Effects of Behavioral Migraine Management Treatment and Preventative Drug Therapy on Positive Psychological and Palliative Migraine Management in Frequent Migraine

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Jamie L. Huckins
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This thesis titled
Effects of Behavioral Migraine Management Treatment and Preventative Drug Therapy
on Positive Psychological and Palliative Migraine Management in Frequent Migraine

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Abstract

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Because there is no known cure for migraine, treatment focuses on the prevention and management of migraine attacks through medication and behavioral treatments. Existing migraine treatment research has focused on treatment outcome in terms of headache reduction, but has failed to fully assess migraine sufferers’ continued use of migraine management skills taught during pharmacological and behavioral treatments (Reid & McGrath, 1996). In an effort to better capture the migraine management skills used by individuals who receive Behavioral Migraine Management (BMM), preventive medication (PM), and their combination, the present study expanded on the efforts of previous longitudinal migraine treatment studies by collecting data on use of migraine management techniques at several time points during and after treatment via structured interview (Interview of Coping Efforts – Migraine, ICE-M, Hill, 2003). Unlike previous measures, the ICE-M (1) used open ended questions to assess migraine management techniques taught during treatment as well as capture novel techniques, (2) identified the phase of migraine at which each headache management technique was used, and (3) categorized each migraine management technique as either positive (active behaviors such as problem solving or progressive muscle relaxation) or palliative (avoidant or passive behaviors such as isolation in a dark room, use of hot/cold packs). A secondary
purpose was to assess migraine-related disability and health-related quality of life as possible moderators between treatment and use of migraine management techniques.

Mixed models analyses revealed that BMM increased the use of positive migraine management techniques to prevent migraines, in anticipation of a migraine and while managing a migraine episode. BMM and PM helped to decrease the use of palliative migraine management techniques in anticipation of migraines and BMM served to decrease use of palliative techniques in managing the migraine episode. Additional analyses demonstrated that, at the anticipatory stage, health-related quality of life serves as a moderator of PM and palliative migraine management techniques so that participants with a lower quality of life at baseline reported greater decreases in palliative techniques. Taken together, the pattern of changes in migraine management suggests that providing behavioral migraine management interventions can affect how migraine sufferers manage their migraines.

Approved: __________________________________________

Kenneth A. Holroyd

Distinguished Professor of Psychology
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>3</td>
</tr>
<tr>
<td>List of Tables</td>
<td>7</td>
</tr>
<tr>
<td>List of Figures</td>
<td>8</td>
</tr>
<tr>
<td>Introduction</td>
<td>9</td>
</tr>
<tr>
<td>Method</td>
<td>15</td>
</tr>
<tr>
<td>Participants</td>
<td>15</td>
</tr>
<tr>
<td>Treatment Conditions</td>
<td>17</td>
</tr>
<tr>
<td>Optimal Acute Therapy (OAT)</td>
<td>17</td>
</tr>
<tr>
<td>Preventative Drug Therapy</td>
<td>17</td>
</tr>
<tr>
<td>Behavioral Migraine Management Therapy</td>
<td>18</td>
</tr>
<tr>
<td>Measures</td>
<td>19</td>
</tr>
<tr>
<td>Interview of Coping Efforts-Migraine Version</td>
<td>19</td>
</tr>
<tr>
<td>Migraine-Specific Quality of Life Questionnaire (MSQL)</td>
<td>20</td>
</tr>
<tr>
<td>Electronic Headache Diary</td>
<td>21</td>
</tr>
<tr>
<td>Procedure</td>
<td>22</td>
</tr>
<tr>
<td>OAT Run-in</td>
<td>22</td>
</tr>
<tr>
<td>Treatment/Dose Adjustment</td>
<td>22</td>
</tr>
<tr>
<td>Evaluation</td>
<td>23</td>
</tr>
<tr>
<td>Analysis</td>
<td>23</td>
</tr>
<tr>
<td>Results</td>
<td>25</td>
</tr>
<tr>
<td>Positive Migraine Management Skills</td>
<td>25</td>
</tr>
<tr>
<td>Proactive Stage</td>
<td>25</td>
</tr>
</tbody>
</table>
Anticipatory Stage ..............................................................................................26
Management Stage ..............................................................................................26
Palliative Migraine Management Skills ...............................................................27
Anticipatory Stage ..............................................................................................27
Management Stage ..............................................................................................29
Moderator Analyses ..............................................................................................30
Discussion ..............................................................................................................31
Positive Migraine Management ...........................................................................32
Palliative Migraine Management ...........................................................................35
Long Term Effects of Treatment ..........................................................................37
Moderation Effects ...............................................................................................38
Clinical Implications ............................................................................................39
Limitations ............................................................................................................39
Future Directions .................................................................................................41
Conclusions .........................................................................................................43
References ............................................................................................................44
Appendix A: Figures and Tables ...........................................................................49
Appendix B: Measures .........................................................................................66
Interview of Coping Efforts ..................................................................................66
Appendix C: Additional Tables .............................................................................73
Appendix D: Additional Results ............................................................................75
Moderator Analyses ..............................................................................................76
List of Tables

Table 1: Common Migraine Management Strategies Reported by TSM Study Participants .................................................................59

Table 2: Baseline Demographics, Levels of MSQL, and Migraine Headache Days by Treatment Conditions ........................................................................................................60

Table 3: Parameter Estimation for Longitudinal Models of Change in Positive Migraine Management During and After Treatment ..........................................................................................61

Table 4: Percent of BMM and no BMM Participants Using at Least One Migraine Management Strategy over Time ........................................................................................................62

Table 5: Percent of PM and no PM Participants Using at Least One Migraine Management Strategy over Time ........................................................................................................63

Table 6: Parameter Estimation for Longitudinal Models of Change in Palliative Migraine Management During and After Treatment ..........................................................................................64

Table 7: Percent of PM and no PM Participants Using at Least One Palliative Migraine Management Strategy at Three Levels of MSQL over Time ..................................................................................65

Table 8: Descriptive Statistics for Migraine Management Variables by Time ..........................................................................................73

Table 9: Comparisons of Percent of Participants Using at least on Palliative Migraine Management Strategy at the Anticipatory Stage ..........................................................................................74

Table 10: Parameter Estimation for Longitudinal Models (with Poisson Distribution) of Change in Positive Coping During and After Treatment ........................................................................77

Table 11: Parameter Estimation for Longitudinal Models (with Poisson Distribution) of Change in Palliative Coping During and After Treatment ........................................................................77
List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Procedure for Treatment of Severe Migraine Trial (TSM)</td>
<td>49</td>
</tr>
<tr>
<td>2a</td>
<td>Use of Positive Migraine Management Techniques over 16 Months</td>
<td>50</td>
</tr>
<tr>
<td>2b</td>
<td>Use of Positive Migraine Management Techniques over 16 Months (cont.)</td>
<td>51</td>
</tr>
<tr>
<td>2c</td>
<td>Use of Positive Migraine Management Techniques over 16 Months (cont.)</td>
<td>52</td>
</tr>
<tr>
<td>2d</td>
<td>Use of Positive Migraine Management Techniques over 16 Months (cont.)</td>
<td>53</td>
</tr>
<tr>
<td>3a</td>
<td>Use of Palliative Migraine Management Techniques over 16 Months</td>
<td>54</td>
</tr>
<tr>
<td>3b</td>
<td>Use of Palliative Migraine Management Techniques over 16 Months (cont.)</td>
<td>55</td>
</tr>
<tr>
<td>4a</td>
<td>Graphs of MSQL Moderation Effects for Anticipatory Stage of Palliative Migraine Management</td>
<td>56</td>
</tr>
<tr>
<td>4b</td>
<td>Graphs of MSQL Moderation Effects for Anticipatory Stage of Palliative Migraine Management (cont.)</td>
<td>57</td>
</tr>
<tr>
<td>4c</td>
<td>Graphs of MSQL Moderation Effects for Anticipatory Stage of Palliative Migraine Management (cont.)</td>
<td>58</td>
</tr>
</tbody>
</table>
Introduction

Migraine is characterized by recurrent episodes of severe headache and associated symptoms that can be triggered by a wide variety of internal and external stimuli (Breslau & Rasmussen, 2001). Migraine has an enormous impact on both society and the individual. It is estimated that in the U.S. nearly one in four households include someone who experiences migraine; this is 30 million people in any given year (Breslau & Rasmussen, 2001; Lipton, Stewart, Diamond, Diamond, & Reed, 2001). Additionally, about one quarter of all migraine sufferers experience four or more severe attacks a month (Lipton et al., 2001). Moreover, recent epidemiologic studies of migraine sufferers indicate that migraine reduces health-related quality of life (Diamond, Dahlof, Paspoulos, Neto, & Wu, 2005; Lipton et al., 2001). According to the epidemiological study by Lipton and colleagues (2001), 90% of migraine sufferers report some type of headache-related disability, while 53% exhibited impairment severe enough to require bed rest during a headache attack, and 51% reported work or school productivity was reduced by at least half due to migraine. The consequences of migraine-related disability and reduced health-related quality of life are also apparent in the negative effects on employment, household work, social, and family activities (Holmes, MacGregor, & Dodick, 2001; Hu, Markson, Lipton, Stewart, & Berger, 1999).

Because there is no known cure for migraine, treatment focuses on the prevention and management of migraine attacks through medication and behavioral treatments. Pharmacological treatments include both preventive and acute therapies (Adelman & Adelman, 2001; Marlowe, 2003). Recent meta-analyses demonstrated that preventative drug therapies yield 55 -60% improvement in migraine frequency and severity (Holroyd
Behavioral headache treatments, such as Behavioral Migraine Management (BMM), are other migraine treatment options. Behavioral treatments are rooted in the conceptualization of headache as a psychophysiological disorder that can be influenced by a patient’s actions. Behavioral treatments target physiological responses, behavior, emotions, and cognitions (Rains, Penzien, McCrory, & Gray, 2005). Identification of prodromal or early warning signs, trigger modification, modification of physiological responses and mental states via relaxation training and thermal biofeedback (TBF), and cognitive-behavioral (CBT) stress management therapy are all important components of behavioral migraine treatment (Lipchik, Holroyd & Nash, 2002; Rains et al., 2005; Reid & McGrath, 1996). BMM, like other behavioral treatments, teaches skills for managing one’s migraine disorder over a lifetime. BMM teaches skills for: (1) the prevention of migraines, (2) recognizing migraines at the first onset of symptoms and taking action to abort the oncoming migraine, and (3) coping with a migraine attack through acquisition and application of behavioral techniques (e.g., relaxation, TBF, positive self-statements; Holroyd & Drew, 2006). Meta-analyses of treatment outcome studies have demonstrated that behavioral interventions like BMM yield improvements in migraine frequency, intensity, and duration, migraine-related disability, and health-related quality of life that are similar to preventative drug therapy (Goslin et al., 1999; Holroyd et al., 1990; Penzien et al., 1985; Rains et al., 2005). Surprisingly, little research has been conducted examining patients’ use of behavioral migraine management skills during and after behavioral treatment. Researchers understand much about treatment effects on migraine
characteristics, but very little is known about how treatment affects behaviors and cognitions associated with managing migraines. The change in migraine management behaviors and cognitions is typically not viewed as treatment outcome; it is more often considered a component of the treatment process (Reid & McGrath, 1996).

