston, & Crouch, 2001; Tombaugh, 1996, 1997). Moreover, performance on several commonly used SVTs is insensitive to the effects of depression and anxiety (e.g., Test of Memory Malingering (TOMM); Ashendorf, Constantinou, & McCaffrey, 2004; Rees, Tombaugh, & Boulay, 2001). In short, SVTs are insensitive to ability and instead are considered to measure test-taking effort. The results of SVTs allow clinicians to draw inferences about the validity of test performance and can contribute to a diagnosis of malingering (e.g., Bianchini et al., 2001). Therefore, SVTs are commonly included in psychological batteries when there is potential incentive to exaggerate symptoms or level of disability, such as personal injury litigation and worker’s compensation claims.

Back and neck pain are common problems in modern America. The lifetime incidence of low back pain is 11–84% (Walker, 2000) while neck pain persists in 10–15% of the adult population (Hardin & Halla, 1995). It is currently well accepted that the pathophysiology is not entirely or clearly understood (Waddell, 1996) and physical/diagnostic characteristics of injuries associated with pain do not fully explain symptomatic or functional outcomes (Boden, Davis, Dina, Patronass, & Wiesel, 1990). This has led to the investigation of psychological factors in search of an explanation for some of this unexplained variance. Recent research has confirmed that certain psychosocial factors are related to outcome (see Linton, 2000, for a review). Moreover, the financial incentive associated with workers compensation claims and personal injury litigation also significantly impacts outcome (Rainville, Sobel, Hartigan, & Wright, 1997; Rohling, Binder, & Langhinrichsen-Rolling, 1995).

Patients with chronic pain may complain of or manifest cognitive symptoms such as impaired memory or concentration. Some cognitive symptoms may legitimately accompany the experience of pain, arising as a consequence of pain-related depression or as a side effect of sedating medications such as narcotic analgesics (Eccleston, 1994, 1995; Ravnkilde et al., 2002). However, cognitive complaints by litigating pain patients without head injury commonly exceed those reported by non-litigating patients with head injury (Iverson & McCracken, 1997; Iverson, King, Scott, & Adams, 2001). There is documentation of malingered cognitive impairment in patients whose primary complaint is pain (Bianchini, Etherton, & Greve, in press; Greve, Bianchini, & Ameduri, 2003; Larrabee, 2003). Moreover, the incidence of malingering in pain may be quite high. Kay and Morris-Jones (1998) reported that video surveillance identified potential malingering in 20% of pain patients pursuing compensation claims. Base rates of malingering may approach 40% in personal injury and workers compensation cases (Mittenberg, Patton, Canyock, & Condit, 2002). Thus, because malingered cognitive disability may be present in some patients with pain, chronic pain evaluations have increasingly included SVTs (Bianchini et al., in press; Gervais, Green, Allen, & Iverson, 2001; Meyers & Diep, 2000).

On a rational basis one can argue that pain and pain-related factors (e.g., use of analgesics known to affect cognition) should not affect performance on SVTs which are relatively insensitive to the effects of severe brain dysfunction. Therefore applying empirical cutoffs derived from patients with documented brain pathology to patients with pain is reasonable and likely conservative (i.e., will result in a low false positive error rate) for use in diagnosing malingering (Bianchini et al., in press). At the same time, some SVTs have empirically-demonstrated insensitivity to pain. For example, performance on the Word Memory Test (WMT; Green, Iverson, & Allen, 1999) and the Computer Assessment of Response Bias (CARB; Cinder, Allen, & Cox, 1992) is insensitive to pain itself and can be under volitional control in some
pain patients (Gervais et al., 2001). Thus, while existing empirical data support the interpretation of positive SVT findings as indicative of poor effort, negative response bias, and potential malingering in patients with pain, the empirical demonstration of SVT insensitivity to pain would enhance the interpretability of positive SVT findings.

