Personality Assessment in Neuropsychology

The Nonspecificity of MMPI-2 Neurocorrection Methods

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Three established methods of neurocorrection claim to improve Minnesota Multiphasic Personality Inventory (MMPI)/MMPI-2 validity with closed-head injury (CHI) patients. These methods (which suggest removing "neurological" items from scoring) were employed here comparing 35 CHI patients with 35 psychiatric patients with elevated profiles. The 14-item correction changed 2-point codes for 41% of CHI and 31% of psychiatric profiles, the 30-item system changed 77% of CHI and 71% of psychiatric profiles, whereas the 37-item system changed 80% of CHI and 71% of psychiatric profiles. There were no significant differences between the two groups in number of profiles changed or number of neurocorrective items endorsed. Using each of the three correction systems, the following percentage of profiles remained elevated: 99%, 87%, and 89%, respectively.

Keywords: neurocorrection; MMPI-2; personality assessment; brain injury

The Minnesota Multiphasic Personality Inventory (MMPI) and its revision, the MMPI-2, have long been used to evaluate the emotional status of individuals with known or suspected brain injury (Reitan, 1974). In fact, use of the MMPI for individuals with neurological symptoms can be traced back to the original development of the instrument (Hathaway & McKinley, 1940). Zillmer (as cited in Zillmer & Perry, 1996) reported that 48% of 1,000

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neuropsychologists surveyed said they used the MMPI frequently in their assessments. Lees-Haley, Smith, Williams, and Dunn (1996) reported that the MMPI (or the MMPI-2) was the second most popular test in forensic reports by neuropsychologists. The MMPI or the MMPI-2 was used in 68% of the 100 forensic reports reviewed.

Farr and Martin (1988) provide an extensive review of attempts that have been made to uniquely identify brain dysfunction using various scales, keys, or 2-point code types of the MMPI. There have been at least six special scales developed that initially showed promise but could not be satisfactorily cross validated on new samples. Farr and Martin pointed out that a major conceptual problem has been the assumption that "brain damage" is a unitary condition rather than a diverse set of conditions ranging from small focal lesions to generalized global injuries. They concluded that the MMPI is sensitive to psychopathology in brain-injured populations but that it did not seem to be sensitive to brain damage in the absence of psychopathology. Because no particular code type was unique to brain-injured groups, they speculated that elevations on MMPI scales in this population might represent loss, accommodation, and/or coping with the dysfunction caused by brain injury. They also noted that this interpretation might be clouded by the presence of premorbid psychopathology in some individuals who suffer a brain injury.

The MMPI-2 items were originally assigned to clinical scales based on their ability to differentiate clinical groups (e.g., depressed, schizophrenic, manic) from people without psychiatric diagnoses (Dahlstrom & Dahlstrom, 1980). This empirical approach removed some of the problematic subjective judgment that had been involved in the construction of earlier personality measures. On the other hand, several research groups (Alfano, Finlayson, Stearns, & Neilson, 1990; Gass & Russell, 1991; Meyerink, Reitan, & Selz, 1988) have maintained that the MMPI profiles of some patients are "inflated" by brain injury symptoms that appear on the basic clinical scales of the MMPI. For example, symptoms such as memory problems or clumsiness/awkwardness that result from brain injury might inadvertently contribute to elevated scores on one or more psychiatric scales, suggesting psychopathology in otherwise normal brain-injured individuals. It is argued that this could result in inaccurate depictions of a patient's problems, with the potential for errors in clinical or forensic decision making.

Meyerink et al. (1988) in work with multiple sclerosis patients identified 30 items that they believed were "neurological" in content. They thought that these particular items might represent an illness dimension (i.e., physical illness, as opposed to mental illness) that would also be relevant for use in adjusting clinical scales for patients with brain injury. These authors suggested making adjustments by subtracting the identified items from the clinical scales' total score when they are endorsed. This subtraction theoretically corrects for the effects of neurological damage and results in a neurocorrected profile.

