

# Migraines and meditation: does spirituality matter?

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**Abstract** Migraine headaches are associated with symptoms of depression and anxiety (Waldie and Poulton *Journal of Neurology, Neurosurgery, and Psychiatry* 72: 86–92, 2002) and feelings of low self-efficacy (French et al. *Headache*, 40: 647–656, 2000). Previous research suggests that spiritual meditation may ameliorate some of the negative traits associated with migraine headaches (Wachholtz and Pargament *Journal of behavioral Medicine*, 30: 311–318, 2005). This study examined two primary questions: (1) Is spiritual meditation more effective in enhancing pain tolerance and reducing migraine headache related symptoms than secular meditation and relaxation? and, (2) Does spiritual meditation create better mental, physical, and spiritual health outcomes than secular meditation and relaxation techniques? Eighty-three meditation naïve, frequent migraineurs were taught Spiritual Meditation, Internally Focused Secular Meditation, Externally Focused Secular Meditation, or Muscle Relaxation which participants practiced for 20 min a day for one month. Pre-post tests measured pain tolerance (with a cold pressor task), headache frequency, and mental and spiritual health variables. Compared to the other three groups, those who practiced spiritual meditation had greater decreases in the frequency of migraine headaches, anxiety, and negative affect, as well as greater increases in pain tolerance, headache-related self-efficacy, daily spiritual experiences, and existential well being.

**Keywords** Migraine · Meditation · Pain · Spirituality · Headache

## Introduction

Annually, 13% of the population of the United States suffers at least one migraine headache (Stewart et al. 1992), though the average migraineur experiences 34–37.5 attacks a year (Hu et al. 1999). In addition to physical pain, migraines are tied to significant psychological and economic costs. Migraineurs tend to have high levels of depression and anxiety (Stewart and Lipton 2002), and migraine headaches have a profoundly negative impact on sufferers' quality of life (Bigal et al. 2001). Lost labor costs due to migraines are estimated at \$13 billion per year (Hu et al. 1999).

Literature reviews have described a variety of non-pharmacological approaches to preventing and aborting headache pain (Penzien et al. 2002). Common forms of non-pharmacological approaches include biofeedback (e.g. electromyography, vascular warming), relaxation training, and coping skills training. These studies show that some non-pharmacological approaches are equal to, or better than, drugs at reducing or preventing headache pain. There is, however, a dearth of literature on two non-pharmacological approaches for migraine headache pain: meditation and spiritual experiences. Only two empirical studies have explored the potential benefits of meditation on headache pain. No studies to date have focused specifically on the role of spirituality in coping with headache pain.

Generally, meditation appears to have a positive effect on positive emotional and physical health (Alexander et al. 1991; Astin 1997). Meditation has proven effective in reducing physiological and psychological arousal to stress (Wachholtz and Pargament 2005), and those practicing

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meditation have 50–70% fewer all-cause hospital admissions and outpatient medical visits (Orme-Johnson 1987).

Religious and spiritual experiences may also buffer the negative physical and psychological consequences of migraines. Previous studies suggest that religion and spirituality reduce anxiety and depression, have a positive effect on health, and decrease mortality among a medically ill population (Koenig et al. 2001, for a review). Further, accessing spiritual resources has been related to improved tolerance of chronic pain (Keefe et al. 2001), and acute pain (Wachholtz and Pargament 2005).

Integrating spiritual resources within the context of meditation may help individuals increase pain tolerance, reduce depression and anxiety, improve spiritual health and enhance quality of life. In support of this idea, a recent study showed that, in comparison to a secular meditation, spiritual meditation was more effective in increasing participants' pain tolerance and their number of daily spiritual experiences, and decreasing negative affect (Wachholtz and Pargament 2005). These positive spiritual, psychological, and physical effects suggest that a spiritual meditation technique may assist individuals who are suffering from migraine headaches. This study tested the hypothesis that spiritual meditation is more effective than secular meditation or relaxation for migraineurs.

### Migraine headaches

Migraine headaches are characterized by intense, unilateral throbbing pain, accompanied by nausea, and either photo- or phono-phobia (International Headache Society 2004). Even between headache attacks, migraineurs have increased sensitivity to pain (Main et al. 2000; Rojahn and Gerhards 1986).

A large percentage of migraineurs are classified with "frequent migraine headaches," indicating that they experience an average of two or more migraine headaches a month. Almost half of all female migraineurs (49%), and 35% of male migraineurs report that they experience twenty-four or more migraine headaches each year (Lipton et al. 2002). Over one-quarter of migraineurs report multiple migraine headaches per week (Lipton et al. 2002). However, despite the negative physical and emotional impact of migraine headaches, it is estimated that 16% of all migraineurs have consulted a physician about their headaches in the past year (Lipton et al. 1998). Further, over 30% of migraineurs have never consulted a physician about their headaches (Lipton et al. 2002).

Even once migraineurs seek treatment, currently many of the pharmacological treatments of migraines are unsatisfactory in several respects; they are prohibitively expensive, do not work for many people, do not completely remove the pain, do not appear to reduce migraineurs elevated pain sensitivity between headaches, do not prevent reoccurrence of the headaches, and have negative side

effects (Goadsby et al. 2002). Given the difficulties with pharmacological efficacy for migraines, migraineurs appear to be an ideal population in which to study alternative practices to headache pain control and prevention.

### *Migraine headaches and negative emotions*

Migraineurs appear to have greater psychosomatic sensitivity to stress. Huber and Henrich (2003) compared 30 migraineurs and 30 healthy controls and found that, although migraineurs do not have more daily stress, they do report elevated feelings of depression and anxiety in response to that stress. Compared to controls, migraineurs had greater difficulty relaxing and experienced increased restlessness, and ill feelings during stressful situations (Huber and Henrich 2003). Not only do migraineurs report greater anxiety than non-headache controls, they also report that anxiety (57.9%), worry (58.6%), and irritation (55.3%) can trigger migraine attacks (Lateri-Minet et al. 2003). Further, this pattern of high anxiety and depression is found among migraineurs around the world, including China (Fan et al. 1999), New Zealand (Waldie and Poulton 2002), and Europe (Huber and Henrich 2003).

In a 26-year study of almost 1,000 migraineurs, Waldie and Poulton (2002) found that migraine headaches were linked to a history of depression and anxiety disorders and high current stress reactivity. Among migraineurs, the severity of depression and anxiety symptoms appear to be related to headache frequency (Zwart et al. 2003). In contrast, positive mood is linked to reduced pain reactivity and increased pain tolerance (Lecci and Wirth 2000), which suggests that interventions targeting mental health factors can be effective in reducing negative emotions and headache frequency in migraineurs (Fan et al. 1999).

It has been shown that people with chronic pain who feel that they have no control over their pain often have more negative pain experiences, greater disability, and less positive emotional health (Arnstein et al. 1999). Providing migraineurs with the tools to help them reduce their headache frequency with psycho-social interventions is likely to increase their perceived sense of control over the onset, and duration of their headaches. When medically compromised patients feel increased control over their symptoms, they report improved mood (Keefe et al. 2001). Further, one study indicated that headache patients who reported greater feelings of pain self-efficacy had reduced pain disability, more active coping, and improved headache pain tolerance (French et al. 2000).

### *Migraine headaches and meditation*

There are multiple ways that meditation may reduce the frequency and severity of migraine headaches, and improve

the quality of life of migraineurs. Relaxation is one method that appears to be effective in reducing migraine headaches. A meta-analysis of major techniques for the behavioral management of headaches showed that relaxation training generally results in a 35–40% reduction in the frequency of headaches (Penzien et al. 2002). While relaxation can reduce the frequency of migraine headaches, meditation may enhance this state of relaxation.

Blanchard and colleagues (Blanchard et al. 1990) compared the effects of thermal biofeedback, biofeedback plus cognitive therapy, and “pseudomeditation” (body scanning + mental control) on headache pain during a 16 session protocol. The researchers defined pseudomeditation as a combination of body awareness (becoming aware of sensations associated with the body) and mental control (creating images of participating in daily activities) without any explicit instructions to relax or to divert attention away from head pain. All three of the experimental groups had significant reductions in the number and severity of headaches, and use of headache-related medication, however, they found no differences between the three treatment groups (Blanchard et al.). The pseudomeditation group was intended to be an inert placebo-control, but in this study it became an active and efficacious treatment group. The distraction provided by the mental control and physical relaxation effects of body scanning may have inadvertently created an active treatment.

#### *Migraine headaches and spiritual meditation*

Spiritual forms of meditation may be especially helpful to migraineurs. Correlational research has suggested that individuals with strong religious and/or spiritual lives tend to be healthier, psychologically and physically (Koenig et al. 2001). In a meta-analysis of 147 independent studies of religiousness and depressive symptoms, religiousness appeared to protect against depression, particularly in times of greater life stress (Smith et al. 2003). This relationship also held true in a study of chronic pain patients; those who reported more spiritual experiences also reported more positive mental health (Rippentrop 2005). Furthermore, the relationship between spirituality and mental health was strongest among those reporting higher levels of pain.