The TOMM (Tombaugh, 1996, 1997) is another widely used SVT. However, little is known about how it is affected by pain. Therefore, the present study investigated the effect of laboratory-induced pain on TOMM performance. Pain was induced by means of the cold-pressor task which has been used for decades to generate pain in the laboratory setting (e.g., Mikail, Vandeuren, & von Baeyer, 1986; Saab, Llabre, Hurwitz, & Schneiderman, 1993). Similarities have been noted between cold pressor-induced pain and cancer-related pain (Graham, Bond, Gerkovich, & Cook, 1980), headache pain (Bishop, Holm, Borowiak, & Wilson, 2001), and back pain (Keefe & Dolan, 1986; Schmidt & Brands, 1986). The cold pressor task is considered to be more like a chronic pain experience than more short-lived laboratory-induced pain, such as electric shock (e.g., Chen & Treede, 1985; Rainville, Feine, Bushnell, & Duncan, 1992; Gracely, 1989).

In the current study non-clinical volunteers were administered the TOMM under one of three conditions: (1) under standard instructions; (2) under instructions to simulate pain-related memory deficit in pursuit of personal injury litigation; (3) while experiencing cold-induced pain. This method allows the direct determination of the effect of pain on TOMM performance and comparison of this level of performance to that of persons known to be intentionally feigning memory impairment.

1. Method

1.1. Participants

A total of 67 undergraduates of both genders were recruited at a liberal arts university in the Southern United States participated for course credit, with 26 men and 34 women ranging in age from 18 to 23 completing the study; data from seven of those recruited were either not gathered or not retained. One participant declined to participate following disclosure that one condition involved moderate cold-induced pain, and a second participant withdrew from the experiment after undergoing several minutes of the cold-pressor procedure. A third participant completed the study but his data were discarded because of failure to attend to the test stimuli (i.e., he looked repeatedly at his hand and conversed with the experimenter rather than attending to the test stimuli). Four participants in the Simulator group (see below) were dropped and replaced because they either indicated upon debriefing that they did not follow instructions to feign memory impairment or because they performed normally (i.e., apparently did not attempt to simulate memory deficit) but were not appropriately debriefed to explain why they had performed normally. Those participants in the Simulator group who performed normally but provided an explanation for how they followed instructions in performing the task were retained. For example, some Simulators who performed normally said that they attempted to appear impaired by responding slowly or appearing uncertain in their responses, strategies which did not lead to reduced TOMM scores.
1.2. Test of Memory Malingering

The TOMM is a commercially published SVT consisting of three stimulus booklets and a scoring sheet (Tombaugh, 1996). Fifty line drawings of common objects serve as target stimuli. These 50 drawings are presented consecutively and participants are instructed to attempt to remember them. A two-item practice trial begins administration. In Trial 1, presentation of the 50 individual line drawings is immediately followed by consecutive presentation of 50 pairs of line drawings, each containing one item previously presented (target) and one item that was not previously presented (distractor). Participants are to identify the item that was previously presented. Trial 2 follows immediately with the same target stimuli in a different order, and two-item forced-choice recognition also in a different order. A 15 min waiting period during which participants engage in a non-pictorial filler task follows the second trial. In the current study participants were given a series of brief readings and answered multiple choice questions about the readings. The “Retention” trial differs from the first two trials in that the target items are not presented for memorization; rather, the 50 pairs consisting of one target and one distractor are presented for recognition, again with order altered.

1.3. Procedure

Approval for this study was obtained from the Institutional Review Board of the first author's university, where the study was conducted. Upon arrival, participants were informed that they would be randomly assigned to one of three conditions and that one of these conditions would involve experiencing moderate pain by means of the cold-pressor procedure. They were informed that they could decline to participate in the study if they did not wish to undergo such a procedure. Participants then read a description of the study and read and signed an informed consent form. They were assigned to one of three conditions by drawing a number out of a box. All participants then completed the TOMM.

1.4. Conditions

1.4.1. Control condition

Participants assigned to the Control condition completed the TOMM in standard fashion as described above.

1.4.2. Simulation condition

In the second condition, participants were asked to simulate pain-related memory impairment. Prior to administration of the TOMM, they read the instructions printed below. At the conclusion of the experiment, Simulators were asked to describe in writing their strategy for feigning memory impairment.

