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Cognitive Techniques for Controlling Pain: Generality and Individual Differences

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There has been a great deal of interest in the last few years in psychological approaches to pain control. In particular, cognitive-behavioral strategies have been investigated as providing a means whereby a person's tolerance to pain can be increased.

Most of the research in this area has been done in the laboratory, using experimentally induced pain. These studies have suggested that tolerance levels can indeed be enhanced through the use of cognitive techniques. The evidence for the efficacy of these strategies in controlling clinical pain is meager. The number of studies is comparatively small and the results have been equivocal [see Tan (6)].

What of the research using experimentally induced pain? Is it possible that in the search for positive evidence as to the efficacy of cognitive-behavioral techniques for pain control, important problems go unnoticed? A perusal of the literature shows that cognitive-behavioral interventions do apparently result in subjects increasing their pain tolerance levels, but the data are averaged over many subjects and the variability is great. What this variability reflects is that some subjects benefit from the interventions, but others do not. If the work of the laboratory is to be translated into the treatment of the clinician, this is of the first importance.

Some recent research attempted a preliminary look at the individual differences which may be associated with the ability to use cognitive interventions effectively. A second question which was explored was whether cognitive techniques are effective *across* stressors. Interventions which would only modify certain kinds of pain, cold, for example, could not be expected to be useful clinically. The generality of pain measures across stressors was addressed in an earlier paper by Harris and Rollman (3) where both generality and discriminant validity were demonstrated.

METHOD

Subjects

Forty students, 20 male and 20 female, served as subjects. The age range was from 18 to 30, with a mean of 20 years.

Apparatus

Three stressors were used to obtain measures of pain threshold and tolerance.

1. Electrical stimulation: A constant current stimulator delivered trains of 40 1-msec monophasic square wave pulses at 100 Hz to the left volar forearm through a pair of Grass silver electrodes filled with Grass electrode paste. Stimulation was increased in discrete steps of 0.15 mA, beginning at 0.075 mA. An upper limit of 7.5 mA was used, but the subjects were not informed of this.

2. Cold water pressor: Observers inserted their right arm into a tank of circulating ice water. The temperature of the water was constantly monitored by a thermistor with a digital display. The mean water temperature was 1.8° C with a standard deviation of 0.29° C. The tank was furnished with a handle which subjects held lowered to the bottom, so that the angle of their arms in relation to the flow of water was identical. The ice was kept behind a wire mesh to prevent it from touching the skin. A 300-sec, unannounced, upper limit was used.

3. Pressure: A Forgione and Barber (2) pressure algometer applied a 2,000-g weight to the first phalanx of the subject's left forefinger. Individuals placed and removed the weight themselves. Again, the maximum exposure was limited to 300 sec.

Procedure

Each subject was exposed to the three stressors in one of the six possible random orders. Estimates of pain threshold and pain tolerance levels were obtained. For cold and pressure, pain threshold was defined as the amount of time elapsed between the beginning of stimulation and the point at which it became painful. Pain threshold for shock was the current level at which the subject reported that its quality first changed from touch to faint pain.

Tolerance for cold and pressure was defined as the amount of time between the beginning of stimulation and withdrawal from the apparatus. For shock, tolerance was the intensity at which the subject indicated that he or she did not wish to receive the next higher stimulus.

After these initial measures were made, subjects were presented with cognitive strategies similar to those used by Scott and Barber (4). These strategies were presented via a tape recording and began with the suggestion that the subject relax, followed by four tactics for coping with pain. The four strategies included attention diversion, dissociation, transformation of the sensation, and imaginative diversion. After listening to the tape, subjects were again presented with the three stressors and threshold and tolerance measures were obtained for each. Finally, the subjects took part in a brief interview and filled out a questionnaire about the use of strategies. During the interview they were asked about the sorts of thoughts they had had during the testing. This was done in order to explore the possibility of catastrophizing thoughts having occurred. The questionnaire was aimed at discovering which of the strategies, if any, the subject had used and whether they had used any strategy of their own during the pretest. There have been occasional suggestions in the literature that the failure of some subjects to increase their tolerance level after the introduction of a cognitive strategy might be due to the fact that they were already using a self generated strategy during the pretest and so could not be expected to improve further. This possibility does not appear to have been tested, however.

