Relationship Between Stress, Coping, and Postconcussion Symptoms in a Healthy Adult Population

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Study 1 examined the association between intensity of postconcussive symptoms (PCS), impact of daily stress, and level of perceived stress over the past month in a group of healthy young adults. There was a significant relationship between intensity of PCS and impact of daily stress, as well as level of perceived stress over the past month, independent of the frequency of stressful events experienced. Study 2 assessed the stability of the relationship between PCS and stress. Subjects rated intensity of PCS, impact of daily stress, and level of perceived stress on two separate occasions approximately 1 month apart. The Perceived Stress Scale demonstrated high test-retest reliability. Significant relationships were again found between intensity of PCS and level of perceived stress at both time points, independent of the frequency of stressful events. These results suggest that persistent symptoms in some individuals with postconcussive syndrome may be due, at least in part, to individual differences in the perceived stress of incurring a mild traumatic brain injury. © 1998 National Academy of Neuropsychology. Published by Elsevier Science Ltd

Estimates of the incidence of mild head injury range from 120 to 300 per 100,000 (Kraus & Nourjah, 1989). The actual number of individuals who experience mild traumatic brain injury (MTBI) may in fact be much higher because alterations in consciousness at the time of injury may be overlooked (Kay, Newman, Cavallo, Ezrachi, & Resnick, 1992). Outcome studies report that between 10% and 40% of those who incur this type of injury continue to experience...
persistent symptoms and disability for several months following the initial injury (Alves, Macciocchi, & Barth, 1993; Barrett, Ward, Boughney, Jones, & Mychkalikin, 1994). The basis of the persistent symptoms in these individuals, often called postconcussion syndrome, remains a source of controversy and apparently cannot be explained by either organic or psychological factors alone. Kay and colleagues (1992) have proposed a multifactorial model suggesting that an interaction between a variety of neurological, psychological, and environmental factors may explain ongoing disability following mild head injury.

In an attempt to delineate the specificity of postconcussive symptomatology, some studies examined the rate of postconcussive symptom complaint in the general population. Fox, Lees-Haley, Earnest, and Dolezal-Wood (1995a) assessed postconcussive symptoms in a large sample of patients who were members of a health maintenance organization. They found that psychiatric patients tend to report more PCS than controls, but the psychiatric patients’ rate of symptom complaint was comparable to patients who were seeking a neurological or family practice consult. Their results are consistent with reports indicating that postconcussive symptoms are not uncommon in the general population (Gouvier, Uddo-Crane, & Brown, 1988) and in individuals seeking outpatient psychotherapy (Fox, Lees-Haley, Earnest, & Dolezal-Wood, 1995b).

The stress and coping literature demonstrates a relationship between level of stress, coping style, and incidence of a variety of physical, emotional, and psychological symptoms. Gouvier, Cubic, Jones, Brantley, and Cutlip (1992) found that a group of healthy young adults who reported a greater number of stressful life events also endorsed more PCS. The relationship between life stressors and symptom complaint has also been proposed to explain differences in symptom complaint in other neurological populations, for example, cerebrovascular accidents and myasthenia gravis (Doering, Henze, & Schussler, 1993; Sinyor et al., 1986). Individual differences in coping with the various stressors associated with mild traumatic brain injury seemingly account for the large differences in levels of symptom complaint and disability.

Advances in the stress and coping literature indicate that individual differences in appraisal and perception of stressful life events are better predictors of symptomatic complaints than simply the number of stressful life events (Holroyd & Lazarus, 1982; Lazarus, 1990). A diagram of this model is provided in Figure 1. In the present study, we examined the frequency of PCS, number of daily stressors, and level of perceived stress over the past month in a healthy group of young adults who had not been injured. We predicted that intensity of PCS would be associated with impact of daily stress and level of perceived stress, independent of the frequency of daily stressors experienced.