“Imagine that you have been in an accident and suffered an injury to your neck and shoulder. Initially you experienced pain in that arm and hand but now you are completely healed and experiencing no problems. Nevertheless, you have filed a lawsuit and you stand to gain a very large settlement if you are disabled. In your lawsuit you are claiming that your pain has
affected your ability to think, especially your memory. Because of the memory problems you have developed, you cannot do college level schoolwork and now your future employment opportunities are limited. You have been sent to a psychologist to evaluate your claim of memory problems and are now about to take a memory test for that purpose. Your task is to perform on that test as if your memory were impaired because of severe, persistent, chronic pain. However, you must fake your memory impairment in a way that is believable because if you are caught, your lawsuit will be thrown out of court and you will get nothing.”

1.4.3. Cold-pressor condition
Participants assigned to the third condition completed the TOMM in the context of cold-induced pain via the cold-pressor task. Immediately prior to administration of the TOMM, participants were directed to place their hand and forearm into a bucket of ice water and asked to keep it in place during administration of the TOMM. They were informed that they could remove their hand from the water if the pain became too great, but were asked to return their hand to the water as soon as they were able to do so. An 11-point numerical pain rating scale was used to record pain intensity. Such scales are commonly used in both clinical and research applications (Gracely, 1989; Peckerman et al., 1991). The scale and associated verbal descriptors (No Pain (0), Mild Pain (1–3), Moderate Pain (4–6), Severe Pain (7–9), Very Severe Pain (10)) were presented prior to initiating the cold-pressor and remained visible throughout the procedure. Pain ratings were recorded at approximately one-minute intervals throughout administration of the TOMM. Water temperature readings were recorded at approximately 5 min intervals.

The majority of participants left their hands in the water throughout the administration of the procedure, although some did withdraw their hand from the water briefly (less than about 30 s) before returning it to the bucket. Data on the frequency and duration of hand removal from the water were not recorded; however, general observation was that brief removal of the hand was not followed by substantial reduction in pain ratings. It was also found in followup analyses that pain ratings were not correlated with TOMM scores; thus, TOMM scores for this group were not affected by participants removing their hands from the pain stimulus to avoid pain. Rather, mean pain ratings remained in the moderate range for all 3 trials (see Section 2) and were generally unaffected by the relatively brief and infrequent pauses by a few participants.

2. Results
Mean TOMM scores and analysis results for each condition are reported in Table 1. Condition effects were analyzed via analysis of variance (ANOVA) for each trial separately. Results indicated significant group effects and large effect sizes for all three trials. Post hoc analyses using the Bonferroni correction indicated that Simulator group scores were significantly worse than the Control and Pain Groups, which did not differ from each other. Thus, the Control and Pain conditions did not differ despite the laboratory-induced pain. Analyses revealed no main effects or interactions involving gender.

Water temperature across the three trials averaged 40.06°F (S.D. = 5.90). Pain ratings were averaged for each of the three trial blocks separately (Trial 1 mean = 5.05, S.D. = 2.21; Trial 2
Table 1
TOMM scores by trial and by condition

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Simulator</th>
<th>Pain</th>
<th>F</th>
<th>P</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOMM</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>S.D.</td>
<td>S.D.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 1</td>
<td>48.5</td>
<td>1.47</td>
<td>19.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.37</td>
<td>4.10</td>
<td>99.42</td>
<td>.001</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td>49.9</td>
<td>.31</td>
<td>21.7</td>
<td>14.85</td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>49.65</td>
<td></td>
<td>71.17</td>
<td>.001</td>
<td>.58</td>
<td></td>
</tr>
<tr>
<td>Retention</td>
<td>49.9</td>
<td>.31</td>
<td>18.7</td>
<td>13.03</td>
<td>.37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>49.85</td>
<td></td>
<td>114.32</td>
<td>.001</td>
<td>.69</td>
<td></td>
</tr>
</tbody>
</table>

df = 2 and 57 in all cases.