Gass and colleagues (Gass, 1991; Gass & Russell, 1991; Gass & Wald, 1997) identified 14 items that they considered representative of common dysfunctions due to neurological insult. They concluded that accuracy of diagnosis would be improved by subtracting these items from the clinical scales. Alfano et al. (1990) proposed a correction scheme involving 44 items that were also judged by experts to be neurological in content. They divided these items into a physical symptom set and an emotional symptom set. These investigators have argued that MMPI (and MMPI-2) clinical scale profiles need to be adjusted by subtracting items that are due to brain injury in order to obtain a valid assessment of psychopathology.

This issue of adjusting profiles has become particularly important where the MMPI or MMPI-2 profiles are used to support a diagnosis of psychopathology rather than a diagnosis of brain injury as the cause of patient complaints. However, the methods that have been proposed to "neurocorrect" MMPI profiles are also subject to criticism. Recently, Dunn and Lees-Haley (1995) concluded that the 14-item correction procedure used by Gass was not useful. These researchers compared brain-injured and psychiatric patients on the 14 individual items identified by Gass and found only 5 items to significantly differentiate the two patient groups. They concluded that these 5 items resulted in "negligible and not clinically significant" changes to the affected scales. Because the majority of the items were not any more frequently endorsed by the brain injury group, they argued that there was no reason to adjust the MMPI clinical scales. Perhaps of even more fundamental concern, the subtraction of multiple items from scoring that is recommended by neurocorrection methods threatens the psychometric properties of the MMPI or MMPI-2 and potentially invalidates the very empirical procedure used for its scale construction that distinguished the MMPI and contributed to its widespread use.

In the clinical practice of the present study's first author the application of these neuro-correction methods to the profiles of clinical and forensic cases led to a change in many profiles, although most profiles seemed to remain elevated even following neuro-correction. The present study was designed to systematically evaluate the effect of neuro-correction on MMPI-2 profiles and to determine whether the items included in these neuro-corrective schemes were characteristic of closed-head-injured (CHI) patients as compared to psychiatric patients.

The present study examines the effect of the three correction systems on the profiles of known brain-injured pa-

tients and a comparison group of psychiatric patients all of whom had elevated MMPI-2 clinical profiles. Most interpretive systems for the MMPI-2 use a basic code type analysis in which specific interpretations are suggested for 2-point and spike (only one scale elevated) code types. Changes in the profile by the three neurocorrection systems could theoretically result in profiles with different 1- and 2-point code types and therefore suggest different clinical interpretations.

Hypothesis 1: A significantly larger proportion of the closed-head-injured (CHI) patients will have their code type changed by neurocorrection than found in the psychiatric group.

Hypothesis 2: A larger mean number of neurocorrection items will be endorsed by the CHI group when compared with the psychiatric group.

METHOD

CHI Sample

The patients included in the CHI sample were recruited from a medical center, a head trauma support group, two community rehabilitation agencies, and a private practice. Although 60 individuals with mild to severe brain injuries volunteered to participate in this study, those patients with traumatic brain injuries due to stroke, anoxia, infection, and tumors were not enlisted in the study in order to keep the mechanism of injury homogeneous by limiting the sample to CHI patients. Forty-two individuals from this group had suffered a closed-head injury. Five of these 42 individuals, however, had normal-level profiles on the MMPI-2 and were not included in the profile analysis. In addition, two patients had *F*-scale scores greater than $T = 89$, suggesting invalid MMPI-2 profiles (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989), and the data from these individuals were therefore not used in further analyses. The 35 remaining participants were 16 women and 19 men. Their ages ranged from 21 to 72 ($M = 39$, $SD = 15$). Injury severity ranged from momentary or no loss of consciousness (suggesting milder injuries) to more than 24 hours' loss of consciousness (suggesting more severe injury).