A few studies have experimentally explored connections between spiritual practices and physical or mental health. Elkins et al. (1979) conducted one of the few research projects that compared a relaxation technique (progressive muscle relaxation) with a devotional practice (prayer). In this study, 42 participants from similar religious and cultural backgrounds were divided into three groups: progressive muscle relaxation, prayer, and control. After 10 days, both experimental groups reported significant reductions in subjective stress. Given that stress appears to

be related migraine headache attacks, this study may have implications for migraineurs.

In the Elkins et al. (1979) study, prayer required conscious control, to verbalize thoughts in communication with God. Carlson et al. (1988) compared the effects of a more free form of Christian devotional practice with progressive muscle relaxation. They divided 36 Christian participants into three groups: Devotional Meditation group which meditated on the 23rd Psalm, Progressive Muscle Relaxation group, and Control group. The Meditation group and the Relaxation group performed their activities 20 min a day for two-weeks. At the end of a two-week program, the Meditation group reported less anxiety and anger than those who underwent the two-week relaxation program. In addition, the Meditation group had less muscle tension (reduced EMG activity). Their study indicated that religious reflection was associated with better results than progressive muscle relaxation. Therefore, despite the rather limited treatment-outcome literature on spiritual practices and health, these findings suggest that spiritual practices may add a unique factor to a relaxation technique, and again, may positively affect migraineurs' experience of pain.

Though the literature addressing links between specific devotional practices and health is sparse, there is one form of spiritual meditation that has been studied in a number of contexts, transcendental meditation. This form of spiritual meditation has been shown to affect a number of factors that may impact migraine headaches: lower heart rate, blood pressure (Wenneberg et al. 1997); enhanced autonomic stability during mentally stressful tasks (Alexander et al. 1989); elevated vasopression and altered endocrine response to stress (O'Halloran et al. 1985). Researchers suggest that the benefits of this type of meditation stem from the fact that it is a spiritual experience which is qualitatively different than simply a physical (like progressive muscle relaxation) or educational one (Alexander et al. 1991).

To test this idea, Wenneberg et al. (1997) divided 66 participants into two groups, stress reduction education, and spiritual meditation training. High compliance meditators demonstrated significant reductions in blood pressure over the course of the study. This group also showed significantly lower blood pressure levels than the low compliance meditation group and individuals in the stress education group (Wenneberg et al. 1997).

Alexander et al. (1991) performed a meta-analysis of the transcendental meditation research. They examined 18 major studies with over 1,200 participants who ranged in meditation experience from five weeks to five years. The researchers reported that within three days of beginning to practice the spiritual meditation, individuals began to show psychological (e.g. improved mood) and physiological changes (e.g. decreased blood pressure). Proponents claim that spiritual meditation practitioners open themselves up

to new spiritual experiences; these new spiritual experiences then provide additional spiritual resources that allow them to adapt better to stress, which, in turn, results in better mental and physical health.

A recent study by Wachholtz and Pargament (2005) specifically compared the efficacy of spiritual meditation, secular meditation, and muscle relaxation techniques; the findings have implications for migraineurs. Sixty-eight meditation-naïve undergraduates were taught one of three relaxation or meditation techniques which they practiced independently for two weeks. Following the two-week period, participants practiced their technique for 20 min while their heart rate was monitored. After the 20 min, participants placed their hand in 2°C water for as long as they could endure the cold-induced pain. Individuals in the spiritual meditation group demonstrated significantly greater pain tolerance, enduring the cold almost twice as long as the secular-based technique groups. While participants in all three groups rated the stimulus as equally painful, use of the spiritual technique appeared to create a greater endurance of that pain (Wachholtz and Pargament 2005). This finding suggests that spiritual meditation may help migraineurs better endure the pain of migraine headaches.

When people use positive religious coping for pain management, they report stronger feelings of spiritual support from God (Keefe et al. 2001) and more spiritual experiences (Wachholtz and Pargament 2005). While spiritual experiences may occur during secular meditation, empirical studies indicate that they occur less often and with less intensity than among those using spiritual meditation (Astin 1997; Wachholtz and Pargament 2005). Thus, spiritual experiences may be linked to less sensitivity to body pain (e.g., Buenaver 2003) resulting in greater headache endurance. Greater endurance may allow migraineurs to continue to participate in activities despite migraine pain or to better tolerate the period between migraine pain onset and medication efficacy.

#### Present study

Previous research indicates that spiritual meditation may increase pain tolerance and decrease negative affect and anxiety symptoms, while increasing daily spiritual experiences. However, there is no research on the impact of spiritual meditation on people who suffer from migraine headaches. This study addresses this gap in the literature. It examines two primary questions: 1) Is spiritual meditation more effective in enhancing pain tolerance and reducing migraine headache related symptoms than secular meditation and relaxation? and, 2) Does spiritual meditation create better mental, physical, and spiritual health outcomes than secular meditation and relaxation techniques?

We reasoned that there are multiple pathways through which spiritual meditation may be effective in helping frequent migraineurs cope with pain (Wachholtz et al. 2007). As a result, spiritual meditators may be able to endure higher levels of pain and prolonged exposure to uncomfortable situations (Alexander et al. 1994; Wachholtz et al. 2007). However, we wanted to test whether including spiritual content into a meditative phrase represents a critical ingredient to the meditation process. It could be argued that a spiritual meditative phrase operates similarly to any distracting phrase, or more specifically, to an externally-oriented or internally-oriented phrase. To test this possibility, we compared spiritual meditation to three contrasting conditions: relaxation and two types of secular meditation, a secular meditation that focused on an internally focused secular phrase and a secular meditation that focused on an externally focused phrase.

## Method

### Participants

Eighty-three participants completed the entire study. All participants met the criteria for vascular headache (migraine; mixed migraine + tension headache) based on the criteria of the International Headache Society (2004). Participants were at least 18 years old, and experienced at least two migraine headaches in the previous month. Participants could have no history of diabetes or Raynaud's syndrome diagnosis. There were 75 women and 8 men with a mean age of 19.1 (SD = 1.10) (See Table 1). The 83 Participants were randomly divided into four groups: Spiritual Meditation (22 participants), Internal Secular Meditation (21 participants), External Secular Meditation (20 participants), and Relaxation (20 participants). There were no significant differences between the groups on any of the pre-test variables. Based on previous research, it was determined that each group required a minimum of 20 participants to achieve power of .80.

Ninety-two individuals initially enrolled in the study but nine participants did not complete the study (See Fig. 1). Two participants from the Relaxation group, three from the External Secular Meditation group, one from the Internal Secular Meditation group, and three from the Spiritual Meditation group did not complete the study, or showed less than 50% adherence to the meditation/relaxation protocol. All noncompleters that were reached to discuss their study involvement reported time constraints as their reason for dropping out of the study. Only two of the six non-completers (1 from Relaxation, 1 from External Secular Meditation) eventually returned to fill out post-test surveys. There were no differences between those who completed

**Table 1** Demographics by group\*

	All N (%)	SP N (%)	IS N (%)	ES N (%)	RL N (%)
<b>Gender</b>					
Women	75 (90.4%)	19 (85.5%)	19 (90.5%)	19 (95%)	18 (90%)
Men	8 (9.6%)	3 (13.6%)	2 (9.5%)	1 (5%)	2 (10%)
<b>Race</b>					
White	61 (73%)	15 (68.2%)	15 (71.4%)	15 (75%)	16 (80%)
Black	9 (10.8%)	1 (4.5%)	3 (14.3%)	4 (20%)	1 (5%)
Hispanic	6 (7.2%)	2 (9.1%)	1 (4.8%)	1 (5%)	2 (10%)
Other/Multi-racial	7 (9%)	4 (18.2%)	2 (9.6%)	0	1 (5%)
<b>Age</b>					
M(SD)	19.1 (1.10)	19.5 (.91)	18.7 (.78)	19.2 (1.67)	18.9 (.72)
<b>Community</b>					
Student	81 (97.6%)	21 (95.5%)	21 (100%)	20 (95.2%)	20 (100%)
University—affiliated	2 (2.4%)	1 (4.5%)	0 (0%)	1 (4.8%)	0 (0%)
<b>Religion</b>					
Protestant	42 (50.6%)	11 (50.0%)	8 (38%)	12 (60%)	11 (55%)
Catholic	33 (39.8%)	10 (45.5%)	11 (52.4%)	5 (25%)	7 (35%)
Agnostic	6 (7.2%)	1 (4.5%)	1 (4.8%)	2 (10%)	2 (10%)
Other	2 (2.4%)	0	1 (4.8%)	1 (5%)	0
<b>Prayer frequency</b>					
Never	9 (10.8%)	2 (9.1%)	3 (14.3%)	2 (10%)	2 (10%)
Formal	7 (8.4%)	2 (9.1%)	3 (14.3%)	1 (5%)	1 (5%)
During stress	30 (36.1%)	10 (45.5%)	8 (38.1%)	6 (30%)	6 (30%)
Regularly	37 (44.6%)	8 (36.4%)	7 (33.3%)	11 (55%)	11 (55%)
<b>Religious person</b>					
Not religious	11 (13.3%)	5 (22.7%)	2 (9.5%)	3 (15%)	1 (5%)
Slightly religious	21 (25.3%)	5 (22.7%)	8 (38.1%)	4 (20%)	4 (20%)
Mod religious	38 (45.8%)	11 (50.0%)	9 (42.9%)	8 (40%)	10 (50%)
Very religious	9 (15.7%)	1 (4.5%)	2 (9.5%)	5 (25%)	5 (25%)
<b>Spiritual person</b>					
Not spiritual	9 (10.8%)	2 (9.1%)	1 (4.8%)	3 (15%)	3 (15%)
Slightly spiritual	24 (28.9%)	3 (13.6%)	7 (33.3%)	6 (30%)	5 (25%)
Mod spiritual	34 (41.0%)	11 (50.0%)	10 (47.6%)	6 (30%)	7 (35%)
Very spiritual	16 (19.3%)	3 (13.6%)	3 (14.3%)	5 (25%)	5 (25%)

\* There were no significant differences between any of the groups on any of the variables

Key:

SP = Spiritual Meditation Group

IS = Internal Secular Meditation Group

ES = External Secular Meditation Group

RL = Progressive Muscle Relaxation Group

the study and those who dropped out on demographic, or pre-test variables, except on the number of reported headaches experienced in the month prior to the intervention (3.22 headaches in the drop-out group versus 12.28 headaches in the completer group). Those with fewer headaches were likely less motivated to complete the study than those who experienced more headaches.

