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Perceptual mindfulness and imagery for chronic pain and skin disorders in a busy college population

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Abstract

Perceptually-oriented training, consisting of an abbreviated "body scanning" exercise of mindfulness along with visual imagery, was assessed for its benefit to chronic conditions in a busy population. While mindfulness interventions are a promising non-invasive psychological approach for managing pain and other conditions, they require a big time commitment from patients. This can decrease compliance and therefore effectiveness. The experiment also sought to assess whether individual differences in imagery ability influence effectiveness and to contribute to the development of paradigms in mindfulness research from t unique perspective of the field of Perception. A brief course of 12-minute training was developed and given to college students with mostly chronic pain or skin conditions of 3 weeks to 18 years duration (mean=6.8 years). Matched subjects without the intervention served as a wait-list control group. Dependent measures consisted of change in participant ratings on symptom severity (semi-objective measure), assessments of the value of the intervention (subjective measure) and independent ratings of photos (objective measure). Results included high ratings for training satisfaction, ease, and compliance, a positive relation between imagery ability and improvement, and a difference between experimental and control groups in severity of symptoms for high visualizers only. Interestingly, high imagers in the control group may have shown worsening of symptoms. In conclusion, brief training is effective in high imagers, and the audio training file can be easily distributed to patients. A novel innovative theory for "mind-body" healing based on perceptual adaptation to vision-immune system conflicts is offered.

Keywords: psychoneuroimmunology Mindfulness, meditation, visual imagery, guided imagery, prism adaptation, perception, perceptual adaptation, cross-modal conflict, pain, skin disorder

Introduction

Perception psychologists are infrequent contributors to the field of psychoneuroimmunology. However,

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common alternative treatments in medicine for pain and other chronic conditions are inherently perceptual in nature (1). The purpose of the present study was to investigate a combination of two especially perceptual interventions, the "body scanning" exercise of mindful meditation along with imagery, also frequently used in mindfulness practice for healing and well-being (2–4).

In body scanning, the practicer closes her eyes and focuses attention on successive parts of the body feeling for the precise sensations (5). The application of attention is relentless in that any mind-wandering is repeatedly guided back to the body. This exercise suggests a role for perception generally and "body schema" specifically. Attention is indispensible to the act of perception. Attention controls the sensory input – what gets in and what does not (6). Without sensory input, perception of the world cannot occur. The consequences of such arguably unnaturally enhanced and sustained attention of mindfulness meditation, however, has not been investigated in the field perception. Body schema has also long been a concept in the field of perception (7). Proprioceptors in the joints and muscles relay positional information enabling the construction of the body envelope without the use of vision; thermoreceptors, nocioreceptors and mechanoreceptors in the skin add additional sensations.

Guided imagery as medical treatment has its roots in clinical therapies, yet visual imagery has a rich history in the field of perception and its use in medical interventions can benefit from such accumulated knowledge. For instance, images conjured in the mind have been shown to stimulate the same brain hardware as real vision (8); this suggests imagined vision can substitute for real vision, if needed. In addition, ability to from visual images has been found to vary markedly across individuals (9, 10) and may therefore contribute to individual differences in the effectiveness of mindfulness treatment.

The purpose of the present experiment was to test a short course of mindfulness training for its effectiveness on managing chronic illness that would be of sufficient ease and brevity to appeal both to patients and to scientists. By extracting and concentrating the perceptual components of mindfulness, we seek to streamline what would otherwise be a major undertaking for a patient on the order of months or even years for thorough meditation study. College students were selected as a population that has little tolerance for extra chores in an already busy schedule. Pain was targeted as an object of treatment because our piloting revealed it to be a frequent complaint among students, especially women, in an otherwise healthy population. A second purpose was to contribute to the development of paradigms in mindfulness-related research (11) especially from the perspective of the field of perception. Therefore, chronic skin problems were also selected as an object of treatment to be amenable to photographs for the development of non-invasive objective measures of training effectiveness. Finally, imagery ability was assessed to determine its effect on outcomes.

Methods

A total of 47 undergraduate college students (mean age 19.8 years) were enrolled with chronic ailments. The two largest subgroups were comprised of pain (migraine headaches, tension type headaches, injury related, arm, knee, herniated lumbar disk, other back, abdominal, endometriosis, arthritis; neck pain, unknown) and skin disorders (dermatitis, warts, acne, psoriasis, unspecified rash, involving hands, arms, and/or face).