BMM is an example of the self-management of chronic disease (Creer & Holroyd, 2006; Rains et al., 2005). Self-management refers to individuals playing the major role in management of their chronic illness (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). Self-management incorporates the narrower concept of adherence (e.g., completing homework assignments, correctly taking medication), but differs from the adherence model in that self-management emphasizes the patient’s active role in decision-making and problem solving, encouraging individuals to generate new migraine management strategies that uniquely fit their personal characteristics as well as their changing environmental opportunities and constraints. Self-management may also incorporate theories of stress and coping where the management of migraine-related stress is part of BMM.

Although there is a paucity of research examining the long-term use of migraine management skills after behavioral migraine treatment, a few longitudinal studies have examined the continued use of specific behavioral techniques taught during treatment (Blanchard, Applebaum, Radnitz et al., 1990; Sorbi, Tellegen, & Du Long, 1989). One such treatment study by Blanchard, and colleagues (1990) examined behavioral changes in participants with migraine or combined migraine and tension-type headache following behavioral treatment. The 113 participants were randomized to: (1) thermal biofeedback (TBF) and relaxation training; (2) TBF plus cognitive therapy; (3) pseudomeditation
attention-placebo; or (4) headache monitoring groups for an eight-week treatment.

Analysis of data from a 4-week post-treatment assessment (through headache diary and structured interview) found that participants reported using a significantly greater number of headache management techniques taught during treatment (relaxation and handwarming) than during baseline assessment. A similar study by Sorbi, Tellegen, and Du Long (1989) assessed migraine management behavior three years following treatment. Three year follow-up data were collected through interview, headache diary, and several self-report behavioral assessments from 24 adult patients who participated in either relaxation training or CBT stress management. The results showed that participants from both treatment groups maintained increases in use of problem solving and decreases in cognitive techniques to challenge depressive self-statements at the 3-year follow-up.

These analyses provided relevant information regarding stability of behavior change at two points after behavioral migraine treatment. However, these studies have several limitations. First, the Blanchard (1990) and Sorbi (1989) studies only examined migraine management techniques at one time point post treatment. Additionally, these studies only assessed adherence to specific treatment elements within each study. As a result, a number of migraine management skills often used by individuals with migraine were ignored (e.g., trigger management, correct medication utilization). Use of open-ended questions, instead of checklists or measures designed to only assess adherence, can allow participants to report a range of migraine management skills and are less likely to lead or prompt recall of certain migraine management techniques (Hill, 2003).

Moreover, measures utilized in the Sorbi et al. (1989) and Blanchard et al. (1990) migraine studies were not migraine-specific and, thus, provided no information about
when in the migraine episode each migraine management technique was used (Hill, Holroyd, & Lipchik, 1999b; Hill, 2003). The migraine episode evolves through several phases – the prodrome, aura, headache, and postdrome. Each migraine phase typically includes specific symptoms, such as fatigue or yawning during the prodrome or severe, throbbing head pain during the headache phase (Young & Silberstein, 2004). Different migraine management strategies may be appropriate depending on the phase of migraine during which they are used (e.g., progressive muscle relaxation and acute medication use during the prodrome or aura, pain coping strategies such as deep breathing and guided imagery during the headache). In addition, specific migraine management techniques have been developed for use preventively (e.g., correct usage of preventive medication, avoiding identified triggers). The questionnaires used in both the Blanchard (1990) and Sorbi (1989) studies were not designed to capture the application of specific migraine management skills at certain time points along a migraine episode. Use of a measure that is able to describe the timing of each migraine management technique reported by participants would more accurately assess migraine sufferers’ use of migraine management techniques. Additional categorization of the types of migraine management techniques utilized preventively and along the course of a migraine would also be more informative. Unlike the Sorbi et al. (1989) and Blanchard et al. (1990) studies, longitudinal studies examining coping with tension-type headaches and other chronic pain disorders (Hill, Holroyd, Lipchik, French, Pinnell, & Davis, 1999a; Ficke & Wittrock, 1995; Rollnik, Karst, Fink, & Dengler, 2001; Rosenstiel & Keefe, 1983) have categorized coping into positive (or active) techniques and palliative (also called avoidant or passive) techniques. Factor analysis has also empirically demonstrated with that such
coping categories do exist (Tobin, Holroyd, Reynolds, & Wigal, 1989). These categories would be very useful when applied specifically to measuring migraine management techniques.

In an effort to better capture the migraine management skills used by individuals who receive BMM, preventive medication, and their combination the present study expanded on the efforts of previous longitudinal migraine treatment studies by collecting follow-up data on use of migraine management techniques at five time points over 12 months via a structured interview that (1) used open ended questions to assess migraine management techniques taught during treatment as well as capture novel or new migraine management techniques, (2) identified the phase of migraine at which each headache management technique was used, and (3) categorized each migraine management technique as either positive (active behaviors such as problem solving or progressive muscle relaxation) or palliative (avoidant or passive behaviors such as isolation in a dark room, use of hot/cold packs). Additional examples of positive and palliative migraine management techniques are provided in Table 1.

We hypothesized that BMM, but not pharmacotherapy alone, would increase positive psychological techniques at all stages of migraine management (preventive, anticipatory, and management). Because of the lack of research in this area, it was unclear how BMM or pharmacological therapies (both acute and preventive) would affect palliative techniques. Analyses were conducted to examine if palliative migraine management techniques were affected by BMM or pharmacological therapies. It was assumed that participants in all treatments would decrease the number of palliative migraine management techniques they used as a result of treatment because they were
provided with new options for managing their migraine (such as additional drug therapy options and behavioral strategies). It was unclear, however, if the treatments would have differential effects.

As an additional research question, two possible moderators were explored, health-related quality of life and migraine-specific disability. A large percentage of migraine sufferers report disability and low health-related quality of life due to migraines (Diamond et al., 2005; Lipton et al., 2001). Individuals more impaired by their migraines, such as migraine sufferers who report low health-related quality of life and high migraine-specific disability, may be more likely to continue using palliative migraine management strategies and may have more difficulty employing positive migraine management skills over the long term. It was hypothesized that as participants’ baseline MSQL or baseline quality of life varied, the amount of change in positive psychological and palliative coping strategies would vary.

Method

The current study was part of a larger grant-funded behavioral migraine management treatment trial, the Treatment of Severe Migraine Trial (TSM). The TSM trial was a 16-month treatment study comparing the effectiveness of BMM, preventive medication, or their combination.

Participants

Participants between the ages of 18 and 65 were recruited in the central and southeast Ohio through physician referrals and local advertisements. Two hundred thirty-two individuals with current migraine with or without aura were recruited and met inclusion criteria for this study; 176 individuals completed the three month treatment/
dose adjustment period. Because a mixed models analysis was used, data collected from all 232 participants could be included in the study.

Baseline demographic and migraine characteristics of the sample (N = 232) are provided in Table 2. The sample was primarily female (79.3%) and Caucasian (83.6%). The average level of education for participants was a bachelor’s degree (M = 14.7 years). Participants experienced between 8 and 9 migraines a month, on average. The four treatment groups did not differ on any demographics at baseline, p < .05 (Table 2).

In order to participate in the study, individuals were required to meet International Classification of Headache Disorders (ICHD; Headache Classification Committee of the IHS, 2003) diagnosis for migraine at two separate evaluations, with diary-confirmed migraine severity criteria during the Optimal Acute Therapy (OAT) Run-in of 3 or more migraines with disability in 30 days.

Exclusion criteria were ICHD diagnosis of probable medication overuse headache, another pain disorder as primary presenting problem (i.e., fibromyalgia), 20 or more headache days per month, contraindication or sensitivity to any study medication, current use of migraine preventive medication, current psychological treatment, psychiatric disorder requiring immediate or priority treatment, and inability to read and understand study materials. For women, current or planned breastfeeding or pregnancy, or unwillingness to use an established contraceptive method were also exclusion criteria. All participants provided written informed consent according to procedures approved by the Ohio University Human Subjects Committee.
Treatment Conditions

During the initial 5 week Optimal Acute Therapy (OAT) Run-in all participants who met initial inclusion criteria received OAT, as described below. At the end of the OAT Run-in, participants who did not improve and continued to meet the migraine severity criteria were stratified by sex and randomized via a computerized randomization procedure to the four treatment conditions:

1) OAT + placebo (PL),
2) OAT + preventative drug therapy (PM),
3) OAT + Behavioral Migraine Management (BMM) + PL, or
4) OAT + BMM + PM.

Once the study was completed, those not in a BMM group were given the opportunity to receive treatment for free.

Optimal Acute Therapy (OAT).

A five-week (in order to include a menstrual cycle) run in period of OAT was conducted to exclude those individuals who responded well to OAT and would not need the additional elements of the treatment. OAT consisted of individually-tailored acute pharmacological treatment. Individualized handouts and a phone call week 3 of the OAT Run-in were used to help participants evaluate and optimize their acute therapy (i.e., learn to use acute therapy early in the migraine episode).

Preventative Drug Therapy.

Of the participants who met inclusion criteria, half were given a placebo while half of them were given a beta-blocker (propanolol HCL, or nadolol HCL if propanolol not tolerated) which served as a preventative drug therapy for migraine. Dosage was
increased and stabilized over the course of treatment according to an established protocol. Participants randomized to the placebo groups were treated in the exact same manner as those receiving active medication; the participants, neurologist, and all study personnel were blind to the treatment condition. During the treatment/dose adjustment period, patients receive phone calls between clinic visits to address side effect concerns and adherence issues that could undermine the effectiveness of the drug therapy. 