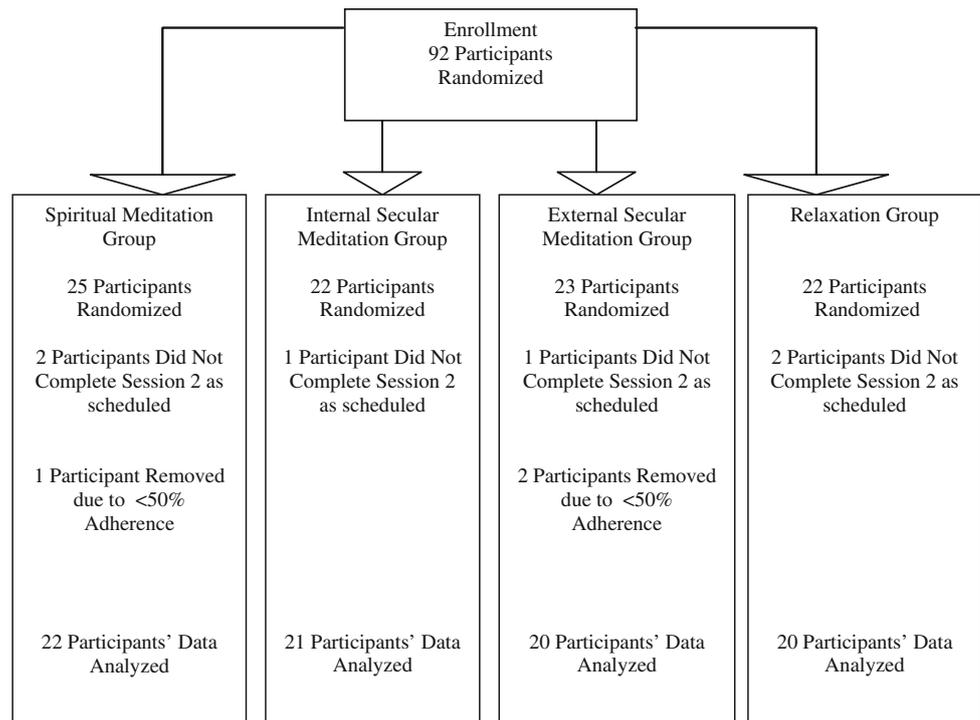
**Screen**

All participants passed the ID Migraine Screener which was given immediately after participants consented to join the study (Lipton et al. 2003). This 3-question (yes/no) migraine headache screen provides a brief assessment of headaches to determine if the headache qualifies as a

migraine headache. Two or more positive responses are required to identify migraine headaches. When studied by Lipton et al., the measure displayed a sensitivity of 0.81, specificity of 0.75, and a positive predictive value of 0.93 (Lipton et al. 2003).

**Adherence**

Adherence was measured through a diary in which participants recorded their daily practice of their technique. Participants were required to complete their meditation task for at least 15 days. Those who did not meditate for at least 15 days (3 participants), and those who did not arrive for their individual appointment at 30 days (6 participants) and failed to respond to researchers' attempts to

**Fig. 1** Participant flow diagram

contact them to reschedule were classified as dropouts (see Fig. 1). Among those participants with at least 15 days adherence, there was no difference between the groups on the number of days practicing their assigned meditation/relaxation, ( $F(3, 79) = 0.75, p = NS$ ). Adherence was likely high since participants were requested not to begin the study unless they felt that they could make the appropriate time commitment to completing the study. No potential participants reported that they did not have sufficient time to complete the 20 min daily time requirement.

#### Manipulation check

In order to assess how the interventions were perceived by participants, a brief manipulation check measure was used. Participants rated their perception of how relaxed they became during their assigned technique, and how stressful they found the cold pressor task. Ratings were on a 0–5 Likert-type scale with higher scales indicating greater relaxation or stressfulness, respectively.

#### Pain measures

##### *Headache frequency and severity*

Participants recorded the frequency and severity of their headaches in their practice diaries during the study and

used retrospective recall to record the number of headaches in the month prior to the study. The number of headaches reported by participants for the month prior to the study was compared to the number of headaches reported over the course of the intervention. Participants rated the severity of each headache on a 0–10 scale where 0 equated to “no pain” and 10 was “the worst pain possible.”

##### *Pain tolerance*

Objective measurements of pain tolerance were taken prior to and after a month of daily practice of the assigned technique by timing the duration that the participant remained in contact with the cold water during the cold pressor task.

##### Psychological measures

##### *Affect*

The Positive and Negative Affect Scale consists of two—10 item subscales that assesses positive and negative affect, respectively (Watson et al. 1988). The positive affect subscale has convergent validity with other brief positive affect measures (.81–.92), and the negative affect subscale also converges with brief negative affect measures (.76–.91). Further, the short-term, state-like version of the questionnaire shows moderately high stability when given

for an 8-week retest, .54 for the positive affect scale, and .45 for the negative affect scale. In previous research, both the positive and negative scales show high internal consistencies, .89 for positive affect, and .85 for negative affect with a negative correlation ( $r = -.15$ ) between the two scales. In the present study, internal reliability was  $\alpha = .83$  on the pre-test and  $\alpha = .87$  on the post-test for the negative affect scale; the positive affect scale's internal reliability was  $\alpha = .81$  on the pre-test and  $\alpha = .85$  on the post-test.

### Anxiety

The State-Trait Anxiety Inventory is a 20-item self-report inventory designed to capture transient and stable anxiety levels. Individual items are scored from 1–4 with higher scores indicating higher levels of anxiety. Modern norms for the state scale yield an internal reliability alpha of .91 (Scott and Melin 1998). In the present study, internal reliability for the state anxiety scale was  $\alpha = .90$ . The state anxiety scale has shown concurrent validity with other anxiety questionnaires ranging from .73–.85. It was used to identify group differences in anticipatory anxiety to the cold pressor task. Previous research has shown the trait anxiety scale has an internal reliability alpha of .91 (Spielberger 1983). In the present study, internal reliability was  $\alpha = .88$  on the pre-test and  $\alpha = .86$  on the post-test for trait anxiety.

### Depression

The Center for Epidemiologic Studies Depression Scale is a 20-item self-report measure of depressive affect experienced in the previous week (Radloff 1977). Individual items are scored from 1–4 with higher scores indicating higher levels of depressive symptoms. Previous research has shown it has high internal reliability ( $\alpha = .87$ ) and convergent validity with other depression scales (.51–.85). In the current study, internal reliability was  $\alpha = .87$  on the pre-test and  $\alpha = .83$  on the post-test.

### Headache specific surveys

#### Quality of life

The Migraine Specific Quality of Life Scale is a 25-item, self-report scale that measures the impact that migraine headaches have on the lives of migraineurs (Wagner et al. 1996). Items are scored on a 4-point Likert scale with higher scores representing greater quality of life. Wagner, et al, showed that the scale has concurrent validity with both the Medical Outcomes Study Short Form (Stewart and

Ware 1991) and the Psychological General Well-Being Schedule (McDowell 1996). Internal reliability has been shown to be extremely high in previous research ( $\alpha = .92$ ) as is one week test-retest reliability ( $r = .90$ ). In the present study, internal reliability was  $\alpha = .89$  on the pre-test and  $\alpha = .91$  on the post-test.

#### Self-efficacy

The Headache Management Self-Efficacy Scale is a 25-item, self-report scale assessing feelings of personal control over the onset, frequency, duration, and severity of serious headaches (French et al. 2000). Items are scored from 1–7 and higher scores indicate greater feelings of headache-related self-efficacy. It has concurrent validity with internal loci of control (.40) and is inversely related to feelings of chance loci of control (–.64), and headache related disability (–.24) (French et al. 2000). In previous research, the scale displayed an internal reliability of .90 (French et al. 2000); in the current study, internal reliability was  $\alpha = .87$  on the pre-test and  $\alpha = .90$  on the post-test.