**FIGURE 1. Model for relationship between stress and symptom complaint.**

**STUDY 1**

**Method**

**Participants.** The sample was composed of 179 undergraduate students from a midwestern university. Of the total sample surveyed, 38 endorsed a prior experience of alteration of consciousness associated with injury. These students were excluded from further analyses, resulting in a final sample of 141 subjects. The prevalence of head injury with accompanying
loss of consciousness in our sample is higher than expected, based on the estimated prevalence rate for head injury cited in other studies in the field (e.g., Fox, Lees-Haley, Earnest, & Dolezal-Wood, 1995a; Kurtzke & Kurland, 1993). This difference may be due to the survey nature of our design, which specifically queried students about previous alterations in consciousness. We used conservative criteria for the inclusion of subjects in our study in order to reduce the possibility of Type I error.

The average age of the mostly Caucasian sample was 20.7 years (range 18–22). Average number of years of education was 13.8 (range 12–16). The gender composition of the sample was 92 women and 49 men. Participants also completed a questionnaire about health history and current medication use. Students received extra credit toward their psychology grade for participation in the study.

Measures

Symptom frequency. All participants rated how much of a problem they had with 37 postconcussive-type symptoms (Symptom Rating Scale) from 0 (none at all) to 4 (extreme). This scale was modified from previously published instruments used to measure these symptoms in head-injured populations (Oddy, Humphrey, & Uttley, 1978; Cicerone & Kalmar, 1995). Some symptoms are relatively common following mild head injury (e.g., headache, fatigue, and memory problems) and others are relatively uncommon (e.g., change in sensation and diplopia: Dikmen, Temkin, & Armsden, 1989). Two additional items were included in order to assess symptom exaggeration and/or random responding (i.e., loss of sensation on one side of your body; loss of peripheral vision). See Appendix for the list of symptoms assessed. Symptom scores were calculated for both the frequency and intensity of the symptoms. Frequency of symptoms was defined as the total number of symptoms endorsed. Intensity of symptoms was defined as the sum of the severity ratings given by the subject for each symptom experienced.

Stressful life events. The Daily Stress Inventory (DSI) is designed to quantify the frequency and impact of stressful experiences that occurred within the previous 24 hours (Brantley, Waggoner, Jones, & Rappaport, 1987; Brantley, Cocke, Jones, & Goreczny, 1988). If a particular item is experienced, its impact is then rated on a scale from 1 (occurred but was not stressful) to 7 (caused me to panic). Two scores from the DSI were used: the frequency of stressful events defined as the total number of events that occurred in the past 24 hours, and the impact of these events defined as the sum of impact ratings from each item experienced.

Appraisal of life stress. The Perceived Stress Scale (Cohen, Kamarck, & Merlstein, 1983) contains 14 items that assess level of perceived stress during the previous month (e.g., in the last month how often have you been upset because of something that happened to you unexpectedly?), which are rated from 1 (never) to 4 (very often), yielding an overall measure of level of perceived stress.

Results

Study participants were generally healthy and had minimal use of medications. Common health complaints included colds/flu, muscle or joint pain, and stomach/intestinal disorders. Common medications taken included nonprescription pain relievers, cold medicines, and
TABLE 1
Rate of Endorsement for Common Postconcussive Symptoms

<table>
<thead>
<tr>
<th></th>
<th>% of Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>87</td>
</tr>
<tr>
<td>Fatigue</td>
<td>83</td>
</tr>
<tr>
<td>Concentration Difference</td>
<td>80</td>
</tr>
<tr>
<td>Irritability</td>
<td>74</td>
</tr>
<tr>
<td>Depression</td>
<td>71</td>
</tr>
<tr>
<td>Headache</td>
<td>57</td>
</tr>
<tr>
<td>Disordered Sleep</td>
<td>41</td>
</tr>
<tr>
<td>Sensitive to Light</td>
<td>26</td>
</tr>
<tr>
<td>Dizziness</td>
<td>19</td>
</tr>
<tr>
<td>Sensitive to Sound</td>
<td>16</td>
</tr>
</tbody>
</table>

antibiotics. Table 1 lists the 10 most frequently endorsed symptoms. Rate of symptom complaint in this study was comparable to that published in earlier studies (Dikmen et al., 1989; Fox, Lees-Haley, Earnest, & Dolezal-Wood, 1995b). Table 2 lists mean scores and standard deviations for the Symptom Rating Scale (Frequency and Intensity Scores), Perceived Stress Scale, and Daily Stress Inventory (Frequency and Impact Scores). The frequency and impact of daily stress and the level of perceived stress over the past month were comparable to normative samples of similar age and education (Brantley et al., 1987; Cohen, Kamarck, & Mermelstein, 1983).