*Behavioral Migraine Management Therapy.*

The Behavioral Migraine Management (BMM) therapy, developed jointly by Ohio University and the National Institutes of Health, is a minimal contact cognitive-behavioral treatment that teaches participants several behavioral migraine management skills to help prevent migraines and manage breakthrough migraine attacks. There are 12 modules in the patient manual, along with 10 audiotapes, each of which focuses on a different facet of migraine management. Techniques taught in the BMM manual were introduced in three monthly clinic visits corresponding with participants’ neurological appointments (see Figure 1). Although the management skills most appropriate for each patient were chosen during clinic visits, actual acquisition and application of the material took place in the individual’s home (guided by the audiotapes and written material). One of the skills taught during BMM was medication management, as BMM is designed to be administered along with an acute medication. The first three chapters of the manual, which primarily involve relaxation, were introduced in treatment session one. Identifying and managing migraine triggers, responding to early warning signs and reducing the impact of migraine were discussed in treatment session two. During the last treatment session, part three was introduced. At this point, the patients had an option to continue
with basic BMM skills, complete a hand-warming module, or do a stress module. Along with assessing medication issues during phone calls between clinic visits, those in the BMM groups also discussed concerns and questions regarding adherence to BMM skills and techniques.

**Measures**

*Interview of Coping Efforts-Migraine Version.*

The Interview of Coping Efforts-Migraine Version (ICE-M; Hill, 2003; Appendix B) was used to assess each patient’s migraine management skills at baseline, during treatment and during the 12-month evaluation phase. The interview is a semi-structured six-question format addressing migraine management efforts at three migraine management stages – proactive, anticipatory, and management – associated with both migraine prevention and the phases of migraine. The proactive stage assesses migraine management techniques participants utilize to manage environmental and physical demands (e.g., migraine triggers, sleep/food schedule, stressful events) to prevent migraines, the anticipatory stage assesses strategies used to manage symptoms of an oncoming attack, and the management stage assesses participants’ use of migraine management techniques to cope with a full-blown migraine headache.

Participants were asked about the migraine management techniques used at each stage of migraine management, if any. They were also asked to report a frequency for every strategy used (five responses ranging from “never” to “frequently,” coded from 0 to 4). After each question, the interviewer was free to query any of the patient’s responses. Responses for each stage were coded into predetermined categories associated with the type of migraine management technique being performed, either positive or palliative.
Positive techniques included active behaviors such as problem solving, progressive muscle relaxation, or use of stress management skills. Palliative techniques encompassed more avoidant or passive behaviors such as isolation in a dark room, distraction, or use of hot/cold packs. Palliative techniques were unlikely to be used at the proactive stage and, thus, were excluded from analyses.

Two measurements were obtained via the ICE-M, a sum of the total number of positive psychological and palliative techniques reported at each of the migraine management stages and a sum of the frequency at which each strategy was used within each stage of migraine management.

Interrater reliability for the ICE-M was high, with kappas ranging from 0.85 to 0.93. The ICE-M shows good discriminant validity, with positive techniques showing moderate correlations between each stage of migraine management (proactive, anticipatory and management), from 0.51 to 0.56. Palliative techniques had slightly lower correlations between stages, ranging from 0.04 to 0.25. Lower correlations are to be expected for palliative strategies as they are not generally used at all stages. The ICE-M was also found to be sensitive to detect changes in the use of migraine management skills that occur over the course of migraine treatment in the pilot study for the TSM trial (Hill, 2003).

**Migraine-Specific Quality of Life Questionnaire (MSQL).**

The MSQL (Jhingran, Osterhaus, Miller, Lee, & Kirchdoerfer, 1998; Appendix B) is a 16-item questionnaire designed to measure the quality of life of individuals with migraine. The MSQL can be divided into three subscales: Role Function-Restrictive, Role Function-Preventative, and Emotional Function. Sample items include “In the past 4
weeks, how often have migraines interfered with how well you dealt with family, friends, and others who are close to you?” (Role-Function-Restrictive), “In the past four weeks, how often have you had to cancel work or daily activities because you had a migraine?” (Role Function-Preventative), and “In the past four weeks how often have you felt fed up or frustrated because of your migraines?” (Emotional Function). All items were answered on a 6-point Likert scale, ranging from “none of the time” to “all of the time.” Higher scores indicate lower migraine-specific quality of life. The subtests demonstrated adequate reliability (0.79-0.85) and were highly correlated (0.84-0.89) (Jhingran, et al., 1998). Total MSQOL score was used in moderation analyses.

Electronic Headache Diary.

An electronic headache diary (Palm III, 3 Com Corp.) was provided to participants to record the occurrence and severity of headaches, migraine-related disability, and medication intake. Patients were prompted each day by a Palm III handheld computer to record headache activity, including level of headache pain, occurrence and severity of associated symptoms (sensitivity to light, sensitivity to sound, nausea), length of headache, and any medication taken for headache. Answers to questions about headache activity (i.e., if participant experienced headache that day) determined subsequent questions. Prompts were pre-scheduled for each participant and happened at the same time every day. If participants were experiencing a headache when headache prompts began they were given the option to answer questions then or at the end of the day. The data was transferred to a database at each patient visit. The information gathered provided data on frequency and severity of migraine and associated symptoms, headache duration, and medication use. Of importance for the moderation analysis was the
migraine frequency during the OAT Run-in period of the TSM trial, measured as number of migraine days per month. To be measured as a discrete migraine episode, headache pain had to offset for at least 24 hours.

Procedure

OAT Run-in.

Participants first completed the OAT Run-in phase, during which they received a structured headache interview and psychosocial history, a neurological and medical evaluation, psychological testing, and OAT. Participants then used the headache diary for five weeks to complete the OAT Run-in phase. Phone contact was made twice during OAT Run-in to address any questions about OAT or use of the headache diary.

Treatment/Dose Adjustment.

Participants who still met the severity inclusion criteria after the five-week pretreatment period were each randomized into one of the four treatment groups. Contact during the 4 month treatment/dose adjustment period consisted of 4 monthly clinic visits, and a phone contact at the midpoint between each scheduled clinic visit (total of 3). At each of the four treatment visits, participants completed psychosocial questionnaires. Those in the BMM groups completed their training sessions during these visits. Preventive and acute medication management protocol continued through the four-month treatment period. During phone calls from clinicians, participants discussed medications, information on the headache diary, and any concerns. Those in the behavioral treatment group reviewed their treatment information and were able to ask questions.
**Evaluation.**

Participants were asked to return for scheduled evaluations 1, 3, 6, 9, and 12 months after termination of behavioral treatment. Each of these evaluations included a neurologist visit and completion of psychosocial questionnaires. Participants also continued to record headache activity in daily diaries until the completion of the study. A pictorial timeline is provided in Figure 1.

**Analysis**

Mixed models for repeated measures analysis (PROC MIXED; SAS Institute, Cary, North Carolina) were used to examine change in the use of migraine management techniques across the study period (Bagiella, Sloan & Heitjan, 2000). The mixed models for repeated measures analysis uses the classic linear regression model, but includes terms in the model that account for correlations among the residuals. As opposed to more traditional repeated measures analyses, such as ANOVA, mixed model analysis has two advantages: (1) the ability to accommodate missing data points often encountered in longitudinal datasets and (2) the ability to model nonlinear, individual characteristics of participants (Tian, 2004).

Because the ICE-M scores showed a restricted range of responses (i.e., use of zero coping techniques by a significant number of participants) and the data was highly skewed, non-normality of the distribution could potentially affect the outcome of the analyses. For this reason, both linear mixed models analyses and mixed models analyses using the migraine management variables fitted to a Poisson distribution were conducted. The latter treated each migraine management variable as a counting variable.
Migraine management strategies served as outcome variables. Separate models were fitted for the two categories of migraine management at each migraine management stage (e.g., positive techniques at the proactive stage, positive techniques at the anticipatory stage, etc.). Treatment conditions were treated as fixed effects and entered as two variables (BMM vs. no BMM & PM vs. no PM). Natural log of month was used as the time variable (Log was used because change over time was expected to be curvilinear). First-order variables and all interactions were entered in the first step. Non-significant interactions were dropped in each of the following steps, beginning with the highest-order interactions, until all variables were significant at \( p < .05 \), or were being used in a higher-order interaction. For the moderation analyses, the moderator variable and all interactions between moderator, time, and treatment conditions were added to each of the final models; non-significant interactions were dropped in sequential steps, using the strategy described above. Each moderator was fitted to separate models. First-order autoregressive/spatial power covariance matrices were used when fitting all models in order to accommodate the unequal time intervals between data collection. The first-order autoregressive matrix had the lowest A1C values in analyses conducted to determine the appropriate covariance matrix.

Chi-squared comparisons were used to assess differences in the proportion of participants in behavioral or non-behavioral and medication or non-medication groups who reported using at least one migraine management technique. These comparisons were conducted with the treatment variables included in the final model of each linear mixed model analysis and in each significant moderator analysis.
Results

Positive Migraine Management Skills

Proactive Stage

A significant BMM x Month interaction and a PM main effect were found at the proactive stage of migraine management (Table 3).

The significant BMM x Month interaction indicated greater change in the BMM groups than the drug therapy only groups (also termed no BMM group). Figure 2a shows that, early in BMM treatment the number of positive techniques participants reported increased. These increases continued over the course of the study. As shown in Table 4, the percent of participants in BMM who utilized at least one positive migraine management strategy also increased across the course of the study. Chi-squared analyses indicated that, at both the 6- and 12-month evaluations, a higher proportion of participants in the BMM group reported using positive migraine management techniques than participants in the drug treatment only groups (Table 4). The slightly greater proportion of participants in the drug only condition reporting the use of at least one positive technique at baseline was unexpected. Although a slightly higher percentage of participants in the drug only groups reported use of positive techniques at baseline, the difference reversed at evaluation, where nearly all BMM participants reported use of at least one positive technique. Comparatively, the percent of participants not receiving BMM that reported using at least one positive technique appeared to decrease slightly from baseline.

The PM main effect found at the proactive stage is likely because of a mean difference between the PM and no PM groups. Throughout the study, both groups
slightly increased their mean use of positive techniques at virtually the same trajectory (Figure 2b). However, this increase in use of positive techniques was so small that it is clinically insignificant.

*Anticipatory Stage*

A significant BMM x Month interaction was found at the anticipatory stage (Table 3), demonstrating that participants who received BMM changed their use of positive migraine management techniques more than participants who did not receive BMM. The graph in Figure 2c shows the mean number of positive techniques reported by participants who received BMM increased across the course of the study, while the mean number reported by participants who did not receive BMM slightly decreased from baseline.

Chi-squared analyses further revealed that, at both the 6- and 12-month evaluations, a greater proportion of participants who received BMM than who did not receive BMM reported use of at least one positive migraine management technique (Table 4). The percent of BMM participants who reported using one or more positive techniques increased considerably from baseline to the 6-month evaluation point. This increase was maintained through the 12-month evaluation. Among individuals who did not receive BMM, the percent of participants who reported using at least one positive migraine management technique in anticipation of their migraines appeared to slightly decrease (Table 4).