Psychiatric Sample

Archival data from a study of the MMPI and MMPI-2 (Edwards, Morrison, & Weissman, 1993) was used for the comparison sample. A group of 100 patients had been collected from admissions to a psychiatric outpatient clinic and to the private practices of two psychologists. Three patients were excluded from consideration for the present study as they had diagnoses of organic brain syndrome, dementia, and a neurological disorder (normal pressure hydrocephalus). In addition, those individuals with invalid ($F > 89$; Butcher et al., 1989) or normal profiles (no elevated scales) were not eligible for inclusion in the study. The 35 psychiatric patients selected for inclusion in the study were selected randomly from the remaining patients in this data set. There were 15 men and 20 women in the psychiatric sample, with ages ranging from 20 to 71 ($M = 37$, $SD = 11$). Diagnoses in the psychiatric group ranged from major depression and other mood or anxiety disorders to substance abuse.

There was no significant difference on gender distributions between the groups. The groups also did not differ on mean age (CHI $M = 39.4$, psychiatric $M = 37.2$), on years of education (CHI $M = 13.3$, psychiatric $M = 14.8$), or ethnicity (CHI 89% White, psychiatric 71% White).

Procedure

CHI patients completed the MMPI-2 followed by structured interviews that included questions about the length of unconsciousness they suffered at the time of injury and the type of injury sustained. Individuals in the psychiatric sample completed the MMPI-2 sometime after admission but did not complete the structured interview.

Each MMPI-2 clinical profile was rescored three times. First, the endorsed MMPI-2 items from the 14-item subset identified by Gass (1991) were subtracted from each of the 10 clinical scales, and new *T*-scores were computed and plotted. Next, this process was repeated for the 30 items identified by Meyerink et al. (1988). Finally, this process was completed for the 37 items identified by Alfano et al. (1990) (these authors originally identified 44 neurological items for the MMPI; 40 of these also appeared in the MMPI-2, and 3 of these were not considered because they were not part of any of the basic clinical scales). The code types for the original (uncorrected) scoring and for each of the three neurocorrection methods were then recorded and compared for significant clinical changes. The number of profiles converted to normal profiles was recorded as well as the percentage of 2-point code type changes and the number of items endorsed from each of the neurocorrection systems.

Statistical Analysis

The number of code types changing and not changing are compared for each group by using a chi-square test to see if the distributions differ. If the neurocorrective items are specific to neurological change, then the CHI group should show significantly more code type change compared with the psychiatric group.

The mean number of items endorsed for each neurocorrective scheme is compared for the two groups by using Student's *t* test. If the neurocorrective items are specific to neurological changes found in head injury, the CHI group should endorse significantly more items than the psychiatric group. The conventional .05 level of significance was used to reject the null hypotheses.

RESULTS

Uncorrected Profiles

The CHI sample ($n = 35$) had between 1 and 8 clinical scales elevated at or above the cutoff of $T = 65$. The mean number of elevated scales was 3.8. The mode was 2 scales elevated for 10 participants. There was extensive variability, with 22 different spike or 2-point code types observed for these 35 patients. The psychiatric sample showed similar variability, with the mean number of elevated scales per participant being 4.6. Eighteen different spike or 2-point code types were observed in the psychiatric sample.

Gass (1991) 14-Item Correction

Removal of the endorsed responses of the 14 Gass items from the clinical scales changed the 2-point or spike code type for 15 (43%) of the CHI participants and for 11 (31%) of psychiatric participants. Contrary to prediction (Hypothesis 1), the differences between the groups were not significant, $\chi^2(1, N = 70) = 0.98$, $p > .05$. It should be noted that the profile was not considered changed if only the order of the two elevated scales changed. However, only 1 participant's MMPI-2 profile ended up with no clinical scale elevations after correction. Thirty-four of the 35 CHI participants and all 35 of the psychiatric participants still had profiles suggesting significant psychopathology after the Gass items were removed.