Table 1. Percent of students responding "True" on the Screening Questionnaire

		Skin hands/ arms	Skin face	Headache frequent	Pain chronic	AI	Sinus frequent	Chronic any	Interest in training?	Type B personality	Type A personality
Female	604	9.4	22.2	39.1	8.8	1.8	19.7	17.7	40.2	65.6	46.2
Male	385	5.5	26.8	15.6	7.0	0.8	17.7	16.1	38.7	70.4	39.5

Table 1 shows details of the population from which participants were recruited. Notable is the high number of students with frequent headaches, twice as high for woman, and likewise, the high incidence of Type A personality which is a known risk factor for subsequent disease. Duration of condition ranged from 3 weeks to 18 years with a mean of 6.8 years.

Intervention

A 12-minute audio file was created consisting of half body-scanning and half imagery. The body scan exercise was adapted from Jon Kabat-Zinn's (5) mindfulness meditation program, except that it lasted 6 minutes rather than 45 minutes and was performed seated rather than supine. A participant's attention was first directed to the left foot with instructions to feel the sensations, followed by such mindfulness on successive parts of the body ascending to the head. Following a few seconds of imagined breathing of fresh air in and stale air out, instructions were given to the participant to feel the body heavily against the chair, which provided the transition to imagery for the second half of the training. The imagery was compiled from a variety of exercises in use (12–15) including our own and included mentally going to a favorite place, experiencing the surroundings, looking at the affected part through a magnifying glass, seeing the ailment under attack, and visualizing full healing.

The initial training took place in the lab in a one-on-one session with each participant. Participants were then instructed to practice subsequent sessions at home either with or without the provided audio file guidance and to be documented in a log over a 3-week period at least 8 more times for at least 10 minutes each time, for a total of approximately 90 cumulative minutes.

Procedure

Participants were assigned alternately within condition (pain, skin, other) and gender to either an experimental group with the mindfulness intervention or a "wait-list" control with just the passage of time (and the hope of future intervention). Participants in both groups were asked 14 questions about the condition and stress including severity of symptoms right now on a scale from 1 ("completely normal") to 25 ("as bad as I've ever had it"). A photo was taken for those with skin conditions. We expected that individual difference in imagery ability (9) might affect the effectiveness of an imagery-heavy intervention (See also 16). Consequently, experimental group participants were asked at the end of the first training session for a rating of the vividness of their immediately preceding images ranging from 1, "couldn't see anything", to 10, "like it was really there". Participants of both groups returned in 3 weeks to retake the questionnaire, answer a question concerning general imagery ability, and have another photo taken, if applicable. Experimental group participants were also asked questions about their experience: Did they think others would be able to engage in this practice and to rate (on a 10-point scale) how easy it was to follow the instructions, to get themselves to actually practice, if it had benefit for improving their specific chronic- illness symptoms they were working on, had benefit for other symptoms, had benefit for reducing stress, and two additional questions on visual imagery during the home sessions.

Photographs

Following the experiment proper, 51 independent observers rated pairs of photos for severity. They were blind to whether each photograph was from pretest (appearing on the left half the time) or posttest, whether from experimental or control group, or the purpose of the photo judging. Mean of all observer ratings was used for each photo and the difference between mean pretest and posttest severity ratings for each photo served as a measure of "photo improvement" or "photo decline".

Results

Nearly all experimental-group participants (95.8%) thought that others would be able to engage in the training and gave relatively high ratings on a 10-point scale for ability to follow the instructions (8.0) and get themselves to practice (7.2). Remarkably, they

also almost all (92%) reported at least a tiny subjective benefit on their specific symptoms they were working on (rating of 2 or higher) although interestingly, rated the benefit for other things, usually stress, higher than for their specific symptoms (mean=8.0 on stress vs. 4.8 on specific symptoms, $t(23)=7.54$, $p<.001$). Also notable was a finding of higher ratings for strength of "vivid imagery generally during the technique" (7.9) compared to specifically being able to "visualize the ailment completely healed" (5.8), a significant difference ($t(23)=4.51$,$p<.001$). Conclusions were not altered by separate consideration of pain and skin subgroups; these were equal on rating for visualizing the condition completely healed and higher for pain than skin subgroup on rating for benefit to specific symptoms at 6.0 (pain) vs. 4.0 (skin condition).