Because we were interested in determining the unique association between intensity of PCS and impact of daily stress, as well as level of perceived stress, we performed partial correlations controlling for frequency of daily stressful events. The partial correlation between intensity of symptoms and impact of daily stress was statistically significant ($r = .50$, $p < .01$); the partial correlation between intensity of symptoms and level of perceived stress was also statistically significant ($r = .52$, $p < .01$). Furthermore, when we controlled for level of perceived stress, there was no longer a significant relationship between frequency of stressful events and intensity of symptoms ($r = .06$, ns).

When frequency of symptom complaint was co-varied out, the symptoms that were most highly related to level of perceived stress included depression ($r = .42$, $p < .01$), anxiety ($r = .33$, $p < .01$), irritability ($r = .29$, $p < .01$), and controlling temper ($r = .24$, $p < .01$).

TABLE 2
Mean Scores and Standard Deviations on Symptom and Stress Measures ($N = 141$)

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
</tr>
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<tbody>
<tr>
<td>Symptom Rating Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency score</td>
<td>18.15</td>
<td>6.28</td>
</tr>
<tr>
<td>Intensity score (sum)</td>
<td>27.52</td>
<td>14.08</td>
</tr>
<tr>
<td>Daily Stress Inventory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency score</td>
<td>20.84</td>
<td>9.04</td>
</tr>
<tr>
<td>Impact score (sum)</td>
<td>59.18</td>
<td>35.96</td>
</tr>
<tr>
<td>Perceived Stress Scale</td>
<td>24.87</td>
<td>6.95</td>
</tr>
</tbody>
</table>
Discussion

These results support our hypothesis that, independent of the number of daily stressors experienced, intensity of PCS is associated with impact of daily stressors as well as level of perceived stress experienced over the past month. They also support the notion that one’s overall perception of stress is a better predictor of intensity of symptoms experienced than simply the number of stressful events experienced.

Our findings are consistent with major models of stress and coping, which assert that appraisal of events has the most direct and the strongest relationship with outcome (i.e., level of symptom complaint) and is a better predictor of symptom complaint than the number of stressful events experienced.

STUDY 2

In order to examine the stability of the relationship between the intensity of PCS and perception of stress over time, we administered the Symptom Rating Scale, Daily Stress Inventory, and Perceived Stress Scale on two separate occasions, approximately 1 month apart. Because number of stressors is likely to vary, we felt it would be useful to examine the stability of one’s perception of the impact of daily stressors over time. We predicted that the association between intensity of PCS and level of perceived stress would be consistent over a 1-month interval, independent of frequency of stressors. If the relationship between intensity of symptoms and appraisal of stress is stable over time, it would offer support for the notion that one’s perception of stress is a stable, trait-like feature.

Method

Participants. A separate sample of 55 undergraduate students completed the Symptom Rating Scale, Daily Stress Inventory, and the Perceived Stress Scale on two occasions 28 days apart. Of these, eight students endorsed having experienced a loss or alteration of consciousness and were excluded from further analyses. Thus, the final sample was composed of 47 students. The sample was mostly female (85%). Average age was 19.8 (range 18–22) and average level of education was 14.3 years (range 13–16). All students received extra credit toward their psychology grade for participation in the study. The first set of ratings was completed at the end of April. The second set of ratings was completed at the end of May, 1 week before final exams.