*Management Stage*

At this stage of migraine management, a significant BMM x Month interaction (Table 3) revealed that participants who received BMM increased their use of positive
migraine management techniques more than participants who did not receive BMM (Figure 2d). Chi-squared analyses indicated that, at the 6-and 12-month evaluations, a greater proportion of BMM participants reported using at least one positive migraine management technique than participants in the no BMM group (Table 3). At the management stage, the increase over time in the percentage of participants using at least one positive technique reported by participants in the BMM group, mirrored increases observed at the proactive and anticipatory stages. As shown in Table 4, at the management stage, these increases were smaller than increases reported at the other two stages.

Palliative Migraine Management Skills

Anticipatory Stage

Somewhat different results were found for palliative migraine management techniques (Table 6). At the anticipatory migraine management stage, a significant BMM x PM x Month interaction (p = .014) was found; there were also significant BMM x Month and PM x Month interactions at this stage (p = .003, p = .001, respectively).

The treatment effect at the anticipatory stage was clarified using a four group (identical groups to those assigned in treatment procedures) x time (month) mixed model. Analyses revealed that all treatment groups significantly differed from placebo (PM, p < .001; BMM, p < .001; PM + BMM, p < .001), but did not differ from one another (PM vs. BMM+PM, p = .709; PM vs. BMM, p = .738; BMM vs. BMM+PM, p = .466).

Further exploration of the four group model indicates that participation in any of the three treatment groups, but not the placebo group helped to decrease the use of palliative migraine management techniques at the anticipatory stage. Chi-squared
analyses indicated that different proportions of participants in the three treatment groups reported using at least one palliative technique at each of two evaluation time points (6-month evaluation: $\chi^2(1, n=232) = 29.67, p<.001$ and 12-month evaluation $\chi^2(1, n=232) = 29.92, p<.001$). Follow-up chi-squared comparisons revealed that, at the 6-month evaluation, a smaller proportion of participants in the BMM, PM and PM+BMM treatment groups ($p = .012$, $p = .004$, & $p < .001$, respectively) each reported using at least one palliative technique than participants in the PL group. The same comparisons were also significant at the 12-month evaluation. Additionally, at the 6- and 12-month evaluation, a smaller proportion of participants in the combined PM+BMM group reported use of one or more palliative techniques than participants in both the PM ($p = .003$, $p = .020$) and BMM ($p = .001$, $p = .001$) groups. The follow-up comparisons indicate that, in addition to differential effects observed between the placebo group and the other three treatment groups, the combined treatment group appeared to affect the number of participants refraining from use of palliative techniques in anticipation of migraines more than either BMM alone or PM alone.

Observation of the percent of participants reporting at least one palliative migraine management technique revealed additional information. At baseline, almost 50% of participants in the PM, BMM and PM+BMM groups reported using at least one palliative technique. At the 6-month evaluation this percent had decreased to between 34 and 17%, with participants in the combined treatment group reporting the sharpest decrease. This decrease continued in all three groups through the 12-month evaluation. However, participants in the placebo group reported an increase in use of palliative migraine management techniques over the course of the study; at baseline 44% reported
using at least one palliative technique, while at the 6-month evaluation the proportion increased to 64%. (Appendix C, Table 9)

**Management Stage**

Analysis of palliative techniques at the management stage of migraine management yielded a marginally significant BMM x Month interaction (p = .06) and a significant BMM main effect (p = .05; Table 6). At the management stage, the significant BMM x Month effect can be seen through the graph in Figure 3b as a decrease in the mean use of palliative migraine management techniques. The significant main effect of BMM is most likely because the mean number of techniques used by participants in the BMM group was larger than the mean for the no BMM group, but during the course of the study these values reversed so the no BMM group had the larger means (Figure 3b).

Chi-square analyses (Table 4) indicate that at the 6-month evaluation a smaller proportion of participants reported using at least one palliative migraine management technique in the BMM than in the no BMM groups. As shown in Table 4, the percent of participants in the BMM group who reported using at least one palliative technique decreased from 93% at baseline to 68% at the 6-month evaluation, while the percent of participants in the no BMM (or drug treatment only) group who reported using at least one palliative technique stayed virtually the same from baseline to the 6-month evaluation. It is to be expected that the majority of participants in each group report using at least one palliative migraine management technique at the management stage, even after BMM treatment. Once a headache has begun it is difficult to stop the pain altogether so migraine sufferers often use palliative techniques to help minimize the pain or to aid in
riding out the headache (e.g., distraction, lying down in a dark room, using ice/hot packs, rubbing neck).

It is of note that similar results were found with both the linear mixed models analyses and the mixed models analyses using a Poisson distribution (Appendix D). It appears the mixed models technique is robust to non-normality within the current data set.

**Moderator Analyses**

For each moderator analysis, the final models from the mixed model analyses above were used. Health-related quality of life and migraine-specific disability at baseline were assessed as moderators in separate analyses.

Health-related quality of life was assessed through the MSQL, where higher scores indicate more impaired quality of life. For palliative migraine management techniques there was a significant Baseline MSQL x PM x Month interaction at the anticipatory stage of migraine management (p = .025), indicating that the baseline level of MSQL moderated the effect of PM on change in the number of palliative techniques used at the anticipatory stage (Figure 4a-c). The reduction in palliative techniques at the anticipatory stage was greater as Baseline MSQL score increased. Chi-squared analyses in Table 7 indicate that individuals with low Baseline MSQL scores decreased their use of palliative migraine management techniques at the same rate in both the PM and no PM groups, but participants with middle or high MSQL scores who received PM decreased their use of palliative techniques more than participants who received no PM.

For positive migraine management techniques, there were no significant Baseline MSQL x BMM x Month interactions at any of the three stages of migraine management
nor was there a significant MSQL x PM x Month interaction (proactive, p = .789; anticipatory, p = .458; management, p = .611).

Migraine-specific disability, assessed by tracking the number of migraine days per month during the OAT Run-in period, was evaluated as a second possible moderator. For use of positive migraine management skills, neither the migraine days x BMM x month interaction nor the migraine days x PM x month interaction were significant at any of the three stages of migraine management (BMM: proactive, p = .371; anticipatory, p = .614; management, p = .827; PM: proactive, p = .569, anticipatory, p = .950, management, p = .993). Analyses of palliative migraine management skills yielded similar results. There were no significant 3-way interactions for either BMM or PM at the anticipatory stage (p = .068, p = .767, respectively). Analysis of the management stage of migraine management also yielded non-significant 3-way interactions (BMM, p = .374; PM, p = .998). Moderation analyses of migraine severity yielded complete non-significant results, demonstrating that number of migraine days reported at baseline had no effect on amount of change in migraine management.

Discussion

To the best of our knowledge, this is the first study examining longitudinal effects of behavioral and pharmacological treatment on migraine management techniques with a migraine-specific assessment of self-management strategies. Participants reported separately on migraine management techniques used at three points before and during a migraine episode and two general categories of migraine management skills (positive and palliative) were assessed. This study demonstrated that certain types of migraine
management skills can be influenced by migraine treatment. Both BMM and PM influenced use of migraine management skills, although they affected migraine management in different ways. BMM increased the use of positive migraine management techniques at all three stages of migraine, while BMM and PM helped to decrease the use of palliative migraine management techniques at the anticipatory stage and BMM served to decrease use of palliative techniques at the management stage. Additional analyses also demonstrated that at the anticipatory stage health-related quality of life serves as a moderator of PM and palliative migraine management techniques so that participants with a lower quality of life at baseline reported greater decreases in palliative techniques.

*Positive Migraine Management*

BMM increased use of positive migraine management techniques at all three stages of migraine management, while PM had virtually no effect. Of note is the rate of increase in positive strategies compared to the rate of decrease in palliative techniques (Tables 3 and 4). The decrease in use of palliative techniques observed with the BMM treatment groups at the anticipatory and management stages was smaller than the increase in positive techniques at the same stage, indicating that BMM had a stronger effect on positive techniques than palliative techniques.

The increase in positive migraine management techniques reported by participants in the BMM groups has important implication for all three migraine management stages. Although participants were most likely to use positive techniques for prevention than in anticipation or management of migraines, at baseline only 42% of BMM participants reported using a positive migraine management technique to prevent migraines (at proactive stage). During the post treatment evaluation period, the percent of participants
who used positive techniques proactively increased to over 90% in the BMM groups. Low utilization of positive migraine management techniques before treatment could be a result of several possible causes. First, before treatment a majority of migraine sufferers may not have been aware of positive migraine management skills. A focus group study conducted with migraine sufferers (n=24) found that migraine sufferers were frustrated with their physicians’ emphasis on medication treatment, leaving patients on their own to research alternative treatment methods (Cottrell, Drew, Waller, Holroyd, Brose, & O’Donnell, 2002), suggesting that many migraine sufferers may have little exposure to or practice with behavioral migraine management skills. Second, migraine sufferers not utilizing positive techniques may lack the confidence or self-efficacy in using migraine management skills because they were not given the opportunity to practice techniques with a practitioner. Third, migraine sufferers may not have expected use of any techniques to affect their migraines (external locus of control). Although there are several possible reasons why migraine sufferers did not utilize positive migraine management techniques prior to treatment, BMM appeared to remedy the situation and teach participants positive techniques that they were able and willing to use as preventive measures.

At the anticipatory migraine management stage, about 10% of participants who received BMM reported using positive migraine management techniques at baseline, as opposed to 80% who reported doing so at the 6-month post treatment evaluation. Migraine is unique to other headache disorders in that there are often warning signs of an oncoming headache (e.g., aura, nausea, prodromal symptoms such as yawning, moodiness, and fatigue) which can prompt migraine sufferers to act before the head pain
begins. The relatively sudden onset of severe pain that can occur with migraine may also lead individuals to “do something” (Hill, 2003). Before participating in BMM, the small number of migraine sufferers who were utilizing positive migraine management techniques in anticipation of an oncoming migraine attack indicates that participants were either unaware of the signs of their oncoming headache or were aware of the signs but unsure what to do about them. By reporting the use of more positive migraine management efforts at the anticipatory migraine management stage after participating in BMM, participants indirectly indicated that after treatment they were able to anticipate the onset of a migraine attack and act accordingly. The ability to detect warning signs and subsequently engage in effective migraine management is important because it may aid migraine sufferers in the prevention of headaches (Bakal, Demjen, & Duckro 1994; Hill, 2003).