### Spirituality measures

#### Religious demographics

Parts of The Brief Multidimensional Measure of Religiousness/Spirituality developed by Fetzer /National Institute on Aging assessed participants' spiritual life (Fetzer 1999). There are two domains that were used. The two-item Religious Intensity (e.g. To what extent do you consider yourself a religious person?) has a reliability rating of  $\alpha = .77$  and explores the self-reported levels of religiousness and spirituality. The five-item Private Religious Activities (e.g. Which of the following best describes your practice of prayer or religious meditation? Daily, During times of stress, During formal ceremonies only, Never) asks about spiritual or religious practices and has a reliability of  $\alpha = .72$  (Fetzer).

#### Spiritual well being

The Spiritual Well Being Scale was developed by Paloutzian and Ellison in 1982 to measure Religious Well Being, the individual's feelings of personal well-being with God, and Existential Well Being, a more horizontal measure of well being between self and others. These subscales can also be combined into a single score. Each subscale consists of 10 items, scored on a 6-point Likert scale with higher scores indicating greater feelings of well-being in that domain. Validity information indicates that scores on the two subscales and the combined scale correlate with

indicators of positive psychological quality of life (higher sense of purpose in life, etc.) (Boivin et al. 1999). Previous research has shown internal reliability coefficients ranging from .89 to .94. In the current study, internal reliability was  $\alpha = .94$  on the pre-test and  $\alpha = .93$  on the post-test.

### *Spiritual experiences*

The Daily Spiritual Experiences Scale is a 16-item scale that was designed by Underwood and included in the 1999 Fetzer Report. It measures how frequently individuals experience behaviors and emotions related to the transcendent in their daily life (Underwood and Teresi 2002). Items are scored on a 6—point Likert Scale. Greater scores indicate greater number daily spiritual experiences, such as “a feeling of deep inner peace or harmony.” Internal reliability estimates range from .91 to .95 in previous research (Fetzer). In the current study, internal reliability was  $\alpha = .92$  on the pre-test and  $\alpha = .93$  on the post-test.

### Procedure

Participants were recruited from psychology classes at a mid-size mid-western university and through flyers and advertisements in the local community surrounding the university. Participants were recruited and assessed from January to May 2005. All research procedures were approved by the university’s Institutional Review Board.

Research assistants were not blind to the treatment protocols for the groups, although they were blind to the study hypotheses. Prior to engaging in the project, research assistants were instructed on how to present the meditation or relaxation techniques. They were observed in teaching mock sessions by the principal investigator. Each research assistant taught an equal number of classes in each group.

Participant contact took place in two phases. Initially, interested individuals met in a group with five to ten other potential participants. At that meeting, research assistants described the project to potential participants and answered questions. After the individuals agreed to participate, they signed the informed consent. No one who chose to attend the group session refused to participate after hearing what participation in the study would entail. Participants completed a survey packet consisting of demographic, psychological, spiritual, and health assessment tools. As participants completed the survey packet, the research assistants took the participants from the room individually to complete a cold pressor task. After all participants completed the survey and the cold pressor task, research assistants randomly assigned participants to a group with a random number generator.

Each treatment group separated from the larger group and was trained in how to perform their assigned medita-

tion/relaxation task. Participants were taught to sit in a quiet room, without any distractions (e.g. no television, radio). They were taught to wear comfortable clothing and told that they could sit in any position they would like, as long as they would not fall asleep. They were encouraged to pick a time during the day that they could use for their regular relaxation/meditation time. During the session, participants discussed problems that frequently arise among new practitioners of relaxation/meditation (e.g. losing focus) and how to solve the problem and continue relaxing/meditating.

Meditation participants were instructed to begin their meditation by softly repeating their meditation aloud a few times to help them focus, and then to continue to silently focus on the phrase, and how the phrase is reflected in their lives. If the participants felt they were losing focus, they should repeat the phrase aloud to refocus and then continue with the silent meditation. All meditation participants received the same training; the only difference was the set of meditative phrases available from which they could choose. Spiritual Meditation participants were allowed to choose one of four spiritual meditative phrases: “God is peace,” “God is joy,” “God is good,” and “God is love.” Those who were uncomfortable with the term “God” were allowed to choose another term that they felt better reflected the focus of their spirituality, only one participant chose to use an alternate term. He chose to use “Mother Earth” instead of “God.” Internal Secular Meditation participants chose from four internally focused secular phrases: “I am content,” “I am joyful,” “I am good,” “I am happy.” In the External Secular Meditation group, participants chose from four externally focused secular meditation phrases: “Grass is green,” “Sand is soft,” “Cotton is fluffy,” “Cloth is smooth.” The participants were asked to practice their meditation for 20 min per day for 30 days.

Relaxation participants were taught a progressive muscle relaxation (Wachholtz 2007) in which they tensed and released muscle groups in their bodies. The relaxation group was not provided a meditation phrase.

In each group, instructors then led the participants through a practice meditation or relaxation. After the practice period, participants were also encouraged to ask questions from the instructors and to contact them if they encountered additional difficulties over the course of the study.

During the one-month of meditation/relaxation practice, participants received weekly emails reminding them of their upcoming appointment, and the contact information for their group leader if they had any questions. Following one month of meditation practice, participants returned to the lab. After they arrived, they rested for 5 min, during that time they completed the State Anxiety Inventory to assess anticipatory

anxiety. Then, participants began a 20-min meditation/relaxation period. After which, participants continued their technique as they placed their hand in the cold water bath up to their wrist and were instructed to maintain contact “until it becomes too uncomfortable.” When they removed their hand from the cold pressor bath, the participants completed a second survey packet containing the psychological, spiritual, and health assessment tools.

## Results

Group by Time ( $4 \times 2$ ) ANOVAs were used to identify simple main effects and significant interactions. Significant interactions were further investigated with analysis of change scores. For measures that were given at two time points, change scores were analyzed using one way ANOVAs to assess whether the four groups changed in different ways over time. Least Square Differences post-hoc tests were used to identify the relationship between the groups' change scores. With respect to those variables that were assessed only at pre-test (e.g. demographic variables) or post-test (e.g. manipulation checks), one way ANOVAs were conducted to test for differences between the four groups (see Table 2). Data analysis was conducted using SPSS 13.0 software (SPSS 2004).

Exploratory analyses of mediation factors used linear regression to assess if psychological factors (self-efficacy, affect, anxiety, depression, or quality of life) explained the association between outcome variables (headache frequency post-intervention, change in headache frequency, pain tolerance post-intervention, change in pain tolerance) and spiritual variables (spiritual well being, religious well being, existential well being, daily spiritual experiences).

### Manipulation check

A manipulation check assessed the perceived stressfulness of the cold pressor task and the perceived relaxation stemming from their assigned technique. There was no subjective difference between the groups on the stressfulness of the cold pressor task ( $F(3,79) = 0.69$ ,  $p = \text{NS}$ ,  $\eta^2 = .025$ ); participants in each group rated their task “somewhat” stressful ( $M = 2.0$ ,  $SD = 1.07$ , range 1.7–2.1). There was also no subjective difference on the level of relaxation experienced between the groups during their assigned tasks as they rated the tasks “moderately” relaxing ( $F(3,79) = 0.19$ ,  $p = \text{NS}$ ,  $\eta^2 = .007$ ;  $M = 3.5$ ,  $SD = .95$ , range 3.4–3.6). To identify their anxiety related to the cold pressor task, participants completed the State Anxiety Inventory, there was no significant difference between the groups ( $F(3,79) = 1.17$ ,  $p = \text{NS}$ ,  $\eta^2 = .036$ ) on state anxiety.

## Pain measures

### Headaches

An analysis of participants' headaches showed a significant time (pre, post) period by group interaction for the number of reported headaches ( $F(3,79) = 15.68$ ,  $p < .001$ ) with a strong effect size ( $\eta^2 = .37$ ). The interaction indicated that the Spiritual Meditation group reported a significantly greater reduction in number of headaches over the course of the study compared to the other groups (See Fig. 2). Those in the Spiritual Meditation group showed a significantly greater reduction in headache frequency than all three other groups: Internal Secular Meditation ( $p < .01$ ,  $\eta^2 = .22$ ), External Secular Meditation ( $p < .001$ ;  $\eta^2 = .82$ ), Relaxation ( $p < .001$ ;  $\eta^2 = .37$ ). The Internal Secular Meditation group reported a greater reduction in the number of headaches than the External Secular Meditation ( $p < .01$ ;  $\eta^2 = .29$ ), or Relaxation ( $p < .01$ ;  $\eta^2 = .11$ ) groups.

Headache severity showed a significant effect by time ( $F(5, 395) = 8.23$ ,  $p < .001$ ,  $\eta^2 = .14$ ). However, there was no time  $\times$  group interaction effect ( $F(15,231) = 0.83$ ,  $p = \text{NS}$ ,  $\eta^2 = .06$ ).

### Pain tolerance

A significant interaction also appeared in the level of pain tolerance displayed by the different groups prior to the intervention and after the intervention ( $F(3,79) = 4.00$ ,  $p < .01$ ) with a moderate effect size ( $\eta^2 = .13$ ). The interaction showed that the Spiritual Meditation group reported a significantly greater increase in pain tolerance compared to the other groups over the course of the intervention (Fig. 3). The Spiritual Meditation group experienced a significantly greater increase in pain tolerance than the Internal Secular Meditation ( $p < .001$ ;  $\eta^2 = .19$ ), External Secular Meditation ( $p < .05$ ;  $\eta^2 = .13$ ) or Relaxation ( $p < .01$ ;  $\eta^2 = .11$ ) groups.