Compliance

Three participants from the experimental group and 2 participants from the control group did not return for the follow-up appointment; all 5 were those with scheduled returns for the last week of the semester.

Experimental group, imagery ability and pre-post-test change on symptom severity

There was a substantial correlation between the imagery vividness rating taken during the very first training session and the change in the pretest to posttest severity rating of symptoms after the 3 weeks of training ($r(22)= -.43$, $p<.05$, Pearson's product-moment correlation, 2-tailed test). See Figure 1. Change in self-report of symptoms (the rating of how bad symptoms are right now on a scale from 1 to 25) is a semi-objective dependent measure despite being self-reported because of the delay between tests and the presence of other questions. That is, posttest response is largely independent of pretest response because it is unlikely subjects remembered the exact score they gave previously. Thus, participants with the most vivid visual imagery showed the greatest improvement in severity of symptoms. Note improvement is reflected by a lowering of severity rating score. The correlation appeared both in women (-.42, n=16) and men (-.52, n=8) and for both skin conditions (-.62, n=10) and pain (-.46, n=9). There is no evidence the result is an artifact of outliers, of averaging men and women, or of participants rating everything highly.

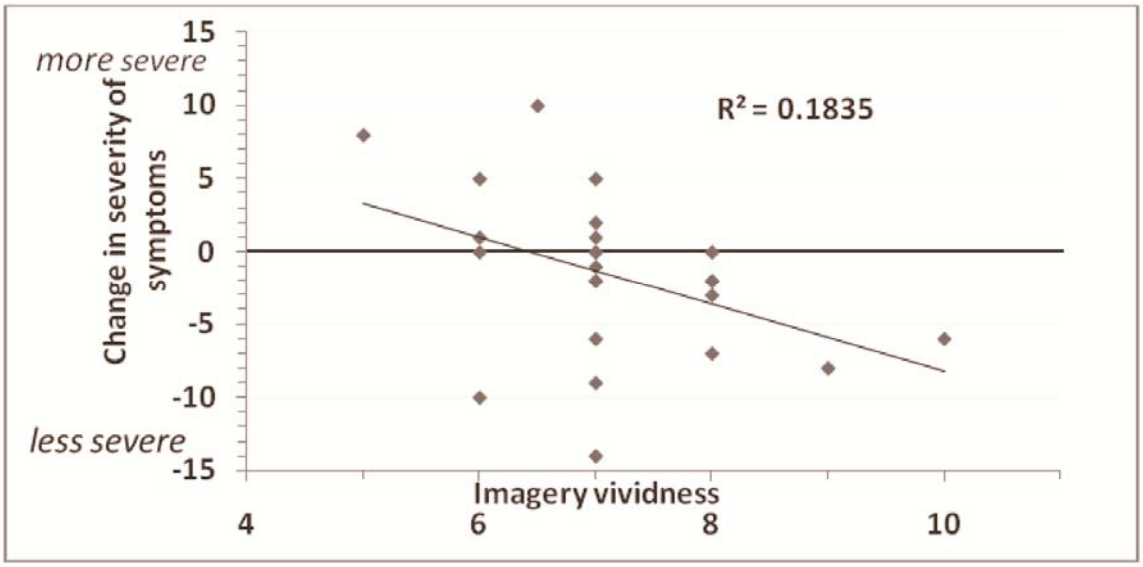

Figure 1. Participants' imagery ability from the very first training session predicts who will improve from the brief mindfulness intervention.

Experimental group vs. control group

A split sample of the top half visualizers from the experimental group and from the control group revealed a difference in the change between pretest and posttest-rated severity of symptoms between the two groups (Figure 2) of 18.2% with improvement in the former and worsening in the latter . The difference did not quite reach significance (t(19) = 2.0, p=.06, two-tailed) with the small sample size. For the entire sample including the bottom visualizers, a difference between experimental and control groups was not found (Δ=1.2%) with both groups showing a small improvement (5.2%, 4.0% respectively) from pretest to posttest.