Results

Table 3 lists means and standard deviations for the Symptom Rating Scale (frequency and intensity of symptoms), Daily Stress Inventory (frequency and impact of symptoms), and Perceived Stress Scale at Time 1 and Time 2. The Perceived Stress Scale had a test-retest reliability of .80. Test-retest reliability of DSI frequency and impact scores were also significantly correlated at Time 1 and Time 2 (frequency $r = .60, p < .01$; impact $r = .56, p < .01$). Arguably, the impact of daily stressors and level of perceived stress are measuring a similar trait-like feature, that is, how one experiences stressful events. The correlation between impact of daily stressors (from the Daily Stress Inventory) and Perceived Stress Scale was significant ($r = .62, p < .0001$). Thus, further analyses only examined the association between intensity of symptoms and level of perceived stress as measured by the Perceived Stress Scale.
TABLE 3
Mean Scores and Standard Deviations on Symptom and Stress Measures (N = 47)

<table>
<thead>
<tr>
<th></th>
<th>Time 1 M</th>
<th>Time 1 SD</th>
<th>Time 2 M</th>
<th>Time 2 SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom Rating Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency score</td>
<td>16.85</td>
<td>6.21</td>
<td>15.81</td>
<td>6.28</td>
</tr>
<tr>
<td>Intensity score (sum)</td>
<td>24.98</td>
<td>14.14</td>
<td>22.94</td>
<td>12.33</td>
</tr>
<tr>
<td>Daily Stress Inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency score</td>
<td>17.89</td>
<td>7.76</td>
<td>19.22</td>
<td>9.43</td>
</tr>
<tr>
<td>Impact score (sum)</td>
<td>50.77</td>
<td>30.42</td>
<td>56.05</td>
<td>37.82</td>
</tr>
<tr>
<td>Perceived Stress Scale</td>
<td>25.30</td>
<td>8.15</td>
<td>25.19</td>
<td>7.16</td>
</tr>
</tbody>
</table>

As predicted, the partial correlation between intensity of symptoms and level of perceived stress (excluding frequency of daily stressors) was significant at both time points: Time 1 ($r = .32, p < .05$) and Time 2 ($r = .47, p < .01$). Conversely, we sought to determine whether intensity of symptoms was associated with frequency of daily stressors while controlling for level of perceived stress. When perceived stress was partialed out, the correlation between stressful events and perceived stress was not significant at either Time 1 ($r = .14, \text{ns}$) or Time 2 ($r = .28, \text{ns}$). See Figure 2 for a diagram of the relationship between frequency of daily stressors, perceived stress, and symptom complaint.

Discussion

Intensity of symptom complaint was significantly related to level of perceived stress at Time 1 and Time 2. These results suggest that, independent of the frequency of daily stressors, the association between intensity of symptoms and level of perceived stress is stable over a 1-month interval.

Interestingly, the relationship between intensity of symptoms and level of perceived stress increased over time. One might expect the impact of daily stress and level of perceived stress to vary within this particular time frame because the second set of questionnaires was completed during finals week. It is possible that the increased stress associated with taking exams might, in part, account for the stronger correlation at Time 2.

FIGURE 2. Relationship between stress and coping over time.
General Discussion

Individuals with persistent symptoms following MTBI provide the fields of neuropsychology, rehabilitation, and health care in general, with a significant clinical and experimental challenge. There are many reports in the scientific and clinical literature, particularly in the last several years, devoted to understanding and appropriately treating persistent symptoms in a minority of individuals following this type of injury. There is general agreement that a variety of psychological factors seem to contribute to, and potentially even explain, persistent symptoms in many of these individuals. The impact of stressful life events, including events related to the injury itself (e.g., ongoing litigation, inability to return to work, financial hardships), are reported as significant factors in eventual outcome (Binder, 1986; Kay et al., 1992).

The view, however, that a simple increase in the number and intensity of stressful life events has a direct effect on similar frequency and intensity of PCS, without any intervening psychological variables, is relatively simplistic and reduces the vast complexities of human behavior down to a simple stimulus-response model.

Stress and coping models as elaborated by Lazarus and Folkman (1984) explain individual differences in reaction to external events. Consistent with this model, we found that individual’s perception of stress, independent of the frequency of the stressful events, is significantly related to the level of symptom complaint. In contrast, we did not find any significant relationship between the frequency of stressful events and level of symptom complaint.

We demonstrated that individual ratings of perceived stress are extremely stable over a 30-day time interval. Perceived stress varies between individuals but is relatively stable within individuals. In the current study such individual differences, and the strong correlation between perceived stress and level of symptom complaint, would potentially explain at least some of the wide variance in individuals’ symptom complaints following MTBI and clarify why symptom complaints cannot be understood on the basis of medical variables alone.