## Psychological measures

### Negative affect

A significant time  $\times$  treatment interaction effect was found for negative mood ( $F(3,79) = 4.73$ ,  $p < .01$ ) with a moderate effect size ( $\eta^2 = .15$ ). The interaction showed that the Spiritual Meditation group experienced a greater drop in negative affect scores compared to the other groups. Specifically, the Spiritual Meditation group reported a significantly greater drop in negative affect over the course of the study than the Internal Secular Meditation

**Table 2** Means of key variables by group and time\*

	SP M(SD)	IS M(SD)	ES M(SD)	RL M(SD)
Headaches/month				
Pre	13.7 (6.36)	12.8 (5.10)	11.1 (5.24)	11.4 (6.25)
Post	8.7 (5.19) <sup>e,f,g</sup>	9.7 (5.23) <sup>e,h,i</sup>	10.4 (6.30) <sup>f,h</sup>	10.1 (5.72) <sup>g,i</sup>
Headache severity				
Pre	4.4 (.95)	4.7 (.66)	4.5 (.69)	4.6 (.69)
Post	3.9 (.77)	3.9 (.92)	4.1 (1.19)	4.0 (1.03)
Intervention adherence for those with >15 days				
M days (SD)	25.6 (3.47)	27 (2.81)	26.2 (3.48)	25.8 (3.37)
Pain tolerance				
Pre	39.1 (31.69)	43.7 (62.91)	43.1 (62.00)	44.6 (63.45)
Post	112.1 (81.90) <sup>c,e,f</sup>	47.1 (41.21) <sup>e</sup>	70.2 (82.56) <sup>c</sup>	63.2 (72.66) <sup>f</sup>
Positive affect scale				
Pre	34.2 (6.20)	33.1 (5.62)	34.2 (5.61)	32.8 (5.99)
Post	36.5 (6.46)	35.6 (4.65)	34.8 (8.38)	34.9 (6.61)
Negative affect scale				
Pre	25.9 (6.56)	23.1 (6.92)	21.1 (6.22)	24.6 (6.25)
Post	16.9 (4.20) <sup>e,f</sup>	22.2 (7.13) <sup>c,e</sup>	19.0 (4.78) <sup>a,f</sup>	18.4 (7.50) <sup>a,c</sup>
Trait anxiety inventory				
Pre	41.2 (10.65)	43.6 (10.19)	40.7 (6.91)	43.7 (7.88)
Post	32.0 (6.93) <sup>a,e</sup>	37.4 (9.90) <sup>a,c</sup>	37.6 (6.21) <sup>c</sup>	34.5 (6.61) <sup>c</sup>
CES-depression				
Pre	35.9 (10.66)	37.6 (9.75)	34.6 (8.34)	37.2 (7.33)
Post	31.0 (7.45)	34.2 (9.89)	29.3 (4.80)	29.4 (7.11)
Migraine-quality of life				
Pre	77.3 (10.17)	75.8 (12.81)	76.7 (8.50)	76.7 (10.69)
Post	82.0 (11.76)	79.0 (8.67)	77.1 (10.80)	76.4 (12.68)
Headache self-efficacy				
Pre	110.6 (22.89)	105.4 (15.78)	102.4 (24.08)	103.3 (20.62)
Post	123.1 (20.54) <sup>a,e</sup>	107.2 (17.17) <sup>b,e</sup>	117.6 (21.58) <sup>b</sup>	113.1 (15.89) <sup>a</sup>
Daily spiritual exp				
Pre	40.6 (17.08)	42.6 (19.22)	40.4 (14.38)	41.7 (14.74)
Post	55.8 (15.14) <sup>a,c,e</sup>	43.0 (18.17) <sup>c</sup>	43.9 (13.74) <sup>a</sup>	41.8 (15.84) <sup>e</sup>
Spiritual well being				
Pre	93.4 (18.64)	93.1 (17.80)	95.5 (18.11)	92.8 (15.18)
Post	100.6 (15.52)	97.3 (16.68)	96.1 (17.08)	97.9 (14.13)
Religious well being				
Pre	44.5 (12.13)	44.4 (11.20)	46.8 (14.23)	44.9 (9.30)
Post	47.1 (12.72)	47.6 (11.58)	47.4 (15.10)	47.2 (9.14)
Existential well being				
Pre	48.1 (8.27)	48.7 (8.87)	48.8 (5.59)	47.9 (8.17)
Post	53.5 (5.63) <sup>c,e</sup>	49.6 (7.49) <sup>c</sup>	48.6 (6.14) <sup>c</sup>	50.7 (6.35)

\* There were no pre-test differences between the groups  
Superscript letters indicate a significant time × group interaction between the two groups that share the same letter.

<sup>a,b</sup>  $p < .10$ , <sup>c,d</sup>  $p < .05$ ,  
<sup>e,f,g,h,i</sup>  $p < .01$

( $p < .001$ ;  $\eta^2 = .25$ ), or External Secular Meditation ( $p < .01$ ;  $\eta^2 = .15$ ) groups. Similarly, the Relaxation group scores showed significantly greater reduction in negative affect over the duration of the intervention than the Internal Secular Meditation group ( $p < .05$ ;  $\eta^2 = .12$ ), and marginally less than the External Secular Meditation group ( $p < .10$ ;  $\eta^2 = .06$ ).

#### Positive affect

Though the scores suggest that three of the four groups (Spiritual Meditation, Internal Secular Meditation, Relaxation) experienced some modest improvement in their positive affect, this was not significant ( $F(3,79) = .26$ ,  $p = \text{NS}$ ,  $\eta^2 = .01$ ).

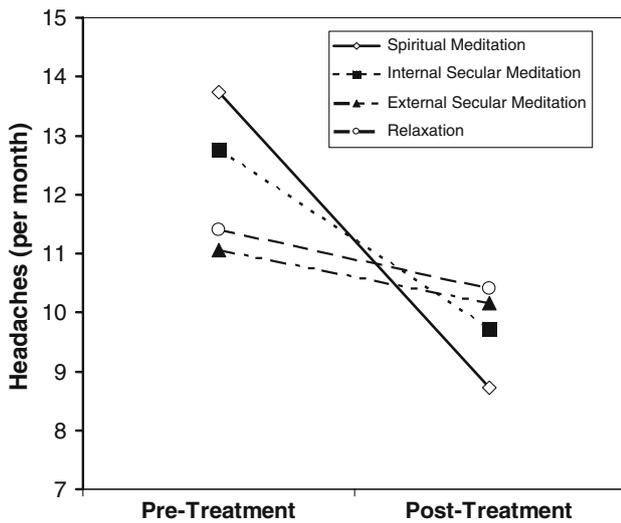


Fig. 2 Headaches per month by group and time

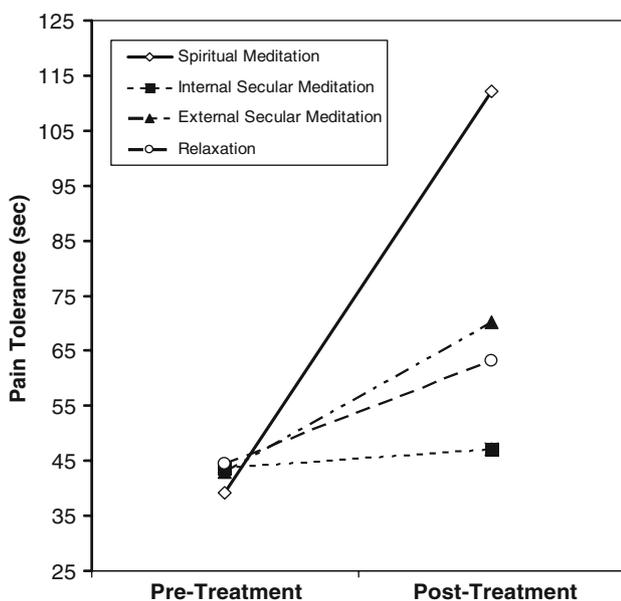


Fig. 3 Pain tolerance by group and time

*Trait anxiety*

A time × treatment interaction occurred for trait anxiety ( $F(3,79) = 3.31, p < .05$ ) with a small to moderate effect size ( $\eta^2 = .11$ ). The Spiritual Meditation group experienced a significantly larger decrease in trait anxiety compared to the other groups over the intervention (See Fig. 4). The Spiritual Meditation group experienced a significantly greater drop in trait anxiety than the External Secular Meditation ( $p < .01; \eta^2 = .15$ ), and marginally greater drop than the Internal Secular Meditation group ( $p < .10; \eta^2 = .07$ ). The Relaxation group reported a greater drop than the External Secular Meditation group ( $p < .05; \eta^2 = .13$ ).