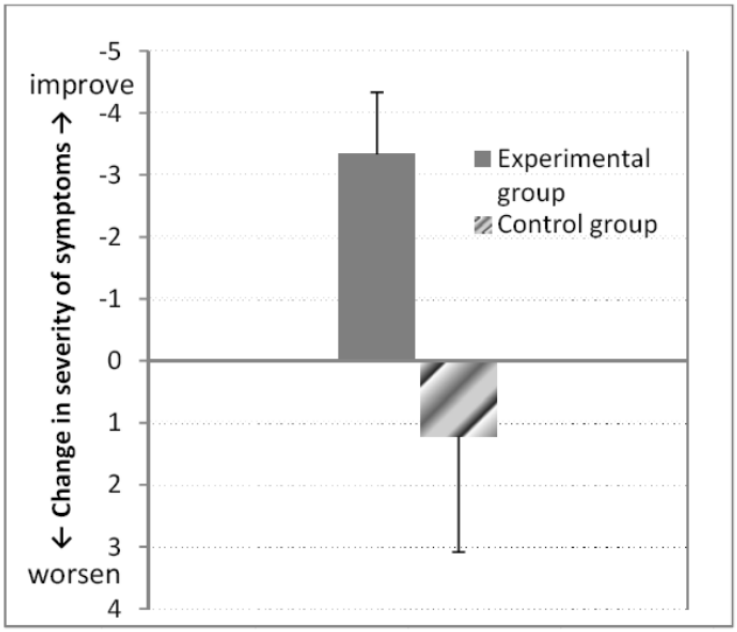

Figure 2. Symptom change in the mindfulness intervention (experimental group) and the waiting non-intervention (control group) in the top half of visualizers.

Control group, imagery ability and pre-post-test change on symptom severity

In the control group, the relation between imagery ability (as measured by the posttest rating on ability to form visual images) and changes in severity was in the opposite direction (r(16) = +.462, p<.05). This result tentatively suggests that natural spontaneous images without training in high imagers may help sustain chronic conditions.

Gender

Women showed a trend for greater improvement in both the experimental group (mean change for women, -2.0; men -1.0) and the control group (women, -1.3; men +0.3). Note that lower severity scores reflect greater improvement.

Photographs

A total of only 12 pairs of photos in the experimental group and 5 pairs in the control group limited analyses. In the experimental group, there was a trend towards a positive relation between photo improvement and imagery ability (r(10)=.43) and between photo improvement and reduction in stress (r(10)=.49, p≈.10). That is: 1) the higher the vividness of imagery in participants, the greater the improvement in skin condition as rated by outside observers and 2) the more stress was reduced in participants by posttest, the greater the improvement in visible skin condition. Considered across both experimental and control groups, the correlation between photo improvement and stress is statistically significant (r(15)=.52,p<.02), and may reflect that stress, well known to affect skin conditions, is a

predictor of improvement that is independent of the effect of an imagery/body scan intervention. See Figure 3 for photos of pre-post change in two of the experimental group participants; anecdotally one of these participants remarked that she tried everything for warts and this was the first thing that helped. Photographic evidence of change is a promising objective outcome measure for the intervention when conditions have visible components (see also (4)).

Figure 3. Photos before (pretest) and after (posttest) the mindfulness intervention in two participants. Visible changes after only three weeks are subtle. Participant's self-assessment of improvement may precede changes visible to outside observers. Top: Pretest is on the left. Bottom: Pretest is on the right.

Discussion

The experiment was successful in implementing a streamlined mindfulness paradigm for mind-body healing that ordinary busy people can engage in and find satisfying. The vast majority of participants subjectively felt this training was of some benefit, especially for stress. This is a notable result because of high patient dissatisfaction with conventional treatments for chronic pain and other conditions.

The experiment also found that people able to form vivid visual images during training had a reduction in severity of symptoms (less pain and/or reduced skin abnormality) as measured by a more objective test, despite not much more than an hour and a half of cumulative practice. Participants without strong imagery, however, did not show this improvement. The relation between vividness of imagery and improvement is consistent with the literature, in which a relation between the two was reported for warts (16) and for immune system activation in breast cancer patients (12). The present study extends those findings to other skin conditions and to pain. Additionally, the study finds the imagery-healing relation with just a single-item imagery vividness assessment administered at the outset of training and with minimal mindfulness training for

healing. This suggests that a brief prescreening imagery test is both feasible and of value to identify individuals who would most benefit from an abbreviated 90-minute cumulative course of training of the sort used in this experiment. Individuals scoring low in imagery ability might instead require longer periods of training to achieve measurable symptom reduction or require greater assistance with forming images.