Before receiving migraine treatment, virtually all (97%) participants reported using some form of migraine management technique during a migraine attack (management stage). The majority of these migraine sufferers relied on palliative techniques (91%), while very few used positive strategies (6%) during the management stage of migraine management. These findings are relatively consistent with previous research involving migraine sufferers (n=72) receiving treatment at an outpatient clinic (Martins & Parreira, 2001). After BMM, the percent of migraine sufferers reporting use of positive migraine management techniques increased to 18% (compared to 68% reporting palliative techniques). This is the smallest increase observed at any of the three migraine management stages. Even though the increase is small, BMM was still effective in increasing participants’ use of positive techniques to manage a migraine attack. Given
the severity of participants’ migraine in the present study, it is not surprising that most migraine sufferers continued to rely on self-soothing (palliative) migraine management efforts. In Martin and Parreira’s study (2001), migraine sufferers reported that several migraine management techniques (e.g., remaining still; used by 89% of sample) were implemented not to relieve pain, but to prevent exacerbation of the pain. Thus, many migraine sufferers may believe that palliative migraine management techniques involving concentration or physical activity, such as progressive muscle relaxation or tender point massage, are incompatible with their desire to remain still in an effort to prevent the worsening of migraine pain (Hill, 2003). Also, it is possible that positive migraine management techniques may be of little value at this stage of a migraine.

_Palliative Migraine Management_

Although it was unclear the kind of effect participating in behavioral or pharmacological treatment would have on palliative migraine management strategies (1) because of the lack of research evaluating this type of migraine management and (2) because BMM, specifically, encourages selective use of palliative techniques during a migraine, analyses revealed that there was an interactive effect between behavioral treatments, pharmacological treatments and time at the anticipatory stage. Treatment groups significantly differed from the placebo group and not from each other, indicating that BMM, PM and BMM + PM each reduced the number of strategies used over the course of the study. However, it is important to note that treatment was able to decrease participants’ use of palliative techniques in anticipation of a migraine. At baseline close to 50% of migraine sufferers in the three treatment groups reported using at least one palliative strategy in anticipation of their migraines, whereas at the end of the 12-month
post treatment evaluation period under 30% of participants reported using palliative strategies at the anticipatory stage. The decrease in use of palliative migraine management techniques in anticipation of a headache may also be due to the increase in positive techniques reported at the same migraine management stage. Like during the proactive stage, migraine sufferers may have replaced unhelpful palliative techniques with useful positive techniques.

As with anticipation of migraines, palliative migraine management techniques used to manage a migraine attack also decreased; however, at this stage only BMM significantly changed palliative migraine management techniques. The decrease in palliative techniques at the management stage can be attributed to a few causes. First, migraine sufferers’ migraine management repertoire may be very limited before participating in behavioral treatment. Although discussed in headache-related literature and media sources (i.e., National Headache Foundation, www.headaches.org; World Health Organization, http://www.who.int/mediacentre/factsheets), the participants may never have been exposed to migraine management skills that might be helpful in managing migraines (Hill, 2003). In a focus group study, for example, migraine sufferers (n=24) voiced frustration regarding their physicians’ emphasis on medication treatment, leaving patients on their own to research alternative treatment methods (Cottrell et al., 2002). Left to their own devices, migraine sufferers apparently focused on palliative migraine management techniques to manage migraine attacks, such as isolation in a dark room, use of an ice/hot pack, and taking a nap. Additionally, a recent study of chronic pain found that use of several pain coping strategies after treatment varied as a function of pain severity, suggesting that those experiencing severe pain may not find the coping
strategies beneficial and as a result use more and more strategies (Jensen & Karoly, 1991). A similar effect may have occurred in the present study; migraine sufferers may have been using several palliative migraine management techniques because use of just one technique was not helping reduce their head pain.

Being able to replace some palliative techniques with a few effective positive migraine management techniques taught through BMM (i.e., neck/shoulder stretches, stress management, positive self-statements) most likely helped reduce the number of palliative techniques migraine sufferers used during a migraine episode, partly because the positive techniques helped reduce head pain and partly because they may have helped migraine sufferers feel more in control of their migraines. The process behind this change in palliative coping after BMM will have to be the subject of future studies, however.

Long Term Effects of Treatment

The change in positive migraine management techniques across all three migraine management stages reported by participants who received BMM was maintained over the 12 month evaluation period (Table 3 & Figure 2a-d). Likewise, the decreases in palliative coping reported by both PM and BMM participants at the anticipatory stage and reported by BMM participants at the management stages were maintained through the 12 month evaluation (Table 6 & Figure 3a-b). These findings support the findings reported by Sorbi and colleagues (1989), whereby three-years after treatment participants reported continued use of self-management techniques (i.e., positive self statements) taught during treatment. Similarly, a longitudinal study examining the effects of self-management treatment on use of self-management techniques to manage another episodic disorder, asthma, demonstrated that at 12-month follow-up participants reported sustained
improvement in cognitive techniques and use of self-management skills taught during treatment (Kotses, Bernstein, Bernstein, Reynolds, Korbee, Wigal, et al., 1995). The current results, combined with the findings by Sorbi et al. (1989), provide support for the long term maintenance of migraine management skills taught through behavioral migraine treatment.

**Moderation Effects**

The one significant moderation effect provided some insight into additional mechanisms influencing the effect of treatment on migraine management behaviors. Health-related quality of life moderated the rate of change in palliative migraine management techniques at the anticipatory stage for migraine sufferers who participated in PM. The combination of the moderation and PM treatment effects demonstrates that PM reduced migraine sufferers’ use of palliative migraine management techniques at the anticipatory stage, but that change happened at an increased rate for those who reported poorer health-related quality of life at baseline (demonstrated by high baseline MSQL scores). One explanation could have been that migraine sufferers who reported poorer migraine-related quality of life at baseline may be so debilitated by their migraines that they had more room for change in their behaviors than migraine sufferers who reported better health-related quality of life. Another explanation could be that participants who reported higher baseline health-related quality of life were using less palliative migraine management techniques to begin with, thus, they had less room for change during the study.

Results indicated that migraine-related disability was not a significant moderator in any analysis. Non-significant results could be explained by the fact that migraine
severity (migraine days/month) was an indirect assessment of participants’ baseline level of migraine-related disability and may not have fully captured the nature of migraine disability. On the other hand, the migraine severity variable may have been an accurate assessment of migraine-related disability, indicating that this particular individual level variable did not affect the rate of change in migraine management strategies due to behavioral and preventive medication treatments.

Clinical Implications

The changes in positive migraine management behaviors found in this study have important clinical implications. People who received BMM increased their use of several positive migraine management techniques generally considered good methods to prevent or manage migraines – sleeping and eating on a regular schedule or avoiding stress. However, individuals who received only medication did not increase their use of any positive techniques. In the focus group conducted by Cottrell and colleagues (2002), migraine sufferers reported difficulty obtaining information from physicians about techniques to treat migraines other than through use of medication. Knowing that learning about medication treatment alone will not increase the use of positive migraine management techniques and that many migraine management patients do not receive additional information to help their migraines, it is essential to communicate to healthcare professionals the importance of educating migraine sufferers about the potential benefits of behavioral migraine management approaches to managing migraines.

Limitations

Measures used in this study were all self-report and were administered with increasing periods of time between assessments as the study progressed. Self-report
measures come with the inherent recall limitations which may have been magnified by the long periods of time between administrations. However, there is the possibility that such limitations were not a major issue in the current study. Migraine sufferers who participated in the study experienced frequent migraines and it is likely that at data collection times participants had experienced a recent migraine which could be used as a reference. If recall was an issue, one alternative would have been to include questions about use of migraine management strategies within the Electronic Headache Diary. Participants could have been prompted with the ICE-M questions daily. However, answering migraine management questions daily might become tedious and contribute to higher dropout rates. An obvious strength of one measure, the ICE-M, is its open-ended interview questions rather than written checklists (Hill, et al., 1999b; Hill, 2003). Open-ended questions are less likely to lead participants and prompt certain coping efforts (Hill, 2003). Moreover, the open-ended questions may better capture novel coping strategies developed by participants and not simply those strategies taught in treatment.

In treatment studies use of a no-treatment control group is suggested in some situations, while others suggest use of a placebo group (Kendall, Holmbeck, & Verduin, 2004). In planning the TSM trial (the larger treatment study within which this study is contained) methodology the investigators agreed with the latter suggestion. They felt it would be inappropriate to place migraine sufferers who experience migraines at such a high frequency on a wait list. With a placebo control group contained in the study, expectancy effects observed by merely giving participants the impression they are being treated can be controlled for even though changes in migraine management that occur by chance cannot be modeled (Kendall et al., 2004). It is also of note that every group
received OAT in addition to being randomized into one of the four research groups. Because the placebo group also received OAT, it was treated as another treatment comparison group and not a true placebo group.

**Future Directions**

Future research investigating the effects of treatment on migraine management behaviors should attempt to include a more representative sample of migraine sufferers, in terms of ethnicity, gender, and diagnostic severity to examine the extent to which these findings can be generalized. Moreover, as this one of the first studies to begin to fill a large gap in the migraine literature, additional inquiry into the specific migraine management strategies participants are using following treatment can provide information regarding more effective migraine management techniques and help to tailor treatments like BMM to the specific needs of the migraine patient.

Presently, there are few studies that have assessed the relationship between treatment outcome (e.g., reduction in headache frequency, severity, intensity) and change in migraine management behaviors (Reid & McGrath, 1996). The empirical studies that have examined this relationship did not assess the full range of migraine-specific coping and management efforts and often mistook adjustment and appraisal for migraine management (Blanchard et al., 1990; Jensen & Karoly, 1991; Sorbi et al., 1989; ter Kuile, Spinhoven, Kinssen, & Hounwelingen, 1995). Additional exploration into the relationship between treatment outcome and migraine management behaviors, specifically examining if change in migraine management behaviors at certain stages (i.e., use of more effective positive or palliative migraine management behaviors at the management stage) leads to more improvement in treatment outcome above and beyond
other known predictors, would be helpful in understanding the mechanisms behind successful migraine treatment.

There are a few issues in the assessment of the relationship between migraine management techniques and treatment outcome that need to be addressed in any future treatment outcome studies. First, individuals may use more migraine management techniques if one does not work. Thus, use of more techniques could mean a poorer outcome. Second, the effectiveness of each migraine management technique utilized by an individual is not evaluated in the ICE-M. Because the use of one effective migraine management technique may be better than four ineffective techniques, it would be important to address the question of effectiveness.