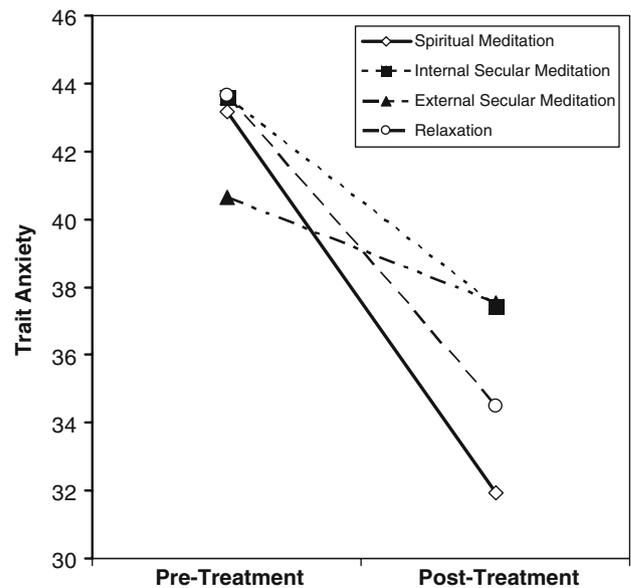


Fig. 4 Trait anxiety by group and time

*Depression*

There was no significant interaction for depression ( $F(3,79) = 0.96, p = NS, \eta^2 = .04$ ), although the scores suggest that all groups had a mild reduction in their depression scores during the study.

*Headache specific surveys*

*Migraine specific quality of life*

While the Migraine Specific Quality of Life scores suggested that the Spiritual Meditation and Internal Secular Meditation groups had mild improvement in their reported quality of life, this was not a significant effect ( $F(3,79) = 0.71, p = NS, \eta^2 = .03$ ).

*Self-efficacy*

A significant time × treatment interaction occurred with respect to headache self-management efficacy ( $F(3,79) = 2.99, p < .05$ ). The magnitude of this effect size was moderate ( $\eta^2 = .10$ ). The interaction effect showed that the Spiritual Meditation group reported greater increases in headache self-efficacy over the course of the study than the other groups. Participants in the Spiritual Meditation group reported a significantly greater increase in their headache management efficacy than those in the Internal Secular Meditation ( $p < .005; \eta^2 = .19$ ) group and marginally greater efficacy than those in the Relaxation ( $p < .10; \eta^2 = .06$ ) group. The Internal Secular Meditation group also reported a marginally greater increase in

efficacy compared to the External Secular Meditation group ( $p < .10$ ;  $\eta^2 = .10$ ).

### Spiritual measures

#### *Spiritual well being*

There was no significant time by group interaction on general Spiritual Well Being ( $F(3,79) = 1.48$ ,  $p = \text{NS}$ ,  $\eta^2 = .05$ ), or the Religious Well Being subscale ( $F(3,79) = 0.76$ ,  $p = \text{NS}$ ,  $\eta^2 = .03$ ). However, on the Existential Well-Being subscale a significant interaction ( $F(3,79) = 2.13$ ,  $p < .05$ ) was found which accounted for a small amount of variance ( $\eta^2 = .09$ ). While all groups experienced an increase in existential well being over the course of the study, the Spiritual Meditation group experienced a greater increase in existential well being than the Internal Secular Meditation ( $p < .05$ ;  $\eta^2 = .09$ ), and External Secular Meditation ( $p < .01$ ;  $\eta^2 = .13$ ) groups.

#### *Spiritual experiences*

The ANOVA yielded a significant time  $\times$  treatment interaction on the frequency of reported daily spiritual experiences ( $F(3,79) = 2.67$ ,  $p < .05$ ). The magnitude of this effect was modest ( $\eta^2 = .09$ ). The Spiritual Meditation group reported a greater increase in daily spiritual experiences over the course of the study than the other groups. Those in the Spiritual Meditation group had a significantly greater increase in the number of daily spiritual experiences than those in the Internal Secular Meditation ( $p < .05$ ;  $\eta^2 = .10$ ), and Relaxation ( $p < .01$ ;  $\eta^2 = .15$ ) groups and a marginally greater increase than those in the External Secular Meditation ( $p < .10$ ;  $\eta^2 = .08$ ) group.

#### Exploratory mediation analyses

Mediation analyses did not reveal any psychological variables that mediated the relationship between the post-intervention spirituality variables and the outcome variables of pain tolerance and headache frequency.

## Discussion

Despite advances in prophylactic, post-onset, and analgesic migraine treatment, many migraineurs are still left without adequate pain management. Migraineurs experience severe headache pain that negatively impacts their mood, their quality of life, their self-identity, their relationships and their ability to work. In the present study, we tested the relative efficacy of a spiritual form of meditation on

headache frequency, pain tolerance, mood, anxiety, quality of life, and spiritual variables among migraineurs. While previous studies have observed consistently positive mental and physical health outcomes among practitioners of meditation (Grossman et al. 2004), few have explored the differences between spiritual and secular forms of meditation. And, to the best of our knowledge, no published studies have explored how adding a spiritual component to a meditation practice may increase pain tolerance and reduce headache frequency among migraineurs.

#### Pain and spiritual meditation

The study's findings supported most of the hypotheses. Not only did migraineurs who practiced spiritual meditation report a greater reduction in the number of headaches they experienced, they displayed more pain tolerance. Similar to others who have explored the effects of spiritual practices on pain, the practice of spiritual meditation in this study did not alter people's sensitivity to pain (based on ratings of pain severity), but it did alter how well they tolerated those pain levels (Keefe et al. 2001; Wachholtz and Pargament 2005; Wachholtz et al. 2007).

These findings suggest that spiritual meditation may have a two-fold benefit for migraineurs. First, with fewer headaches, migraineurs experience less pain during their daily lives. As a result, they may encounter fewer social and personal consequences that accompany frequently occurring headache pain (Bigal et al. 2001) as well as reducing the potentially negative side effects that accompany migraine medication. Second, improved pain tolerance suggests that when participants do experience pain, such as migraine headaches, they may be better able to continue with their daily personal, work, and family activities less impeded by pain. The spiritual meditation technique is an eminently portable skill that requires no special equipment or financial commitment yet appears to yield notable benefits to those with frequent migraine headaches.

#### Mental health and spiritual meditation

Regular practice of spiritual meditation in this study created significant decreases in negative mood among its practitioners. Spiritual meditators reported a larger decrease in negative affect than those in any of the non-spiritual technique groups. Though previous research has shown that general forms of meditation can be effective in improving mental health (Grossman et al. 2004), the spiritual component appears to have a unique additive effect that enhances the ability of meditation to decrease negative affect and anxiety. It is not unusual for practi-

tioners of meditation to report a general reduction in negative mood and trait anxiety (Wachholtz and Pargament 2005). However, the unique finding in the present study is that the addition of an explicitly spiritual component enhanced this effect compared to migraineurs using non-spiritual techniques.

Perceived self-efficacy to control health outcomes, such as the onset and duration of headache pain, should also be a consideration when treating medically compromised individuals. The ability to feel in control of one's pain is related to less pain-driven negative emotion and more positive mood (French et al. 2000; Keefe et al. 2001). One of the key findings of the present study is that after only one month, spiritual meditation participants reported that they were better able to control their headache status. By providing migraineurs with a powerful tool in the form of spiritual meditation, migraineurs felt they have more control over their headaches.

Anecdotally, participants in the study indicated that migraine headaches interfered with their lives by consuming valuable time intended for family, friends, work, or leisure. With an initial average of 12 migraine headaches a month among the study population, headache pain created severe intrusions on their daily lives. Reducing these intrusions should enhance quality of life. While not statistically significant in the current study, after practicing for one month, those practicing spiritual meditation showed a trend toward improvement on the Migraine Specific Quality of Life. Nonetheless, because the spiritual meditation group reported improvements in other areas that contribute to quality of life (e.g. fewer headaches, improved headache efficacy, decreased anxiety, less negative mood, better tolerance of pain), it is likely that this group did experience improved quality of life as measured by these indices.

As a whole the findings speak to a fundamental improvement in emotional health and improved feelings of control following the use of spiritual meditation that was not replicated with non-spiritual techniques.

### Spiritual health and spiritual meditation

The positive benefits of spiritual meditation appear to reach beyond the physical and mental health domain, into the spiritual health domain (Wachholtz et al. 2007). Spiritual meditators reported significant increases in their number of daily spiritual experiences. As a result of the spiritual meditation, meditators appeared to view the world through more of a spiritual lens and experience a greater sense of connectedness with the sacred on a daily basis.

The spiritual meditation group also reported the greatest improvements in their existential spiritual well being. The concept of existential well-being relates to experiencing a

sense of meaning and purpose in one's life. Spiritual meditation appears to enhance these feelings. Spiritual meditation may provide people with the time and mental space outside of their day-to-day routine to recognize important aspects of their lives that they might otherwise take for granted, leading to a greater sense of meaning and/or self-purpose. Moreover, the positive valence of the spiritual meditation phrase may enhance these feelings by focusing meditators on positive aspects of their spiritual lives.

The lack of effect for religious well being, and consequently spiritual well being which is comprised of the Religious and Existential Well Being subscales, is somewhat surprising given that this subscale is focused specifically on interactions with a theistic being (e.g. God). Despite having a theistically-directed meditative phrase, perhaps participants' did not identify their meditative technique as religious like they would if they were engaged in more traditional religious activity, such as prayer. However, puzzling as this is, the lack of findings on this subscale addresses another potential criticism of the study for it suggests participants did not simply answer positively to all spiritual questions due to social desirability or a pro-spiritual bias. Rather they appeared to differentiate between their existential and religious well being during the course of the intervention.