Few psychological theories exist for how and why mindfulness training works to promote physical healing. Recently, I put forth an innovative new theory from the perspective of the field of perception in the theoretical journal Psychological Bulletin (1,17). According to the theory, mind-body healing is merely an example of the very common perceptual adaptation that occurs following conflict between sensory modalities. Such cross-modal perceptual adaptation has been extensively researched in the perception literature; for example, in the phenomenon known as prism adaptation (or spatial adaptation), the sensory modalities of vision and proprioception are made to conflict with one another and the result is a change in one modality or the other (18–20). As applied to mindfulness and healing, the theory builds on the claim that the immune system is another sensory modality, like vision or proprioception (17, 21, 22). A visual image then of one's self fully healed and healthy, along with an immune system that has erroneously detected an antigen, would reflect a conflict between perceptual modalities. As with prism adaptation, mindfulness creates a conflict between sensory systems, except in this context, according to Bedford's theory, there is a conflict between vision and the immune system organ rather than between vision and proprioception. As with prism adaptation, a conflict suggests an error and one of the modalities must change.

In the present experiment, the cross-modal conflict purported to occur is brought about by the training in which the visual images generated by the participant indicate that a bodily region of interest is fully healed and healthy while the immune system modality continues to detect that something is wrong. Acquired immunity is involved in many skin diseases and in both inflammatory and neuropathic pain (23). (In pain, for instance, opoid brain receptors are also found in the immune system whilepain modulating endorphins, i.e., neuropeptides produced in the brain, are also produced by the immune system.) As in prism adaptation, a conflict between modalities leads to change because it is indicative of an error in perceptual systems. One or the other modality must change to remove the error, which also brings the modalities back in agreement (24). When that required change occurs to the immune system, the mindfulness intervention will be judged successful. While such a change may still seem to some to reflect an attainment of an extraordinary "mind-body connection", it is instead ordinary adaptation between sensory systems. The chemical messengers of the immune organ (cytokines) and of the nervous system (neurotransmitters) were once thought separate but have been shown to be shared (21,25). The shared ligands can provide the physical mechanism for instantiating the conflict-induced change proposed by the theory.

Note that this process will only be successful to the extent the participant is able to generate the images of health to conflict with the immune system. Consistent with this is the finding that only high imagers in the group that received training appeared successful, as well as the finding that participants who received training scored lower on ratings of ease of visualizing the medical condition fully healed compared to forming other kinds of visual images (such as of their favorite place). It may not be easy to visualize the counterfactual, which is precisely what is required for effective change. Additionally, among high imagers that did not receive the training, there was an apparent worsening of symptoms. Without the guidance to form images of healing, natural spontaneous imagery may be doing exactly the opposite. If images that conflict with the immune system can make symptoms better than we would expect that images consistent with a chronic illness should make things worse. High visual imagers may be contributing to the chronicity of their symptoms by reinforcing through imagery a problem that may not even still exist.

Attention as well as imagery is critical for success. The unnaturally sustained and focus attention of mindfulness is important in order to strengthen and modulate which modality will change in the conflict. In prism adaptation, it has been shown that attention to one modality - e.g., through manipulating when the

hand is visible (19) - leads to changes in the other modality. In addition, increasing the signal to a modality - e.g., through arm vibration (26) - increases the amount of adaptation. Thus, immune system change will be more likely with a strong and attentive signal of vision (and perhaps felt body position), the other modalityin the immune-vision conflict. Mindfulness can provide this attentional boost.

The procedure of the intervention in the present experiment is to some extent guilty of throwing everything at the wall to see what sticks. It lumped together body scanning and imagery and used several types of imagery. Its purpose was to extract the notably perceptual components of mindfulness in attempt to streamline mindfulness training for pain and other chronic conditions in a busy population with little patience for months of difficult practice. Refinements of the types of images trained, as well as assessing separate contributions of body scanning and imagery, should now be possible. One intriguing avenue of pursuit concerns the nature of images that are useful for pain. While it is sensible to visualize a red rash faded to the color and texture of normal skin, what does one, and what should one, visualize for the absence of pain? An advantage of visual imagery over actual vision is its ability to conjure things that do not exist.

The present experiment can hopefully serve as a launch of a new approach to mindfulness-based interventions for illness and well-being: We are calling this *perceptual repair*. At present, the 12-minute audio training can be easily distributed by practitioners to patients electronically or in the office.

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