Mean = 5.55, S.D. = 2.23; Retention Trial mean = 5.00, S.D. = 2.83). Mean pain ratings ranged from 1.86 to 9.43 for Trial 1, 2.17 to 9.25 for Trial 2, and 1.0 to 9.0 for Retention Trial. For Trial 1, 2 participants reported mean pain in the Mild Pain (1–3), 12 reported Moderate Pain (4–6) and 6 reported Severe Pain (7–9). For Trial 2, 3 reported Mild Pain, 10 reported Moderate Pain, and 7 reported Severe Pain. For the Retention Trial 1 reported No Pain (0), 4 reported Mild Pain, 7 reported Moderate Pain, 7 reported Severe Pain, and 1 reported Very Severe Pain (10).

Despite the fact that 85% (17/20) reported at least Moderate pain and 55% (11/20) reported Severe pain on at least one trial, none of the participants in the Pain group scored below the standard TOMM cutoffs for Trial 2 and Retention (i.e., <45) and never approached the performance levels of the Simulators. In effect, as a group, the performances of those persons with laboratory-induced pain were indistinguishable from those without pain. To further evaluate the relationship between pain ratings and TOMM performance, correlations were calculated between mean pain ratings for each section of the TOMM and corresponding performance for that section. These correlations (Trial 1: \( r = .15, r^2 = .02 \); Trial 2: \( r = .22, r^2 = .05 \); Retention: \( r = .06, r^2 = .00 \)) were not significant.

While group effects are interesting, it is the single subject analysis that is most important since, ultimately, the relevant clinical question regards the meaning of the performance of one person. Table 2 provides a summary of the frequency counts for four different clinically

Table 2
Summary of individual TOMM performance

<table>
<thead>
<tr>
<th></th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut</td>
<td>Sim</td>
<td>Pain</td>
<td>Cut</td>
</tr>
<tr>
<td>45–50 (pass(^a))</td>
<td>20</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Below cutoff(^b) (33–44)</td>
<td>0</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Chance (18–33)</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Below chance (^c) (≤17)</td>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

N = 20 per group; Cut: control; Sim: simulator.

\(^a\) Performance in this range on Trial 2 and Retention is considered a pass; Trial 1 is not normed.

\(^b\) Performance in this range or lower on Trial 2 and Retention is considered a failure and indicative of negative response bias.

\(^c\) Below chance scores on any trial are considered indication of intentionally poor performance (e.g., Reynolds, 1998).
relevant levels of performance. Subjects in the Control condition produced virtually no errors in Trial 2 or the Retention Trial with only two participants performing less than perfectly. No one in this group scored below 45 on any trial. These scores are consistent with the manual’s reference norms for non-brain injured individuals (Tombaugh, 1996). The Simulators’ varied considerably with 80–85% failing the test (i.e., scoring less than 45) depending on trial. Nearly 50% scored in the chance range (i.e., at a level consistent with guessing) and the remainder, also nearly 50%, scored statistically below chance (i.e., at a level worse than guessing). Seven members of the cold-pressor group scored in the 33–44 point range with most scoring greater than 40. On Trial 2 and Retention, 85% of the Pain condition had perfect scores, the remainder missed only one item.

3. Discussion

The purpose of the present study was to evaluate the sensitivity of the TOMM to pain. Pain was induced in healthy participants via the cold-pressor test, a standard laboratory method of pain induction. Results demonstrate that laboratory-induced moderate to severe pain that approximates the intensity and characteristics of chronic forms of pain has essentially no effect on performance on TOMM Trial 2 and Retention. These findings generally support the use of the TOMM in evaluating patients with pain. It is noteworthy that although the Pain condition led to Trial 2 and Retention performance that was indistinguishable from the performance of individuals in the no-pain Control condition, instructions to simulate a cognitive deficit generally resulted in performance that would be considered evidence of negative response bias. That is, 75–85% of participants intentionally trying to appear impaired failed the TOMM; half of these performed at below chance levels. The current study thus indicates that such performance is reflective of deliberate misrepresentation of capabilities and is not attributable to pain.