Future moderation analyses could also shed more light on the mechanisms involved in change in migraine management behaviors after treatment. There are multiple individual-level and group-level variables, such as headache-specific locus of control and headache self-efficacy that could be explored as possible moderators in future analyses. For example, social learning theory (Bandura, 1977) suggests that, compared to individuals with high self-efficacy, those with low self-efficacy would not take any direct, systematic action to prevent or manage a stressor such as a headache, and thus are less likely to engage in positive migraine management efforts than their high self-efficacy counterparts. Hill (2003) found that higher levels of self-efficacy were associated with higher frequencies of positive migraine management techniques at all stages of migraine management. However, such a relationship has not been examined within a longitudinal framework. Hill (2003) also found a similar relationship with locus of control, with greater internal locus of control positively related to greater frequency in positive
migraine management techniques. Once again, this relationship was only examined at one time point, not over the course of a longitudinal treatment study to examine the long term relationship between this expectancy variable and migraine management.

Conclusions

In summary, the present study begins to fill a gap in the literature by providing more information about the effectiveness of migraine treatments in helping migraine sufferers develop migraine management skills. Specifically, this study provides more comprehensive information regarding the effect of behavioral and pharmacological migraine treatments on migraine-specific management techniques, demonstrating that BMM increased positive techniques at all three migraine management stages and decreased palliative techniques at the management stage. Participants in BMM were able to apply positive migraine management techniques learned through treatment and, in the process, replace several palliative techniques they had been using before treatment. Additionally, BMM and PM decreased palliative techniques at the anticipatory migraine management stage. Taken together, the pattern of changes in migraine management suggests that providing migraine management interventions can affect how migraine sufferers manage their migraines (e.g., increases of the targeted migraine management skills and decreases of the migraine management techniques not discussed; Hill, 2003).
References


Appendix A: Figures and Tables

Figure 1

*Procedure for Treatment of Severe Migraine Trial (TSM)*

- **Acute Therapy**
  - OAT + PL
  - OAT + PR
  - OAT + BMM
  - OAT + PR + BMM

- **Evaluation**

<table>
<thead>
<tr>
<th>Months</th>
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†"C" = Clinic visits outside of treatment phase

* Bold Months = ICE-M administered
Figure 2a

Use of Positive Migraine Management Techniques over 16 Months
Figure 2b

Use of Positive Migraine Management Techniques over 16 Months (cont.)
Figure 2c

Use of Positive Migraine Management Techniques over 16 Months (cont.)

Anticipatory Stage

![Graph showing use of positive migraine management techniques over 16 months.]
Figure 2d

Use of Positive Migraine Management Techniques over 16 Months (cont.)
Figure 3a

Use of Palliative Migraine Management Techniques over 16 Months
Figure 3b

Use of Palliative Migraine Management Techniques over 16 Months (cont.)
Figure 4a

*Graphs of MSQL Moderation Effects for Anticipatory Stage of Palliative Migraine Management*
Figure 4b

Graphs of MSQL Moderation Effects for Anticipatory Stage of Palliative Migraine Management (cont.)
Figure 4c

Graphs of MSQOL Moderation Effects for Anticipatory Stage of Palliative Migraine Management (cont.)
Table 1

*Common Migraine Management Strategies Reported by TSM Study Participants*¹

<table>
<thead>
<tr>
<th>Positive Strategies</th>
<th>Palliative Strategies</th>
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<tbody>
<tr>
<td><strong>Systematic Muscle tension reduction strategies:</strong></td>
<td><strong>Unsystematic muscle tension reduction strategies:</strong></td>
</tr>
<tr>
<td>• Practicing meditation or yoga in a regular basis.</td>
<td>• Changing position in chair at work (but not addressing ergonomic factors)</td>
</tr>
<tr>
<td>• Engaging in deep breathing (e.g., diaphragmatic breathing).</td>
<td>• Unsystematic relaxation (e.g., lying on the couch and watching television or reading).</td>
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<tr>
<td>• Practicing stretching exercises periodically throughout the day.</td>
<td>• Engaging in neck rolls or shoulder shrugs.</td>
</tr>
<tr>
<td><strong>Systematic behavioral and cognitive strategies:</strong></td>
<td>• Sitting/laying down in a quiet, dark place.</td>
</tr>
<tr>
<td>• Keeping a regular sleep and meal schedule.</td>
<td><strong>Ignore pain:</strong></td>
</tr>
<tr>
<td>• Avoiding foods that trigger migraines.</td>
<td>• Ignoring the headache, prodromal symptoms, or aura and continuing with daily routine.</td>
</tr>
<tr>
<td>• Avoiding stressful situations at work that can trigger migraines.</td>
<td>• Thinking about something else to distract from the headache pain.</td>
</tr>
<tr>
<td>• Engaging in positive self-talk (e.g., “I tell myself that I can make it through this migraine.”)</td>
<td><strong>Other behaviors designed to reduce head pain or associated stress:</strong></td>
</tr>
<tr>
<td>• Reinterpreting pain sensations as manageable, short-term, etc.</td>
<td>• Using a hot or cold pack on head/neck.</td>
</tr>
<tr>
<td></td>
<td>• Eating or drinking water or non-alcoholic beverage.</td>
</tr>
<tr>
<td></td>
<td>• Doing a general exercise activity.</td>
</tr>
</tbody>
</table>

¹ Based on answers to the Interview of Coping Efforts-Migraine (ICE-M; Hill, 2002). See Methods section for description.
Table 2

Baseline Demographics, Levels of MSQL, and Migraine Headache Days by Treatment Condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Placebo</th>
<th>PM only</th>
<th>BMM only</th>
<th>BMM + PM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M (SD)</td>
<td>% in</td>
<td>N</td>
</tr>
<tr>
<td>Age</td>
<td>55</td>
<td>39.53 (10.19)</td>
<td>53</td>
<td>37.68 (10.13)</td>
</tr>
<tr>
<td>Education</td>
<td>55</td>
<td>14.69 (2.21)</td>
<td>53</td>
<td>14.74 (2.47)</td>
</tr>
<tr>
<td>SES</td>
<td>53</td>
<td>0.002 (.938)</td>
<td>44</td>
<td>-0.03 (-.103)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>47</td>
<td>85.5</td>
<td>44</td>
<td>83.0</td>
</tr>
<tr>
<td>Black</td>
<td>7</td>
<td>12.7</td>
<td>9</td>
<td>17.0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>1.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>18.2</td>
<td>8</td>
<td>15.1</td>
</tr>
<tr>
<td>Female</td>
<td>45</td>
<td>81.8</td>
<td>45</td>
<td>84.9</td>
</tr>
<tr>
<td>MSQL</td>
<td>55</td>
<td>40.3 (13.4)</td>
<td>53</td>
<td>40.3 (13.4)</td>
</tr>
<tr>
<td>MA Days</td>
<td>55</td>
<td>8.4 (4.3)</td>
<td>53</td>
<td>8.6 (3.0)</td>
</tr>
</tbody>
</table>

*Total N = 232, unless otherwise specified

*Percent of participants in each category

*Socioeconomic status = normalized factor with range of -1 to 1 includes years of education completed and annual income, N = 210.

*MA = Migraine
Table 3

*Parameter Estimation for Longitudinal Models of Change in Positive Migraine Management During and After Treatment*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proactive Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMM&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.088</td>
<td>0.243</td>
<td>.719</td>
</tr>
<tr>
<td>PM&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.449</td>
<td>0.240</td>
<td>.016</td>
</tr>
<tr>
<td>Month&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.723</td>
<td>0.069</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>BMM * Month</td>
<td>-0.761</td>
<td>0.104</td>
<td>&lt; .001</td>
</tr>
<tr>
<td><strong>Anticipatory Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMM</td>
<td>-0.098</td>
<td>0.135</td>
<td>.221</td>
</tr>
<tr>
<td>PM</td>
<td>0.031</td>
<td>0.134</td>
<td>.918</td>
</tr>
<tr>
<td>Month</td>
<td>0.418</td>
<td>0.044</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>BMM * Month</td>
<td>-0.448</td>
<td>0.067</td>
<td>&lt; .001</td>
</tr>
<tr>
<td><strong>Management Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMM</td>
<td>0.001</td>
<td>0.073</td>
<td>.625</td>
</tr>
<tr>
<td>PM</td>
<td>-0.012</td>
<td>0.072</td>
<td>.454</td>
</tr>
<tr>
<td>Month</td>
<td>0.188</td>
<td>0.028</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>BMM * Month</td>
<td>-0.226</td>
<td>0.042</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

<sup>a</sup> BMM = 1, no BMM = 0  <sup>b</sup> PM = 1, no PM = 0  <sup>c</sup> Natural log of month used
Table 4

Percent of BMM and no BMM Participants Using at Least One Migraine Management Strategy over Time

<table>
<thead>
<tr>
<th>Treatment Groupa</th>
<th>BMM</th>
<th>no BMM</th>
<th>$\chi^2_{b}$</th>
<th>p</th>
<th>BMM</th>
<th>no BMM</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive Migraine Management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proactive Stage Baseline</td>
<td>41.9</td>
<td>59.3</td>
<td>6.93</td>
<td>.008**</td>
<td>Baseline</td>
<td>47.6</td>
<td>44.4</td>
<td>0.23</td>
</tr>
<tr>
<td>Post Treatmentc</td>
<td>96.0</td>
<td>51.9</td>
<td>60.62</td>
<td>&lt;.001†</td>
<td>Post Treatment</td>
<td>33.9</td>
<td>48.1</td>
<td>4.88</td>
</tr>
<tr>
<td>Evaluation 6-monthd</td>
<td>95.2</td>
<td>50.9</td>
<td>59.56</td>
<td>&lt;.001†</td>
<td>6-month</td>
<td>29.8</td>
<td>55.6</td>
<td>15.69</td>
</tr>
<tr>
<td>12-monthf</td>
<td>93.5</td>
<td>51.9</td>
<td>52.34</td>
<td>&lt;.001†</td>
<td>12-month</td>
<td>30.6</td>
<td>53.3</td>
<td>12.14</td>
</tr>
<tr>
<td><strong>Anticipatory Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>10.5</td>
<td>13.9</td>
<td>0.63</td>
<td>.427</td>
<td>Baseline</td>
<td>92.7</td>
<td>88.9</td>
<td>1.04</td>
</tr>
<tr>
<td>Post Treatment</td>
<td>75.0</td>
<td>0.9</td>
<td>0.01g</td>
<td>&lt;.001†</td>
<td>Post Treatment</td>
<td>75.8</td>
<td>78.7</td>
<td>2.75</td>
</tr>
<tr>
<td>Evaluation 6-month</td>
<td>79.8</td>
<td>4.6</td>
<td>0.01g</td>
<td>&lt;.001†</td>
<td>6-month</td>
<td>67.7</td>
<td>87.0</td>
<td>12.03</td>
</tr>
<tr>
<td>12-month</td>
<td>79.0</td>
<td>5.6</td>
<td>0.01g</td>
<td>&lt;.001†</td>
<td>12-month</td>
<td>59.7</td>
<td>63.9</td>
<td>0.43</td>
</tr>
<tr>
<td><strong>Management Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>5.6</td>
<td>6.5</td>
<td>0.07</td>
<td>.790</td>
<td>Baseline</td>
<td>25.0</td>
<td>1.9</td>
<td>25.35</td>
</tr>
<tr>
<td>Post Treatment</td>
<td>25.0</td>
<td>1.9</td>
<td>25.35</td>
<td>&lt;.001†</td>
<td>Post Treatment</td>
<td>17.7</td>
<td>1.9</td>
<td>15.72</td>
</tr>
<tr>
<td>Evaluation 6-month</td>
<td>17.7</td>
<td>1.9</td>
<td>15.72</td>
<td>&lt;.001†</td>
<td>6-month</td>
<td>17.7</td>
<td>1.9</td>
<td>15.72</td>
</tr>
</tbody>
</table>

a Group sizes: N = 124, N = 108, respectively. Missing cases estimated through linear mixed models.
b df = 1 for all tests.  c Month 5 of study.
d Month 6 of evaluation period was 10th month of study.
f Month 12 of evaluation period was month 16 of study.
g cells counts less than 5, small number corrected for in calculating significance.
*p<.05  **p<.01 † p<.001
Table 5