These were not the only spiritual health findings of interest. Spiritual improvements were also found among the secular meditation and relaxation groups in the area of spiritual well-being. While the improvements were more modest than those observed in the spiritual meditation group, it raises the question as to why spiritual improvements were found at all among practitioners of ostensibly secular tasks.

As found in previous studies (Wachholtz and Pargament 2005), even secular meditation techniques may enhance the individual's spiritual well-being by setting aside daily time to reduce the external noise of life and focus on quieting the self. This raises the possibility that participants in secular meditation groups were injecting spiritual aspects into the technique. Yet another possibility is that people were extracting a spiritual essence from the seemingly secular techniques.

Historically, meditation has been embedded in a larger spiritual matrix. These findings suggest that it may be impossible to disconnect meditative practices fully from this larger context. Thus, the distinction between "secular" and "spiritual" meditation may be overdrawn. Harris et al. (1999) ask a number of intriguing questions that may need to be addressed to adequately respond to these observations, "Are the spiritual or religious components of various meditative practices, in essence, 'delivery systems' for the actual mechanism of change, that is the relaxation re-

sponse? Or do the spiritual or religious components, when present, contribute to observed effects of meditative practice in a more integral or facilitative way, allowing the relaxation response to work in a way that otherwise could not or would not happen? Or do the spiritual and religious components act as an addition and separate ‘active ingredient’?” (Harris et al. 1999, 419). These possibilities could be pursued in future studies through daily diaries that allow narrative space for participants to explore their thoughts and feelings as they experience both spiritual and secular meditative processes.

### Implications

The findings of this study have important practical implications for those working with chronic or acute pain patients. Since spiritual meditation was related to improved mental health variables, improved pain tolerance, and improved spiritual health variables, other individuals struggling with painful conditions may benefit from the use of a spiritual meditation technique. Health practitioners who work with clinical pain patients have varying levels of comfort in discussing religious or spiritual issues with their patients. However, the current study suggests that by encouraging their patients to integrate the patient’s spiritual resources into treatment, practitioners may help their patients experience better mental health, and improved pain tolerance and, perhaps in turn, reduce patients’ reliance on medications (Pargament 2007).

### Limitations and future directions

While this study contributed to an understanding of how different forms of meditation can affect migraineurs, there were limitations. The participant population consisted largely of undergraduate students, which limited the study’s generalizability. The participants did report experiencing repeated pain through a high number of monthly migraine headaches. Nevertheless, future studies should expand the demographic variability in the participant populations by recruiting migraineurs from pain clinics or the general population. Gathering participants from pain clinics would also address another limitation of the study; a pain specialist did not verify participants’ report of a migraine headache diagnosis. Instead, the Migraine ID Screener and a high number of reported monthly headaches with migraine characteristics were used to identify potential participants. It should be noted that despite its brevity, the Migraine ID screener has been shown to be a valid and reliable diagnostic tool for migraine headaches; however, it was developed for use in a primary care setting, not for an undergraduate population which may be a limitation in its use with the current study.

Contact between the participants and the experimenter was intentionally held to a minimum in order to maintain a high level of internal validity. However, this minimal participant contact might also be a limitation. Future studies could integrate the meditation protocol from this study with a combination of therapeutic techniques and weekly therapist contact to further enhance the efficacy of the spiritual meditation technique.

The study contains a large proportion of women (90%). However, women comprise 80% of migraine headache sufferers (Lipton et al. 2002). Therefore, while gender is a factor that should be noted, the gender differences are not dramatically different from the identified patient population.

Finally, the present study was limited by lack of follow-up data after the completion of the study. Even though the current study showed promising results after only a month of spiritual meditation practice, it leaves open the question of whether these benefits would be sustained over the long-term. Future studies should examine the impact of continued meditation on physical, emotional, and spiritual outcomes during long-term follow-up. Such a study would also be enhanced by controlling for the effects of social desirability and possibly including a measure on mindfulness.

Yet another exciting potential future direction for this line of research involves a project with a larger participant population and qualitative analyses of participant writings in their daily diaries. This would provide the opportunity to better understand participants’ thoughts and feelings during their daily meditation practices. It would also allow the researchers to develop a richer understanding of the developmental process that participants go through as they learn a new meditation/relaxation technique. Further, researchers could identify how participants in the secular meditation groups integrated spiritual themes into their meditation practice. Additionally, a larger subject pool would allow for more complex path analyses that would help solidify our understanding of the relationship between spiritual meditation, anxiety, mood, self-efficacy, and quality of life and their connection to migraine headaches.

Future research could also explore the explanatory pathways that lead to the greater mental, physical, and spiritual health benefits found in those who practice spiritual meditation (Wachholtz et al. 2007). These potential mediating factors include improved mood, decreased anxiety, increased self-efficacy, distraction from bodily pain, and/or increased spiritual emotions and support. The current study did not find any mediating effects, however larger studies with greater power may yield different results. Nevertheless, it should be noted that it is also possible that spiritual meditation has distinctive effects on outcomes that cannot be fully explained by these psychological and social factors (Pargament et al. 2005).

## Conclusions

The explicit inclusion of spirituality into a meditation task appears to add to the efficacy of this technique among those with migraine pain. Individuals with migraine headaches experience a great deal of pain and pain-related stress as a result of their headaches. This pain and stress often results in functional disability leading to lost time for work, family, social, or other activities. The present study suggested that spiritual meditation has unique properties that mitigate some of the negative impact of migraines on people's lives. Despite the seemingly minor alteration of the meditation technique used in the study, the addition of an explicitly spiritual component produced profound effects. Spiritual meditation was shown to decrease negative mood, decrease anxiety, increase feeling of spirituality, and increase feelings of self-efficacy in coping with headache pain. Spiritual meditators also displayed an increased pain tolerance and fewer headaches than other participants in the study. Without the addition of spirituality to the relaxation practice, the benefits of meditation were more modest. Thus, the information gained from the present study suggests that the combination of spirituality and meditation in the daily practice of a spiritual meditation technique may enhance psychological, physical, and spiritual health in migraineurs. Additional studies are needed to determine whether spiritual meditation holds similar implications for individuals experiencing other forms of chronic or acute pain.

## References

- Alexander, C. N., Rainforth, M. V., & Gelderloos, P. (1991). Transcendental meditation, self-actualization, and psychological health: A conceptual overview and statistical meta-analysis. *Journal of Social Behavior and Personality*, *6*, 189–248.
- Alexander, C., Robinson, D., Orme-Johnson, R., Schneider, R., & Walton, K. (1994). The effects of transcendental meditation compared to other methods of relaxation and meditation reducing risk factors, morbidity, and mortality. *Homeostasis*, *35*, 243–264.
- Alexander, C. N., Swanson, G. C., Rainforth, M. V., & Carlisle, T. W. (1989). Effects of the transcendental meditation program on stress reduction, health, and employee development. *Anxiety, Stress, and Coping*, *6*, 245–262. doi:10.1080/10615809308248383.
- Arinstein P., Caudill M., Mandl C., Norris A., & Beasley R. (1999). Self efficacy as a mediator of the relationship between pain intensity, disability and depression in chronic pain patients. *Pain*, *80*, 483–491. doi:10.1016/S0304-3959(98)00220-6.
- Astin, J. A. (1997). Stress reduction through mindfulness meditation: Effects on psychological symptomatology, sense of control, and spiritual experiences. *Psychotherapy and Psychosomatics*, *66*, 97–106.
- Bigal, M. E., Bigal, J. M., Betti, M., Bordini, C. A., & Speciali, J. G. (2001). Evaluation of the impact of migraine and episodic tension type headache on the quality of life and performance of a university student population. *Headache*, *41*, 710–719. doi:10.1046/j.1526-4610.2001.041007710.x.
- Blanchard, E. B., Applebaum, K. A., Radnitz, C. L., Morrill, B., Michultka, D., et al. (1990). A controlled evaluation of thermal biofeedback and thermal biofeedback combined with cognitive therapy in the treatment of vascular headache. *Journal of Consulting and Clinical Psychology*, *58*, 216–224. doi:10.1037/0022-006X.58.2.216.
- Boivin, M. J., Kirby, A. L., Underwood, L. K., & Silva, H. (1999). Spiritual well-being scale (a review). In P. C. Hill & R. W. Hood (Eds.), *Measures of Religiosity* (pp. 382–385). Birmingham: Religious Education.
- Buenaver, L. F. (2003). Evaluating the role of religious coping in a self-reported headache population. Unpublished doctoral dissertation. Virginia Commonwealth University.
- Carlson, C. A., Bacasetta, P. E., & Simanton, D. A. (1988). A controlled evaluation of devotional meditation and progressive relaxation. *Journal of Psychology and Theology*, *16*, 362–368.
- Elkins, D., Anchor, K. N., & Sandler, H. M. (1979). Relaxation training and prayer behavior as tension reduction techniques. *Behavioral Engineering*, *5*, 81–87.
- Fan, A. Y., Gu, R. J., & Zhou, A. N. (1999). MMPI changes associated with therapeutic intervention: A migraine control study. *Headache*, *39*, 581–585. doi:10.1046/j.1526-4610.1999.3908581.x.
- Fetzer Institute (1999). *Multidimensional measurement of religiousness/spirituality for use in health research*. Kalamazoo, MI: John E. Fetzer Institute.
- French, D. J., Holroyd, K. A., Pinell, C., Malinoski, P. T., O'Donnell, F., & Hill, K. R. (2000). Perceived self-efficacy and headache related disability. *Headache*, *40*, 647–656. doi:10.1046/j.1526-4610.2000.040008647.x.
- Goadsby, P. J., Lipton, R. B., & Ferrari, M. D. (2002). Migraine—current understanding and treatment. *New England Journal of Medicine*, *346*, 257–270. doi:10.1056/NEJMr010917.
- Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health: A meta-analysis. *Journal of Psychosomatic Research*, *57*, 35–43. doi:10.1016/S0022-3999(03)00573-7.
- Harris, A. H.S., Thoresen, C. E., McCullough, M. E., & Larson, D. B. (1999). Spiritually and religiously oriented health interventions. *Journal of Health Psychology*, *4*, 413–433.
- Hu, X. H., Markson, L. E., Lipton, R. B., Steward, W. F., & Berger, M. L. (1999). Burden of migraine in the United States: Disability and economic costs. *Archives of Internal Medicine*, *159*, 813–818. doi:10.1001/archinte.159.8.813.
- Huber, D., & Henrich, G. (2003). Personality traits and stress sensitivity in migraine patients. *Behavioral Medicine*, *29*, 4–13.
- International Headache Society (2004). The international classification of headache disorders, (2nd ed.). *Cephalalgia*, *24*(suppl 1), 1–160.
- Keefe, F. J., Affleck, G., Lefebvre, J., Underwood, L., Caldwell, D. S., et al. (2001). Living with rheumatoid arthritis: The role of daily religious and spiritual coping. *Journal of Pain*, *2*, 101–110. doi:10.1054/jpai.2001.19296.
- Koenig, H. G., McCullough, M. E., & Larson, D. B. (2001). *Handbook of religion and health*. New York: Oxford University Press.
- Lateri-Minet, M., Auray, J., Hasnaoui, A., Dartigues, J., Duru, G., et al. (2003). Prevalence and description of chronic daily headache in the general population. *Pain*, *102*, 1143–1149.
- Lecci, L., & Wirth, R. J. (2000). Investigating the effects of physical discomfort on laboratory-induced mood states. *Journal of Behavioral Therapy and Experimental Psychiatry*, *31*, 231–247. doi:10.1016/S0005-7916(01)00008-8.
- Lipton, R. B., Dodick, D., Sadovskiy, R., Kolodner, K., Endicott, J., et al. (2003). A self-administered screener for migraine in primary care. *Neurology*, *61*, 375–382.