Meyerink et al. (1988) 30-Item Correction

Removing a larger number of items resulted in more change. Twenty-seven (77%) of the profiles in the CHI group and 25 (71%) of profiles in the psychiatric group showed a change in code type when the endorsed responses suggested by Meyerink et al. (1988) were subtracted from the clinical scales. Again, contrary to Hypothesis 1, the small difference between the two groups was not significant, $\chi^2(1, N = 70) = 0.30$, $p > .05$. Only 6 of the CHI profiles and 3 of the psychiatric profiles became normal-level profiles following correction. The majority of the profiles (85%) still suggested significant psychopathology.

Alfano et al. (1990) 37-Item Correction

Twenty-eight profiles (80%) in the CHI group and 25 profiles (71%) in the psychiatric group showed a change in code type when the Alfano et al. (1990) items were removed. As found for the first two methods (and contrary to Hypothesis 1), there were no significant differences between the two groups in the number of profiles changed by the Alfano et al. method, $\chi^2(1, N = 70) = 0.70$, $p > .05$. In addition, only 4 profiles in each group became normal-level profiles, with 31 (89%) still showing indications of significant psychopathology.

Comparison of Mean Items Endorsed

The mean number of items from each neurocorrection system endorsed by the CHI and psychiatric groups were compared by using Student's *t* tests. These results appear in Table 1. Contrary to prediction (Hypothesis 2), there were no significant differences between the groups in the mean number of items endorsed. This finding replicates the results found by Dunn and Lees-Haley (1995) in their investigation of the Gass neurocorrection method. In the present study, however, the Gass comparisons came closest to significance ($p = .06$), with a mean of 6.0 for the CHI group and 4.5 for the psychiatric group.

In summary, neither Hypothesis 1 nor Hypothesis 2 were supported by our findings.

DISCUSSION

Taken on their own, the high percentages of code type changes we found within the CHI group following neurocorrection could be taken to suggest that Dunn and Lees-Haley were misguided in their conclusion that the 14 items of the Gass system were not clinically relevant. A comparison of these changes with those found in the psychiatric group, however, suggests that the items from Gass et al. and the other neurocorrection systems are not specific to head injury, because psychiatric patients show a similar degree of change upon neurocorrection.

The findings from this study also document, however, that many of those known to have suffered a significant brain injury also have substantial emotional symptoms that need to be addressed. This, of course, has long been recognized in the field and underscores why neuropsychology has always been sensitive to issues traditionally addressed in the treatment of those with emotional disturbances and other psychiatric disorders.

Brulot, Strauss, and Spellacy (1997) compared the Gass (1991) and Alfano, Paniak and Finlayson (1993) cor-

TABLE 1
Comparisons of the Mean Number of Endorsed Items in Three Neurocorrection Systems

	Closed-Head Injury Group (n = 35)		*Psychiatric Group (n = 35)*			
Correction Method	M	SD	M	SD	t	p
Gass (1991)	6.00	2.87	4.51	3.59	1.91	.06
Myerink, Reitan, & Selz (1988)	13.97	5.82	12.60	5.75	0.99	.33
Alfano, Finlayson, Stearns, & Neilson (1990)	14.47	5.80	12.29	6.80	1.63	.13

rection methods with a new proposed correction method proposed by Artzy (as cited in Brulot et al., 1997), by creating a new scale from each of the item sets to represent each correction factor. They found that these new scales did not correlate with duration of loss of consciousness or with length of post-traumatic amnesia (traditional indicators of the severity of brain damage). The new scales did, however, correlate significantly with the MMPI-2 content scale for depression even though the content scale for depression shared no items with the Gass item set and only two items with the Alfano et al. (1993) item set. The correlations were greater than .50. They concluded that the new scales representing the correction factors were more sensitive to depression than to severity of closed-head injury.

The neurocorrection procedures apparently solve no problems yet create new difficulties. Many code types and high-point scales are changed, but the subtraction process may damage scale validity such that on these modified scales it is no longer clear what an elevated score means. The subtraction procedure changes the MMPI-2 scales in ways that make it impossible to rely on standardized norms. The current research shows that the subtraction procedures do not provide neurocorrections of a nature specific to closed-head injury and therefore suggests clinicians should find other ways to evaluate MMPI-2 profiles for CHI patients.

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