Percent of PM and no PM Participants Using at Least One Migraine Management Strategy over Time

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>PM</th>
<th>no PM</th>
<th>$\chi^2$</th>
<th>p</th>
<th>PM</th>
<th>no PM</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proactive Stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>42.6</td>
<td>58.2</td>
<td>5.60</td>
<td>.018</td>
<td>Baseline</td>
<td>46.7</td>
<td>45.5</td>
<td>0.04</td>
</tr>
<tr>
<td>Post Treatmentc</td>
<td>70.5</td>
<td>80.9</td>
<td>3.39</td>
<td>.066</td>
<td>Post Treatment</td>
<td>30.3</td>
<td>51.8</td>
<td>11.09</td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-monthd</td>
<td>74.6</td>
<td>74.5</td>
<td>0.00</td>
<td>.994</td>
<td>6-month</td>
<td>27.9</td>
<td>57.3</td>
<td>20.56</td>
</tr>
<tr>
<td>12-monthf</td>
<td>73.0</td>
<td>75.5</td>
<td>0.19</td>
<td>.664</td>
<td>12-month</td>
<td>27.0</td>
<td>56.9</td>
<td>12.16</td>
</tr>
</tbody>
</table>

a Group sizes: N = 122, N = 110, respectively. Missing cases estimated through linear mixed models.
b df = 1 for all tests.
c Month 5 of study.
d Month 6 of evaluation period was 10th month of study.
f Month 12 of evaluation period was month 16 of study.
*p<.05   **p<.01 † p<.001
Table 6

Parameter Estimation for Longitudinal Models of Change in Palliative Migraine Management During and After Treatment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticipatory Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMM(^a)</td>
<td>0.091</td>
<td>0.134</td>
<td>.308</td>
</tr>
<tr>
<td>PM(^b)</td>
<td>0.085</td>
<td>0.133</td>
<td>.280</td>
</tr>
<tr>
<td>Month(^c)</td>
<td>-0.150</td>
<td>0.042</td>
<td>.011</td>
</tr>
<tr>
<td>BMM * Month</td>
<td>0.024</td>
<td>0.064</td>
<td>.003</td>
</tr>
<tr>
<td>PM * Month</td>
<td>0.046</td>
<td>0.063</td>
<td>.001</td>
</tr>
<tr>
<td>BMM<em>PM</em>Month</td>
<td>0.225</td>
<td>0.091</td>
<td>.014</td>
</tr>
<tr>
<td><strong>Management Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMM</td>
<td>-0.234</td>
<td>0.167</td>
<td>.046</td>
</tr>
<tr>
<td>Month</td>
<td>-0.426</td>
<td>0.054</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>BMM * Month</td>
<td>0.215</td>
<td>0.082</td>
<td>.061</td>
</tr>
</tbody>
</table>

\(^a\) BMM = 1, no BMM = 0  \(^b\) PM = 1, no PM = 0  \(^c\) Log of month used
Table 7

Percent of PM and no PM Participants Using at Least One Palliative Migraine Management Strategy at Three Levels of MSQOL over Time

<table>
<thead>
<tr>
<th></th>
<th>PM</th>
<th>no PM</th>
<th>$\chi^2_{b}$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticipatory Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low MSQOL $^a$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>47.5</td>
<td>51.72</td>
<td>0.120</td>
<td>0.73</td>
</tr>
<tr>
<td>(40)</td>
<td>(29)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eval 6 $^d$</td>
<td>22.5</td>
<td>31.0</td>
<td>0.064</td>
<td>0.43</td>
</tr>
<tr>
<td>(40)</td>
<td>(29)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eval 12 $^f$</td>
<td>17.5</td>
<td>20.7</td>
<td>0.112</td>
<td>0.74</td>
</tr>
<tr>
<td>(40)</td>
<td>(29)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Middle MSQOL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>9.1</td>
<td>41.9</td>
<td>0.040</td>
<td>0.84</td>
</tr>
<tr>
<td>(46)</td>
<td>(56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eval 6</td>
<td>26.1</td>
<td>50.0</td>
<td>6.059</td>
<td>0.014*</td>
</tr>
<tr>
<td>(46)</td>
<td>(56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eval 12</td>
<td>19.6</td>
<td>37.5</td>
<td>3.913</td>
<td>0.048*</td>
</tr>
<tr>
<td>(46)</td>
<td>(56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>High MSQOL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>55.6</td>
<td>48.0</td>
<td>0.337</td>
<td>0.56</td>
</tr>
<tr>
<td>(36)</td>
<td>(25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eval 6</td>
<td>25.0</td>
<td>72.0</td>
<td>13.211</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>(36)</td>
<td>(26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eval 12</td>
<td>30.6</td>
<td>84.0</td>
<td>16.898</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>(36)</td>
<td>(26)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$a$ low MSQOL = scores between 0 and 30, middle = scores across mean, between 30 and 50, high = scores above 50 (mean = 39, st. dev. = 12.39)

$b$ df = 1 for all tests.

$c$ Month 12 of evaluation period was 16th month of study.

$d$ Month 6 of evaluation period was 10th month of study.

$e$ Missing cases estimated through linear mixed models.

$p<.05$  **$p<.001$
## Appendix B: Measures

### Interview of Coping Efforts

#### INTERVIEW OF COPING EFFORTS – MIGRAINE (ICE-M)

<table>
<thead>
<tr>
<th>ID # _______________________</th>
<th>Patient #:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Visit:</td>
<td>____ 1</td>
<td>____ 2</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up Visit:</td>
<td></td>
<td>____ 1 month</td>
</tr>
</tbody>
</table>

### PROACTIVE Coping Strategy

1a. What do you do on a regular basis to keep from getting migraines, if anything? (i.e., regardless of whether pt. anticipates a migraine. Write response verbatim.)

<table>
<thead>
<tr>
<th>Category (Enter Frequency)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1b. How often do you x to prevent migraines?

<table>
<thead>
<tr>
<th>Category (Enter Frequency)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Number of Strategies | |

### ANTICIPATORY Coping Strategy

2a. Do you have continuous headaches? No Yes (skip to question #3a)

2b. What do you do when you feel a migraine is about to begin, if anything? (Before any pain is present!) (Write response verbatim.)

<table>
<thead>
<tr>
<th>Category (Enter Frequency)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Number of Strategies | |

2c. How often do you x when a migraine is about to begin?

<table>
<thead>
<tr>
<th>Category (Enter Frequency)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Number of Strategies | |
### 3a. Have you stopped getting migraines?  
- No
- Yes (skip to question #3a)

### MANAGEMENT Coping Strategy

#### 3b. What do you do when you have a migraine, if anything? (Write response verbatim.)

<table>
<thead>
<tr>
<th>Ø</th>
<th>Rar</th>
<th>Occ</th>
<th>Oft</th>
<th>Freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

#### 3c. How often do you x when a migraine is about to begin?

<table>
<thead>
<tr>
<th>Ø</th>
<th>Rar</th>
<th>Occ</th>
<th>Oft</th>
<th>Freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
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<td>3</td>
<td>4</td>
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<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tbody>
</table>

#### Category

- (Enter Frequency)

<table>
<thead>
<tr>
<th>Pos</th>
<th>Pal</th>
<th>Med</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sum</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Number of Strategies</th>
</tr>
</thead>
</table>
Please fill out this questionnaire. It will help us understand the effects of migraine headache on your daily activities.

The questionnaire has been designed so that it can be completed quickly and easily. Please check only one answer for each question. You should answer every question.

Thank you for your time.

While answering the following questions, please think about all migraine attacks you may have had in the past 4 weeks.

1. In the past 4 weeks, how often have migraines interfered with how well you dealt with family, friends, and others who are close to you? (Select only one response.)

   1 □ None of the time
   2 □ A little bit of the time
   3 □ Some of the time
   4 □ A good bit of the time
   5 □ Most of the time
   6 □ All of the time

2. In the past 4 weeks, how often have migraines interfered with your leisure time activities, such as reading or exercising? (Select only one response.)

   1 □ None of the time
   2 □ A little bit of the time
   3 □ Some of the time
   4 □ A good bit of the time
   5 □ Most of the time
6. All of the time

3. In the past 4 weeks, how often have you had difficulty in performing work or daily activities because of migraine symptoms? (Select only one response.)

   1. None of the time
   2. A little bit of the time
   3. Some of the time
   4. A good bit of the time
   5. Most of the time
   6. All of the time

4. In the past 4 weeks, how often did migraines keep you from getting as much done at work or at home? (Select only one response.)

   1. None of the time
   2. A little bit of the time
   3. Some of the time
   4. A good bit of the time
   5. Most of the time
   6. All of the time

5. In the past 4 weeks, how often did migraines limit your ability to concentrate on work or daily activities? (Select only one response.)

   1. None of the time
   2. A little bit of the time
   3. Some of the time
   4. A good bit of the time
   5. Most of the time
   6. All of the time
6. In the past 4 weeks, how often have migraines left you too tired to do work or daily activities? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time

7. In the past 4 weeks, how often have migraines limited the number of days you have felt energetic? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time

8. In the past 4 weeks, how often have you had to cancel work or daily activities because you had a migraine? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time
9. In the past 4 weeks, how often did you need help in handling routine tasks such as everyday household chores, doing necessary business, shopping, or caring for others, when you had a migraine? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time

10. In the past 4 weeks, how often did you have to stop work or daily activities to deal with migraine symptoms? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time

11. In the past 4 weeks, how often were you not able to go to social activities such as parties, dinner with friends, because you had a migraine? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time
12. In the past 4 weeks, how often have you felt fed up or frustrated because of your migraines? (Select only one response.)