RESULTS

The group means suggested that subjects increased their tolerance levels significantly after the introduction of the cognitive strategies. The intervention appeared to be effective for all three stressors, the change being significant at the $p < 0.001$ level for shock and $p < 0.05$ for cold and pressure. As in earlier studies, however, these data showed considerable variability.

There is some evidence that subjects whose initial pain measures are high appear to be able to increase them significantly more than subjects with low initial measures, [Spanos et al. (5), Vallis (7)]. In the present study, the data from the pretest measures were divided by a median split into high and low pain sensitivity range (PSR) groups for each stressor. The PSR is defined as being the range between pain threshold and pain tolerance. When the pre- and postintervention measures were compared for these two groups within each of the three stressors, only the high PSR groups had significantly increased their tolerance levels for shock and cold, while the low groups had not. Both groups, however, increased their tolerance levels for pressure significantly (Table 1).

The answers to the questionnaire showed that approximately half of the subjects had been using a self-generated coping strategy during the pretest. With all three stressors, the group of subjects who had used these strategies increased their tolerance measures beyond those achieved by subjects who had not used a strategy during the pretest. These differences approached but failed to meet significance for shock and cold. For pressure the differences are significant, $p < 0.05$, and indeed only the group of subjects who used an original strategy increased their tolerance levels for pressure after the inter-

TABLE 1. *Mean changes in tolerance, compared to baseline, after cognitive intervention: high and low PSR groups*

	Tolerance change		
	Shock (mA)	Cold (sec)	Pressure (sec)
High PSR	0.98[a]	28.73[a]	23.66[b]
Low PSR	0.67	4.94	25.92[b]

[a] $p < 0.001$.
[b] $p < 0.01$.

vention (Table 2). Therefore, it was not the case that using a coping strategy in the pretest precluded an increase in tolerance level in the posttest.

A survey of the individual data suggested the following. Subjects who used a coping strategy during the pretest and were in the high PSR group always increased their tolerance levels. The subjects who failed to increase their tolerance for any stressor had all reported not using a strategy in the pretest. Some subjects actually decreased their tolerance levels for some stressors but the variables associated with this were not clear cut, though having a low tolerance measure and failing to use coping strategies were clearly important. If subjects reported catastrophizing thoughts during the test, tolerance levels did not improve and were invariably below the median PSR for the stressor involved. This was the case even if they reported that they were trying to use a coping technique.

DISCUSSION

It was demonstrated that the cognitive strategies could be effective for all three stressors and it is useful to know that there is a general rather than a

TABLE 2. *Mean changes in tolerance, compared to baseline, after cognitive intervention*[a]

Pretest strategy	Tolerance change		
	Shock (mA)	Cold (sec)	Pressure (sec)
Yes	0.92[b]	25.77[b]	44.27[b]
No	0.72[b]	9.22[b]	−3.86

[a] Subjects who used a coping strategy in the pretest (Yes) and those who did not (No).
[b] $p < 0.05$.

stressor-specific response. At the same time, however, the variability of the data reflect individual differences which need to be pursued. A subject's PSR or pain tolerance measures may have some predictive power as to the likelihood that a cognitive coping strategy will be effective. It is clear, however, that this variable can be modified by other factors. Indeed, it was the high PSR group which showed the greatest variability of response. Having the habit of using coping strategies, measured here by the presence or absence of use of these techniques in the pretest, also appeared to be a potential predictor of effectiveness of a cognitive intervention. When questioned, subjects who reported that they had used coping tactics in the pretest said that listening to the intervention tape had enabled them to organize their strategies and use them more effectively in the posttest.

The ability to cope with pain must be a function of many interacting variables. There is not as yet a clear understanding of how this occurs, nor is it known which of the variables might be the most amenable to modification and change or even if it is always wise to attempt to do so. It is possible that the subjects who did not benefit from the use of a cognitive coping strategy are similar to the people identified as "avoiders" by Cohen and Lazarus (1). These were the patients who, when given preparatory information for surgery and postoperative pain, did relatively worse than similar patients who were not given such information. If this is the case then one must consider the possibility that to use cognitive strategies wholesale, without regard to individual differences, may mean that some people will suffer more pain than would otherwise have been the case. Clearly, if cognitive strategies are to be used clinically, this is an important ethical, as well as scientific, consideration.

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