Our results are also consistent with an emerging literature on postconcussive syndrome, which proposes that pre-existing characterological features that are subclinical and do not differentiate individuals under stable, nonstressful conditions come to the forefront under stressful situations and differentiate individuals’ reaction to stressful events. In other words, normal variance in individuals’ response to stress in most environmental conditions is exaggerated when they are faced with more challenging, and often confusing, environmental conditions, such as MTBI (Gouvier et al., 1992).

Evaluating patients’ perceptions of the impact of stressful events (e.g., the injury and subsequent sequelae) and ability to manage stressful experiences may help to explain why some individuals experience prolonged difficulty with Post Concussive Syndrome. For example, Bohnen, Jolles, Twijnstra, Mellink, and Sulon (1992) found that a group of MTBI patients with PCS were more likely to report decreased ability to cope with problems, decreased active problem solving, and increased depressive attitude toward problems than a control group of MTBI patients without Post Concussive Syndrome. In order better to understand the nature of persistent symptoms after head injury, clinicians need to go beyond models of cognitive dysfunction and physical symptoms and assess level of perceived stress following mild head injury (Fox, Lees-Haley, Earnest, & Dolezal-Wood, 1995b).

These findings offer a potential explanation for persistent symptoms in a variety of medical populations in addition to outcome after MTBI, especially illnesses with vague and varying symptoms that are difficult to diagnose and for which the exact course and nature cannot always be fully determined. This last statement is perhaps best summarized by Lazarus and Folkman (1984) who state that “in cases of ambiguity, person factors shape the understanding
of the situation, thereby making the interpretation of the situation more a function of the person than of the [symptoms]” (p. 104).

Caution must be used in suggesting cause-effect relationships due to the correlational design of this research. However, these results provide the framework for further hypothesis testing of the relationship between postconcussive symptomatology and perceived stress. A prospective study that may more clearly elucidate the relationship between symptom complaint and stress over time should utilize an A-B-A--type design, whereby individuals would be evaluated before, during, and after a stressful experience, such as final examinations.

Our sample is predominantly female and contains a limited age and education range. All of these factors differ from general demographic studies of the characteristics of the MTBI population as a whole (Evans, 1992; Kurtzke & Kurland, 1993). These sample differences do not necessarily alter the interpretation of our findings, however, and in fact may represent a conservative estimate of the relationship between perceived stress and symptom complaint. Obviously, a broader sample should be included in subsequent studies.

The existence of postconcussion syndrome following MTBI will likely continue to be an area of controversy within the medical community and within clinical neuropsychology. Outcome studies following MTBI, which have concentrated primarily on cognitive deficits and physical sequelae, neglect important advances in understanding psychosocial variables in medical populations. Our findings offer support for the need to address the relationship between Post Concussive Syndrome and the perception of one’s ability to manage stressful experiences in the mild head-injured population.

REFERENCES


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**APPENDIX**

Symptom Rating Scale (SRS)

1. Expressing your ideas clearly.
2. Finding the correct words to say.
3. Understanding what is said in a conversation.
4. Remembering what you had for dinner last night.
5. Remembering names of people you see often.
6. Remembering your daily schedule.
7. Remembering important things you must do.
8. Understanding new instructions.
9. Concentrating on what you are doing for an extended period of time.
10. Completing projects quickly.
11. Keeping from being depressed.
12. Controlling your temper.
13. Controlling crying.
14. Staying involved in work activities even when bored or tired.
15. Recognizing when something you say has upset someone else.
16. Scheduling your daily activities.
17. Consistently meeting your daily responsibilities.
18. Controlling laughing.
20. With headaches.
22. Being dizzy.
23. Loss of sensation on one side of your body.
24. With poor concentration.
25. With nausea.
26. With blurred vision.
27. With poor hearing. (continued)
28. Being overly sensitive to sound.
29. Being overly sensitive to light.
30. Either staying asleep or maintaining sleep.
31. Irritability.
32. Feeling anxious or tense.
33. With your sense of smell and/or taste.
34. Being easily distracted.
35. Doing two things at once.
36. Loss of peripheral vision.
37. With ringing in your ears.