1 □ None of the time
2 □ A little bit of the time
3 □ Some of the time
4 □ A good bit of the time
5 □ Most of the time
6 □ All of the time
### Appendix C: Additional Tables

#### Table 8

**Descriptive Statistics for Migraine Management Variables by Time**

<table>
<thead>
<tr>
<th>Measure Time</th>
<th>Statistics</th>
<th>Positive Migraine Management</th>
<th>Statistic</th>
<th>Palliative Migraine Management</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Range&lt;sup&gt;b&lt;/sup&gt;</td>
<td>≥ 1 strategy&lt;sup&gt;c&lt;/sup&gt;</td>
<td>N&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Range&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Proactive Stage</td>
<td>Baseline</td>
<td>232</td>
<td>0 – 2</td>
<td>50.0</td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td>Evaluation</td>
<td>158</td>
<td>0 – 6</td>
<td>72.8</td>
<td>Evaluation</td>
</tr>
<tr>
<td></td>
<td>3-months</td>
<td>126</td>
<td>0 – 8</td>
<td>70.7</td>
<td>3-months</td>
</tr>
<tr>
<td></td>
<td>9-months</td>
<td>117</td>
<td>0 – 6</td>
<td>74.1</td>
<td>9-months</td>
</tr>
<tr>
<td></td>
<td>12-months</td>
<td></td>
<td></td>
<td></td>
<td>12-months</td>
</tr>
<tr>
<td>Anticipatory Stage</td>
<td>Baseline</td>
<td>232</td>
<td>0 – 2</td>
<td>12.1</td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td>Evaluation</td>
<td>158</td>
<td>0 – 7</td>
<td>35.8</td>
<td>Evaluation</td>
</tr>
<tr>
<td></td>
<td>3-months</td>
<td>124</td>
<td>0 – 4</td>
<td>36.2</td>
<td>3-months</td>
</tr>
<tr>
<td></td>
<td>9-months</td>
<td>114</td>
<td>0 – 3</td>
<td>50.9</td>
<td>9-months</td>
</tr>
<tr>
<td></td>
<td>12-months</td>
<td></td>
<td></td>
<td></td>
<td>12-months</td>
</tr>
<tr>
<td>Management Stage</td>
<td>Baseline</td>
<td>232</td>
<td>0 – 3</td>
<td>6.0</td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td>Evaluation</td>
<td>153</td>
<td>0 – 3</td>
<td>13.8</td>
<td>Evaluation</td>
</tr>
<tr>
<td></td>
<td>3-months</td>
<td>118</td>
<td>0 – 3</td>
<td>8.6</td>
<td>3-months</td>
</tr>
<tr>
<td></td>
<td>9-months</td>
<td>109</td>
<td>0 – 3</td>
<td>10.3</td>
<td>9-months</td>
</tr>
</tbody>
</table>

<sup>a</sup> Missing cases estimated through linear mixed models to reach total N of 232

<sup>b</sup> Range of number of strategies reported at each time point

<sup>c</sup> Percent of participants utilizing at least one coping strategy, percentages taken from N = 232
Table 9

*Comparisons of Percent of Participants Using at least one Palliative Migraine Management Strategy at the Anticipatory Stage*

<table>
<thead>
<tr>
<th>Treatment Group(^a)</th>
<th>PL</th>
<th>PM</th>
<th>BMM</th>
<th>PM+BMM</th>
<th>(\chi^2)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-month Eval(^c)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PL vs PM</td>
<td>69.1</td>
<td>41.5</td>
<td></td>
<td></td>
<td>8.32</td>
<td>.004</td>
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<tr>
<td>PL vs BMM</td>
<td>69.1</td>
<td>45.5</td>
<td></td>
<td></td>
<td>6.28</td>
<td>.012</td>
</tr>
<tr>
<td>PL vs PM+BMM</td>
<td>69.1</td>
<td>17.4</td>
<td></td>
<td>33.99</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>PM vs BMM</td>
<td>41.5</td>
<td>45.5</td>
<td></td>
<td></td>
<td>0.17</td>
<td>.679</td>
</tr>
<tr>
<td>PM vs PM+BMM</td>
<td>41.5</td>
<td>17.4</td>
<td></td>
<td>8.67</td>
<td>.003</td>
<td></td>
</tr>
<tr>
<td>BMM vs PM+BMM</td>
<td>45.5</td>
<td>17.4</td>
<td></td>
<td>11.51</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>12-month Eval(^d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PL vs PM</td>
<td>68.5</td>
<td>37.7</td>
<td></td>
<td></td>
<td>10.18</td>
<td>.001</td>
</tr>
<tr>
<td>PL vs BMM</td>
<td>68.5</td>
<td>45.5</td>
<td></td>
<td></td>
<td>5.91</td>
<td>.015</td>
</tr>
<tr>
<td>PL vs PM+BMM</td>
<td>68.5</td>
<td>18.8</td>
<td></td>
<td>30.99</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>PM vs BMM</td>
<td>37.7</td>
<td>45.5</td>
<td></td>
<td>0.66</td>
<td>.416</td>
<td></td>
</tr>
<tr>
<td>PM vs PM+BMM</td>
<td>37.7</td>
<td>18.8</td>
<td></td>
<td>5.42</td>
<td>.020</td>
<td></td>
</tr>
<tr>
<td>BMM vs PM+BMM</td>
<td>45.5</td>
<td>18.8</td>
<td></td>
<td>10.20</td>
<td>.001</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Group sizes: N = 55, N = 53, N = 55, N = 55, respectively.

\(^b\) df = 1 for all tests.

\(^c\) Month 6 of evaluation period was 10\(^{th}\) month of study.

\(^d\) Month 12 of evaluation period was 16\(^{th}\) month of study.
Appendix D: Additional Results

Because the outcome variable, assessed via the ICE-M, is a highly skewed counting variable with a restricted range of values (0-4, at the largest range), change in migraine management was examined using a mixed models analysis that fitted the migraine management variables to a Poisson distribution. Final models for both sets of analyses are shown in Tables 10 and 11.

Analyses of positive migraine management techniques demonstrated the same results as the linear mixed models analyses. A significant Month x BMM interaction was found at the proactive stage (p < .0001), at the anticipatory stage (p < .0001), and at the management stage (p < .0001). These results demonstrate that BMM treatment significantly increased the number of positive migraine management techniques used at each stage of migraine management, relative to those who received no BMM.

Analyses of palliative migraine management techniques were slightly different than linear mixed model analyses. At the anticipatory stage only a significant BMM x Month interaction (p < .0001) was found. At the management stage, the BMM x PM x Month interaction (p = .05) and the Month x BMM interaction were significant (p = .039). Additional analyses of the four-group treatment x time (month) mixed models revealed that at the management stage there was only one significant difference between the treatment groups (OAT + PM vs. OAT + BMM + PM, p = .042), indicating that there was a difference in change of palliative migraine management techniques between the group receiving PM and the group receiving both PM and BMM.
Moderator Analyses

For each moderator analysis, the final models from the mixed model analyses above were used. Migraine-specific disability, assessed by tracking the number of migraine days per month during the OAT Run-in period, was evaluated as a possible moderator. There were no significant moderation effects at any of the three stages of positive migraine management (BMM x Month x migraine days: proactive, \( p = .557 \); anticipatory, \( p = .887 \); management, \( p = .597 \)). Palliative migraine management analyses yielded similar results. There were no significant BMM x Month x migraine days interactions at the anticipatory (\( p = .887 \)) or management stages (\( p = .597 \)) of migraine management. Moderation analyses of migraine-specific disability yielded complete non-significant results, demonstrating that number of headache days reported at baseline had no effect on level of change in coping behaviors.
### Table 10

*Parameter Estimation for Longitudinal Models (with Poisson Distribution) of Change in Positive Coping During and After Treatment*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proactive Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time(^a)</td>
<td>0.756</td>
<td>0.065</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>PM</td>
<td>0.443</td>
<td>0.230</td>
<td>.013</td>
</tr>
<tr>
<td>BMM</td>
<td>0.125</td>
<td>0.232</td>
<td>.537</td>
</tr>
<tr>
<td>BMM * Time</td>
<td>-0.797</td>
<td>0.097</td>
<td>&lt; .001</td>
</tr>
<tr>
<td><strong>Anticipatory Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time(^a)</td>
<td>0.456</td>
<td>0.040</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>PM</td>
<td>0.062</td>
<td>0.118</td>
<td>.729</td>
</tr>
<tr>
<td>BMM</td>
<td>-0.057</td>
<td>0.119</td>
<td>.299</td>
</tr>
<tr>
<td>BMM * Time</td>
<td>-0.475</td>
<td>0.060</td>
<td>&lt; .001</td>
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<tr>
<td><strong>Management Stage</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Time(^a)</td>
<td>0.174</td>
<td>0.030</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>PM</td>
<td>0.014</td>
<td>0.084</td>
<td>.691</td>
</tr>
<tr>
<td>BMM</td>
<td>-0.041</td>
<td>0.084</td>
<td>.193</td>
</tr>
<tr>
<td>BMM * Time</td>
<td>-0.210</td>
<td>0.045</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

\(^a\) Log of time used

### Table 11

*Parameter Estimation for Longitudinal Models (with Poisson Distribution) of Change in Palliative Coping During and After Treatment*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticipatory Stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time(^a)</td>
<td>-0.104</td>
<td>0.043</td>
<td>.658</td>
</tr>
<tr>
<td>PM</td>
<td>0.215</td>
<td>0.137</td>
<td>.438</td>
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<tr>
<td>BMM</td>
<td>-0.059</td>
<td>0.139</td>
<td>.050</td>
</tr>
<tr>
<td>PM * Time</td>
<td>-0.011</td>
<td>0.064</td>
<td>.104</td>
</tr>
<tr>
<td>BMM * Time</td>
<td>0.113</td>
<td>0.064</td>
<td>&lt; .001</td>
</tr>
<tr>
<td><strong>Management Stage</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Time(^a)</td>
<td>-0.433</td>
<td>0.053</td>
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<td>PM</td>
<td>-0.007</td>
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<tr>
<td>BMM</td>
<td>-0.253</td>
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<td>.034</td>
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<tr>
<td>PM * Time</td>
<td>0.150</td>
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<td>.500</td>
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<tr>
<td>BMM * Time</td>
<td>0.230</td>
<td>0.080</td>
<td>.039</td>
</tr>
<tr>
<td>BMM * PM * Time</td>
<td>-0.224</td>
<td>0.114</td>
<td>.050</td>
</tr>
</tbody>
</table>

\(^a\) Log of time used