There are several limitations of the present study. There are likely cognitive/intellectual differences between these college student participants and typical chronic pain patients. Therefore, it is possible that these participants have greater cognitive reserve, whichbuffered the otherwise disruptive influences of pain. Moreover, it is possible that the disruptive effects of laboratory-induced pain may not mirror perfectly the effects of chronic pain. However, most of these college student participants reported pain at levels similar to those reported in patients with chronic pain (Ehde et al., 2003; Jensen, Sjogren, Ekholm, Rasmussen, & Eriksen, 2004) and the pain was induced via a method that has been empirically demonstrated to produce effects similar to chronic pain (Gracely, 1989; Rainville et al., 1992). Behavioral observation indicated that some of the participants were distracted by the pain induction. In this context, it is important to note that Trial 1 performance of the Pain group was more variable than in the Control group and that more of the Pain group performed poorly (score < 45) on Trial 1. Moreover, the pain group in this study performed worse on Trial 1 than the depressed and anxious elderly persons reported by Ashendorf et al. (2004). At the same time, their Trial 1 performance was indistinguishable from the traumatic brain injury and aphasia patients reported by Tombaugh (1997). Only his dementia patients performed worse than our sample with laboratory-induced pain. Thus, despite potential differences between our Pain sample and
clinical chronic pain patients, our pain group did perform on Trial 1 like some clinical samples (e.g., TBI), suggesting that differences between our laboratory pain sample and patients seen in clinical practice did not appreciably affect TOMM performance.

Might the nature and severity of the cognitive deficits observed in chronic pain differ from those seen in other diagnostic groups such that the effects of chronic pain in a clinical sample might differ in meaningful ways from those suggested by the results of this study? Disturbances in speed of processing and attention are the primary cognitive deficits seen in patients with mood disorders and/or mild TBI (Cohen, Malloy, & Jenkins, 1998; Lezak, 1995). These deficits are also diagnostically nonspecific. Eccleston (1994) demonstrated that chronic pain patients were impaired only on more complex attention-demanding tasks but that tasks requiring fewer attentional resources were unaffected even when reported pain levels were high. Thus, cognitive deficits seen in patients with chronic pain are comparable in severity and kind to those seen in persons with pathologies associated with minimal or no brain dysfunction who are able to perform the TOMM successfully. Moreover, the TOMM is not a complex, attention-demanding task, but one on which even individuals known to have significant neurologically-mediated memory deficits (e.g., moderate-severe TBI and other cognitive impairments) are able to perform successfully (Teichner & Wagner, 2004; Tombaugh, 1997). Similarly, children as young as 5 years old have been shown to perform at levels comparable to normal adults (Constantinous & McCaffrey, 2003).

Nonetheless, no laboratory study will capture perfectly the complexity of the clinical presentation of a given diagnostic or clinical category, such as chronic pain. There may be different features of the clinical presentation of these patients that are not well represented in our sample. For example, sleep deprivation, a common sequelae of chronic pain, may by itself or in interaction with medication effects produce cognitive problems that would not be identified with the current design involving pain induction in healthy volunteers. For this reason, investigations such as the current study represent a first step in addressing potential influences of pain on TOMM performance and follow-up clinical studies using clinical patients with pain will be needed to address the complex medical and psychological processes that often are present in patients with chronic pain.

Accordingly, in clinical practice TOMM performance below empirically established cutoffs (but not worse than chance) could potentially be due to factors other than deliberate misrepresentation. If factors are present (e.g., fatigue, poor motivation, medication side-effects) that result in not appropriately engaging the task (i.e., not attempting to do their best) then poor SVT performance would not necessarily reflect a deliberate attempt to misrepresent one’s capabilities. It is therefore important to address clinically the potential influence of these variables on SVT performance by questioning patients about factors that may have interfered with their ability to give their best effort. As is the case with any psychological assessment, careful behavioral observation and evaluation of multiple sources of information (e.g., medical records) are important for making sense of test results. This is particularly true when using specialized malingering detection techniques like the TOMM. Ultimately, a diagnosis of malingering requires the careful review and integration of a range of information and the results of symptom validity testing are one important potential source of evidence regarding the presence of response bias (Slick, Sherman, & Iverson, 1999). The current study demonstrates that use of the TOMM in detecting response bias and possible malingering may reasonably be extended to
the assessment of pain-related cognitive impairment in patients whose primary complaint is pain.

References