- Lipton, R. B., Scher, A. I., Kolodner, K., Liberman, J., Steiner, T. J., & Stewart, W. F. (2002). Migraine in the United States: Epidemiology and patterns of health care use. *Neurology*, *58*, 885–894.
- Lipton, R. B., Stewart, W. F., & Simon, D. (1998). Medical consultation for migraine: Results from the American Migraine Study. *Headache*, *38*, 87–96. doi:10.1046/j.1526-4610.1998.3802087.x.
- Main, A., Vlachonikolis, I., & Dowson, A. (2000). The wavelength of light causing photophobia in migraine and tension-type headache between attacks. *Headache*, *40*, 194–199. doi:10.1046/j.1526-4610.2000.00028.x.
- McDowell, I. (1996). *Measuring health: A guide to rating scales and questionnaires* (pp 206–213). New York: Oxford University Press.
- O'Halloran, J. P., Jevning, R., Wilson, A. F., Skowsky, R., Walsh, R. N., & Alexander, C. (1985). Hormonal control in a state of decreased activation: Potentiation of arginine vasopressin secretion. *Physiology and Behavior*, *35*, 591–595. doi:10.1016/0031-9384(85)90146-5.
- Orme-Johnson, D. (1987). Medical care utilization and the transcendental meditation program. *Psychosomatic Medicine*, *49*, 493–507.
- Paloutzian, R. F., & Ellison, C. W. (1982). Loneliness, spiritual well-being and quality of life. In L. A. Peplau & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research, and therapy* (pp. 224–237). New York: Wiley Interscience.
- Pargament, K. I. (2007). *Spiritually integrated psychotherapy: Understanding and addressing the sacred*. New York: Guilford Press.
- Pargament, K. I., Magyar, G., & Murray, N. (2005). The sacred and the search for significance: Religion as a unique process. *Journal of Social Issues*, *61*, 665–687. doi:10.1111/j.1540-4560.2005.00426.x.
- Penzien, D., Rains, J., & Andrasik, F. (2002). Behavioral management of recurrent headache: Three decades of experience and empiricism. *Applied Psychophysiology and Biofeedback*, *27*, 163–181. doi:10.1023/A:1016247811416.
- Radloff, L. S. (1977). The CES-D: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385–410. doi:10.1177/014662167700100306.
- Rippentrop, A. E. (2005). A review of the role of religion and spirituality in chronic pain populations. *Rehabilitation Psychology*, *50*, 278–284. doi:10.1037/0090-5550.50.3.278.
- Rojahn, J., & Gerhards, F. (1986). Subjective stress sensitivity and physiological responses to an aversive auditory stimulus in migraine and control subjects. *Journal of Behavioral Medicine*, *9*, 203–212. doi:10.1007/BF00848478.
- Scott, B., & Melin, L. (1998). Psychometric properties and standardized data for questionnaires measuring negative affect, dispositional style and daily hassles. A nation-wide sample. *Scandinavian Journal of Psychology*, *39*, 301–307. doi:10.1111/1467-9450.00088.
- Smith, T. B., McCullough, M. E., & Poll, J. (2003). Religiousness and depression: Evidence for a main effect and the moderating influence on stressful life events. *Psychological Bulletin*, *129*, 614–636. doi:10.1037/0033-2909.129.4.614.
- Spielberger, C. D. (1983). *Manual for the state-trait anxiety inventory STAI*. Palo Alto, CA: Mind Garden.
- SPSS (2004). *Statistical package for the social sciences, 13.0*. New York: Prentice Hall.
- Stewart, A. L., & Ware, J. E. (1991). *Measuring function and well-being: The medical outcomes study approach*. Durham, NC: Duke University Press.
- Stewart, W., & Lipton, R. (2002). Need for care and perceptions of MIDAS among headache sufferers study. *CNS Drugs*, *16S*, 5–11. doi:10.2165/00023210-200216001-00002.
- Stewart, W. F., Lipton, R. B., Celentano, D. D., & Reed, M. L. (1992). Prevalence of migraine headache in the United States. Relation to age, income, race, and other socio-demographic factors. *Journal of the American Medical Association*, *267*, 64–69. doi:10.1001/jama.267.1.64.
- Underwood, L. G., & Teresi, J. A. (2002). The daily spiritual experiences scale: Development, theoretical description, reliability, exploratory factor analysis, preliminary construct validity using health-related data. *Annals of Behavioral Medicine*, *24*, 22–33. doi:10.1207/S15324796ABM2401\_04.
- Wachholtz, A. B. (Speaker) (2007). *Progressive muscle relaxation. Guided self-awareness [CD]*. Durham: Duke University Diet and Fitness Center.
- Wachholtz, A. B., & Pargament, K. I. (2005). Is spirituality a critical ingredient of meditation? Comparing the effects of spiritual meditation, secular meditation, and relaxation on spiritual, psychological, cardiac, and pain outcomes. *Journal of Behavioral Medicine*, *28*, 369–384. doi:10.1007/s10865-005-9008-5.
- Wachholtz, A. B., Pearce, M., & Koenig, H. (2007). Exploring the relationship between spirituality, coping, and pain. *Journal of Behavioral Medicine*, *30*, 311–318. doi:10.1007/s10865-007-9114-7.
- Wagner, T. H., Patrick, D. L., Galer, B. S., & Berson, R. A. (1996). A new instrument to assess the long-term quality of life effects from migraine: Development and psychometric testing of the MSQOL. *Headache*, *36*, 484–492. doi:10.1046/j.1526-4610.1996.3608484.x.
- Waldie, K. E., & Poulton, R. (2002). Physical and psychological correlates of primary headache in young adulthood: A 26-year longitudinal study. *Journal of Neurology, Neurosurgery, and Psychiatry*, *72*, 86–92. doi:10.1136/jnmp.72.1.86.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070. doi:10.1037/0022-3514.54.6.1063.
- Wenneberg, S., Schneider, R., Walton, K., Maclean, C., Levitsky, D., et al. (1997). A controlled study of the effects of the Transcendental Meditation program on cardiovascular reactivity in ambulatory blood pressure. *International Journal of Neuroscience*, *89*, 15–28. doi:10.3109/00207459708988461.
- Zwart, J. A., Dyb, G., Hagen, K., Odegard, K. J., Dahl, A. A., Bovim, G., & Stovner, L. J. (2003). Depression and anxiety disorders associated with headache frequency: The Nord-Trøndelag Health Study. *European Journal of Neurology*, *10*, 147–152.